

Substance use, situational characteristics and sexual outcomes in men who have sex with men

G.J. Melendez-Torres
St Hilda's College

A thesis presented for the degree of
Doctor of Philosophy
in Social Intervention



University of Oxford
Trinity Term 2014

Substance use, situational characteristics and sexual outcomes in men who have sex with men

**G.J. Melendez-Torres
St Hilda's College
DPhil in Social Intervention
Trinity Term 2014**

This thesis presents an empirical investigation into substance use, situational characteristics and sexual outcomes in men who have sex with men (MSM) motivated by the high rates of substance use in MSM; the association between substance use and sexual risk behaviours in MSM; the lack of specific theory addressing relationships between substance use, sexual interactions and social interactions between MSM; and the need for clearer understandings of encounter-level associations with sexual risk.

Qualitative metasynthesis. This thesis begins with laying the methodological groundwork for a qualitative metasynthesis that theorises the relationship between substance use and social spaces in MSM, with a particular focus on sexual outcomes. The qualitative metasynthesis derives the key organising perspective of 'littoral spaces' in which substance use is associated with a pre-planned, though temporary, escape from the boundaries of everyday life to engage in maximal sensory exploration, including through sexual contact.

Systematic review of multiple-event analyses. The thesis then turns to a systematic review of previous quantitative multiple-event analyses examining associations between situational characteristics and sexual outcomes, which establishes the need for additional multiple-event analyses addressing specific substance use, location of sex, partner serodiscordance and partner type.

Multiple-event analyses. Finally, informed by the qualitative metasynthesis and the systematic review of event-level analyses, this thesis presents multiple-event analyses addressing unprotected anal intercourse (UAI), pleasure and control as sexual outcomes in MSM in England. These analyses found that substance use was associated with greater odds of UAI and pleasure, but not with control, and that non-private locations of sex were associated with decreased odds of UAI and pleasure, but not control. Furthermore, there was sparse evidence of interactions between respondent and partner substance use and between respondent substance use and location of sex in associations with sexual outcomes. These analyses contribute to understandings of associations between substance use, situational characteristics and sexual risk behaviour by presenting the first known analyses on MSM in England and by examining sexual outcomes besides UAI.

Acknowledgements

*giving thanks giving thanks
for ropes and coils and braids and hanks
for jobs and jokes and plots and pranks
for whistles bells and plinks and clanks
giving giving giving thanks
--Eve Merriam*

Finishing a doctoral thesis is a really good time to step back, take stock and give thanks. Most of all, I'm grateful to have no shortage of people who deserve thanks for the help, wisdom, time and generosity of spirit they have provided me on this journey that is just beginning.

Thanks are certainly due to the people and organisations that made my doctoral work financially possible. Specifically, thanks to the Marshall Aid Commemoration Commission for the support of a Marshall Scholarship, and to Oxford Brookes University, St Hilda's College and the Department of Social Policy and Intervention for employment that helped me both financially and professionally. Actually, while we're on the subject of the Marshall Commission, I certainly owe a debt of gratitude to Mary Denyer, Lizzie Clark, and Pete Vlahos for their administrative wizardry.

I am also most grateful for the attentive and supportive supervision of Prof Frances Gardner and Prof Chris Bonell. The level of enthusiasm and engagement they showed towards my work was inspiring and affirming. I am most excited to continue working with them in the future. Thanks to you both for your supervision and for your patience with my occasional anxieties. I hope I wasn't too difficult!

I should also acknowledge the excellent mentorship of Sarah Kagan, Ann Kutney-Lee and Julie Sochalski, who showed me what it meant to be a nurse who pushes the boundaries of practice, policy and research. Sarah's frequent emails and visits to Oxford provided helpful reality checks, particularly when they involved chocolate (either discussion or consumption thereof).

One of the many unexpected joys of working on this particular topic was the opportunity to work closely with groups outside of Oxford. My visits to Sigma Research at the London School of Hygiene and Tropical Medicine were both a welcome break from the routine and a time to be challenged, stretched and encouraged. Thanks to Ford Hickson and Peter Weatherburn for making data from The Sigma Panel 2011 available, to David Reid for his magical data management skills, and to Adam Bourne for good humour and moments of interpretive wisdom.

The Centre for Evidence-Based Intervention has been a dynamic, friendly and rigorous place to complete my doctoral work and start my academic career. Thanks to the faculty of CEBI and SPI—including Paul Montgomery, Lucie Cluver and the inimitable Stuart Basten—for many well-received moments of knowledge. Thanks as well to Thees Spreckelsen for many statistical consults across the hall, and to Jenny Burton, the most excellent protector of marginalised populations everywhere, both for intriguing conversation and for teaching me so much about what it means to be an excellent and engaged researcher. I am most pleased to call my fellow doctoral

students and colleagues both past and present, including Sean, Felix, Joe, Ellie, Elizabeth, Becky, Patty and Franziska, good friends. They have showed me what it means to be deeply passionate about your work. I look forward to sharing chocolate with all of them (except for Sean) in the future.

While we're on the subject of friends, I've greatly enjoyed the companionship of Marshall Scholars near and far. Thanks to those who started the journey with me, especially Ariel, Dylan, Ben and Andy, and those who joined me later on, including Kareem, Garrett, Kerry, Zach, and Alex.

Friends from before Oxford and from my first year, including Suz, Aoife, Stephen, Sarah, Beth, James and Nick, helped make my time here that much more pleasant, including through heavy doses of G&Ds (to whom I probably owe thanks as well).

I also am grateful to friends from the University of Pennsylvania, including Matt, Ali and the nurses who inspire me with their commitment to clinical excellence, and to friends from even before (including particularly the indomitable Christina, who was supportive in my race to the finish even from the chilly remove of St Petersburg). Thanks for staying in touch across an ocean.

Finally and foremost, I owe so much to my loving family. Como dijo la escritora Cynthia Ozick, 'Muchas veces se dan por sentado precisamente las cosas que más merecen nuestro agradecimiento.' Me siento muy afortunado de tener una familia tan inteligente y tan intensa y a la misma vez tan cariñosa. Por todo su apoyo y su amor les mando mil gracias. ¡Los amo mucho! A ustedes les dedico esta tesis.

Brief table of contents

Chapter 1. Review of the evidence and motivations for this thesis	1
SECTION 1. Methods for the metasynthesis of qualitative studies	39
Chapter 2. An introduction to qualitative metasynthesis	40
Chapter 3. A systematic review and critical appraisal of qualitative metasynthetic practice	55
Chapter 4. Dimensional analysis as an approach to lines-of-argument synthesis	73
SECTION 2. Systematic review and qualitative metasynthesis of MSM, substance use and social venues	91
Chapter 5. Qualitative metasynthesis methods	92
Chapter 6. Results of the qualitative metasynthesis	101
Chapter 7. Discussion	146
SECTION 3. Systematic review of event-level situational characteristics in multiple-event analyses of sexual encounters of MSM	159
Chapter 8. Systematic review methods	160
Chapter 9. Results of the systematic review	164
Chapter 10. Discussion	194
SECTION 4. Multiple-event analyses of substance use, situational characteristics and sexual outcomes in MSM	201
Chapter 11. Introduction to analyses	202
Chapter 12. Survey background and statistical methods	206
Chapter 13. Describing The Sigma Panel 2011	240
Chapter 14. Analyses of multipartner encounters	242
Chapter 15. Analyses of new partner encounters	257
Chapter 16. Analyses of single-partner encounters	271
Chapter 17. Discussion	312
Tables	355
Works cited	457
Appendices	493

Table of contents

Chapter 1. Review of the evidence and motivations for this thesis	1
Introduction to this chapter and to this thesis	1
Key definitions	3
Historical context of HIV/AIDS	4
Psychosocial, clinical and economic impacts of HIV infection	5
Physiological effects of substance use	10
Prevalence of HIV/AIDS and substance use in MSM	11
Social and cultural contexts of substance use in MSM	23
Associations between substance use and sexual risk behaviours among MSM	25
State of the evidence on HIV prevention interventions for substance-using MSM	33
Aims of this research and why this research is needed now	35
 SECTION 1. Methods for the metasyntesis of qualitative studies	 39
 Chapter 2. An introduction to qualitative metasyntesis	 40
A brief description of qualitative methodologies	40
Foundations and logic of qualitative metasyntesis	45
Methods for qualitative metasyntesis	48
Philosophical clefts in practice	51
Methodological clefts in practice	52
Chapter 3. A systematic review and critical appraisal of qualitative metasyntetic practice	55
Introduction to the review	55
Methods	57
Results	59
Discussion and conclusion	71
Chapter 4. Dimensional analysis as an approach to lines-of-argument synthesis	73
The logic of lines-of-argument synthesis	73
Grounded theory and line-by-line coding approaches to qualitative metasyntesis	76
An introduction to dimensional analysis	79
A dimensional analysis approach to lines-of-argument synthesis	82
A closer elaboration of the lines-of-argument synthesis	87
Conclusion	89
 SECTION 2. Systematic review and qualitative metasyntesis of MSM, substance use and social venues	 91
 Chapter 5. Qualitative metasyntesis methods	 92
Criteria for considering studies for this review	92
Search methods for study identification	93
Study selection and data extraction	96
Analysis	98
Chapter 6. Results of the qualitative metasyntesis	101
Studies awaiting classification and excluded studies	101

Characteristics of included studies	103
Critical appraisal of studies	105
Analytic process	106
The grounded theory	107
Chapter 7. Discussion	146
Verification of the grounded theory	147
Reflexive comments	148
Strengths and limitations of this project	149
Contribution to knowledge	150
Implications for public health practice	150
Implications for research	154
Conclusion	157
 SECTION 3. Systematic review of event-level situational characteristics in multiple-event analyses of sexual encounters of MSM	 159
 Chapter 8. Systematic review methods	 160
Criteria for considering studies for this review	160
Search methods for study identification	161
Study selection and data extraction	162
Quality assessment	163
Data analysis	163
Chapter 9. Results of the systematic review	164
Studies awaiting classification and excluded studies	164
Characteristics of included studies	165
Outcomes and analytic methods	168
Narrative synthesis of study results and measurement issues	171
Chapter 10. Discussion	194
Overview of findings	194
In relation to previous evidence	196
Excluded studies in relation to evidence	197
Gaps in the evidence and future research	198
Strengths and limitations of this review	199
Conclusion	200
 SECTION 4. Multiple-event analyses of substance use, situational characteristics and sexual outcomes in MSM	 201
 Chapter 11. Introduction to analyses	 202
Chapter 12. Survey background and statistical methods	206
Survey background	206
Variable construction	209
Statistical methods	219
Model building and selection	233
Analysis plan	235
Chapter 13. Describing The Sigma Panel 2011	240
Demographic statistics at enrolment	240
Sexual health and history	241
Relationships and gender orientation	241

Chapter 14. Analyses of multipartner encounters	242
Descriptive statistics	242
Models testing associations with UAI	245
Models testing associations with pleasure	250
Models testing associations with control	252
Summary of findings	254
Chapter 15. Analyses of new partner encounters	257
Descriptive statistics	257
Models testing associations with UAI	261
Models testing associations with pleasure	264
Models testing associations with control	267
Summary of findings	268
Chapter 16. Analyses of single-partner encounters	271
Descriptive statistics	271
Models testing associations with UAI	276
Models testing associations with pleasure	291
Models testing associations with control	298
Multilevel latent class analysis	301
Summary of findings	306
Chapter 17. Discussion	312
Summary of findings by research aims	313
Contribution to research	326
Study findings in the context of multiple-event analyses	327
Study findings in theoretical context	333
Study findings through the lens of qualitative metasynthesis	336
Strengths, limitations and an agenda for future research	340
Implications for public health and clinical practice	349
Conclusion	353
Tables	355
Works cited	457
Appendices	493
Appendix 1. Search strings and hits for the qualitative metasynthesis	494
Appendix 2. Authors contacted for the qualitative metasynthesis	497
Appendix 3. Data extraction and adapted critical appraisal guidance for the qualitative metasynthesis	498
Appendix 4. Search strings and hits for the systematic review of multiple-event analyses	503
Appendix 5. Text of The Sigma Panel 2011	505
Appendix 6. Naïve univariate correlation matrices	522
Appendix 7. Conditional logistic regression analyses testing associations with UAI and control in the sample of new partner encounters	527
Appendix 8. Ethics approval for projects included in this thesis	530

List of tables and figures

Figure 3.1. PRISMA flow diagram for systematic review and critical appraisal of qualitative metasyntheses.	60
Figure 6.1. PRISMA flow diagram for qualitative metasynthesis.	102
Figure 6.2. Initial codes used to generate the provisional coding scheme.	108
Figure 6.3. Initial explanatory matrix (matrix I).	109
Figure 6.4. Explanatory matrix II.	110
Figure 6.5. Explanatory matrix III.	111
Figure 6.6. Explanatory matrix IV.	112
Figure 6.7. Explanatory matrix V.	113
Figure 6.8. Explanatory matrix VI.	114
Figure 6.9. Final explanatory matrix—dimensions and properties.	115
Figure 6.10. Final explanatory matrix—roles of dimensions.	116
Figure 9.1. PRISMA flow diagram for systematic review of multiple-event analyses.	165
Figure 9.2. Associations between any respondent substance use and sexual risk behaviours.	174
Figure 9.3. Associations between any partner substance use and sexual risk behaviours.	176
Figure 9.4. Associations between alcohol use and sexual risk behaviours.	178
Figure 9.5. Associations between use of amphetamine-group substances and sexual risk behaviours.	181
Figure 9.6. Associations between meeting partners on the internet and sexual risk behaviours.	187
Figure 9.7. Associations between partner type and sexual risk behaviours.	190
Table 3.1. Characteristics of included qualitative metasyntheses.	357
Table 3.2. Metasynthetic methods of included qualitative metasyntheses.	372
Table 6.1. Characteristics of included studies.	378
Table 6.2. Critical appraisal of included projects.	381
Table 9.1. Characteristics of included multiple-event analyses.	383
Table 9.2. Models testing anal intercourse and sexual risk behaviours in included multiple-event analyses.	386
Table 10.1. Key excluded studies and reasons for their exclusion.	394
Table 12.1. Variables used in each set of analyses.	395
Table 13.1. Number of surveys submitted per month.	396
Table 13.2. Demographic characteristics of enrolment survey sample.	397
Table 13.3. Sexual health and history, relationships and gender orientation characteristics of enrolment survey sample.	398
Table 14.1. Demographic characteristics of multipartner encounter sample respondents.	399
Table 14.2. Sexual health and history, relationships and gender orientation characteristics of multipartner encounter sample respondents.	400
Table 14.3. Encounter-level and individual-level characteristics for the sample of multipartner encounters	401
Table 14.4. Initial models testing associations with UAI in the sample of multipartner encounters.	403
Table 14.5. Multivariate models with categorical measures of any substance use testing associations with UAI in the sample of multipartner encounters.	405

Table 14.6. Multivariate models with continuous measures of substance use testing associations with UAI in the sample of multipartner encounters.	406
Table 14.7. Multivariate models with categorical measures of specific substances testing associations with UAI in the sample of multipartner encounters.	407
Table 14.8. Initial models testing associations with pleasure in the sample of multipartner encounters.	408
Table 14.9. Multivariate models with continuous measures of substance use testing associations with pleasure in the sample of multipartner encounters.	409
Table 14.10. Initial models testing associations with control in the sample of multipartner encounters.	410
Table 15.1. Demographic characteristics of new partner encounter sample respondents.	411
Table 15.2. Sexual health and history, relationships and gender orientation characteristics of new partner encounter sample respondents.	413
Table 15.3. Encounter-level and individual-level characteristics for the sample of new partner encounters.	414
Table 15.4. Initial generalised estimating equation models testing associations with UAI in the sample of new partner encounters.	416
Table 15.5. Models testing an interaction between a binary respondent substance use measure and location of sex and associations with UAI in the sample of new partner encounters.	417
Table 15.6. Models testing an interaction between number of substances used and location of sex and associations with UAI in the sample of new partner encounters.	417
Table 15.7. Multivariate models testing an exploratory interaction between poppers use and location of sex and associations with UAI in the sample of new partner encounters.	418
Table 15.8. Initial models testing associations with pleasure in the sample of new partner encounters.	419
Table 15.9. Models testing an interaction between a binary respondent substance use measure and location of sex and associations with pleasure in the sample of new partner encounters.	420
Table 15.10. Models testing an interaction between number of substances used and location of sex and associations with pleasure in the sample of new partner encounters.	420
Table 15.11. Multivariate models testing associations between specific substance use and pleasure in the sample of new partner encounters.	421
Table 15.12. Initial generalised estimating equation models testing associations with control in the sample of new partner encounters	422
Table 16.1. Demographic characteristics of single-partner encounter sample respondents.	423
Table 16.2. Sexual health and history, relationships and gender orientation characteristics of single-partner encounter sample respondents.	425
Table 16.3. Encounter-level and individual-level characteristics for the sample of single-partner encounters.	426
Table 16.4. Initial conditional logistic regression models testing associations with UAI in the sample of single-partner encounters.	429

Table 16.5. Conditional logistic regression models with categorical measures of any substance use testing interactions in associations with UAI in the sample of single-partner encounters.	430
Table 16.6. Multivariate conditional logistic regression models with categorical measures of any substance use testing associations with UAI in the sample of single-partner encounters.	431
Table 16.7. Conditional logistic regression models with continuous measures of substance use testing interactions in associations with UAI in the sample of single-partner encounters.	432
Table 16.8. Multivariate conditional logistic regression models with continuous measures of substance use testing associations with UAI in the sample of single-partner encounters.	433
Table 16.9. Multivariate conditional logistic regression models with categorical measures of specific substances testing associations with UAI in the sample of single-partner encounters.	434
Table 16.10. Initial random intercept models testing associations with UAI in the sample of single-partner encounters.	435
Table 16.11. Random intercept models with categorical measures of any substance use testing interactions in associations with UAI in the sample of single-partner encounters.	437
Table 16.12. Multivariate random intercept model with categorical measures of any substance use testing associations with UAI in the sample of single-partner encounters.	438
Table 16.13. Random intercept models with continuous measures of substance use testing interactions in associations with UAI in the sample of single-partner encounters.	439
Table 16.14. Multivariate random intercept models with continuous measures of substance use testing associations with UAI in the sample of single-partner encounters.	440
Table 16.15. Multivariate random intercept models with categorical measures of specific substances testing associations with UAI in the sample of single-partner encounters.	441
Table 16.16. Initial random intercept models testing associations with pleasure in the sample of single-partner encounters.	442
Table 16.17. Random intercept models with categorical measures of any substance use testing interactions in associations with pleasure in the sample of single-partner encounters.	444
Table 16.18. Multivariate random intercept model with categorical measures of any substance use testing associations with pleasure in the sample of single-partner encounters.	445
Table 16.19. Random intercept models with continuous measures of substance use testing interactions in associations with pleasure in the sample of single-partner encounters.	446
Table 16.20. Multivariate random intercept models with continuous measures of substance use testing associations with pleasure in the sample of single-partner encounters.	447
Table 16.21. Multivariate random intercept models with categorical measures of specific substances testing associations with pleasure in the sample of single-partner encounters.	448

Table 16.22. Initial conditional logistic regression models testing associations with control in the sample of single-partner encounters.	449
Table 16.23. Multivariate conditional logistic regression models testing associations between number of substances used by respondent and control in the single-partner encounter sample.	450
Table 16.24. Initial random intercept models testing associations with control in the sample of single-partner encounters.	451
Table 16.25. Diagnostic statistics for latent class models tested.	453
Table 16.26. Model specifications and conditional probabilities.	454
Table 16.27. Mean probabilities for most likely class membership by latent class.	455
Table 16.28. Classification probabilities for most likely class membership.	455
Table 16.29. Chi-square tests for equality of means on distal outcomes between classes.	455
Table 16.30. Tests of associations between month of reporting and encounter class.	455

**Substance use, situational
characteristics and sexual outcomes in
men who have sex with men**

Chapter 1. Review of the evidence and motivations for this thesis

This thesis presents an empirical investigation into substance use, situational characteristics and sexual outcomes in men who have sex with men (MSM). Five key issues motivate this thesis: the high rates and negative consequences of HIV/AIDS and substance use among MSM, including the syndemic—or co-occurring and interacting epidemics—of substance use and HIV infection; the distinctive and culturally bounded nature of drug use in MSM, especially as defined by the relationship between substance use and social spaces; the lack of qualitative metasynthetic evidence on MSM and substance use, and the theoretical gap this represents; the need for more robust evidence on event-level relationships between substance use, situational characteristics, and sexual outcomes, especially with regards to MSM in the United Kingdom; and the need to improve interventions to reduce the harmful consequences of public drug use in MSM.

Introduction to this chapter and to this thesis

This chapter will review the evidence that motivates this thesis and outline the gap in the evidence this thesis aims to fill. First, this chapter offers several key definitions and a brief historical overview. After examining the sequelae of HIV infection and the physiological mechanisms of substance use, discussion then moves to an overview of the prevalence and broader epidemiological contexts of HIV/AIDS and substance use in MSM to establish the macro-level epidemiological parameters of the phenomenon being investigated. This discussion will subsequently turn to the social and cultural contexts of both substance use and risky sexual behaviours among MSM to establish the qualitative parameters of the phenomenon under investigation and to establish the need for the qualitative metasynthesis.

Then, to set out the need both for the systematic review of multiple-event analyses and for the multiple-event analyses themselves, the theory, the methodological issues and the quantitative evidence on associations between substance use and sexual risk behaviours in MSM will be examined. Finally, the state of the evidence on risk reduction interventions for substance-using MSM is summarised. This chapter concludes with a statement of why this research is needed now and the contribution to research that the qualitative and quantitative work in this thesis fulfils.

The subsequent three chapters, which together comprise Section 1 of this thesis, lay the methodological groundwork for Section 2 by outlining the methods of qualitative metasynthesis (Chapter 2), by systematically reviewing and critically appraising current practice in the field of qualitative metasynthesis (Chapter 3) and by setting the stage for the use of dimensional analysis in the metasynthesis of qualitative studies (Chapter 4).

Section 2 of this thesis includes the methods (Chapter 5), results (Chapter 6) and discussion (Chapter 7) of the qualitative metasynthesis addressing substance use and social venues in MSM with a focus on sexual outcomes.

Section 3 of this thesis includes the methods (Chapter 8), results (Chapter 9) and discussion (Chapter 10) for a systematic review of multiple-event analyses addressing sexual outcomes and situational characteristics in MSM. In Section 4, Chapter 11 sets out the aims for the multiple-events analyses conducted on data from The Sigma Panel 2011, a longitudinal survey of MSM living in England. Chapter 12 outlines the statistical methods for the analyses. Chapter 13 describes the study sample, and Chapters 14 through 16 set out the results for each of the three sets of multiple-event analyses undertaken. Chapter 17 summarises findings across the

three sets of analyses and analyses them in the context of the qualitative metasynthesis, of the systematic review of multiple-event analyses and of the broader theoretical evidence.

Key definitions

For the purposes of this thesis, ‘substance-using MSM’ will be defined as those men who self-identify as gay, queer, or homosexual, or who report sexual contact with a man in the last 12 months, and who also report use of a substance, whether as part of casual use or as part of a pattern of dependence. This definition includes injection drugs; club drugs, such as MDMA, gamma-hydroxybutyric acid (GHB), and ketamine; alcohol; and other recreational drugs, including cocaine, marijuana, and sildenafil (Viagra). This does not include anabolic steroids, for which the proximal context of use is rarely sexual in MSM (Halkitis, Moeller, & DeRaleau, 2008).

‘Social venues’, used interchangeably with ‘social spaces’, are those places—both concrete and socially constructed—in which more than two people meet for face-to-face social contact. For example, a ‘private’ location such as a motel room would not be included, but the concrete locations of a club, café, or bar, or the socially constructed places of a party or other live event, would be considered social venues.

‘Situational characteristics’ are those features of a sexual encounter that reflect choices of behaviours, partners and contexts. Another way to understand this is in terms of what a situational characteristic is not. An ongoing line of inquiry in event-level sexual risk is the link between depression and unprotected anal intercourse (UAI) in substance-using MSM (Alvy et al., 2011). However, because depression is an individual characteristic and not necessarily a characteristic of the

sexual encounter, negative (or positive) affect states are not *per se* situational characteristics.

Finally, ‘sexual outcomes’ refer to the behavioural and perceptual results of a sexual encounter. To be clear, the use of the phrase ‘sexual outcomes’ implies not causality, but merely temporality, in the order of events in a sexual encounter. Each of the situational characteristics examined here, including substance use before sex, reflect circumstances that preceded unprotected anal intercourse, the experience of control over what happened in the sexual encounter, and the pleasure of the sexual encounter.

Historical context of HIV/AIDS

The HIV/AIDS epidemic first set shore in high-income countries in the early 1980s. From the very beginning, AIDS afflicted communities of gay men and injection drug users to a disproportionate degree (Feinberg, 1996). Initial reports of AIDS noticed the intersection of several unusual symptoms in clusters of gay men, including severe immunodeficiency and immune cell abnormalities, the rare skin cancer Kaposi’s sarcoma, and pneumonia caused by the protozoan organism *Pneumocystis carinii* (Vanley, Huberman, & Lufkin, 1982). Vanley and colleagues’ (1982) initial report termed this collection of symptoms ‘gay-related immune deficiency syndrome’. Within several years of these initial reports, HIV was isolated from the sera of men experiencing this syndrome—later called AIDS—and HIV was shown to be the cause of AIDS (Gallo, 2002; Montagnier, 2002). By the mid-1980s, researchers conclusively established that HIV was spread through contact with bodily fluids—via unprotected sexual intercourse, injection drug use, and transplants and transfusions from seroconverted donors, and from mother to infant in utero—but not through casual contact (van der Graaf & Diepersloot, 1986). HIV research has

moved at a rapid pace since its initial discovery, with a critical watershed in treatment coming with the arrival of HAART, or highly active anti-retroviral therapy, in 1996 (Mor & Dan, 2012). Yet even today, the same risk groups identified at the start of the epidemic continue to be disproportionately affected by HIV and its sequelae. Over the brief history of HIV research in men who have sex with men, the relationship of substance use to the risky sexual behaviours that lead to HIV transmission have formed a critical line of inquiry. Many—but not all—reports, both qualitative and quantitative, note that substance use, urban sexual and social contexts and sexual risk behaviour are linked (Colfax & Guzman, 2006; Drumright, 2006; Vosburgh, Mansergh, Sullivan, & Purcell, 2012). In particular, ‘chemsex’—or the practice of substance use, particularly with ‘club drugs’ and crystal methamphetamine, in the context of sexual intercourse—has been flagged as a key and ongoing feature of urban sexual sociality in MSM in high-income countries (Bourne, Reid, Hickson, Torres Rueda, & Weatherburn, 2014; A. I. Green, 2003; Slavin, 2004).

Psychosocial, clinical and economic impacts of HIV infection

To understand why HIV/AIDS is a problem, it is important to understand the potential consequences it has for those who contract it. This section briefly draws out key psychosocial and clinical impacts of HIV infection on MSM, with a specific focus on substance-using MSM.

Psychosocial sequelae of HIV infection. The psychosocial toll, including via depression and HIV-related stigma, of the disease on MSM living with HIV is high, and is only increased by substance use. Penedo and colleagues (2001) report high rates of maladaptive coping skills and depression in HIV positive MSM, the existence of both which is related to perceptions of HIV-related stigma. HIV-related

stigma was further associated with greater HIV symptoms in a sample of HIV positive men and women (Vanable, Carey, Blair, & Littlewood, 2006). A survey of 3,778 people living with HIV found that health-related quality of life (HRQOL) decreased with the severity of HIV infection as measured by CD4 cell counts, though of all at risk subgroups, MSM living with HIV reported higher overall HRQOL overall than heterosexuals and injection drug users (Campsmith, Nakashima, & Davidson, 2003). Moreover, HRQOL was even further impacted by substance use, with all major illicit drugs for which use was surveyed by Korthuis and colleagues (2008) impacting mental HRQOL in current HIV positive users, and with sedatives and amphetamines having an accompanying effect on physical HRQOL as well.

Clinical history of HIV infection. Physically, the clinical history of HIV begins shortly after initial infection with a set of short-term symptoms frequently characterised by nausea, fever, malaise, and lymphadenopathy, or ‘swollen glands’—all aspects of what is clinically termed an ‘acute retroviral syndrome’ that could easily be confused with a cold or influenza (Volberding & Deeks, 2010). It is at this time that the body is struggling to develop an immune response (Feinberg, 1996). This period of acute HIV infection lasts between several weeks and two months, around which point the immune system produces antibodies against HIV and seroconversion is complete. Acute HIV infection is also when the infected person is most infectious to others (Kelly et al., 2009). Moreover, common HIV tests detect antibodies for the HIV virus, but these antibodies are not yet present in the bloodstream during acute HIV infection (Rothenberg, 2009). It is because of these twin factors that mathematical models consistently support the large role that acute HIV infection plays in continuing the spread of HIV (Miller, Rosenberg, Rutstein, & Powers, 2010).

Once the acute stage has passed, HIV infection is associated with an asymptomatic period of several years. During this period, the HIV virus acts to damage and deplete the CD4 T-cells that form a key part of the human body's immune system (Volberding & Deeks, 2010). While approaches to diagnosing the presence of AIDS vary according to clinical practice guidelines, the World Health Organization's (2007) standard definition places the threshold for AIDS at a CD4 cell count of fewer than 350 cells per cubic millimetre of blood and the confirmed diagnosis of an AIDS-defining illness—including, among others, Kaposi's sarcoma, *Pneumocystis carinii* pneumonia, and toxoplasmosis, all of which are exceedingly rare in those with normal immune systems.

HIV treatment and substance use. HIV treatment, which has its own unpleasant side effects on various organ systems throughout the body, is thus focused on preventing the rapid multiplication of HIV. First-line treatment frequently consists of a combination of drugs called nucleoside reverse transcriptase inhibitors, whose function is to disrupt the cellular machinery that unpacks HIV genetic material for replication (Volberding & Deeks, 2010). However, the imprecise and rapid intracellular reproductive processes of the HIV virus mean that enough genetic diversity is produced within one infected person for rapid evolution. This means that eventually the HIV virus in a person living with HIV will develop resistance to the drug regimen, with the evolution of resistance further accelerated by incomplete adherence to treatment regimen (Feinberg, 1996). AIDS develops from HIV, among other reasons, because of poor clinical management or adherence to treatment regimens, or because of the failure of multiple treatment regimens. All of these reasons converge on the common pathway of inadequate immunological

response by the person infected with HIV, the eventual collapse of the immune system, and the onset of an AIDS-defining illness (Lyles et al., 2000).

It follows that an appropriate treatment regimen is a critical part of survival with HIV. However, substance use, in MSM or in any population, poses a major threat to the success of the treatment regimen. A major reason for this is that substance use is strongly associated with poor adherence to medication regimen. A systematic review including 88 studies used an innovative combination of qualitative and quantitative synthesis across reports of interventions and descriptive studies to understand barriers and facilitators of adherence in HIV treatment regimens (Sandelowski, Voils, Chang, & Lee, 2009). Sandelowski and colleagues found that a consistent barrier to treatment adherence across all studies was substance use.

Another important reason for the failure of treatment regimens in the presence of substance use is the potential impact of substance use on medication effect, independent of adherence—this is a finding that is particularly noted for cocaine and heroin use (Gonzalez, Barinas, & O’Cleirigh, 2011). Comorbid substance use disorders and HIV are particularly challenging to treat, not least because of the potential pharmacokinetic interactions between medication-based therapies (e.g. methadone and buprenorphine) for substance use and antiretroviral therapies (Altice, Kamarulzaman, Soriano, Schechter, & Friedland, 2010). Among HIV positive patients enrolled in an American integrated primary care programme, a substance use or substance abuse diagnosis was associated with excess mortality, with hazard ratios statistically significant and greater than 1.65 for all drug use measured over 11 years of follow up (DeLorenze, Weisner, Tsai, Satre, & Quesenberry, 2011). Professional consensus is that the best approach to HIV prevention in substance-using persons at high risk for HIV—including, particularly,

substance-using MSM—is to address substance use and its associated risky behaviours before onset of HIV, rather than wait for a diagnosis of HIV to actively manage substance use (Metzger, Woody, & O’Brien, 2010).

Economic consequences of HIV/AIDS. In addition to the clinical and psychosocial burdens associated with HIV, the economic impact of the HIV epidemic is a profound one, even when measured in direct costs. HIV continues to be one of the most expensive chronic illnesses to treat, not least because of the high cost of antiretroviral medications (Levy, Johnston, Annemans, Tramarin, & Montaner, 2010). Moreover, HIV-related costs are inversely related to CD4 count, with more advanced disease stages associated with higher costs across studies of this relationship (Levy et al., 2010). A microcosting study in an Irish teaching hospital (n=69 patients) found that HIV-related hospital stays were more costly and longer in duration than the average hospital stay (Ryan et al., 2004). A computer model using a comprehensive set of patient data from an integrated healthcare system in northern France found that those entering the care system for an HIV diagnosis could expect to cost about €535,000 (about £423,330) over the course of a lifetime undiscounted for the time value of money, with about 75% of that cost going to antiretroviral medications (Sloan et al., 2012). Gebo and colleagues (2010) measured the costs associated with HIV care by surveying 10 major AIDS care centres across the United States, covering 14,691 patients in the year 2006. They found that direct major costs, including medical investigations, hospital visits and stays, and medication, attributable to one year of HIV management were on average \$15,693 (about £10,000). When Gebo and colleagues (2010) included minor costs, such as non-routine medical investigations and ancillary medications, associated with HIV infection, that cost increased to \$19,912 per year (about £12,730, with IQR \$11,045-

\$22,626). As expected, Gebo and colleagues (2010) also found that expenditures on antiretroviral medications formed the majority of HIV-related direct costs, with an average expenditure of \$10,138 (about £6,480) per year over all patients and an average expenditure for those taking retroviral medications of \$13,024 (about £8,330).

Physiological effects of substance use

Most of the substances that MSM commonly use in the context of social settings and sexual risk affect the human body by altering the normal function of neurotransmitters. One taxonomy of commonly used substances classifies them according to whether these substances act in the place of naturally occurring neurotransmitters, including heroin, alcohol, marijuana, LSD, GHB, and many illicitly used prescription drugs, including benzodiazepines and painkillers; increase these natural neurotransmitters' release, such as cocaine, MDMA, crystal methamphetamine, and other amphetamine-type substances; or block the release of neurotransmitters, including alcohol and ketamine (Stark & Norfolk, 2011). This has the effect of altering normal sensory processing mechanisms. For example, amphetamine-group substances, including crystal methamphetamine, amphetamine (also known as Speed), and 3,4-methylenedioxymethamphetamine, which is commonly known as MDMA, Ecstasy, or E, all act by causing rapid increases in the release of serotonin, norepinephrine, and dopamine, with the result of surges in energy and empathy, as well as altered vision and touch (Colfax & Guzman, 2006; Stark & Norfolk, 2011). In contrast, GHB acts as the inhibitory neurotransmitter GABA, resulting in a profoundly euphoric state (Colfax & Guzman, 2006; Ireland et al., 1999; Stark & Norfolk, 2011).

Different substances also have different modes of administration. Whereas MDMA is almost always taken as a pill, crystal methamphetamine can be insufflated (i.e., ‘snorted’), smoked, injected into a vein (known as ‘slamming’), ingested, or used as a rectal suppository (known as ‘booty bumping’), depending on user preference (Halkitis, Parsons, & Wilton, 2003). GHB comes as a clear liquid, and is ingested in this form, though its dilution level is important—it has a very narrow level of safety, beyond which respiratory arrest can ensue (Bourne, 2012). Cocaine comes in several forms, corresponding to its form of administration. While cocaine is frequently insufflated as a white powder, it is also smoked in its alkaloidal form—either as ‘freebase’ or as a rock of crack cocaine—for a much faster effect (Tashkin, 2001).

Finally, two commonly used substances for which primary mechanisms do not impact neurotransmitter function merit attention. Sildenafil, known as Viagra, is an erectile dysfunction medication that is taken either alone or as part of a polydrug combination to produce and sustain an erection, often across multiple partners in the same substance use event (Crosby & Diclemente, 2004). Amyl nitrates, colloquially known as ‘poppers’ and chemically related to nitroglycerine, result in systemic vasodilation and relaxation of the smooth muscle (Williams, 2003). In addition to producing a brief ‘rush’, this facilitates receptive anal intercourse, especially when several insertive partners are expected in succession (Bourne, 2012; Hickson, Bourne, et al., 2010).

Prevalence of HIV/AIDS and substance use in men who have sex with men

Epidemiology of HIV/AIDS in MSM. Throughout the rapid pace of research, gay men—and MSM generally—remained, and continue to be, the highest-risk group for HIV transmission in the United Kingdom. According to the latest

surveillance report from the UK Health Protection Agency with data ending December 2012, the prevalence of both diagnosed and undiagnosed HIV in UK MSM is estimated to be about 4.7% and about 8.0% in London MSM more specifically, as compared to about 0.15% in the general UK population (Aghaizu, Brown, Nardone, Gill, & Delpech, 2013). In 2011, the Health Protection Agency reported that new diagnoses among MSM had for the first time since the 1990s surpassed diagnoses in all other groups combined (Health Protection Agency, 2011). Aghaizu and colleagues (2013) confirmed that this situation persisted in 2013, with MSM reporting 51% of all new diagnoses. A retrospective simulation-based study of HIV incidence in the UK that drew on data from Health Protection Agency surveillance data, from Natsal and from the Gay Men's Sex Survey, among other sources, found that incidence of HIV in UK MSM grew from 0.30/100 person-years between 1990 and 1997 to 0.45/100 person-years between 1998 and 2010 (Phillips et al., 2013). Phillips and colleagues (2013) conclude that the increase in incidence is due to increases in UAI—a conclusion that will be discussed in context below.

As expected, this epidemic is not specific to UK MSM. A secondary analysis of the 2001-2006 United States National Health And Nutrition Examination Survey concluded that adult MSM, estimated to compose 5.2% of the population in the United States, have HIV prevalence of 9.1% (Xu, Sternberg, & Markowitz, 2010). This is compared to prevalence of HIV of 0.2% in men who do not report any male partners. Of this group, those men who further identified as gay had HIV prevalence of 16.5%. This 9.1% of MSM with HIV accounts for 49% of all HIV cases in the United States—about 580,000 MSM out of 1.2 million people living with HIV (Centers for Disease Control and Prevention, 2011). Moreover, in many countries, MSM are not the key drivers of the HIV epidemic (Pisani et al., 2006). Even in these

settings, HIV is endemic among MSM. Beyrer and colleagues (2010) systematically reviewed HIV prevalence studies for low-income and middle-income countries, concluding that even where heterosexuals are the primary drivers of the HIV epidemic, MSM still have unacceptably high HIV prevalence—as high as 32.9% in Zambia, for example.

The prevalence of HIV appears to be even higher among MSM living in urban areas. HIV prevalence was more than twice as high for MSM living in London (as noted above, about 8.0%) as compared to other parts of the UK, where MSM-specific HIV prevalence was 2.9% (Aghaizu et al., 2013). Data collected in 2008 from 21 major urban areas in the United States reflected HIV prevalence of 19% in MSM, with 44% of those with HIV unaware that they were infected (A. Smith, Miles, Le, Finlayson, & Oster, 2010). A study conducted in Baltimore, Maryland showed that the prevalence of HIV in MSM (n=645) was about 37.7% in 2004-2005, and 37.5% in 2008 (German et al., 2011). Moreover, HIV prevalence varies greatly by ethnicity. Black MSM in the United States have a much higher HIV disease burden than Hispanic MSM, who in turn have a higher disease burden than non-Hispanic white MSM—this finding is consistent across several studies (Centers for Disease Control and Prevention, 2011; German et al., 2011; A. Smith et al., 2010). German and colleagues (2011) measured the impact of race on HIV prevalence in MSM as part of their study in Baltimore and found that black ethnicity was associated with an odds ratio of HIV infection of 4.0 (95% CI: 2.3-7.0) in their 2004-2005 wave of data collection.

Social and cultural trends in risky sexual behaviours among MSM.

Writing in 1993, Dowsett warned that the Western gay community's newly found zeitgeist of safer sex in light of the HIV epidemic would be a short-lived one, even as

activists cheered the apparent success of HIV prevention strategies in the United Kingdom, the United States, and Australia. In fact, in 2000, Ostrow—following Dowsett’s (1996) original statement—declared that gay men had entered the ‘post-AIDS era’, a time marked by a shift in HIV services and a decentring of the HIV prevention agenda away from MSM, even as risk behaviours and HIV prevalence appeared to rise in this at-risk population. To use the language of ‘relapse’ (Dowsett, 1993), it would appear that earlier predictions about a ‘return’ to high levels of unsafe sex have been fulfilled—that Western gay men have relapsed to the unsafe sex behaviours that characterised the period before 1993 (Dowsett, 2009; Wolitski & Fenton, 2011).

Using back calculation methods on the HIV epidemic in US MSM, Wolitski and Fenton (2011) point to a 60% increase in the HIV incidence from 1991-1993—the ‘golden age’ of HIV prevention in MSM—to 2006, and they chart a continuing growth in the incidence of HIV between 2006 and 2008. Sullivan and colleagues (2009) used HIV notifications and surveillance reports from North America, Western Europe, and Australia to chart this turning point in HIV incidence at the period around the year 2000, before which HIV incidence in MSM in the global West decreased by about 5.2% per year from 1996-2000 and after which HIV incidence increased at the rate of 3.3% a year through 2005. However, comparisons between this ‘golden age’ and current numbers are challenging due to improved surveillance. Furthermore, incidence of HIV infections cannot in itself be an adequate measure of risky sex, especially as uptake, acceptability, and availability of HIV testing continue to increase (Hart & Elford, 2010)—though Sullivan and colleagues (2009) argue that trends in HIV testing alone cannot fully explain the change in HIV incidence.

Yet it is not immediately clear that gay men have seen an increase in HIV risk behaviours from 1993 levels. More recent, local evidence from community-based surveys of MSM is also in conflict as to emergent trends in unprotected sex, suggesting that what may be most important is a nuanced understanding of local norms and customs around unsafe sex—not in itself a new insight (Gatter, 1995). Evidence from a sample of MSM seeking sexual health services in San Francisco shows that, overall, the prevalence of MSM reporting unprotected anal intercourse in the last six months increased from 31% in 1998 to 46% in 2007 (Scheer et al., 2008). On the other hand, a telephone survey of MSM in Seattle showed that sexual risk behaviours were stable from 2003 to 2006 (Menza, Kerani, Handsfield, & Golden, 2011). Across the United States, the mean number of partners per year MSM reported declined from 2.9 to 2.1 from 2002 to 2006-2010, while other sexual risk behaviours remained stable (Leichliter, Haderxhanaj, Chesson, & Aral, 2013). However, results from the Gay Men's Sex Survey in the UK point to slight increases: of a community sample of MSM reporting homosexual activity in the prior 12 months, 55.1% reported unprotected anal intercourse in the last 12 months in 2008, as compared to 48.8% in 2002 (Hickson, Bourne, et al., 2010; Hickson, Weatherburn, Reid, & Stephens, 2003). The computer-based simulation model used by Phillips and colleagues (2013) drew in part on data from the Gay Men's Sex Survey to reach a similar conclusion on an ongoing rise over the years from 1998 in UAI reported in the last 12 months by UK MSM.

Complicating conclusions about sexual risk behaviour is that UAI appears to vary by social venue (Hickson et al., 2003). For example, UAI with anonymous or one-time partners is common at gay circuit parties, or large, gay-themed, weekend-long parties. One analysis conducted at the 2003 White Party (n=185), one of the

largest gay circuit parties in the United States, found that 50% of participants had anal intercourse at the event; of those 50%, 15% had unprotected anal intercourse and 34% had unprotected oral intercourse (Patel et al., 2006). In fact, public sex environments—including sex clubs, bathhouses, and sex-on-premises venues generally—appear to be correlated with a higher HIV risk profile. Taking a cross-venue approach, a study of 321 MSM living with HIV drawn from an intervention trial in San Diego, California compared the profiles associated with three types of venues: what the authors termed ‘commercial’, or sex clubs and bathhouses; ‘public’, or public restrooms or parks; and ‘private’, such as homes or motel rooms (Semple, Strathdee, Zians, & Patterson, 2010). Semple and colleagues (2010) found that participants in sexual encounters in commercial venues tended to be younger and better educated, and to use poppers, GHB, and ketamine. In contrast, public venues were characterised by participants who were more likely to be homeless and use cocaine, crack cocaine, and heroin. Both types of non-private venues involved riskier sex, particularly through higher rates of UAI in encounters in those venues.

Serosorting as a risk management strategy. One method of risk management in MSM wishing to engage in UAI is ‘serosorting’, or the practice of choosing partners for UAI based on perceived compatibility with HIV serostatus (Parsons et al., 2006). A corollary to this practice is ‘seropositioning’, in which the partner with HIV-positive serostatus is receptive while an HIV-negative partner is insertive (McFarland et al., 2011). A systematic review of serosorting and associations with HIV incidence and testing patterns demonstrated mixed evidence of effectiveness as a risk reduction tool, especially given inaccurate or uninformed disclosure, infrequent HIV testing patterns and multiple concurrent partners as problems for HIV seronegative MSM using this strategy (Eaton, Kalichman,

O'Connell, & Karchner, 2009). Put otherwise, to what degree is serosorting actually 'seroguessing' (Zablotska et al., 2009)?

Serosorting may also be unequally effective across groups and contexts. A mathematical modelling study demonstrated that serosorting may be especially risky in populations with high rates of undiagnosed HIV infections (D. P. Wilson et al., 2010). Moreover, an audit-based study from Seattle covering the years 2001 to 2010 found that rates of positive HIV testing were not different for Black MSM reporting serononconcordant UAI and Black MSM reporting only seroconcordant UAI, though serosorting non-Hispanic White MSM were less likely to test positive for HIV (Golden, Dombrowski, Kerani, & Stekler, 2012).

Explanations for a 'relapse' to UAI. Several culturally grounded explanations for the perceived 'relapse' to high rates of risky sex among MSM arise throughout the body of evidence, all of which are associated to the history of HIV in communities of MSM. One of the most popular is variously called 'safer sex burnout' (Ostrow, 2000), 'AIDS fatigue' (Mor & Dan, 2012), or 'condom fatigue' (Dowsett, 2009; McKirnan, Vanable, Ostrow, & Hope, 2001; Morris & Little, 2011; O'Leary & Wolitski, 2009; Wolitski, 2005). What all of these terms point to is the exhaustion that MSM communities have experienced with the continuous array of HIV preventions, especially as messaging relating to HIV behaviours grows stale and the threat loses its immediacy. Having lived with the continuous threat of HIV and the latent stigmatisation of their sexual practices that HIV prevention interventions imply, MSM engaging in risky sex have now grown tired of the rigorous norms and practices that HIV prevention demands.

Another popular explanation for the continuing high rates of risky sex among MSM is the emergent chronicity of HIV, especially since the advent of HAART in

the late 1990s (Dowsett, 2009; O’Leary & Wolitski, 2009; Wolitski, 2005). As this explanation would have it, HIV no longer posed a risk of death, particularly as MSM began to enjoy access to HIV drugs that would extend life and turn a ‘death sentence’ into a manageable long-term condition (Dunbar, 2011; Flores, Blake, & Sowell, 2011). Some qualitative evidence from a study of recently HIV-positive young MSM supports this causal link (Flores et al., 2011). Additionally, HIV complacency was found to mediate the relationship between beliefs in the efficacy of HAART and HIV risk in one large population of young MSM in the United States recruited as part of a venue-based sample (MacKellar et al., 2011b). In contrast, Elford, Bolding, and Sherr (2002) concluded that this complacency did not explain the increase in the risky sexual behaviour reported by cross-sectional samples of MSM in London gyms.

Finally, one structural argument raised by Dowsett (2009), echoing his earlier work (Dowsett, 1993), is that individual and structural HIV prevention strategies have all failed to ‘reconstitute shared values’ in the gay community, instead focusing on either interpersonal therapies or capitalising on the initial fear of HIV. This approach is reflected in both the ‘condom fatigue’ and ‘HAART complacency’ arguments, in that a durable strategy of cultural change would have reduced risky sex and kept it at low levels, regardless of clinical advances or repetition of the message. Viewed another way, in order for HIV prevention services to be successful and durable in reducing risky sex, they must abandon their latent pathologising of gay sexual intimacy and move towards a ‘sex-positive’ orientation—or one that emphasises intimacy and pleasure in the context of safety (Bourne, Hickson, Keogh, Reid, & Weatherburn, 2012; Bourne, 2012).

Substance use prevalence in MSM. As difficult as it is to capture HIV prevalence in substance-using MSM, it is also a challenge to define the prevalence of substance use itself in the population and its link to risky sexual behaviours. Across the evidence, estimates are heterogeneous, in part due to the challenges of a representative sampling frame, and the problem that many MSM may not identify as ‘gay’, or be easily accessible by traditional survey methods (Groves, Bux, Parsons, & Morgenstern, 2009; Leigh & Stall, 1993; McDavid & Hart, 2010a; Williamson, Dodds, Mercey, Hart, & Johnson, 2008). However, substance use among MSM generally is higher than in the population at large (Vosburgh et al., 2012). A survey of 1,169 MSM at three gay circuit parties in the United States revealed high reported use at parties in the last 12 months of alcohol (79%), MDMA (72%) and ketamine (60%) (Mattison, Ross, Wolfson, & Franklin, 2001). Another survey of 350 MSM attending a gay pride event in Denver, Colorado that focused on non-medical use of prescription drugs (e.g. narcotic painkillers, including oxycodone) found that 17.3% of respondents reported such use in the last three months, with 38% reporting lifetime use (Benotsch, Martin, Koester, Cejka, & Luckman, 2011). One popular set of estimates included 98 MSM compared with 3,922 heterosexual men and noted that marijuana, cocaine, and hallucinogen use in the month prior to survey were notably higher in MSM as compared to heterosexuals, with prevalence of use of any drug class at 16.3% for MSM in the prior month as compared to 9.9% for heterosexual men (Cochran, Ackerman, Mays, & Ross, 2004).

Evidence from the UK. Hickson, Bonell, Weatherburn, and Reid (2010) note that little research exists regarding the prevalence of substance use in the UK. Their report indicates that in the UK, data from a cross-sectional survey of MSM in 2005 show that 43.7% of respondents report use of poppers in the last year, almost a third

report use of cannabis, and almost a quarter report use of MDMA (Hickson, Bonell, et al., 2010). In an update of their survey in 2007, crystal methamphetamine use in the last year had risen in London-based MSM from 1.8% in 2005 to 7.8% in 2007 (Bonell, Hickson, Weatherburn, & Reid, 2010). Most recently, an analysis of responses to the European MSM Internet Survey from 2010 revealed that MSM living in the boroughs of Lambeth, Southwark and Lewisham in London reported last-year crystal methamphetamine use of 8.7% and use in the last four weeks of 4.9% (Bourne et al., 2014). A recent survey (Wood, Hunter, Measham, & Dargan, 2012) undertaken in two South London gay-friendly nightclubs notes that an emergent trend is the use of novel psychoactive substances, such as mephedrone, with 53.2% of those surveyed reporting use in the last month—higher than use in the last month of cocaine (44.6%) or MDMA (26.9%)—though these results should be interpreted with some caution as 82% of respondents were men. Anecdotally, reports from an LGBT drug use service in London indicate that in 2012, 85% of presentations to the clinic were due to GHB, mephedrone and crystal methamphetamine as compared to 3% for the same in 2005 (Stuart, 2013). Overall, all of these reports are based on help-seeking or community-based samples, which may overestimate estimates of prevalence of risky behaviours (Dodds, Mercer, Mercey, Copas, & Johnson, 2006). However, the estimates still point to high prevalence of substance use behaviours in MSM.

Evidence from other settings. Evidence for substance use by MSM in other countries is patchy, but it generally supports high prevalence of the same. A community-identified sample of MSM in Peru demonstrated 58% prevalence of problem drinking, defined as a score of two or greater on the CAGE questionnaire (Deiss et al., 2013). In Spain, 56.3% of MSM surveyed in gay venues reported non-

alcohol substance use before or during sex at least once in the last 12 months, with 21.6% reporting non-alcohol substance use before or during sex ‘always or frequently’ (Folch, Esteve, Zaragoza, Muñoz, & Casabona, 2010). In another gay venue and clinic-recruited sample, 67.8% MSM in Sydney, Australia reported any non-alcohol substance use at any point in the prior six months, with a third reporting any amphetamine use and one in five reporting ketamine use (Lea et al., 2013).

Drug use patterns may also differ by community and over time. For example, crystal methamphetamine use has long presented a public health problem for MSM in the United States. Reback’s 1997 ethnographic study of crystal methamphetamine use in Los Angeles charted the rise of crystal methamphetamine as a social drug of choice in communities of gay and bisexual males in California. However, as late as 2008, crystal methamphetamine was not considered to be a public health priority for UK MSM (Bonell et al., 2008). This has changed recently, especially as anecdotal reports come in of new popularity of injecting crystal methamphetamine use in UK MSM (Kirby & Thornber-Dunwell, 2013a; Stuart, 2013) and, as discussed above, prevalence of crystal methamphetamine use among MSM grows.

HIV/AIDS and substance use as syndemic in MSM. It is clear that substance use carries negative consequences for MSM, including the possibility of dependence and its comorbidities. The twin epidemics of substance use and HIV in MSM intersect to form a syndemic (Wohlfeiler & Potterat, 2005). This syndemic is driven by the reciprocal relationships between substance use and HIV risk behaviours. Singer first coined the term ‘syndemic’ to describe two or more co-occurring epidemics in a population for which coexistence creates an interaction effect (Singer & Clair, 2003). The conceptual nature of syndemic theory means that it is difficult to test as a causal model. Yet evidence at the level of the individual (i.e.

global association studies as defined by Leigh and Stall (1993)) consistently points to the association between several psychosocial health problems, including substance use, and HIV risk behaviours (Halkitis et al., 2011).

Possibly the first to name substance use as a key syndemic factor in MSM, Stall and colleagues (2003) analysed a probability sample of MSM in large cities in the United States and concluded that substance use was a key syndemic factor with psychological distress and sexual violence in predicting HIV risk behaviour and HIV serostatus. Further evidence was provided by a community-based sample of young MSM in Chicago in which substance use was again found to be a key syndemic factor with intimate partner violence, HIV risk behaviours and HIV seropositive status (Mustanski, Garofalo, Herrick, & Donenberg, 2007). Parsons, Grov and Golub (2012) observed that in a community-based sample of MSM in New York City, substance use, HIV-positive serostatus and sexual compulsivity were all significantly related to each other and all significantly predicted HIV risk behaviours, including UAI. Santos and colleagues observed similar syndemic relationships between substance use, HIV risk behaviours and HIV infection in a global sample of MSM (Santos et al., 2014).

Finally, some evidence suggests that HIV prevalence is higher in substance-using MSM and that substance use may be higher in MSM living with HIV. A study of 2,389 MSM at HIV treatment sites across the United States showed those who demonstrated little methamphetamine use had the lowest HIV prevalence at baseline (44.3%) and engaged in constant, low levels of risky sexual behaviours; those who demonstrated increasing methamphetamine use had higher HIV prevalence at baseline (62.0%) and engaged in increasing levels of risky sexual behaviours over time; and those who were high users of methamphetamine also had high HIV

prevalence at baseline (60.3%) and consistently engaged in high levels of risky sexual behaviours (Lim et al., 2012). On the other side, an analysis of a community-based sample of MSM living in Lambeth, Southwark and Lewisham in London showed that last month use of each of GHB, ketamine, crystal methamphetamine, mephedrone, poppers, cocaine and MDMA in MSM was higher in those with positive HIV tests as compared to those whose last test was negative (Bourne et al., 2014). A qualitative study of MSM in New York City found that HIV positive MSM reported substance use as a tool to manage depressive symptomatology arising from an HIV diagnosis and stigma (Jerome, Halkitis, & Siconolfi, 2009). A qualitative sample of 23 HIV positive MSM from San Francisco revealed a similar result, with researchers noting that these MSM used methamphetamine to engage in 'experiential avoidance', chiefly from the stigmas and trauma associated with HIV positive status and homosexuality (Chartier et al., 2010). In sum, the presence of substance use as a syndemic with HIV and HIV risk behaviours suggests that understanding substance use by MSM should be a priority for public health research.

Social and cultural contexts of substance use in MSM

Men who have sex with men report a variety of motivations for engaging in drug use, with different social settings regularly surfacing in researchers' reports on these motivations. Several themes appear repeatedly in the qualitative evidence: substance use as a means to increased sociability; substance use as a means to increased pleasure, duration, and response in sexual contact, particularly in commercial settings such as bathhouses and sex clubs; and expectations of substance use both as a tool for sociality and as a part of urban sexual settings (Chartier et al., 2009; A. I. Green, 2003; Halkitis, Fischgrund, & Parsons, 2005; Kurtz, 2005;

Mullens, Young, Hamernik, & Dunne, 2009; Wilton, Halkitis, English, & Roberson, 2005).

Qualitatively, substance use not only makes sexual encounters more pleasurable (i.e., ‘expectancies’), but also makes them possible. Marathon sex, or the phenomenon of extended sexual encounters often including several people that last hours or even days, is associated with use in MSM—specifically methamphetamines, poppers, and sildenafil, all of which are used to prolong the duration and pleasurable sensation of a sexual encounter (Semple, Zians, Strathdee, & Patterson, 2009). One qualitative study of 59 MSM of different ages in New York City highlighted not only that gay men reported the importance of club drug use to improve and intensify sexual contact, but also the role of club drug use in decreasing MSM’s refractory period after ejaculation to facilitate a rapid succession of partners in venues such as bathhouses (A. I. Green, 2003). Bathhouses, or places where gay men meet to have generally anonymous sex, are themselves key settings for substance use.

Respondents in a qualitative study of sexual risk in bathhouses indicated that the intersection of substance use and risky sex formed a key part of the experience in these settings (Elwood & Williams, 1998). As reported in another study, the practice of ‘chemsex’, or sexual encounters fuelled by MDMA, crystal meth, and other recreational substances, allows for sexual encounters that can last the entire weekend (Slavin, 2004).

Because the qualitative evidence will be discussed extensively in Section 2, it will not be summarised further here. However, it is clear from the qualitative literature on substance use in MSM that substance use and sexual behaviour are intimately connected and that social venue has a critical role in substance use behaviours. Yet that role has been inadequately theorised and poorly studied across

social venues for MSM. Qualitative discussions of social and sexual venues for MSM often involve discussion of substance use, as discussions of substance use in MSM often reflect their interconnection with the social contexts in which that substance use occurs. This suggests that understanding the interrelation of substance use and social venue is important to understand the other, and to understand the production of sexual outcomes. For example, a crosscutting dimension across all three major themes identified above was the importance of community to perpetuating substance use in men who have sex with men. Green (2003) noted how substance use helped MSM form what one respondent termed ‘insta-community’, or the ability of relative strangers in gay venues to form close homosocial bonds through shared drug use and the disinhibition that accompanies it. Another study of 15 methamphetamine-using MSM in Miami, Florida found that a key reason for continued use of club drugs was to escape loneliness and increase courage, both of which facilitate social and sexual risk taking (Kurtz, 2005). At the same time, Kurtz (2005) found that gay men reported that long-term use of these drugs to improve perceived social interactions also led to difficulty in forming connections without the use of club drugs.

Associations between substance use and sexual risk behaviours among MSM

Associations between substance use and risky sex are important to understand in order to address the potential of substance use behaviours to increase risk for HIV transmission. A prospective study encompassing 2,633 person-years of follow-up found that unprotected receptive anal intercourse is the highest-risk common sexual activity in MSM, at 0.82% risk of HIV infection when the insertive partner is HIV positive (Vittinghoff et al., 1999). Moreover, certain drugs—especially poppers—compound the HIV risk of unprotected intercourse through their biological

mechanisms of action (Hickson, Bourne, et al., 2010). A common theme throughout commentary and qualitative evidence, reviewed above, is that substance use before or during sex is strongly associated with unprotected anal intercourse in MSM, though the statistical evidence does not consistently point to a causal relationship between substance use and risky sex.

The importance of event-level analyses. While many studies have established that MSM experience higher rates of HIV, the relationship between substance use and increased HIV prevalence in this population is considerably more difficult to estimate reliably or appropriately. As noted above, evidence of prevalence of HIV in substance-using MSM is spotty and insubstantial. One key reason for this is that substance use exists on a continuum from complete abstinence to psychological and physiological dependence, with most people's substance use patterns falling somewhere between both extremes (Gonzalez et al., 2011; Santos, Das, & Colfax, 2011). As Gonzalez and colleagues (2011) observe, substance use and substance abuse are clinically diagnosable mental health disorders. However, to limit the definition of substance use in this discussion to the clinically significant would be to ignore a large amount of substance use that occurs episodically, particularly given the role of substance use in temporally and contextually bounded settings such as gay circuit parties (weekend-long dance parties with a variety of social events), a culturally significant dimension of the gay community in many Western countries (Mattison et al., 2001). Indeed, following the line of thought of the Rose hypothesis (Rose, 1992), more HIV infections will come from those MSM using substance use and engaging in risky sex episodically, as episodic substance users make up a larger part of the population than the small minority with clinical

use disorders. This suggests the importance of examining sexual risk behaviour at the level of the sexual encounter, instead of at the level of the person.

Methodological considerations. However, the statistical nature of the relationship between specific substances and unprotected anal intercourse is heterogeneous across the evidence (Vosburgh et al., 2012). This is, in part, due to varying study designs. Leigh and Stall (1993) outline three different designs examining this relationship: ‘global association’ studies (e.g. how often do you consume substances, and how often do you have risky sex?), ‘situational association’ studies (e.g. how often do you consume substances and have sex, and how risky is that sex?), and ‘event analyses’ (e.g. at your last sexual encounter, did you consume substances and how risky was the sex that you had?). These types of studies, more generally, each point to different questions. Global association studies, for example, may be valuable in understanding overall risk behaviours and trends in those behaviours, especially as they change over time, while event analyses look at specific temporal associations.

For example, Thiede and colleagues (2009) conducted a case-control study of 142 MSM in Seattle, of which 32 had recently seroconverted, and that included several different types of analyses. In univariate analyses that tested global associations, using drugs more than four times a week in the last six months, using poppers in the last six months, and other drug use were associated with recent seroconversion. Another global association analysis showed that non-medical use of prescription drugs in the last 3 months was associated with unprotected anal intercourse, both receptively and insertively (Benotsch et al., 2011), while a global association analysis of 444 MSM in Chicago and Los Angeles found that methamphetamine, poppers, and sildenafil use during unprotected anal intercourse

were all associated with recent HIV infection (Carey et al., 2009). A situational association analysis examined the frequency of unprotected anal intercourse in a venue-recruited sample of travellers to Key West, Florida and concluded that number of anal sex intercourse partners over the course of the trip was associated with alcohol or drug use before sex (Benotsch, Mikytuck, Ragsdale, & Pinkerton, 2006). Finally, Mansergh and colleagues (2006) carried out an event-level analysis of 388 MSM in San Francisco, California by querying respondents as to their last sexual encounter. They found in multivariate analyses that methamphetamine was positively associated with unprotected receptive anal intercourse, and that sildenafil was positively associated with unprotected insertive anal intercourse.

Multiple-event analyses. A ‘stronger’ version of the event analysis is a study in which multiple events per person are captured, often as a case-crossover analysis (Maclure & Mittleman, 2000; Maclure, 1991). Though cross-sectional studies cannot adequately capture whether substance use is a causal risk factor for HIV transmission, event-level case-crossover analyses provide the most reliable measures of the situationally co-located and possibly causal relationship between drug use and risky sexual behaviours, as the quantitative methods frequently used in multiple-events analyses at a minimum produce estimates adjusted for intraperson correlation and, in case-crossover analyses and within-subjects comparisons, allow the person reporting multiple events to act as his own control (Maclure, 1991; Vosburgh et al., 2012). A germinal example of this approach was reported by Colfax and colleagues (2004) for the EXPLORE study team. Colfax and colleagues (2004) asked 4,295 HIV negative MSM about their last sexual encounters with up to three different sexual partners. Case-crossover analyses using multivariate conditional logistic regressions showed that the use of poppers, inhaled cocaine, or methamphetamines

(OR: 1.5, 95% CI: 1.1-2.2), or the consumption of 6 or more alcoholic drinks (OR: 2.4, 95% CI: 1.6-3.7), immediately prior or during sex predicted serodiscordant unprotected anal intercourse, their main study outcome (Colfax et al., 2004).

Evidence from prior systematic reviews of substance use and sexual risk.

Two major reviews have addressed associations between substance use and sexual risk. Vosburgh and colleagues (2012) systematically reviewed event-level studies, though not necessarily multiple-event analyses alone, testing associations between substance use and sexual risk behaviours in MSM. The review concluded that the strongest evidence existed for event-level links between both crystal methamphetamine use and binge drinking and increased risk of UAI. However, only six studies examined binge alcohol use, and only eight studies studied methamphetamine use. Non-binge alcohol use, poppers, sildenafil, MDMA, ketamine, GHB, marijuana, and cocaine (including crack), general measures of substance use, and general measures of polydrug use were inconsistently associated with risky sex, with the most common finding being a statistically non-significant effect. Though this suggests that additional primary research needs to address event-level associations between substance use and sexual risk, it also suggests that a new systematic review is required.

Vosburgh and colleagues' (2012) review was beset by several limitations, including an inadequate distinction between event-level studies and situational association studies, several of which were included, and an inaccurate distinction between multiple-event analyses and single-event analyses, which have substantively different interpretations. Searches were run for this review in early 2010, in which time research in this area may have advanced in several directions.

Another review took a broader view of the evidence, including global and situational association studies, and evaluated these studies in the context of causal risk factors for HIV transmission and not just sexual risk behaviour (Drumright, Patterson, & Strathdee, 2006). Drumright, Patterson and Strathdee (2006) found strong evidence for use of crystal methamphetamine and poppers before or during sex as causal risk factors for HIV transmission in MSM.

Both reviews were limited by the large diversity of observational study designs and analyses that they attempted to synthesise. Overall, individual studies may be hampered by unrepresentative samples and underpowered analyses, and the lack of meta-analysis in either Vosburgh and colleagues' (2012) or Drumright and colleagues' (2006) systematic reviews did not allow for these problems with power to be overcome. However, meta-analysis of risk factors may be specious and more difficult to meaningfully accomplish than in systematic review of interventional studies, for example.

Psychosocial hypotheses linking substance use and sexual risk behaviours. Several psychosocial hypotheses have been developed to associate substance use and risky sex. Ostrow (2000) offers the following taxonomy of the plausible relationships between substance use and risky sex in MSM: first, that substance use disinhibits the user towards risky sexual behaviours (as in disinhibition and the alcohol myopia theory); second, that substance use increases the pleasurable nature of sexual encounters (as in the findings on 'chemsex' above); third, that setting causes both substance use and risky sex (as in, for example, the bathhouse discussed above); and fourth, that factors in individual persons' personalities drive both substance use and risky sex (an explanation that would be at home with both 'cognitive distancing' and the 'sensation seeking' hypothesis). Hypotheses in the

first and fourth categories will be discussed here, as the second and third are the subject of the qualitative metasynthesis in Section 2.

Myopia and disinhibition. One basic and intuitive explanation is the ‘alcohol myopia theory’, which posits that the effect of substance use on cognitive functioning and the ability to foresee longer-term consequences is what increases the odds of risky behaviours (Steele & Josephs, 1990)—including HIV transmission risk behaviours. A narrative review that discussed relationships between alcohol myopia and sexual risk behaviour found inconsistent evidence across studies, almost all of which were laboratory experiments on samples of heterosexual college students (Giancola, Josephs, Parrott, & Duke, 2010).

This disinhibitory process is what could be said to ‘cause’ sexual risk behaviour as a result of substance use (Digiusto & Rawstorne, 2013). However, this explanation is neither complete nor able to account for the full complexity of linkages between substance use and risky sex (Mustanski, Newcomb, Du Bois, Garcia, & Grov, 2011). Drumright, Patterson and Strathdee’s (2006) conclusion notwithstanding, empirical support from event-level studies for this hypothesis is limited. As Digiusto and Rawstorne (2013) observe in their narrative review, absent a randomised controlled trial of crystal methamphetamine use against placebo before sex, a causal effect between substance use and sexual risk behaviour cannot be established.

Cognitive escape. A more nuanced hypothesis is ‘cognitive escape’, which posits that substance use is a mechanism by which MSM can escape the rigorous norms governing gay sexuality in order to engage more freely in risky sexual behaviours (McKirnan, Ostrow, & Hope, 1996; McKirnan et al., 2001). Put otherwise, substance use helps MSM to engage in risky sex that they would

otherwise not engage in while sober. This includes expectancies of substance use and sexual disinhibition, which themselves are associated with sexual risk behaviour (Mustanski, Newcomb, Du Bois, et al., 2011). Emphasising a different angle, O’Leary and Wolitski (2009) argue that a developmental explanation for substance use and risky sex is located in the ability of MSM to experience ‘moral disengagement’, or the ability of MSM living with HIV to extricate themselves from the moral implications of risky sex with a serodiscordant partner.

The theory of ‘cognitive escape’ has some empirical support. McKirnan and colleagues (2001) found in a situational association analysis of an intervention trial sample of MSM that substance-using MSM who expect that they will be able to escape their fears and beliefs of HIV risk through substance use reported higher frequency of unprotected receptive anal intercourse. In another study using a street-recruited sample in Chicago, McKirnan, Houston, and Tolou-Shams (2007) observed that the global associations between internet use for sex-seeking and risky sexual behaviours in MSM were mediated by both substance use and expectancies of cognitive escape, which, they argue, further advances this hypothesis. Finally, a situational association study of a street-recruited sample of MSM in New York City found that the rate of UAI while under the influence of substances in the past three months was predicted by levels of cognitive escape and expectancies (Wells, Starks, Parsons, & Golub, 2013).

Sensation seeking. Another explanation for the link between substance use and risky sex is ‘sensation seeking’, or the desire to pursue the most sensorily powerful sexual experiences (Kalichman & Rompa, 1995). As Mustanski and colleagues (2011) observe, the evidence for the hypothesis in which sensation seeking has a main effect on sexual risk is mixed, possibly because of the importance

of contextual and personality factors in determining risky sex behaviours—put otherwise, substance use and risky sex are not determined by each other, but by characteristics inherent in the person combining these two behaviours. However, there is some evidence that sensation seeking is a moderator of UAI risk. For example, Newcomb, Clerkin and Mustanski (2011) studied situational associations of frequency of sexual risk behaviours in partnerships within respondents and concluded that sensation seeking moderated the effect between substance use and frequency of UAI.

State of the evidence on HIV prevention interventions for substance-using MSM

While evidence on the cost-effectiveness of HIV prevention interventions generally is limited, a systematic review of cost-effectiveness evaluations suggests that costs per HIV infection averted are lower than even the cost of one year of HIV treatment (Galárraga, Colchero, Wamai, & Bertozzi, 2009). This points to the importance of understanding HIV prevention interventions, as they are potentially powerful tools for reducing the burden of HIV infection on substance-using MSM. A methodologically rigorous systematic review concluded that there was substantial evidence of efficacy for behavioural interventions for HIV risk reduction for MSM generally (Johnson et al., 2008). Johnson and colleagues (2008) reviewed 40 interventions that were compared against minimal or no treatment comparison conditions and concluded that while HIV risk reduction interventions as a whole are effective for reducing events of unprotected anal intercourse by 27% (95% CI: 15%-37%), *a priori* specified subgroup analyses showed that particular features associated with greater effectiveness included shorter interventions and components pertaining to what the authors termed ‘personal skills development’.

However, the review-level evidence for interventions targeted at substance-using MSM is considerably less consistent. Rajasingham and colleagues (2012) systematically reviewed intervention studies for methamphetamine-using MSM living with HIV. The review team, however, in an effort to include as much information as possible made several unusual methodological decisions: it included interventions not directly targeted at substance-using MSM or MSM at all, used a suspect search strategy, combined intervention studies for crystal methamphetamine dependence with studies examining antiretroviral therapy adherence and studies assessing HIV risk behaviour in this population, and did not meta-analyse studies in any of the groups. Though Rajasingham and colleagues (2012) concluded that the long-term impact of substance use treatment on risky sex outcomes in this population was nil, this does not speak to the larger group of MSM who use crystal methamphetamine episodically instead of as a pattern of dependence. A non-systematic review that mostly examined single reports of behavioural interventions for risky sexual behaviours in substance-using MSM concluded that these interventions were effective, though it is unclear how rigorous this review was (Shoptaw & Reback, 2007). Finally, a systematic review of cognitive behavioural interventions for HIV risk reduction in substance-using MSM found little evidence of efficacy and only one intervention targeted at MSM not presenting with substance use dependence (Melendez-Torres & Bonell, 2013).

Together, these reviews of variable rigour suggest a conclusion others have reached—that there is a need for a robust focus on interventions for episodic substance use and sexual risk behaviour, as well as the qualitative and epidemiologic understandings necessary to develop these interventions (Wolitski & Fenton, 2011). Substance use continues at high levels among MSM, with a concomitantly high HIV

disease burden (Stuart, 2013). Addressing substance use may be part of the key to addressing risky sexual behaviours—perhaps even more than addressing risky sexual behaviours themselves (Shoptaw & Frosch, 2000). Structural interventions—defined as interventions that alter the ‘context’ of health, generally by changing availability, accessibility, or acceptability of health resources (Blankenship, Bray, & Merson, 2000)—may also be an important part of a strategy to reduce HIV in substance-using MSM (Santos et al., 2011).

Aims of this research and why this research is needed now

The growing syndemic of substance use and HIV in MSM and the concomitant impetus to develop intervention targets to address the specific substance use and sexual risk patterns in MSM point urgently to the need for a better qualitative and quantitative understanding of the relationships between substance use, co-occurring situational characteristics including social spaces of sex, and sexual risk in this vulnerable population.

Primary aims of this research. This research aims to make a contribution towards theorising the poorly understood relationships between substance use, the social contexts of that substance use and sexual outcomes via a systematic review and qualitative metasynthesis of qualitative studies. Spaces of substance use have been addressed in the literature largely as a latent theme, and as they relate to specific social settings, suggesting that motivations for substance use are connected to social space. This qualitative metasynthesis will investigate these motivations and extend research findings to tie them to social space in a way that accounts more broadly both for the role of this space in motivations for substance use and for the sexual outcomes that result from these interactions.

This research also aims to generate improved understandings of the statistical evidence on associations between substance use, additional situational characteristics relevant to sexual encounters and sexual outcomes via a systematic review of multiple-event analyses addressing situational characteristics of sexual encounters and sexual outcomes. This systematic review will update the findings of previous reviews and overcome the limitations of previous reviews by focusing on the most robust study design for understanding event-level associations with sexual risk behaviours.

Finally, this research aims to contribute to the body of evidence of multiple-event analyses connecting substance use and situational characteristics by presenting both the first multiple-events analyses testing associations with sexual outcomes for MSM in the United Kingdom and the first multilevel latent class analysis of situational characteristics and sexual outcomes. The multiple-event analyses here will also address several of the substantive and methodological limitations identified in previous multiple-event analyses. The multilevel latent class analysis will understand how underlying typologies of situational characteristics are associated with sexual outcomes. Because the projects for this dissertation were undertaken sequentially, both the qualitative metasynthesis and the systematic review of multiple-event analyses influenced and expanded the aims of the multiple-event analyses. A fuller discussion of this is in Chapter 11.

Secondary and methodological aims. This thesis also aims to develop the methodology used in these analyses by offering insights and novel applications throughout. The most substantial way in which this thesis contributes to methodological development is via the discussion contained in Section 2, which contains an overview and critical appraisal of current methods for the metasynthesis

of qualitative studies and a description of a novel method to accomplish qualitative metasynthesis. Moreover, the multiple-event analyses contained in Section 4 include a novel application of multilevel latent class mixture modelling, a relatively new approach in the field of structural equation modelling. The multiple-event analyses also attend to the measurement of substance use to overcome some of the methodological limitations of prior studies.

SECTION 1. Methods for the metasynthesis of qualitative studies

Chapter 2. An introduction to qualitative metasynthesis

This chapter begins with a brief description of qualitative methodologies. It then moves to a discussion of the foundations, logic, and practice of qualitative metasynthesis. Finally, this discussion summarises and engages current theoretical debates about the practice of qualitative metasynthesis.

A brief description of qualitative methodologies

To understand the complexities of qualitative metasynthetic methods, a discussion of qualitative research methods is helpful. Qualitative research is a collection of methods and approaches, rather than a more prescriptive design, such as the randomised controlled trial (Frankel & Devers, 2000). As a whole, qualitative methods aim to understand meaning rather than quantify the effects or distributions of parameters (J. Green & Thorogood, 2009). Data are often found as interviews, accounts, observations, or documents that are then analysed according to a particular paradigm (Bowling, 2009).

Qualitative research is hardly monolithic in its intersecting and overlapping approaches to data collection and analysis data. Overall, a common thread is an interpretive epistemology—an epistemology that aims to understand, for example, how people interpret a phenomenon, perceive a particular issue or problem, or account for a certain behaviour (J. Green & Thorogood, 2009). This interpretive epistemology has been called ‘hermeneutic’, or understanding the object of study as both parts and whole through experiences and understandings contained in collected data (Zimmer, 2006). For example, social realists believe that collected data represents a concrete, commonly shared reality—a perspective arguably more positivistic than interpretive (Fine, 1993). Critical realism modifies social realism to note that phenomena exist at different ‘levels’, including the level at which they

concretely occur and the level at which people experience them, with qualitative data focusing on accounts of these phenomena (Houston, 2001). Social constructionism dispenses with the idea of commonly experienced reality and instead studies how people construct this reality (J. Green & Thorogood, 2009; Riegler, 2005). A ‘strong’ version of social constructionism holds that all in the world is socially constructed, while a ‘weak’ version of this epistemology addresses the construction of social structures and phenomena (Houston, 2001). Phenomenology addresses the specific ‘lifeworlds’ of interview subjects by understanding how they relate to and understand specific phenomena, often through presentation of substantial detail and examination of how subjects process their own understandings (Schutz, 1962; Suddaby, 2006).

Symbolic interactionism deserves special attention, as grounded theory—one of the most widely used approaches to qualitative data analysis, explained in detail below—was developed by the symbolic interactionists Barney Glaser and Anselm Strauss. Originally developed from a social constructionist standpoint, symbolic interactionism examines how the ‘situated self’ understands the different dimensions of the lived world as a set of interactions through which meaning is produced and ascribed, with these ascribed meanings called ‘symbols’ (Fine, 1993). These meanings produce interactions, themselves altering the meanings informing them (Blumer, 1992). Symbolic interactionism is a framework, rather than an epistemology or a theory—an approach to sociological analysis instead of a ‘way of knowing’ (Annells, 1997a; Suddaby, 2006). Research oriented by a symbolic interactionist framework takes as the object of analysis the meanings embedded in the interactions between actors, and how these intersect to produce a social process (Corbin & Strauss, 2008).

The key link between symbolic interactionism and grounded theory lies in their shared fundamental concern with these ‘causal relations between actors’ (Suddaby, 2006). Because symbolic interactionism is a framework rather than an epistemology, researchers have used various interpretive epistemologies in grounded theory research. While Glaser (2002) posits that grounded theory can be used across epistemologies, Charmaz (2006) argues that grounded theory must be oriented in a social constructionist epistemology to remain true to its original conception. On the other hand, several major grounded theory exponents, while preserving a symbolic interactionist framework, have moved towards an essentially positivist approach (Annells, 1997a; Corbin & Strauss, 2008).

Introduced in the 1960s, grounded theory became a dominant force in Western qualitative research and, particularly, qualitative health research (Thorne, Jensen, Kearney, Noblit, & Sandelowski, 2004). Also called the ‘constant comparative method’, grounded theory rigorously ‘discovers’ from collected qualitative data underlying concepts then developed into theories of causation and relation (Glaser & Strauss, 1967). It discovers the ‘latent’ concepts embedded in the collected data, from which grounded theory emerges (Glaser, 2002). These concepts are generated both inductively (e.g. what do these data have in common?) and deductively (e.g. how do these data confirm or disconfirm the hypotheses?) (Charmaz, 2006; Corbin & Strauss, 2008; Glaser & Strauss, 1967; Heath & Cowley, 2004).

Grounded theory analysis begins with open coding, a close reading of small parts of the data to identify common concepts in different sources, and to understand data in depth (J. Green & Thorogood, 2009). From this, a starting set of codes—or labels attached to the data that identify an idea the data expresses—is systematically

assigned to all the data fragment-by-fragment. This coding scheme is constantly updated through constant comparison with newly analysed data during ‘axial coding’, in which the data are examined to see how codes relate to each other and point to underlying, higher-order ‘concepts’, into which codes are collapsed (Corbin & Strauss, 2008). Corbin and Strauss then describe the process of generating ‘categories’, an even higher-order set of abstractions that are theoretically saturated collections of concepts. These categories have ‘properties’—concepts representing different aspects of the category—and ‘dimensions’, concepts representing how the properties of the category might vary across different respondents. Throughout analysis, the process should be methodologically auditable, both through generation of frequent memos recorded by the analyst and through records of decisions from open coding to the final theory (Corbin & Strauss, 2008; Finfgeld-Connett, 2010; Kearney, 2001).

Due to its rapid proliferation, grounded theory has developed in several different directions. This is not a new problem—researchers have been long aware of the problem of ‘cooked up’ versions of grounded theory (H. Wilson & Hutchinson, 1996). Most significantly, Glaser and Strauss, the originators of grounded theory, moved in different directions after their 1967 text defining grounded theory. Strauss, with Corbin, published a major text outlining an extensive, procedurally elaborated method for grounded theory analysis (Corbin & Strauss, 2008; Strauss & Corbin, 1990, 1998). This method emphasises deduction—testing of hypotheses emergent from the data for disconfirmation, as in deviant case analysis—with inductive hypothesis development, whereas Glaser’s grounded theory method emphasises deduction only as a starting point for analysis, with categories elaborated inductively (Corbin & Strauss, 2008; Glaser, 2002; Heath & Cowley,

2004). Other prominent departures include Charmaz's (2006) social constructivist grounded theory, and 'dimensional analysis', a grounded theory variant emphasising the arrangement of categories, here called 'dimensions', into configurations that maximise explanatory and conceptual power (Kools, McCarthy, Durham, & Robrecht, 1996; Schatzman, 1991). This last variant will be discussed in depth later.

Three other approaches to qualitative data analysis deserve brief mention here. The first is thematic analysis, which is a method for the identification of themes within the data. This method proceeds systematically through interviewing; examination of data; clustering into themes that are relevant, auditable, and reliable themes; and presentation of these themes (Saldana, 2009). The second method, which is closely related to thematic analysis, is framework analysis, originally developed for rapid analysis and policy relevance (J. Green & Thorogood, 2009). Framework analysis proceeds similarly, but accommodates large amounts of data through mapping of identified themes. Themes may be defined inductively or deductively, depending on the research team's needs (Pope, Ziebland, & Mays, 2000). Finally, Miles and Huberman (1984, 1994) present a method of cross-case analysis that proceeds through the steps of 'data reduction', 'data display', and formulation of conclusions. This method is helpful for comparing and contrasting data both within and across cases. While all three methods are relevant for elaboration of recurring patterns in the data, they do not invite consideration of underlying themes, perceptions, and processes in the way grounded theory does. The inductive and deductive processes of searching for latent concepts and categories through open coding and axial coding, the imperative to theoretical saturation, and the symbolic interactionist framework orienting grounded theory towards an explicit

examination of social structures invite a depth and focus of analysis other methods might lack.

Foundations and logic of qualitative metasynthesis

Across approaches, qualitative research focuses on descriptive, rather than statistical, power. Qualitative studies often eschew large sample sizes for samples capturing a diversity of thought and approaches. Studies frequently stop data collection when data no longer generates substantively new insights (Bowling, 2009). Instead of seeking to describe a population phenomenon from a statistical sample, qualitative researchers often seek to capture a broad range of experiences in an effort to find the unifying themes and concepts that tie a variety of experiences together, or that separate some participants from others. Glaser and Strauss (1967) labelled this point ‘theoretical saturation’. The goal is not to develop statistical correlations in which one variable predicts another, but to develop explanations of social phenomena useful in a variety of situations. This is ‘analytic generalizability’, wherein the study results are analysed in light their conceptual and descriptive power, and whether they describe hypotheses consistent with other studies (Mills, Durepos, & Wiebe, 2010). This prioritisation of conceptual richness over statistical generalizability poses a problem for those seeking to comprehend and simultaneously understand the findings of several qualitative studies that point to the same object of study. Several methods, commonly called ‘qualitative metasynthesis’ or, as originally used with ethnographies, ‘meta-ethnography’, synthesise qualitative studies in order to develop higher-order understandings with increased analytic generalizability.

A commonly cited rationale (Kearney, 2001; Sandelowski, Docherty, & Emden, 1997; Walsh & Downe, 2005) for qualitative metasynthesis arises from

‘analytic interruptus’. These metasynthesists find ‘interruptus’ in the lack of horizontal relationships between qualitative studies to aid in transferring concepts between different studies’ accounts. However, Lofland (1970) initially coined ‘analytic interruptus’ to describe not relations between study-level understandings, but how qualitative research does not carry through to broader ‘middle-range’ theories. Lofland described qualitative research as ‘conceptually impoverished’, highlighting the vast gap in theoretical range between large-scale grand theories and the small, context-specific descriptions popular in accounts of qualitative research. The ‘interruptus’, as discussed by Lofland, occurs in the failure to ‘follow through to the implied, logical, or entailed conclusion’, the higher-order understandings that characterise ‘middle-range’ theory. Elsewhere, Strauss (1970) describes the process of ‘discovering new theory from previous theory’, or the building of theory from initial accounts by adding data and developing increasingly nuanced understandings. Strauss was more concerned with horizontal links between studies, and between accounts within studies. Yet his comment applies to qualitative metasynthesis, in that the existing theory developed by individual studies can be used to develop new theories.

Qualitative metasynthesis first came to prominence with Noblit and Hare’s (1988) *Meta-Ethnography: Synthesizing Qualitative Studies*. Though Noblit and Hare were not the first to write on this issue, their approach to synthesis of qualitative evidence began a new and major methodological line of inquiry (Thorne et al., 2004). While qualitative metasynthesis methods have grown and developed in various directions, several elements are common across approaches. The most basic is that qualitative metasynthesis is both ‘hermeneutic’ and ‘dialectical’—or engaged in extracting and reporting constructs within studies, but also in comparing and

contrasting between studies to understand variation and commonality (Jensen & Allen, 1996; Zimmer, 2006). Relatedly, qualitative metasynthesis, like the qualitative research underlying it, is ‘interpretive’ rather than ‘aggregative’—that is, offering new interpretations and insights instead of combining studies, as in quantitative meta-analysis (Jensen & Allen, 1996; Thorne et al., 2004; Walsh & Downe, 2005). Sandelowski refers to the type of study that would vote-count or otherwise quantify qualitative research as ‘metastudy’ rather than true qualitative metasynthesis (Thorne et al., 2004).

Another common element is the ‘reciprocal translation’, which, conceptually, is the understanding of one study’s findings in terms of other studies’ findings in an effort to develop syntheses that are consistent across included studies (Jensen & Allen, 1996; Walsh & Downe, 2005). A related idea, described in Noblit and Hare’s (1988) approach, is the ‘third-order construction’. This is the meta-ethnographic equivalent to the second-order construction that is a finding in primary qualitative research. These third-order constructions are the outcome of the qualitative metasynthesis, in the way that second-order constructions are the outcome of the original qualitative report, and first-order constructions are interpretations that the original study informants provide of their experiences (Malpass et al., 2009).

In developing syntheses of qualitative studies, Noblit and Hare (1988) described three main outcomes growing from an initial reciprocal translation. The first is ‘reciprocal synthesis’, which aims to understand larger constructs expressed by the studies in the inclusion set. A reciprocal synthesis arises when the second-order constructions expressed in studies broadly agree, and can be understood in terms of each other to form third-order constructions. In contrast, a ‘refutational synthesis’, which exposes and develops heterogeneity in the included studies, arises

when contradictions between metaphors expressed in different studies contradict insurmountably and cannot be reciprocally translated. Finally, ‘lines-of-argument synthesis’ constructs a new, mid-range theory from the findings expressed in the included studies, and is used when studies report ‘parts of the whole’ phenomenon under investigation. For example, Malpass and colleagues (2012) used qualitative studies of patients at different ‘parts’ of the process of a mindfulness meditation intervention to develop a lines-of-argument synthesis of the ‘whole’ therapeutic process of mindfulness meditation, which they identified as ‘exposure’ to the intervention, ‘learning new skills’ in mindfulness and coping, and ‘transformation’ as participants integrated skills into their lives at the intervention’s end. Of these three approaches to meta-ethnography, Noblit reports that the first is most common, while refutational synthesis remains underutilised (Thorne et al., 2004).

Methods for qualitative metasynthesis

This discussion now turns its attention to demonstrating the large diversity in metasynthetic approaches manifest in the literature. Rather than exhaustively cataloguing different approaches (Barnett-Page & Thomas, 2009; Dixon-Woods, Agarwal, Young, Jones, & Sutton, 2004), this discussion demonstrates the need for an assessment of current metasynthetic practice.

Several different approaches to qualitative metasynthesis have emerged, with most connected to the original procedures Noblit and Hare (1988) outlined originally. Atkins and colleagues (2008) interpreted the steps Noblit and Hare laid down as beginning with a research question; locating, filtering, and appraising reports of qualitative studies; ‘reading the studies’; understanding interrelations between studies; developing ‘reciprocal translations’ between studies; and then ‘synthesizing’ the studies and ‘expressing’ this synthesis.

Of note is that Noblit and Hare (1988) demonstrate the development of reciprocal translations and the synthesis of these translations, but they offer little guidance as to how to accomplish these steps. At an early point in the methodological development of meta-ethnographic methods, it appeared that the different approaches, like Noblit and Hare's method, tended to remain vague in the details of their execution (Sandelowski et al., 1997). However, Sandelowski and colleagues (1997) laid down what they believed to be several principles, including purposive sampling of studies, metasynthesis only of studies rooted in the same qualitative epistemology, and a target sample of about 10 studies.

An important variant of the Noblit and Hare (1988) approach is 'critical interpretive synthesis' (Dixon-Woods et al., 2006). Dixon-Woods and colleagues begin by rejecting the reciprocal translation as adequate for capturing the complexity inherent in collections of qualitative research. Instead, they adopt the lines-of-argument synthesis, arguing that qualitative metasynthesis should be critical—engaged in how researchers construct the interpretations of the phenomenon—and interpretive, or engaged in how the interpretations offered by researchers compare and contribute to higher order understandings. They describe the output of their metasynthesis as the 'synthetic argument', a term clearly connected with the conceptual heritage of the 'lines-of-argument synthesis' (Barnett-Page & Thomas, 2009; Dixon-Woods et al., 2006; Noblit & Hare, 1988).

Another major approach to qualitative metasynthesis, called the 'meta-study', describes a process simultaneously metasynthesising and reciprocally translating methods, results, and discussion to understand how these three sections interact and form mid-range theory relating to the object of study (Paterson, Thorne, Canam, & Jillings, 2001). (It is noted that this version of 'meta-study' is different from the

‘meta-study’ which Sandelowski describes elsewhere as primarily a vote-counting summary (Thorne et al., 2004).) The ‘meta-methods’ analysis elaborates the different methods, data, and epistemologies used to examine the phenomenon of interest (Barnett-Page & Thomas, 2009). Unlike Dixon-Woods and colleagues’ (2006) critical interpretive synthesis, the meta-study’s ‘meta-methods’ and ‘meta-discussion’ form distinct parts of the final analysis, where the parts are then integrated to view how each informs the other. Paterson and colleagues’ metasynthetic method shares much in common with ‘meta-narrative’, an emergent approach to research synthesis that concerns itself as well with how these different epistemologies shape results and understandings of the phenomenon. In particular, meta-narrative is used in mixed-methods reviews, in which quantitative and qualitative evidence are examined together (Greenhalgh et al., 2005).

A grounded theory-inspired approach develops the metasynthesis by constant comparison through line-by-line coding of study findings and recording analytic memos (Finfgeld-Connett, 2010). Finfgeld-Connett (2010) asserts that a well-developed metasynthesis using these approaches to triangulate across studies with different qualitative methodologies, which she terms *meta-interpretation*, improves generalizability and transferability of the findings of the metasynthesis, though the author does not further explain these benefits. Another grounded theory-inspired method of qualitative meta-synthesis emphasises the role of metaphors—the building block of qualitative analysis—in developing ‘grounded formal theory’ from the findings of qualitative studies (Kearney, 2001).

Finally, one of the most recent approaches to qualitative metasynthesis is Thomas and Harden’s (2008) ‘thematic analysis’ approach, which marshals qualitative evidence for practice-based relevance and for intervention development

and evaluation. This method involves line-by-line coding of the findings of a study to develop specific hypotheses to inform systematic reviews and intervention development and without the articulated underpinnings of grounded theory. This discussion will return to thematic synthesis and grounded theory approaches later.

Philosophical clefts in practice

As Barnett-Page and Thomas (2009) observe, these metasynthetic approaches have numerous philosophical differences between them. One is the role of critical appraisal in qualitative metasynthesis—should qualitative studies be excluded based on quality, and how is quality appraised (Walsh & Downe, 2005)? One argument posits that the inability to define a ‘unified’ qualitative research paradigm means that each study should be judged on its own merits, rather than on one set of guidelines (Rolfe, 2006). Conversely, Dixon-Woods, Shaw, Agarwal, and Smith (2004) posit that certain characteristics of qualitative research reporting and conduct are constant, regardless of methodology. Sandelowski and Barroso (2007) recommend appraisal, while advising against excluding studies based on perceived quality.

Another asks whether qualitative metasynthesis should synthesise across approaches, such as phenomenology or grounded theory (Jensen & Allen, 1996)? One possible approach is to carry out simultaneous syntheses across studies grouped by framework and then ‘triangulate’ to validate findings (Fingeld-Connett, 2010). Other methods, such as meta-study and meta-narrative, take these differences in methods as foci for analysis in their own right (Greenhalgh et al., 2005; Paterson et al., 2001). Finally, Zimmer (2006) advances that with due attention to the epistemological differences underlying qualitative methodologies, synthesis across qualitative traditions is acceptable and appropriate.

A major issue on which Sandelowski and Barroso (2007) stake a clear position is whether qualitative metasyntheses should be based on purposive or comprehensive samples of studies. Though Thomas and Harden (2008) clearly assert the value of systematic search and retrieval in generating a qualitative metasynthesis, Sandelowski and colleagues (Sandelowski & Barroso, 2007; Sandelowski et al., 1997; Sandelowski, 2012) state that a purposive sample is appropriate, as this is the same logic that guides primary qualitative research. However, because qualitative reports are themselves partly interpretations and partly summaries, it is an open question whether a purposive sample could truly lead to theoretical saturation, especially when nuances between themes and the relationships between themes expressed in different studies could continue to inform analysis in ways not otherwise detected through purposive sampling.

And finally, is qualitative metasynthesis intended to be a practice-relevant endeavour, particularly given Noblit's later reservations regarding its use in the clinical paradigms of evidence-based practice (Thorne et al., 2004)? Given the subjectivity and reflexivity inherent in all qualitative research enterprises, it is an open, inadequately addressed question in the application of metasynthetic knowledge to clinical practice how the positivist and interpretive paradigms meet, if not reconcile, to allow knowledge transfer from one to the other (Paterson et al., 2001; Zimmer, 2006).

Methodological clefts in practice

The diversity of opinion on qualitative metasynthesis is mirrored in its practice. Even in those papers embracing Noblit and Hare (1988), many approaches exist. Researchers have found the idea of reciprocal translation difficult to put into practice (Atkins et al., 2008). For example, Atkins and colleagues (2008) conducted

a reciprocal synthesis of qualitative studies describing barriers and facilitators of adherence to tuberculosis treatment. They arranged studies chronologically, and then synthesised the first two papers by ‘comparing the themes and concepts’ expressed in each. This synthesis was used to study the third paper, with each subsequent paper being included in the synthesis one-by-one. The outcome was a set of third-order constructions that described a larger interpretive framework (Noblit & Hare, 1988). A similar approach to this ‘index paper’ reciprocal translation method appears in a meta-ethnography of cancer patients’ help-seeking behaviours (L. K. Smith, Pope, & Botha, 2005). Smith and colleagues (2005), describing their approach as ‘reciprocal translation’, began with an index paper, chosen as the oldest of the included studies. Other papers were compared against the index paper to develop the synthesis. It is unclear how this comparison occurred, though Smith and colleagues report being open to ‘convergent or divergent cases’ in the synthesised studies.

Finally, Malpass and colleagues (2009) describe a clearer process. After extracting second-order constructions from the included studies, Malpass and colleagues entered each study as one axis of a table and each identified second-order constructions as the other axis. For each of the two syntheses, the reciprocal translation was then developed by checking how papers’ second-order constructions mapped onto the other papers in the set, and then taking those second-order constructions with the most explanatory power—that is, those second-order constructions that best mapped across included studies—to develop the reciprocal translation. Malpass and colleagues (2009) then use causal diagrams describing patients’ experiences taking antidepressant medication to demonstrate the lines-of-argument synthesis arising from these reciprocal translations.

In sum, even those studies taking a meta-ethnographic approach (Noblit & Hare, 1988) demonstrate various approaches to reciprocal translation and metasynthesis. This discussion now turns to a systematic review and critical appraisal of qualitative metasynthesis as it is currently practiced.

Chapter 3. A systematic review and critical appraisal of qualitative metasynthetic practice

The diversity of thought and practice in qualitative metasynthesis point to the importance of assessing how qualitative metasynthesis is currently practiced. The objective of this review is to understand how qualitative metasynthesists are practicing this methodology—and specifically, how they are conducting the reciprocal translation. In order to assess the empirical status of this diversity, qualitative metasyntheses published in 2012 and indexed on the three major public health-relevant databases were systematically searched, retrieved, and appraised. First, prior reviews of this nature are highlighted before the methods, results, and implications of this review are discussed.

Introduction to the review

In their critical, non-systematic reviews of qualitative metasynthetic methods, Finfgeld (2003), Dixon-Woods, Agarwal, Young, Jones, and Sutton (2004), and Barnett-Page and Thomas (2009) highlight the major schools and divisions of thought in qualitative metasynthetic practice. Together, these three reviews suggest that the large diversity of methods mirrors current qualitative research practice: there is no unifying paradigm that ties qualitative research together, except perhaps, on the whole, engagement with meaning and understanding (Denzin & Lincoln, 2011).

Two groundbreaking systematic reviews (Dixon-Woods, Booth, & Sutton, 2007; Hannes & Macaitis, 2012) of qualitative metasyntheses bore out this methodological heterogeneity, and further, demonstrated heterogeneity of the quality of the metasyntheses themselves. Dixon-Woods, Booth, and Sutton (2007) systematically reviewed qualitative metasyntheses published between 1988, the date of Noblit and Hare's publication, and 2004; written in English and published in peer-

reviewed journals; and relating to ‘a health or healthcare context’. The 42 papers they located were mostly in the field of nursing, and all published since 1994. The review authors observed that only five papers used the phrase ‘systematic review’ in the title. Many papers did not describe systematic, specific, or well-elaborated search strategies. Almost half of the papers did not critically appraise included studies. Finally, Dixon-Woods, Booth, and Sutton (2007) observe that a plurality (19 of the 42) studies adopted meta-ethnographic methods. In sum, the review authors observe that very little about the field of qualitative metasynthesis is uniform.

In updating Dixon-Woods and colleagues’ (2007) review, Hannes and Macaitis (2012) examine qualitative metasyntheses published between January 2005 and December 2008, locating 82 papers. Hannes and Macaitis note that search strategy reporting improved greatly, with only 5 studies neglecting to report one. However, they still noted that a quarter of included reviews did not critically appraise included studies, with only five papers explaining why the authorship team did not appraise studies. Hannes and Macaitis also point out the vast array of appraisal guidelines used in the study. They observe that meta-ethnography continues to be the most popular approach used. They also point to the overall lack of transparency in the reporting of how the reciprocal translation occurred.

The current review extends the findings of Dixon-Woods, Booth, and Sutton (2007) and Hannes and Macaitis (2012) and engages ongoing debates in the field of qualitative metasynthesis by systematically searching three major databases with a sensitive and precise search strategy to locate reports published in 2012. Specifically, this review captures and defines how qualitative metasynthesis and the reciprocal translation that forms the key analytic step are currently practiced. This review does this by moving beyond classification of metasynthetic approaches based

on the metasynthesists' 'intellectual heritage' (e.g. Noblit and Hare's meta-ethnography, Paterson and colleagues' meta-study, Finfgeld's grounded theory approach) to develop a taxonomy of how current published metasyntheses actually organise and reciprocally translate between studies.

Methods

Inclusion and exclusion criteria. This review included studies if they were reports of qualitative metasyntheses, or analyses of multiple qualitative studies using methods reviewers described as metasynthetic. To be included, studies needed to: a) have reported methods and findings in explicitly marked sections, and b) be full-length articles published in English in peer-reviewed journals. Methods articles were excluded if they did not focus on a specific case study of a qualitative metasynthesis. Like prior reviews (Dixon-Woods et al., 2007; Hannes & Macaitis, 2012), included metasyntheses needed to focus on health-related questions. This was done both to improve comparability across reviews and to address practice in a broad area of inquiry with roughly similar areas of concern.

Systematic search strategy. Searches were run on 19 August 2013 on MEDLINE and MEDLINE In-Process & Other Non-Indexed Citations, Embase, and PsycINFO, all on the Ovid platform. The search string was designed to maximise precision and sensitivity. It was created using the same search terms for qualitative research as in the qualitative metasynthesis included later in this dissertation. The search string was as follows:

1. (qualitative* or focus group* or focus-group* or interview* or grounded theor* or thematic analys* or framework analys* or hermeneutic* or grounded-theor* or phenomeno* or ethnograph* or interpretiv* or interpretativ* or realis* or (theoretical* adj sampl*) or constructiv* or field

research or field-research).mp. or exp qualitative research/ or exp ethnography/ or exp ethnopsychology/ or exp anthropology, cultural/ or exp sociology/ or exp sociology, medical/

2. (meta-ethnograph\$ or metaethnograph\$ or meta-synthes\$ or metasynthes\$ or metasummar\$ or meta-summar\$ or metastud\$ or meta-stud\$ or metanarrative\$ or meta-narrative\$ or (reciprocal\$ and translat\$) or line argument or lines argument or line arguments or lines arguments or (refutational\$ and translat\$)).mp
3. 1 and 2
4. limit 3 to yr="2012"

All abstracts were then imported into Mendeley (Mendeley Ltd & Glyph & Cog LLC, 2014), where they were deduplicated. Two screeners working independently then screened out titles and abstracts for records that were not qualitative metasyntheses. These two screeners, again working independently, assessed full-text articles corresponding to screened records, against which inclusion and exclusion criteria were applied.

Data extraction and synthesis. For each included metasynthesis, the following information was extracted by both reviewers independently into a Microsoft Excel spreadsheet alongside the citation for each metasynthesis:

- metasynthesis title,
- number of studies in the metasynthesis,
- whether a systematic search was undertaken,
- how that systematic search was undertaken,
- inclusion and exclusion criteria for studies,

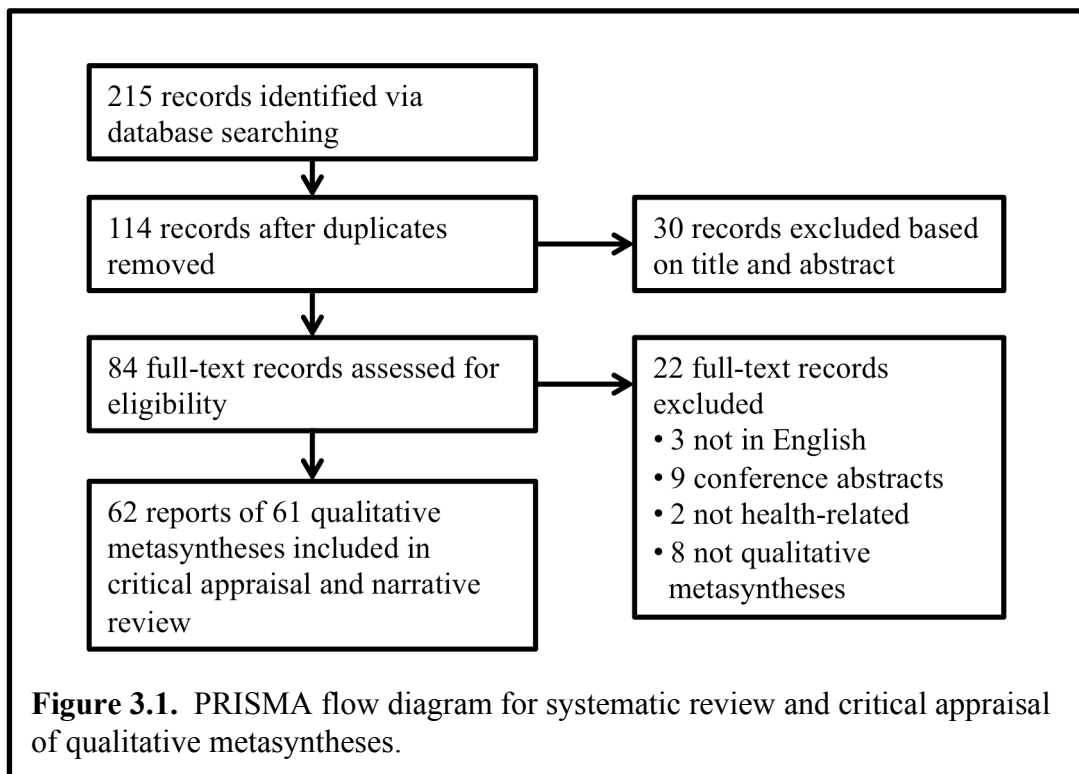
- whether included studies were critically appraised,
- the checklist or guideline used to critically appraise studies,
- whether studies were excluded based on critical appraisal,
- the ‘intellectual heritage’ the metasynthesists declare as guiding their approach, and
- how the authors reported conducting the metasynthesis and reciprocal translation.

Results were then narratively synthesised by reading different characteristics across studies, examining differences between studies, and where applicable, grouping them based on methodological approach. In particular, the classification of reciprocal translation approaches was developed by examining how the metasynthesis author teams used specific approaches to qualitative metasynthesis (e.g. Noblit and Hare 1988), how authors referenced previous metasyntheses (e.g. studies that referenced Malpass et al., 2009), and the actual mechanisms by which they reported analysing included studies (e.g. study-by-study comparison, or line-by-line coding).

Results

Searches yielded 78 hits for MEDLINE databases, 74 hits for Embase, and 63 hits for PsycINFO. This resulted in 114 unique records. Initial screening led to a set of 84 records for which full-text articles were accessed, with 62 reports of 61 metasyntheses included in this review. See Figure 3.1 for the PRISMA flow diagram.

Studies awaiting classification and excluded studies. No studies await classification, as all studies for which full text assessment was required were accessed.



Of the 22 excluded records, three were not in English, nine reported on conference abstracts, two did not address health-related questions, and eight were not qualitative metasyntheses as described in the inclusion and exclusion criteria.

General characteristics of the sample. See Table 3.1 for study characteristics and data extraction. Unlike in past samples where journals such as *Qualitative Health Research* and *Journal of Advanced Nursing* have had near-monopolies on published metasyntheses (Dixon-Woods et al., 2007; Hannes & Macaitis, 2012), no journal published more than three metasyntheses.

Metasyntheses could be readily categorised into several overlapping groups:

- 25 metasyntheses on chronic illness and disease management,
- 19 metasyntheses on provision of health services and the health professions workforce,
- 8 metasyntheses on women's health,
- 8 metasyntheses on geriatric care,
- 7 metasyntheses on child development, and

- 7 metasyntheses on mental health.

Systematic search strategies. It appears that search strategy reporting continues to improve from Hannes and Macaitis's (2012) review, particularly as search strategies converge towards the PRISMA (Liberati et al., 2009) reporting standards for systematic reviews. Of the 61 included metasyntheses, three (K. Brown, Worrall, Davidson, & Howe, 2012; Heaton, Corden, & Parker, 2012; O'Halloran, Grohn, & Worrall, 2012) did not use a search strategy because these metasyntheses only examined studies from the same research programme or centre. All of the other 58 metasyntheses reported a searching approach. One metasynthesis (Dillon, Roscoe, & Jenkins, 2012) reported a non-replicable search string, but not databases used. One metasynthesis (Lee et al., 2012) reported databases searched, but not search strings.

The remaining 56 metasyntheses can be divided into those reporting PRISMA-compliant (Liberati et al., 2009) replicable search strategies—both databases searched and a replicable search string for at least one database. Of these, 35 metasyntheses reported non-replicable search strings and 21 metasyntheses reported fully PRISMA-compliant replicable search strategies. Of the 35 metasyntheses reporting non-replicable search strings, 28 reported additional search strategies—reference chaining (scanning reference lists of included studies and other reviews), hand searching (manually searching journals and books and free-searching the internet), and contacting authors. Of the 21 metasyntheses reporting replicable search strategies, 14 reported additional search strategies.

Critical appraisal. Though some metasyntheses appeared to disregard critical appraisal, most authorship teams regarded it as an important part of the metasynthesis process. Of the 58 included metasyntheses involving searching for

studies, eight did not critically appraise included studies. Only one (G. Hubbard, McLachlan, Forbat, & Munday, 2012) offered an explicit rationale, citing the lack of clarity or standard for appraisal of qualitative research. The remaining seven metasyntheses simply did not mention critical appraisal, marking either a positive decision or a lack of methodological awareness. This is a much lower proportion of metasyntheses without critical appraisal than reported by Hannes and Macaitis (2012) or Dixon-Woods, Booth, and Sutton (2007).

Of the 51 metasyntheses demonstrating critical appraisal, four metasyntheses (Anderson, Jason, Hlavaty, Porter, & Cudia, 2012; Birnbaum & Saini, 2012; Finfgeld-Connett, Bloom, & Johnson, 2012; Schulman-Green et al., 2012) did not specify a guideline. Consistent with Hannes and Macaitis's (2012) review, the critical appraisal checklist for qualitative research (Burls, 2010) published by the Critical Appraisal Skills Programme (CASP) was by far the most popular choice.

Moreover, of the 51 metasyntheses demonstrating critical appraisal, 15 metasyntheses excluded qualitative reports based on methodological quality, though quality thresholds were poorly defined. Metasynthesis authorship teams had different ways of deciding which studies to exclude. For example, both metasyntheses using the Walsh and Downe (2005) appraisal method eliminated all studies with less than a C grade. Metasyntheses using the CASP checklist generally overlaid a scoring mechanism to produce a grading system. For example, the authorship team of one metasynthesis (Chenail et al., 2012) overlaid a scoring mechanism onto the CASP checklist and scored each item from 1 to 10, summing all item scores to grade papers. Aside from the substantial heterogeneity in critical appraisal and exclusion approaches, perhaps most troubling is the authorship team

that excluded papers based on quality without an explicit critical appraisal method (Anderson et al., 2012).

Theoretical sampling of studies and metasynthesis across qualitative epistemologies. It would appear that the questions of purposive sampling and metasynthesis across epistemologies are theoretical debates that are empirically non-existent, given that many authors recognised the value of using all available data to develop as complete a picture as possible of the subject of the research question. Only one of the 58 metasyntheses reporting searching for studies used theoretical sampling, for which the authors did not provide a rationale (Lamb, Bower, Rogers, Dowrick, & Gask, 2012). All other metasyntheses analysed all included studies. None of the included metasyntheses avoided comparing findings across qualitative epistemologies.

‘Intellectual heritage’ of metasynthetic method. See Table 3.2 for reciprocal translation characteristics. The enduring influence of Noblit and Hare (1988) is clear, as this continues to be the most popular declared approach. Of the 61 included metasyntheses, 45 stated that their metasynthetic practice was based at least in part on Noblit and Hare (1988). Two metasyntheses (Agudelo-Suarez et al., 2012; Perry et al., 2012) did not specifically state a basis for their metasynthetic method, but these likely were inspired by meta-ethnography, in part because these methods used the term ‘reciprocal translation’ or appeared to mimic the process Noblit and Hare originally outlined. Other specific methods include thematic synthesis (Thomas & Harden, 2008), cited three times, and Sandelowski and Barroso (2007), cited six times.

The authors of metasyntheses often cited other well-known metasyntheses as precedent for the metasynthetic method they used, even when the cited metasynthesis

did not necessarily describe a qualitative metasynthetic method. Specifically, Malpass and colleagues' (2009) metasynthesis of experience with antidepressant medications, discussed above, was cited four times as a metasynthetic method. Moreover, Atkins and colleagues' (2008) 'lessons learned' paper from a metasynthesis of research on factors impacting adherence to tuberculosis medication was cited four times as a metasynthetic method.

Finally, of note is that several metasyntheses did not ground their approach in an existing metasynthetic method, but rather borrowed from primary qualitative research practice. Two metasyntheses (Schulman-Green et al., 2012; Stankov, Olds, & Cargo, 2012) based their method on cross-case analysis (Miles & Huberman, 1994), and one metasynthesis (Neubeck et al., 2012) used a social constructivist grounded theory approach (Charmaz, 2006). These methodological decisions were not justified. It did not appear that these methods resulted in an analysis with an appearance or format distinct from those using a metasynthetic method. As seen below, metasyntheses using these primary methods were readily classifiable within the categories of reciprocal translation used for metasynthetic methods.

Taxonomy of reciprocal translation. Two axes of difference appear to describe the reciprocal translation and outcome of the metasynthesis. The first axis of difference is the method of reciprocal translation. The second axis of difference is the synthetic quality of the metasynthesis. Each will be discussed in turn. These axes describe the current practice of reciprocal translation in qualitative metasyntheses.

Methodologies of reciprocal translation. The methods authors used to organise data and translate themes reciprocally could be categorised in four overlapping categories. These categories are a) the visual metaphor, b) data

reduction and thematic extraction, c) key paper integration, and d) line-by-line coding.

The visual metaphor. One class of approaches to reciprocal translation used the visual metaphor—generally maps and grids of second-order and third-order constructs—to understand how themes relate to each other. The visual metaphor accomplishes the reciprocal translation by connecting similar themes within and across studies and examining how different papers’ themes matched onto each other.

One approach was to map themes between and within studies to develop the reciprocal translation—what one research group (Borg Xuereb, Shaw, & Lane, 2012) referred to as ‘mind maps’. Borg Xuereb and colleagues (2012) used these mind maps to chart the progress of their reciprocal translation as it developed through discussions in the research team. In one example (Lamb et al., 2012), authors drew a variety of maps to connect themes within studies and across studies. The metasynthesis authors, working in conference, undertook a process of ‘experimenting’ with different maps emphasising different connections between themes. Third-order constructs then emerged out of closely connected and related groups of themes. By verifying maps against original study findings, Lamb and colleagues (2012) choose the map in which the third-order constructs and the connections between them had optimal conceptual and explanatory power. Another metasynthesis used similar maps of themes within and across studies, but instead of conferencing, the process took the lead author’s map as a starting point for other authors to edit the map individually and iteratively until consensus was reached (Andersen, Nielsen, & Brinkmann, 2012).

Representing another visual metaphor, grids of themes were used to see to what degree themes expressed in one study could be used to explain findings in other

studies. In such a grid, patterned after Malpass and colleagues (2009), all themes identified from included studies are entered as rows, with either studies or all themes identified from those studies entered as columns. As Malpass and colleagues (2012) showed, by looking at individual cells, the theme corresponding to the cell row can be interrogated either against the theme on the cell column to see how they relate, or on the study on the cell column to see if the theme is represented in the study. An important output, in all metasyntheses using this approach, is a table listing the themes from the reciprocal translation and those papers in which the specific theme appears (Bennion, Shaw, & Gibson, 2012; Malpass et al., 2012; Nagata, Gatti, & Barg, 2012).

Data reduction and thematic extraction. Another popular class of approaches, data reduction and thematic extraction, also operated at the level of the themes expressed in each study. Like data maps, this popular method of reciprocal translation primarily considered themes as the objects of analysis. At times, authors included connections between themes as part of the analysis. The metasyntheses generated using this approach displayed a range of conceptual power.

In one approach, themes were grouped together based on whether authors believed the themes had similar meaning. Often, this method clustered themes based on apparent similarity, without looking at how themes from different studies related to each other in both similarity and difference of meaning. For example, Agudelo-Suarez and colleagues' (2012) analytic strategy was one of 'aggregation of findings', in which they clustered themes with similar meanings and named those clusters of themes as the third-order constructs. Similarly, in their metasynthesis of nurses' decision-making processes when faced with the use of physical restraints with patients, Goethals and colleagues (2012) sorted the themes in their included studies

into several groups that described the content of the group's themes, but not the meanings of the themes—for example, 'ethical issues' in decision-making and physical restraint, but not what those ethical issues were or how nurses characterised those ethical issues. Both of these metasyntheses generated themes that were conceptually impoverished, but that were broad enough to apply to most of the studies included in the review.

On the other hand, several research teams used the approach of data reduction and thematic extraction with a constant comparative approach (Glaser & Strauss, 1967) between themes and papers to identify meaningful clusters of themes, relationships within those clusters of themes, and the emergent third-order constructs (Hodge, Horvath, Larkin, & Curl, 2012; Lawrence, Fossey, Ballard, Moniz-Cook, & Murray, 2012). Indeed, Noblit and Hare (1988) identify the constant comparative approach as a critical part of the lines-of-argument synthesis. Understanding thematic relationships within studies is important to preserve how different aspects of the subject under examination intersect and relate to produce meaning, and how these relationships might differ between studies. Similarly, understanding thematic relationships across studies is important to point out how themes address similar or different aspects of meaning of the same emergent third-order constructs. Lawrence and colleagues (2012, p. 345) specifically described their metasynthetic process as 'similar to the constant comparison method', where the emergent third-order constructs were verified against the themes and the relationships between themes. They did this by moving back and forth both between studies and also between studies and the emergent third-order constructs to develop the final synthetic product.

Key paper integration. One approach that has clear roots in the case studies originally employed by Noblit and Hare (1988) is the key paper integration

approach. Generally, this approach takes a paper as a starting point, arranges papers into a list, and then integrates the thematic understandings and metaphors in each paper into a subsequent paper. Each paper is then synthesised into the increasingly powerful explanation until the final translation and synthesis is reached. Of the seven metasyntheses explicitly using this approach, four arranged papers chronologically for key paper integration. This approach has the benefit of taking a paper-by-paper approach, which allows for careful examination and systematic comparison of themes and constructs derived in each study. The key paper integration method might be successful because rigorous use of this approach requires a detailed examination of how each paper fits into the emerging third-order constructs. One possible pitfall is that any insights in papers synthesised later may not be adequately treated due to perceived saturation.

Line-by-line coding. Metasyntheses using a line-by-line coding approach to the reciprocal translation generally proceeded on one of three ways. First, some metasyntheses took a grounded theory approach (Finfgeld, 1999, 2003; Kearney, 2001) that involved analysing findings and, at times, discussion sections using open coding, axial coding, and analytic memos (Finfgeld-Connett et al., 2012; Neubeck et al., 2012). Most metasyntheses using line-by-line coding, however, used a thematic synthesis approach (Thomas & Harden, 2008) that involved generating inductive, descriptive codes, initially by developing a set of phrases that appeared to cover the meaning of different lines of text in studies' findings sections, as in Bradshaw, Playford, and Riazi's (2012) metasynthesis. As the analysis progressed, this 'code bank' was expanded to include new insights from different studies (Kramer, Olsen, Mermelstein, Balcells, & Liljenquist, 2012). These codes were then hierarchically arranged by similarity of meaning into more abstract 'analytical codes' representing

higher-order constructs (Bradshaw et al., 2012; Fletcher, Gheorghe, Moore, Wilson, & Damery, 2012; Kramer et al., 2012). Other metasyntheses used a deductive coding strategy where studies were coded based on external frameworks—for example, one study used ecological systems theory (Bronfenbrenner & Morris, 2006) to develop a coding system used to organise findings for the generation of third-order constructs (Stankov et al., 2012).

Line-by-line coding methods involve exhaustive readings of studies in a way that will induce the careful metasynthesist to consider closely latent higher-order constructs. Even when line-by-line coding is not guided by grounded theory, the reciprocal translation can be accomplished by collecting into the same category similar properties, or aspects and characteristics of a category, and dimensions, or parts of a category that account for variation, both within and between studies (Thomas & Harden, 2008).

Synthetic qualities of the metasynthesis. In their narrative review of methods for qualitative metasynthesis, Barnett-Page and Thomas (2009) discuss the degree to which different methods go “beyond” the primary studies’. They observe that some methods stop at translation across studies, while others push for higher-order understandings. This review suggests a more fundamental continuum—specifically, the extent to which the metasynthesis is *aggregative or interpretive*.

Metasynthesists generally agree that the logic of qualitative metasynthesis is not aggregative, as in quantitative meta-analysis, but interpretive (see, among many others, Thorne et al., 2004). However, qualitative metasyntheses exist somewhere on the continuum between those that merely lump similar themes into bins that are then named, to those that generate totally fresh and new understandings that are not manifestly expressed in the primary studies. The metasyntheses included here range

from those that cluster themes from studies and name these clusters (Agudelo-Suarez et al., 2012; Goethals et al., 2012) to those presenting novel, innovative understandings, such as Malpass and colleagues' (2012) lines-of-argument synthesis that drew on studies of patient experiences in mindfulness interventions for chronic illness to construct a novel temporal model of the process of coming to terms with the new reality of illness through meditation.

At the same time, no metasynthesis can be wholly at one end of the spectrum or the other. Because metasyntheses are interpretations of interpretations of data (Dixon-Woods et al., 2006), the amount to which metasynthesists can make completely novel declarations is limited by many factors, including previous sensitisation to certain concepts and theories, the conceptual depth of primary studies, and the adroitness of the metasynthesis team itself. On the other end, even grouping themes into bins of similar categories implies an act of interpretation that, however slight, goes beyond the mechanical or mathematical.

Metasyntheses may be presented as interpretive when they are, in fact, largely aggregative. For example, a metasynthesis addressing the experiences of those affected by sickle cell disease and the impact of this illness on their reproductive decisions used a method termed 'qualitative interpretive meta-synthesis' (M. Smith & Aguirre, 2012). However, the metasynthesis simply clustered themes and quotes by broad similarity. For example, the authors presented as a third-order construct arising from the included studies 'Attitudes Toward Learning One's SCT [sickle cell trait] Status'. These themes were less representations of new understanding, but merely recategorisation of existing data (H. Wilson & Hutchinson, 1996)—put otherwise, despite the methodological label, there was little interpretive here.

Assuming that the goal of the qualitative metasynthesis is to develop new higher-order understandings, it may be more helpful in evaluating the success of the qualitative metasynthesis to locate the metasynthesis on the spectrum between aggregative and interpretive. This perspective might help the reader in interpreting the product of the metasynthesis. One aspect that would help in evaluating the interpretive dimension of the metasynthesis would be improved reporting of coding schemes and their evolution, when applicable, or at least of the auditable methodological trail that marks rigorous primary qualitative research. For example, Walsh and Devane's (2012) metasynthesis of pregnancy care led by midwives included their coding scheme to demonstrate how their reciprocal translation developed.

Discussion and conclusion

This review is limited by the fact that all metasyntheses in journals included in searches may not have been fully indexed. However, this review presents a snapshot of metasynthetic practice and develops two axes of difference for understanding both approaches to reciprocal translation and the outcome of the qualitative metasynthesis.

When judged by the same standards many authors used to appraise primary studies, the metasyntheses would score very poorly indeed. For example, as stated above, evolution of coding schemes across all methods was poorly elaborated and not transparent. Moreover, the substantial popularity of the CASP tool for critical appraisal of qualitative studies is problematic. CASP tools were originally developed as 'field guides' to the qualitative research in order to assist novices in critical appraisal. It is an open question whether this checklist, though effective for its purpose, is the most appropriate way to collect information on the rigour and

trustworthiness of qualitative findings. Additionally, as qualitative metasyntheses take an increasingly large role in evidence-based practice, a checklist for the appraisal of these same types of reviews will be a useful tool indeed.

Since the original pioneering systematic reviews of qualitative metasyntheses by Hannes and Macaitis (2012) and Dixon-Woods, Booth, and Sutton (2007), it appears that the quality and transparency of certain aspects of qualitative metasynthetic practice—specifically, conduct and reporting of searches and critical appraisal of primary studies—continues to improve. Moreover, questions of metasynthetic practice that are presented as up for debate appear to be settled in the actual doing of qualitative metasynthesis, or at least unexamined by metasynthesists. Meta-ethnography (Noblit & Hare, 1988) continues to be, far and away, the most popular approach to qualitative metasynthesis. Finally, as demonstrated above, current metasynthetic practice can be organised across two main categories—one of approach to reciprocal translation and one of continuum between interpretation and aggregation.

Chapter 4. Dimensional analysis as an approach to lines-of-argument synthesis

This chapter briefly reviews the original conception of lines-of-argument synthesis as an approach to meta-ethnography before introducing the dimensional analysis method of grounded theory. A review of line-by-line coding and grounded theory in qualitative metasynthesis will then be followed by a description and rationale of dimensional analysis for qualitative metasynthesis.

The logic of lines-of-argument synthesis

Noblit and Hare (1988; Thorne et al., 2004) developed lines-of-argument synthesis for the meta-ethnography of heterogeneous studies each representing part of a larger social process. The lines-of-argument synthesis involves two steps: first, a reciprocal translation of studies; and second, a rearrangement of emergent third-order constructs into a statement about the larger phenomenon to which each included study speaks (Noblit and Hare, 1988). The end product of a lines-of-argument synthesis is a statement about ‘what is hidden’ in each study, in which the constructs expressed across reports go beyond reciprocal translation to take on ‘new meaning(s)’ (Noblit & Hare, 1988, pp. 74–75).

Though Noblit and Hare’s (1988) work was methodologically scant, they offer two methodological clues to assist in developing a lines-of-argument synthesis. Specifically, Noblit and Hare (1988) first point to Clifford Geertz’s (1973) discussion of ‘clinical inference’—a process of integrating and locating metaphors and their interconnections in a larger context. They then point to ‘constant comparison’ as a method of elaborating differences and similarities between primary studies to develop an ‘integrating scheme’ (Glaser & Strauss, 1967, p. 41; Noblit & Hare, 1988, p. 63).

Before proceeding, a clear explanation as to what ‘theory’ is will be helpful. The definition used here comes from Alasuutari (1996), who describes theory as offering an ‘interpretive frame’ by which to interrogate and understand a phenomenon. In this view, a theory is one of multiple understandings potentially arising from investigation of a phenomenon. It is tentative, situational, and located in a specific social context. A theory is judged not by whether it provides the one right answer, but whether it ‘fits’ what has been observed and described about the phenomenon. This definition of theory is particularly well suited to this task, as it matches the perspective on thick description and cultural interpretation asserted by Geertz (1973) in the discussion of clinical inference reflected by Noblit and Hare (1988). The goal is not prediction of outcomes, but interpretation of how different parts of the phenomenon under investigation relate to each other—to ‘generalise within cases’ and ‘interpret the matters at hand’ (Geertz, 1973, pp. 26–27).

Challenges of the constant comparative metaphor. The grounded theory-based ‘constant comparison’ metaphor that Noblit and Hare (1988) introduce for the development of a lines-of-argument synthesis is not perfect or immediately generalizable. Meta-ethnography was originally developed to address the integration and reinterpretation of ethnographies. Ethnography concerns itself with describing a specific community, operational unit, or site—it is frequently an in-depth case study of one specific entity, or a ‘case’ (J. Green & Thorogood, 2009; Schatzman & Strauss, 1973), a set of ‘thick descriptions’ about culture and behaviour (Geertz, 1973). In fact, the qualitative reports that motivated the development of meta-ethnography were ethnographies of individual state schools (Noblit & Hare, 1988). This suggests that the constant comparative method Noblit and Hare propose should be scrutinised for its applicability to non-ethnographic qualitative research.

Specifically, if an ethnography studies a case (i.e., $n=1$), then ‘constant comparison’ can be used to develop grounded theory from several ethnographies, or cases. This is analogous in the same way that a primary qualitative study would use the constant comparative approach across several ‘cases’, where the cases are individual persons’ accounts (Corbin & Strauss, 2008). Indeed, most primary, non-ethnographic qualitative research studies multiple individuals, or ‘cases’, with the result being a synthesis of these cases (Bowling, 2009).

So, when non-ethnographic, account-based qualitative studies are included in metasyntheses, a ‘unit-of-analysis’ issue arises—how does the metasynthesist compare both reports of specific cases, and reports of multiple cases? More generally, can the use of the constant comparative approach between major themes expressed in studies achieve maximum depth when reports are themselves abstractions of multiple cases? Because account-based reports of qualitative research are often collections of multiple cases across which themes have been identified, the metasynthesist will need to rethink how the constant comparative approach in lines-of-argument synthesis addresses both the first-order constructs expressed by participants and the second-order constructs expressed by the social scientists in interpreting the participants’ accounts.

Lessons from the constant comparative approach. While Noblit and Hare (1988) cited the constant comparative approach outlined by Glaser and Strauss (1967), the evolution of this method into Straussian grounded theory (Corbin & Strauss, 2008; Strauss & Corbin, 1990, 1998) offers useful lessons for the practice of qualitative metasynthesis. First, Corbin and Strauss (2008) outline a method of grounded theory analysis focused not on participants’ accounts at face, but on underlying social processes. Analogously, a lines-of-argument synthesis should lie

closer to the interpretive end of the interpretive-aggregative continuum by examining underlying constructs, rather than clustering similar-sounding themes.

Second, the qualitative metasynthesis should be rigorously conducted and oriented towards the development of hypotheses from the data, the deductive examination of these hypotheses through a search for disconfirming data, and the inductive elaboration of these hypotheses grounded in the data (Corbin & Strauss, 2008; Heath & Cowley, 2004).

Third, as in a primary grounded theory analysis (and, in fact, systematic reviews generally), qualitative metasynthesis should have an auditable methodological trail (Higgins & Green, 2011; Pope et al., 2000). Specifically, grounded theory analysis requires the recording of ‘memos’ throughout research to aid in remembering analytical steps, processes, and decisions (Charmaz, 2006).

Grounded theory and line-by-line coding approaches to qualitative metasynthesis

Grounded theory approaches to qualitative metasynthesis are not new. The most commonly cited methodological exemplars of this approach (see, among others, Barnett-Page & Thomas, 2009) are those of Finfgeld (Finfgeld, 1999, 2003; Finfgeld-Connett et al., 2012), Kearney (Kearney, 1998, 2001; Thorne et al., 2004), and Eaves (2001). However, while Eaves (2001) titles her article ‘A synthesis technique for grounded theory data analysis’, a closer examination reveals that this presents not a technique for qualitative metasynthesis, but a synthesis of several methods for developing grounded theory. Yet it remains frequently cited by metasynthesists as a grounded theory method for the metasynthesis of qualitative data! Moreover, Kearney’s (1998, 2001) method for developing ‘grounded formal theory’ from qualitative research reports focuses on integrating results from other

grounded theory reports, and has not been described for use of the combination of studies from across qualitative epistemologies.

Thus, this discussion focuses on the work of Finfgeld (Finfgeld, 1999; Finfgeld-Connett et al., 2012), who demonstrates an approach to the lines-of-argument synthesis by the application of a Straussian grounded theory method (Corbin & Strauss, 2008; Strauss & Corbin, 1998). Finfgeld (1999) describes a process of ‘meta-interpretation’ which involves dividing the text of reports’ findings into chunks then coded through processes that could be described as open and axial coding, with the process recorded via memos and categories developed as suggested by Strauss and Corbin (1998). Because Finfgeld does not report her methodological decisions, it is difficult to understand the nuances of how she adapted the primary grounded theory method. Finfgeld (Finfgeld-Connett et al., 2012) varies her own method in a recent metasynthesis by excluding participants’ quotes in primary study reports. Indeed, the presentation of the results of her metasynthesis does not contain any participant quotes from primary studies.

This stands in contrast to the line-by-line coding method termed ‘thematic synthesis’ (Thomas & Harden, 2008), first introduced in Chapter 2. The thematic synthesis method describes an analytic procedure that helps to clarify confusion about how to conduct reciprocal translations. Closely mapped to Noblit and Hare’s (1988) work and inspired by a thematic analysis approach to primary qualitative data analysis, Thomas and Harden describe their method as ‘thematic synthesis’. After formulating an appropriate question and conducting a systematic review-type search and retrieval, the metasynthesists critically appraise studies. Sections labelled ‘results’ or ‘findings’ are then copied into a qualitative research programme, where the text is coded line-by-line. Codes are extracted into ‘descriptive’ themes across

studies, and then ‘analytical’ themes across descriptive themes (Thomas & Harden, 2008). Analytic codes can be understood in terms of the lines-of-argument synthesis, in that analytic codes form an argument about the phenomenon studied (Thomas & Harden, 2008)—that is, as in grounded theory, a hypothesis to be tested (Charmaz, 2006). Codes are continuously elaborated and compared for increased detail and clarity.

An example of thematic synthesis is its use in guiding a systematic review of interventions for increasing uptake of healthy foods in elementary schools (Thomas, Harden, Oakley, Oliver, & Sutcliffe, 2004). Following a thematic synthesis of relevant reports, Thomas and colleagues (2004) found that children viewed healthy foods with less suspicion when advertised as tasty rather than healthy. A meta-analysis comparing programmes emphasising the tastiness of healthy foods against programmes emphasising foods’ healthiness bore out this qualitative finding (Thomas et al., 2004).

However, this method has its limitations. First, Thomas and Harden (2008) acknowledge that while descriptive codes accomplish the reciprocal translation by capturing the nuances and variations in the same code across themes within and between studies, analytical codes were, as originally described, intended to inform quantitative systematic reviews, instead of standing alone as third-order constructs. While analytic codes could possibly stand on their own as third-order constructs, thematic synthesis has not been adequately elaborated as a method for theory generation. By corollary, the approach Thomas and Harden (2008) describe is underspecified in its epistemological and philosophical underpinnings. While this is consistent with a pragmatic approach, it suggests that their method could leave on the table a good deal of potential insight into the phenomenon at hand. Finally, Thomas

and Harden (2008) do not describe a way to generate starting codes grounded in the data in the way that a grounded theory method would suggest going about open coding, stating only that reviewers assigned codes to data ‘to capture the meaning and content’ of each line and that additional codes were added as the analysis progressed. How did they generate a starting code bank? What data were used to generate initial codes and how were these data chosen?

On the other hand, the advantages of Thomas and Harden’s (2008) methods reveal a latent, though substantially unacknowledged, influence from grounded theory. First, the continuous elaboration of codes through constant comparison of data from current studies should be familiar to grounded theorists. Second, Thomas and Harden (2008) note that the members of their review team verified descriptive and analytic codes from the data—an example of the sort of verification that characterises the development of codes in grounded theory. Third, the methodological auditability of their process through the development of codes and the conferencing of review team members emphasises rigour and leaves a process trail. Finally, their use of line-by-line coding probes reports for deeper meaning beyond the thematic level—an essential advantage when metasynthesising studies that are already summaries and abstractions of multiple cases.

An introduction to dimensional analysis

The goal of this qualitative metasynthesis is to generate theory to account for the phenomenon of substance use by MSM in social spaces. To accomplish theory-building from metasynthesis, the method used should present a coherent approach to theory-building that is rigorous and auditable, and that makes use of all the data in order to produce a metasynthesis with optimal conceptual power and fit to the data. Moreover, the metasynthetic method should be explicit as to the roles of the

emergent parts of the theory in explaining the subject of investigation. Dimensional analysis, a grounded theory variant, provides a starting point by which to integrate the benefits of both thematic synthesis and Finfgeld's grounded theory method and to ground methodological decision-making around questions of participant data and combining different research epistemologies.

First formally described by Schatzman (1991), dimensional analysis represents a variant of grounded theory that first grew out of the close collaboration of Schatzman with Strauss in the early days of grounded theory (Kools et al., 1996). As Kools and colleagues (1996) note, Schatzman published infrequently on methods. Thus, the only two methods texts describing dimensional analysis are Schatzman's 1991 publication and Kools and colleagues' 1996 paper elaborating the formalities, processes, and epistemological basis for Schatzman's work. Nevertheless, dimensional analysis for the generation of grounded theory is a potent, relevant method for qualitative metasynthesis.

Dimensional analysis shares the key hallmarks of grounded theory analysis. In addition to theoretical sampling and the termination of data collection once theoretical saturation has been reached, Annells (1997a, 1997b) emphasises that the essentials of Straussian grounded theory analysis are a constant comparative approach to data collection and analysis, the writing of memos to track the analytic process, the elaboration of a theory via the grounding of the developing theory in the data, and the development of a core category to name the central theme of the grounded theory. Dimensional analysis shares all of these properties, albeit with different nomenclature (Kools et al., 1996).

The most fundamental difference between dimensional analysis and Straussian grounded theory analysis is that dimensional analysis seeks not to uncover

the basic social process (Corbin & Strauss, 2008), but rather to uncover the complexity of the entire phenomenon (Kools et al., 1996). As Schatzman (1991) observes, the question is not what the basic social process is, but rather ‘what *all* is going on here?’ Kools and colleagues (1996) posit that this question better reflects the symbolic interactionist underpinnings of grounded theory by rejecting a fixation with basic social process, in favour of opening up the realms of interaction and engagement with the phenomenon. Second, Schatzman (1991) posits his analytic method as being an ‘exaggerated’ form of the ways in which humans process the world through sense-making, interpretation, and story-telling. As Kools and colleagues (1996) observe, researchers interact with data like persons making sense of different situations—not by asking what the social process is, but by attempting to understand the different dimensions and parts of the phenomenon under examination. In this way, asking ‘what *all* is going on here?’ leads to a more natural form of analysis, as Schatzman (1991) believed. This increases the sensitivity of the analysis to experiences and abstractions that mirror what those in the situation might understand. Together, these two differences orient grounded theory analysis in social constructivism, in which the phenomenon under investigation is understood in terms of how those experiencing this phenomenon construct it (Charmaz, 2006).

Operationally, dimensional analysis diverges from Straussian grounded theory analysis. Dimensional analysis focuses on ‘dimensionalisation’ and ‘designation’, in which different ‘dimensions’ in the data are named and their properties elaborated (Kools et al., 1996). In the same way that dimensionalisation is analogous to open coding and designation is analogous to axial coding (Schatzman, 1991), dimensions are similar to what Corbin and Strauss (2008) call categories. Dimensionalisation and designation, like open and axial coding, proceed

simultaneously on the data (Kools et al., 1996). However, decisions about the relative importance or role of each dimension are delayed until late in the process, when ‘differentiation’ occurs. In differentiation, dimensions are assigned to the positions of either context for the phenomenon, the conditions necessary for the phenomenon to arise, the process occurring in the phenomenon, and the consequences of the phenomenon (Kools et al., 1996; Schatzman, 1991).

Differentiation clarifies the analysis and the resultant theory. One dimension is assigned to the position of the perspective, which is the dimension with the most ‘significant explanatory power’—the dimension through which the other parts of the theory are viewed, and that unifies the analysis (Kools et al., 1996). Schatzman (1991) calls the perspective the dimension that ‘choreographs’ the data. The process of placing the differentiated dimensions back together into the central explanatory matrix is called ‘reintegration’ (Kools et al., 1996).

A dimensional analysis approach to lines-of-argument synthesis

This is the first elaboration of dimensional analysis as an approach to the metasynthesis of qualitative data. This elaboration is based on the constant comparative approach as applied to meta-ethnography (Glaser & Strauss, 1967; Noblit & Hare, 1988), the specifics of dimensional analysis (Schatzman, 1991), and the line-by-line coding approaches outlined by Finfgeld (Finfgeld, 1999; Finfgeld-Connett et al., 2012) and Thomas and Harden (2008). It is the first explicitly elaborated metasynthetic method that attends specifically to theory-building while addressing the challenge of generalising the method across various qualitative approaches.

Application of dimensional analysis. This discussion of application takes as given that qualitative reports have been systematically searched, retrieved,

appraised, and assessed for inclusion, as in most systematic reviews of qualitative research (Dixon-Woods et al., 2007; Hannes & Macaitis, 2012; Hawker, Payne, Kerr, Hardey, & Powell, 2002; Popay, Rogers, & Williams, 1998). Several papers selected both for high quality as captured in appraisal, and for diversity in qualitative method, setting of the phenomenon, and characteristics of respondents of data, are sampled for the development of the initial dimensionalisation scheme.

The findings sections of these initial papers, which form the data, are first closely examined at the sentence or phrase level to develop an initial list of working dimensions and properties. All data are then dimensionalised and designated, with each study constantly compared against others. Thus, as each study is folded into the synthesis, the list of dimensions and designations grows and is elaborated. Data are dimensionalised and designated at the level of the sentence, phrase, or meaningful section of text. As the metasynthesis approaches theoretical saturation, the dimensions and their properties are differentiated and arranged into the explanatory matrix according to the roles that they play, with each dimension ‘rehearsed’ for the position of perspective (Schatzman, 1991). The dimensions are then reintegrated in the final qualitative metasynthesis.

The emergent grounded theory is then verified by asking several questions (Corbin & Strauss, 2008). Does the theory fit the data? Are the dimensions in the data fully saturated? Do the dimensions relate to each other? And is the theory ‘parsimonious’ (Glaser & Strauss, 1967)? Finally, consistent with Noblit and Hare’s (1988) final step of meta-ethnography, the dimensional analysis is written. Throughout, the process is recorded in memos (Corbin & Strauss, 2008).

Totality of data. Unlike Finfgeld’s method (Finfgeld-Connett et al., 2012) but in keeping with Thomas and Harden (2008), this approach specifically calls for

the coding of participant quotes and researcher interpretations of participant quotes. As Dixon-Woods and colleagues (2006) point out, a lines-of-argument synthesis integrates first-order constructs and second-order constructs into third-order constructs, in effect blurring the boundaries between each 'level' of construct. To this end, they call the third-order constructs used in the final synthesis 'synthetic constructs' to better emphasise their role. This represents what Dixon-Woods and colleagues call an 'extension' of the work of Schutz (1962), who hypothesised that first-order, second-order, and third-order constructs are interlocked by the 'postulate of adequacy', or the consistency of the second-order construct with the first-order construct, and the third-order with the second.

The dimensional analysis method outlined here does not carry through Dixon-Woods and colleagues' (2006) argument to the conclusion to which they arrive, which is that the lines-of-argument synthesis can be composed of constructs from each level. Indeed, from a grounded theory perspective, the conclusion Dixon-Woods and colleagues reach is problematic. The use of first-order and second-order constructs in the final lines-of-argument synthesis that have not also been identified as third-order constructs invites the use of dimensions that have not been theoretically saturated, and concepts that do not have generalizability over the entire data set. In order for a first order construct to appear in the final synthesis as a building block of the grounded theory, it must 'appear' as a dimension emergent from the dimensional analysis of the included studies.

Instead, this discussion assesses Dixon-Woods and colleagues' (2006) argument through dimensionalisation of the data. Much in the same way that the difference between aggregation and interpretation is a continuum, so is the difference between the levels of construct. Despite the many admonitions in grounded theory

against doing a literature review prior to analysis or importing external theoretical concepts, researchers do bring in their own conceptions and theoretical frameworks (Robrecht, 1995; H. Wilson & Hutchinson, 1996)—in effect, their own preconceived third-order constructs. Similarly, qualitative researchers may use the particularly poignant words of a participant to frame the theme for analysis, thus blurring the hypothetical divide between first-order and second-order.

This interpretation of dimensional analysis extends Schutz's (1962) hypothesis consistent with the idea of structure and structuration (Giddens, 1984)—that is, people create the structures in which they live, which in turn impact the people that live in them. When the notion of first-order, second-order and third-order constructs is read through a symbolic interactionist lens, in which meaning is interactively constructed and interpreted by subjects in a wider world, it becomes clear that first-order, second-order and third-order constructs dynamically inform each other at every level. This occurs as subjects' experiences inform the higher-order constructs that then reciprocally structure the individual's observations. This occurs at the level of the participant, the social scientist, and the metasynthesist. Part of interrogating 'what *all* is going on here', as in dimensional analysis, is to examine how these orders inform each other. Asking 'what *all* is going on here' includes not only the representation and interpretation of the subject by researchers, but also how individual participants present the subject through their own words, and how those presentations are drawn on by researchers.

Three more pragmatic arguments, beyond dimensional analysis, are offered here for the use of participant quotes from the start of the analysis. First, as discussed earlier, Noblit and Hare's (1988) constant comparative metaphor for meta-ethnography generalises to non-ethnographic qualitative reports with difficulty

because of the ‘unit of analysis’ issue. Using participant quotes allows for a richer, more nuanced analysis by engaging the maximum amount of data closest to the individual ‘case’. Second, participant quotes provide opportunities for the development of ‘in vivo’ codes, or codes directly informed by the schema that participants use to organise their experiences (Corbin & Strauss, 2008). Finally, given the dynamic interplay of the levels of construct posited above, the use of participant quotes allows the metasynthesist to develop a grounded theory that fits the data at every level, conditional on appropriate, representative use of participant data by the primary researchers.

Differences in included studies’ epistemologies and questions. By nature of the question ‘what *all* is going on here?’, dimensional analysis invites the use of differences in epistemologies and approaches as part of the final analysis. This ‘critical’ approach to included studies is invited by both different accounts of the subject under investigation, and different representations of those accounts along lines of epistemology and approach. In the original dimensional analysis formulation, dimensions taking the role of ‘context’ describe the contours of the situation under analysis that give rise to understandings of the situation (Kools et al., 1996; Schatzman, 1991). As demonstrated in the metasynthesis below (see, for example, the section on ‘relating worlds’ in the qualitative metasynthesis), this idea of dimensions of ‘context’ can be used to help formulate how the research ‘contexts’, such as epistemology and approach, give rise to different understandings of the subject.

More generally, the suggestion that ‘dissimilar but related studies’ (Noblit & Hare, 1988, p. 64) form the basis of the lines-of-argument synthesis points to the possibility of including different approaches and orientations. Much like a primary

grounded theory study uses theoretical sampling to derive a wide variety of experiences and perspectives, so too is a lines-of-argument synthesis strengthened by a diversity of approaches and views. (Social constructionists might disagree, preferring instead to let each study stand as its own understanding, but this level of epistemological discourse is beyond the scope of this discussion.) However, Finfgeld (2003) cautions that findings should be ‘sensitivity analysed’ for differences in methodological assumptions between studies. It is also possible that extremely different epistemologies might not be reconcilable in a final analysis. The idea of ‘dissimilar but related studies’ also suggests that not all studies included need to completely address the question guiding the qualitative metasynthesis, but that the primary studies can answer the question only as a part of their findings. Certainly, to avoid data overload, a minimum inclusion criterion will need to be set.

A closer elaboration of the lines-of-argument synthesis

The dimensional analysis approach has several characteristics that contribute to developing a more fully actualised lines-of-argument synthesis. First, dimensional analysis offers a coherent, explicit approach to theory-building in which the roles of the different parts of the theory are clear. The dimensional analysis approach lends explicit structure to the final lines-of-argument synthesis and its interpretation. This approach also offers benefits over traditional grounded theory methods. Noblit and Hare (1988, p. 74) state that the outcome of a lines-of-argument synthesis is an ‘interpretation’. Unlike the ‘core category’ in grounded theory that names the theme of the data, the examination of different dimensions and the final selection of one for the perspective position explicitly names a central organising dimension through which all other aspects of the phenomenon are observed and interpreted. ‘Perspective-choosing’ and differentiation are themselves important acts of

interpretation. The same perspective-choosing process means that the grounded theory developing from the dimensional analysis lends itself to more rigorous verification.

Second, the orienting question of dimensional analysis—‘what *all* is going on here?’ (Schatzman, 1991)—is better suited to a wider range of questions than the narrower grounded theory method Finfgeld proposes. As Geertz (1973) observes, thick description of a situation requires attending to all manner of cultural, behavioural and contextual signifiers and signified. Thus, a broader perspective is key. Dimensional analysis extends the purview of the analysis beyond the narrower province of the basic social process. This is of particular help when, as in the current qualitative metasynthesis, examining the role of place in a behaviour—a question in which social process is important, but not necessarily the analytic focus. In this metasynthesis, for example, it was not immediately clear how space might factor into a social process. At the same time, it was clear that individuals’ relations to space would likely form an important part of the final analysis. Querying the role of space arose naturally out of the dimensionalisation and designation processes.

Third, and by corollary, the asking of the question ‘what *all* is going on here?’ also helps in providing coherent answers to methodological questions that arise in metasyntheses that Thomas and Harden (2008) avoid and Finfgeld (2012) answers with no methodological justification. When constructs are viewed as dynamically informing each other, the role of the dimensional analysis also becomes to sort through how these constructs inform each other. This suggests that participant quotes should be used, and also that different epistemologies and approaches should be accommodated as part of the final analysis itself.

Fourth, this approach builds on the line-by-line coding in the thematic synthesis method (Thomas & Harden, 2008) in accomplishing a rigorous reciprocal translation. It also avoids premature closure by constant comparison, focusing on close reading of the data, and incorporating all data. Premature closure is the ‘underanalysis’ of data by sticking to what participants said instead of moving to what participants’ accounts signified, or the latent constructs that comprise the grounded theory (Eaves, 2001; H. Wilson & Hutchinson, 1996). This specific dimensional analysis method offers an advantage over Thomas and Harden’s (2008) description in two ways: first, it presents a starting point for ‘open coding’ by the close reading of small sections of data, and second, it elaborates an approach to line-by-line coding for theory-building.

Conclusion

A lines-of-argument synthesis that incorporates dimensional analysis as the analytic method is an appropriate, rigorous and epistemologically well-founded approach that extends both the original work of Noblit and Hare (1988) and the work on metasynthetic methods of Thomas and Harden (2008) and Finfgeld (Finfgeld, 2003; Finfgeld-Connett, 2010). Dimensional analysis offers several advantages for the interpretability of the resultant grounded theory, including a methodological basis for addressing key debates in qualitative metasynthetic methods.

SECTION 2. Systematic review and qualitative metasynthesis of MSM, substance use and social venues

Chapter 5. Qualitative metasynthesis methods

Because systematic review registers do not accept protocols for systematic reviews of qualitative research, this review protocol was unregistered. However, the review team conferenced and agreed on several key dimensions of this review *a priori*, and in all cases, an auditable methodological trail was kept.

Criteria for considering studies for this review

First, studies included in this review were limited to those reporting qualitative data. Mixed-methods studies and studies reporting qualitative data incidental to quantitative findings—for example, in a process evaluation of an intervention—were considered.

Second, studies included in this review were limited to those reporting data from MSM, either as the sole focus of the article or when analysed separately. This was done to privilege the perspectives of MSM, especially since an objective of this review was to understand the social and cultural contexts of substance use by MSM.

Third, the findings of the studies included in this review needed to explicitly triangulate substance use, the experiences of MSM, and venues in which MSM meet socially—for example, gay circuit parties, bathhouses, or dance clubs, or any combination thereof. That is to say, the study's findings needed to include discussion of how the substance use of MSM relates to a specific setting or venue, or class of venues.

It seemed clear, *a priori*, that this could occur in one of three ways: first, in a study examining substance use by MSM in the context of a specific venue or class of venues; second, in a study examining substance use by MSM, and including specific content relating to substance use in a specific venue or class of venues; or third, in a study of a specific venue or class of venues and MSM, in which specific content

about substance use is included. However, this criterion was challenging to apply. Another way to understand this last inclusion criterion would be to re-word it as an exclusion criterion—that is, we would exclude studies exploring the relationship of substance use by MSM only to their general social networks. Because of this review’s specific focus on the relation of substance use to venues in which MSM meet socially, understanding social networks and sociality generally was believed to be important, but not sufficient, to understanding the phenomenon of interest.

Finally, studies were excluded if they discussed only nicotine use or anabolic steroid use, or injection drug use not in the context of a ‘gay venue’. Anabolic steroid use is rarely a ‘public’ phenomenon, and injection drug use has a different set of social and cultural contexts among MSM than other substance use, including different venues, social networks, and norms—specifically, substance use networks are often not composed of other MSM (Dowsett, Wain, & Keys, 2005; Ireland et al., 1999; Southgate & Hopwood, 1999b, 2001).

Inclusion and exclusion criteria did not specify an epistemology or method of analysis, in keeping with the dimensional analysis method outlined above. However, analytic approach was flagged for sensitivity analysis of findings.

Search methods for study identification

Consistent with current methodological practice, a comprehensive, systematic search strategy was used to uncover published and unpublished reports of qualitative research relating to substance use by MSM. This task was more challenging than searching for reports of randomised controlled trials in an intervention systematic review because of the diversity of qualitative research and the lack of a trial register or catalogue (Thomas & Harden, 2008).

Searching focused on articles published in scholarly journals and dissertations, with books and grey literature identified incidentally. This decision was made in response to the veritable difficulty in systematically searching books and grey literature, again in the absence of trial registers.

Searches were conducted on 28 October 2012 on Ovid MEDLINE and MEDLINE In-Process & Other Non-Indexed Citations, Embase, PsycINFO, ISI Web of Science (including Science Citation Index, Social Sciences Citation Index, Arts & Humanities Citation Index, Conference Proceedings Citation Index—Science, Conference Proceedings Citation Index—Social Science & Humanities), Cumulative Index to the Nursing and Allied Health Literature (CINAHL), ERIC, Sociological Abstracts, Applied Social Sciences Index and Abstracts (ASSIA), ProQuest Dissertations and Theses A&I and JSTOR.

The search string used for MEDLINE, Embase, and PsycINFO was as follows:

1. gay OR bisexual OR homosexual OR queer OR LGBT* OR men who have sex with men OR MSM OR exp homosexuality/ OR exp homosexuality, male/ OR exp bisexuality/ OR exp transsexualism/ OR exp transvestism/
2. drug* OR substance* OR alcohol* OR marijuan* OR cannab* OR marihuan* OR hashish* OR cocaine* OR crack* OR GHB OR *hydroxybutyric OR crystal* OR n-methyl-3-4-methylenedioxyamphetamine OR ketamine OR MDMA* OR meth* OR alkyl nitrites OR poppers OR ecstasy OR heroin* OR lsd* OR lysergic acid diethylamide* OR opiat* OR opioid* OR narcot* OR illicit drug* OR recreational drug* OR club drug* OR party drug* OR sniff* OR exp substance-related disorders/ OR exp

- alcohol-related disorders/ OR exp street drugs/ OR exp prescription drugs/
OR exp designer drugs/ OR exp marijuana smoking/
3. public* OR social* OR circuit part* OR White Party OR Black Blue Party
OR Winter Party OR dance club* OR rave* OR cruis* lounge* OR gay bar*
OR sauna* OR bath house* OR bathhouse* OR tea room* OR tea part* OR
tea dance* OR cruis* OR cottag* OR sex club* OR glory hole* OR glory-
hole* OR backroom* OR back room* OR sex on premises* OR sex-on-
premises* OR commercial sex venue* OR marathon OR (group adj2 sex)
 4. qualitative* OR focus group* OR focus-group* OR interview* OR grounded
theor* OR thematic analys* OR framework analys* OR hermeneutic* OR
grounded-theor* OR phenomeno* OR ethnograph* OR interpretiv* OR
interpretativ* OR realis* OR (theoretical* adj sampl*) OR constructiv* OR
field research OR field-research OR exp qualitative research/ OR exp
ethnography/OR exp ethnopsychology/ OR exp anthropology, cultural/ OR
exp sociology/ OR exp sociology, medical/
 5. 1 AND 2 AND 3 AND 4

All other search strings, with number of hits by string, can be found in Appendix 1. Search strings are based on those taken from a systematic review on risk reduction interventions for substance-using MSM (Melendez-Torres & Bonell, 2013), developed using expert consultation (K. Underhill, personal communication, 21 September 2012) and information from a prior review of risk HIV reduction interventions generally for MSM (Johnson et al., 2008). The current search string includes a set of terms specifying the population, a set of terms including substance use, a set of terms indicating possible venues or social settings for substance use, and a set of terms to flag concepts associated with qualitative research designs and

related epistemologies. Several changes were made to the search strategies for JSTOR and Dissertations and Theses A&I to improve specificity, since both use full-text searching instead of subject heading and abstract searching. For JSTOR, the search strategy was modified to specify that the population terms had to be found in the title of the article. For Dissertations and Theses A&I, the search strategy was modified to specify that the search terms were found in the abstracts of indexed dissertations.

Based on the journals in which included studies were published, three journals were hand-searched from the first online issue to November 2012, including pre-publication articles. These journals were *Culture, Health, & Sexuality*, *Journal of Homosexuality*, and *Journal of Drug Issues*. Reference lists of included studies were reviewed for sources, including books and grey literature. Moreover, five authors were emailed for any potentially missed studies. A list of those contacted is available in Appendix 2.

Study selection and data extraction

Abstracts generated from database searches were exported to Mendeley (Mendeley Ltd & Glyph & Cog LLC, 2014) and deduplicated. Titles and abstracts of studies were screened for eligibility by the first reviewer to include studies reporting both qualitative data relating to substance use by MSM and referring to venues in which MSM meet socially.

Subsequently, the first reviewer accessed full-text articles to assess studies for inclusion, with audits by the second reviewer. Because the third inclusion criterion was difficult to apply, studies were ultimately included if they identified at least one specific finding, or second-order construct, that met the third criterion. Several studies also did not explicitly identify in their study aims or hypotheses that

they sought to examine a class of venues, though they referred to venues in which MSM meet socially in their findings. These studies were included as well.

A data extraction form previously piloted on a subset of included studies was used to collect relevant study-level information and to critically appraise included studies. Critical appraisal was based on the EPPI-Centre tool for appraising qualitative research for systematic reviews (Thomas & Harden, 2008). Studies were not excluded based on quality, but flagged for sensitivity analysis. Study-level characteristics collected included:

- study aims, research questions, and hypotheses;
- methods used to collect and analyse data;
- sample selection methods;
- theoretical groundings, rationales, and frameworks for analysis;
- geographical location and timeline for data collection;
- culturally bounded places discussed in the study;
- substance use patterns examined;
- specific subpopulations of MSM targeted;
- critical appraisal indices;
- study sections to be extracted for coding; and
- appropriateness for consideration as an index paper.

The full data extraction and critical appraisal form is available in Appendix 3.

One issue encountered early in data extraction was that many of the studies were multiple reports stemming from the same project. In order to present a coherent critical appraisal of both the research done and the research reported, studies arising from the same project (e.g. a dissertation then published as multiple articles) were critically appraised both together and separately, to ensure that specific

reporting issues varying by publication were highlighted against the quality of the research itself.

Finally, data, or the sections labelled ‘findings’ or ‘results’ in each study, were extracted into Text Analysis Markup System Analyzer (Weinstein, 2012) for analysis. However, one key issue came in the multiple reporting of results from the same study, particularly in the case of publications arising from a dissertation. The themes and content in the publications stemming from the original publication were thus compared against the themes and content discussed in the ‘master’ publication. When themes and content were judged to be similar in breadth and depth, the content contained in the smaller, subsequent publications were prioritised for coding with themes and sections not contained in these publications then coded in the original publication.

This was done for several reasons. First, treating each publication from a research project as a separate account would ‘over-privilege’ those findings by coding the same information multiple times. Second, dividing what were frequently large amounts of data into smaller chunks facilitates sensitivity analysis by checking not only if a specific account dominates a certain class of codes, but also which aspects of that account dominate those codes. Third, while it would be methodologically defensible to divide the original publication into several parts and code those as distinct accounts, it is more defensible to follow the decisions regarding ‘data splitting’ the original researchers made.

Analysis

Several studies appraised as demonstrating medium or high relevance and medium or high trustworthiness were purposively sampled for open coding based on geographic diversity of population, diversity of drug use studied, and variety in

qualitative analysis method. Two reviewers, working independently, generated an initial list of detailed codes. These lists were then checked for compatibility and merged to form a provisional coding scheme.

The first reviewer, working independently, analysed the data as described initially in Chapter 4, with dimensionalisation, designation, and—later—differentiation occurring simultaneously. The results sections of each study were analysed line-by-line, with attention to the emerging dimensions and their properties. Codes became concepts, which became properties and dimensions, with concepts shifting back and forth between roles as the analysis developed. Properties in the explanatory matrix represent emergent reciprocal translations between studies. Each property is part of a dimension, which represents the latent third-order construct that explains its properties. Put otherwise, dimensions are the ways in which properties are connected to the overarching, theoretically saturated building blocks of the grounded theory.

Studies were analysed in an order determined by several criteria: first, studies that were used in the initial generation of the coding scheme by the primary analyst were not recoded until late in the process; second, studies arising from the same project were coded in groups to avoid overlap; third, every effort was made to avoid coding in consecutive order studies that were ‘similar’—that is, addressing similar geographic regions or venues, or using similar qualitative methods. This was done in order to remain sensitised to both differences and commonalities in the data (Glaser & Strauss, 1967).

Towards the conclusion of the analysis, emerging dimensions were ‘sensitivity analysed’ to test whether sources appraised as having low trustworthiness were substantially responsible for the development of any dimensions or properties

of those dimensions (Finfgeld-Connett, 2010; Sandelowski & Barroso, 2007). The grounded theory was verified against the data for rigour and explanatory power. The emergent dimensions were then reintegrated.

Analytic memos were kept throughout, and at several points in the process, the reviewers had several ‘expert checks’ in which the data analysis was reviewed and discussed. Data were coded until all sources were analysed, though the reviewers remained aware of possible theoretical saturation (i.e. when sources might have stopped contributing new insights).

Chapter 6. Results of the qualitative metasynthesis

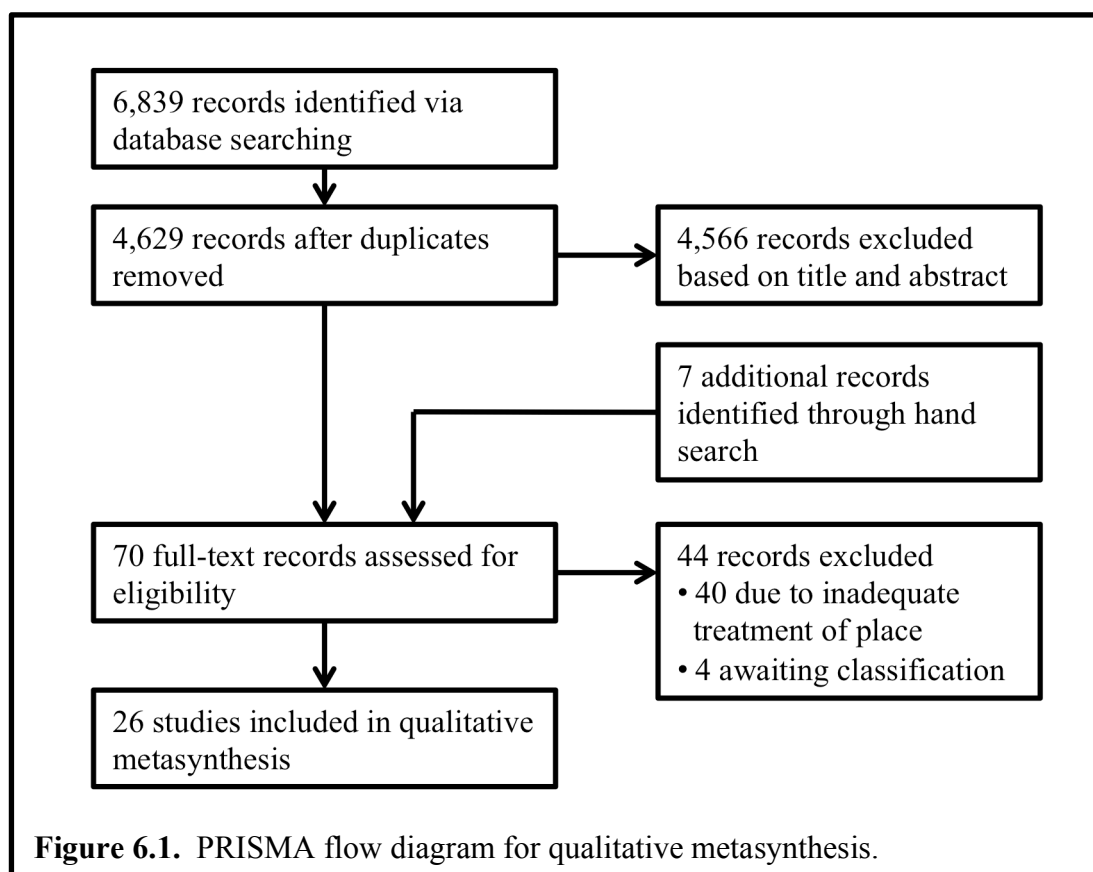
After de-duplication, 4,629 titles and abstracts were identified. Initial screening of titles and abstracts led to exclusion of 4,566 records, with 63 records remaining. For each of the 63 records, multiple attempts were made to access full-text articles. Articles were read and re-read, leading to a final inclusion set of 19 records identified. See Figure 6.1 for a PRISMA flow diagram.

Reviewing the bibliographies of the 19 included records led to identification of seven additional records. Of these seven records, two were books associated respectively with a dissertation (Weems, 2007) and an article (Lewis & Ross, 1995) in the inclusion set. Two records (G. Brown, Lau, Murray, & Lyons, 2000; Husbands et al., 2004) were grey literature reports related to an article (Greenspan et al., 2011) in the inclusion set. The remaining three references included two grey literature reports (Ireland et al., 1999; Southgate & Hopwood, 1999b) and one journal article (Southgate & Hopwood, 1999a). Hand searching of journals and contact with authors yielded no new records.

In total, 26 reports encompassing 18 projects were identified, with four projects that awaiting classification.

Studies awaiting classification and excluded studies

Despite our best efforts to secure full-text articles, we were unable to locate one journal article and three dissertations. The journal article in question examined the social use of alkyl nitrites by several groups, including gay men (French & Power, 1998). When contacted, neither author had a copy of the article, nor was the article available via interlibrary loan. The three dissertations had authors that were not contactable. The material in one dissertation (Lewis, 1994) was reflected in one of the journal articles (Lewis & Ross, 1995) in the inclusion set. The other two



dissertations of interest included a study of gay men’s crystal methamphetamine use (Usndek, 2004) and a study of gay men’s risky sexual behaviours (Brown III, 2003).

Because the inclusion and exclusion process in a systematic review of qualitative research involves different degrees of ‘belongingness’ of studies (Sandelowski et al., 1997; Thomas & Harden, 2008), it is difficult to tabulate excluded studies in a way that is comprehensive and appropriate without discussing all studies for which full-text articles were accessed. Almost all of the 44 excluded records for which full-text articles were sought lacked a concrete and substantial treatment of the role of place in the substance use of MSM. For example, Bauermeister’s (2007) included article on social settings of Latino gay men’s drug use discussed substantial thematic content relating substance use to dance clubs, sex clubs, and gay bars. However, the same author’s article on social networks and Latino gay men’s functionality in the context of drug use (Bauermeister, 2008),

based on the same project as the 2007 article, was not included because it did not explicitly mention the role of place in substance use. Similarly, though path-breaking upon its release, Reback's (1997) ethnography of crystal methamphetamine use by Los Angeles MSM did not discuss use of crystal meth use in relation to social venue.

Characteristics of included studies

See Table 6.1 for characteristics of included studies. Mode of publication for included reports was diverse. While 16 included reports were journal articles, four included reports were from the grey literature and four included reports were dissertations, two of which had books attached. Five projects had multiple included reports, with four projects originating as dissertations and one originating as a monograph.

Analytic and theoretical methods. Analytically, almost all projects used thematic analysis, ethnography, or grounded theory. While those projects using grounded theory all referred to Straussian grounded theory analysis (Corbin & Strauss, 2008), ethnographic studies were methodologically eclectic. Epistemologically, half of all projects did not declare an orientation, though projects in which authors declared a specific theoretical framework used a social constructionist orientation (Caceres & Cortinas, 1996; Lewis & Ross, 1995) or used continental philosophy and critical theory, such as the work of Judith Butler or Pierre Bourdieu. Two projects carried out from a clinical psychology standpoint used specific psychological theories as a framework, whether the theory of reasoned action (Elwood & Williams, 1998) or cognitive distancing and escape (P. A. Wilson, 2004).

Data collection and analysis. Almost all studies used face-to-face interviews as a substantial part of their data collection, with most of these interviews semi-structured. Many studies also used ethnographic observation methods. Exceptions include Weems's (2007) study of circuit parties, which, though nominally ethnographic, had an indiscernible qualitative methodology, and Southgate and Hopwood's (1999a) discourse analysis of letters to the editor in response to a circuit party organising committee's public anti-drug pronouncement. Studies where interviews were an important part of the data collection had a wide range of numbers of accounts collected, with a range from an in-depth ethnography with one account taking prominence (Slavin, 2004) to a study with nearly 100 accounts (Natale, 2008).

Study settings and foci. All projects were undertaken in major urban areas, with most in the United States and Canada. Five projects originated in Australia. Data were collected between 1991 and 2007. Four projects collected data before the 1996 advent of highly active antiretroviral therapy (HAART). The introduction of HAART into clinical therapy is commonly considered to be a critical turning point in HIV/AIDS treatment and the cultural response to HIV/AIDS (Rowe & Dowsett, 2008). Most included reports addressed gay social spaces generally, though those focusing on a specific type of space generally focused on circuit parties or dance clubs. One project focused on bathhouses specifically (Elwood & Williams, 1998) and another focused on a Latino gay bar (Caceres & Cortinas, 1996).

Most projects did not specify a particular substance use focus, though three used the flexible, poorly specified term 'club drugs' to describe the substance use of interest. Alcohol, MDMA, and crystal meth were other drugs of focus. Projects

specifying particular populations of interest were generally geared towards ethnically diverse groups, such as Latino MSM.

Critical appraisal of studies

As a group, projects were of variable quality. Results of critical appraisal are presented in Table 6.2. Reports demonstrated different degrees of rigour in their sampling strategies. The best studies demonstrated either an appropriately elaborated theoretical sampling strategy, or in the case of ethnographic studies, evidence of prolonged engagement at different points and times. Many studies used snowball sampling and community venue-based recruitment. Similarly, reports demonstrated a wide range in rigour of data collection. Studies demonstrating the most rigorous data collection discussed how and where data were collected, the nature of the data collection tools used, and what steps were taken to put informants at ease. Data analysis was problematic, with many studies mentioning only notionally the method used. The best studies on this criterion elaborated how researchers left an auditable methodological trail, including specifics of analytic method and coding mechanisms. Studies scoring poorly on this criterion generally did not elaborate sufficiently on the strategies used.

Across most projects, strong points included breadth and depth of findings, and the use of data to support findings. Study findings addressed a wide variety of social processes, with high-depth studies attending to multiple perspectives, contrasting viewpoints, and conceptual development. Studies generally privileged the perspectives of MSM, with the semi-structured nature of interviews permitting exploration of viewpoints. Studies scoring well on this item also explained how they put MSM at ease and described attention to ethical issues—an item on which many projects scored poorly, given the lack of reporting on ethical approval and steps

taken for anonymity. Few studies mentioned reflexivity in data analysis and reporting.

On the whole, included studies ranged widely in their reliability and trustworthiness. Studies scoring well on this item also scored well across all of the first four questions. Similarly, studies demonstrated a wide range in their usefulness to this review, though this was not necessarily correlated with quality. Projects with high usefulness to this review took up as their main focus substance use by MSM in social settings.

Analytic process

Development of a provisional coding scheme. Each author worked on three papers independently, with one paper overlapping between the two authors. Specific papers are noted in Table 6.2. The papers used for development of the provisional coding scheme demonstrated geographic diversity and covered a range of qualitative methods. The range of venues covered was also broad, including gay bars, dance clubs, circuit parties, and sex clubs. When both sets of codes (see Figure 6.2) were compared, they were judged to overlap sufficiently and were combined (see Figure 6.3).

Coding of studies. The evolution of the dimensional analysis as studies were coded and the constant comparative process unfolded is charted in Figures 6.2-6.10. Elliptical shapes represent dimensions and rectangular shapes represent properties, with arrows demonstrating relationships either between properties and dimensions or between dimensions. The order in which studies were coded after development of the provisional coding scheme is found in Table 6.2. Because studies found through hand-searching were discovered late, most analysis towards the end of the project focused on studies from Australia. However, these three studies (Ireland et al., 1999;

Southgate & Hopwood, 1999a, 1999b) each used different qualitative methods and explored different social venues.

Theoretical saturation—the point at which dimensions or properties were no longer emerging from the data—was confirmed during the analysis of the final report in the included studies. The dimensions that had been differentiated throughout the process were then reintegrated. The grounded theory was verified through a final search for disconfirming data and properties that may have been missed through the initial dimensional analysis. No new dimensions or properties emerged through this process.

The grounded theory

The grounded theory discovered in the metasynthesis is expressed as two explanatory matrices (Corbin & Strauss, 2008; Kools et al., 1996)—one demonstrating the final dimensions, their properties, and their interrelations (Figure 6.9) and one demonstrating the roles of the final dimensions (Figure 6.10).

The lines-of-argument synthesis is the final grounded theory, as displayed in the final explanatory matrices. As in the dimensional analysis method described earlier, identification of the properties, the dimensions organising those properties, and the designation of those properties to their places in the explanatory matrix proceeded simultaneously. Throughout, properties became dimensions and dimensions reverted to properties (i.e., dimensionalisation and designation), and the roles of dimensions became clearer (i.e., differentiation) until the analysis was finally reintegrated. Each property that emerged represented common understandings and nuances across studies, and formed the reciprocal translation. Dimensions formed the building blocks of the grounded theory by organising the properties through the properties' latent constructs.

Dimensions are presented in the order of the final explanatory matrix in Figure 6.10. Throughout the presentation of the grounded theory, the links between specific dimensions are described and the theoretical frameworks that emerged to support dimensions are presented as appropriate.

Everyday world of jobs, age	Aim of building community from disparate elements
Everyday world vs gay space fantasy world	Bar as realm of fantasy
Fantasy identities e.g. leather	Performance central to this construction
Fantasy places – bar, club, circuit party, bathhouse	People do drugs on their own
Gay fantasy world mediated through drug use	Drug use of the person leading to sex
This is a subjective, mediated world	Intense enjoyment from individual drug use and sex
Public performance central to this fantasy world	Ineffability of the experience—cannot be coherently expressed
Market - commodification of bodies and performance	People do drugs with other people
Drug use as individual resource	People do drugs as a group in preparation and enjoyment
Maximise efficiency of time invested	People do drugs and sometimes have sex afterwards
Strategic investment – preplanning, mixing drugs strategically, storing drugs to offer partners	Drug use is a phenomenon on the part of a 'people' together
Bolster an individual's commodities - confidence, performance, physical and emotional anaesthetic	The people in a space link drug use and sex
Manage ambivalence	Reciprocal effects of places and drug use
Drug use as collective resource	Effects between person and context and drug use are reciprocally determined
Create psychological communion	Places that are social are also good for drug use and sometimes sex
Unite socially and geographically disparate individuals	Performance happens at the personal level with fitting in
Transcend/deny commodification of sex	Performance happens with a group
Everyday self versus 'pushing limits' in gay spaces/facilitated by drugs	Performance in the space
Fantasy world defined by boundary testing	All the world is a stage—especially in the gay social milieu
Pushing limits in terms of:	Drug use helps fit in
Duration and type of practice	Drug use is a display mechanism
Number of partners	Drug use is instrumental
Physical endurance/pain	Staging drug use
Transcending everyday psychology	Drug use behaviours are shaped by the space
Consumerisms of sexual events	Drug use behaviours shape the person
Individual strategic calculations	Groups shape drug use norms
Prospective transformation of self	Getting sloppy and overindulging
Retrospective distancing once back in sober everyday world	Diminished capacity
Rationalisation of untypical/unwanted decisions to preserve everyday self-concept	Intentional diminished capacity
Drug use maximises efficiency of fun/minimizes risk of no fun	Pre-planning drug use
Some drugs to transcend limitations of other drugs e.g. marijuana for come down	Drug use as a way to maximum enjoyment
Alcohol as individual resource for enabling ritual, sociality	Drug use to overcome barriers
Alcohol as resource enabling negotiation of sexual intimacy for gay and non-gay identified	Spaces are on the border
Alcohol to prospectively enable move from everyday to fantasy self	People are on the edge
Alcohol to retrospectively enable dismissal of transgressions	Combining drug use for a certain goal
Collective drunkenness as resource for building community of choice with transient and less transient elements	Drug use is tribal
Performance exemplified by drag queens –pushing limits of gender	People are tribal together throughout drug use
	Drug use is an equaliser
	Norms of drug use—expectations of intoxication
	Spaces that are liminal for marginalised populations

Figure 6.2. Initial codes used to generate the provisional coding scheme.

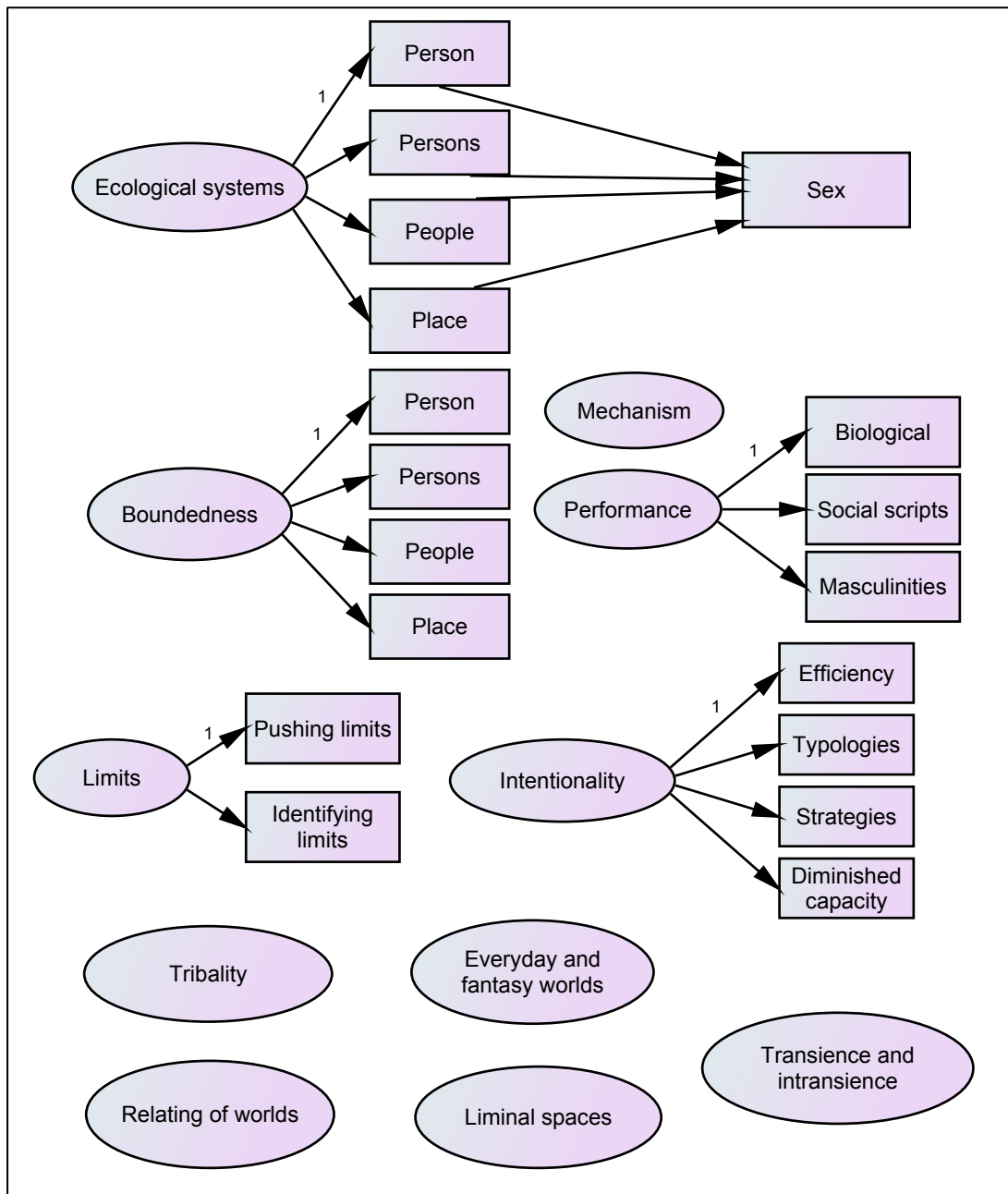


Figure 6.3. Initial explanatory matrix (matrix I).

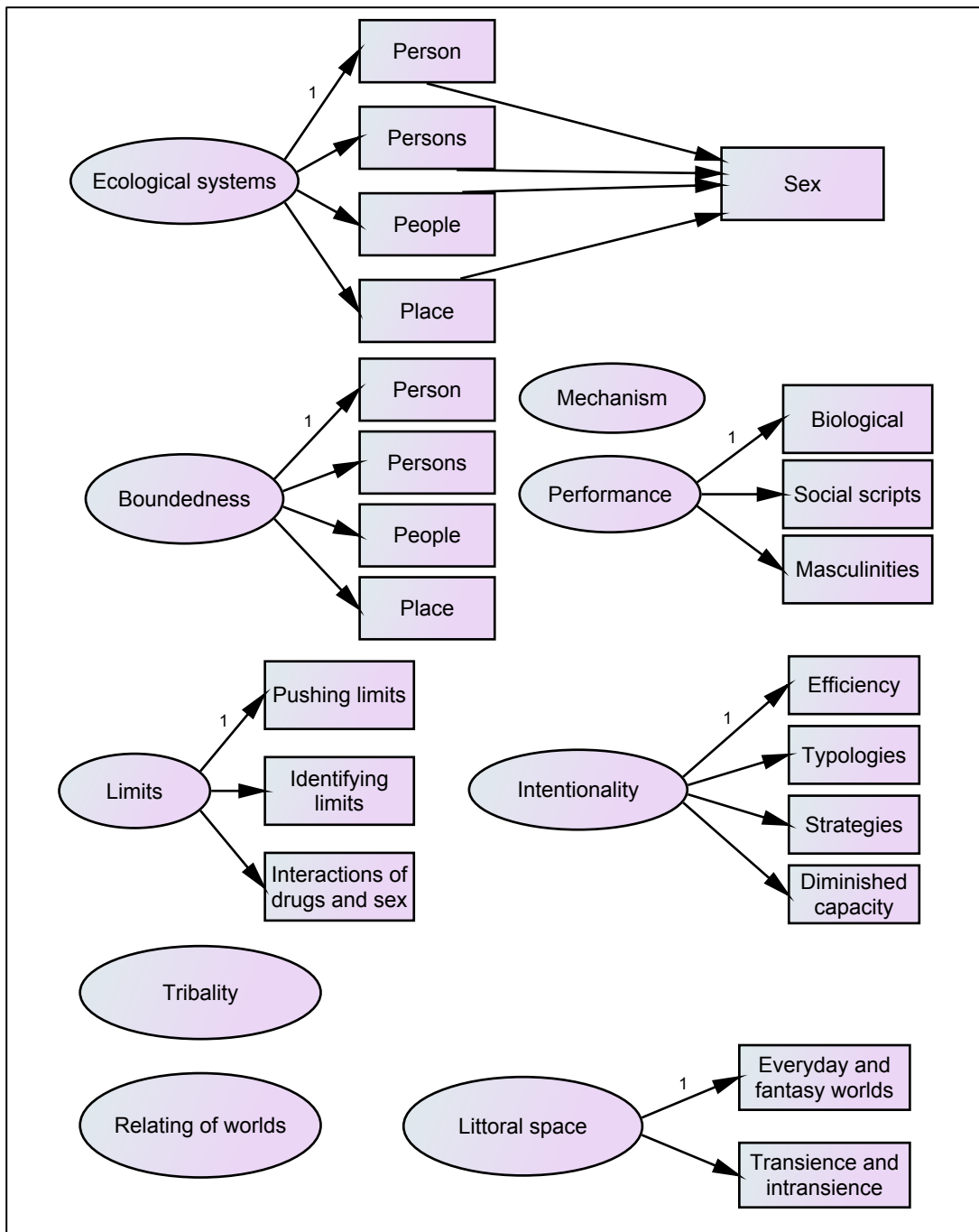


Figure 6.4. Explanatory matrix II.

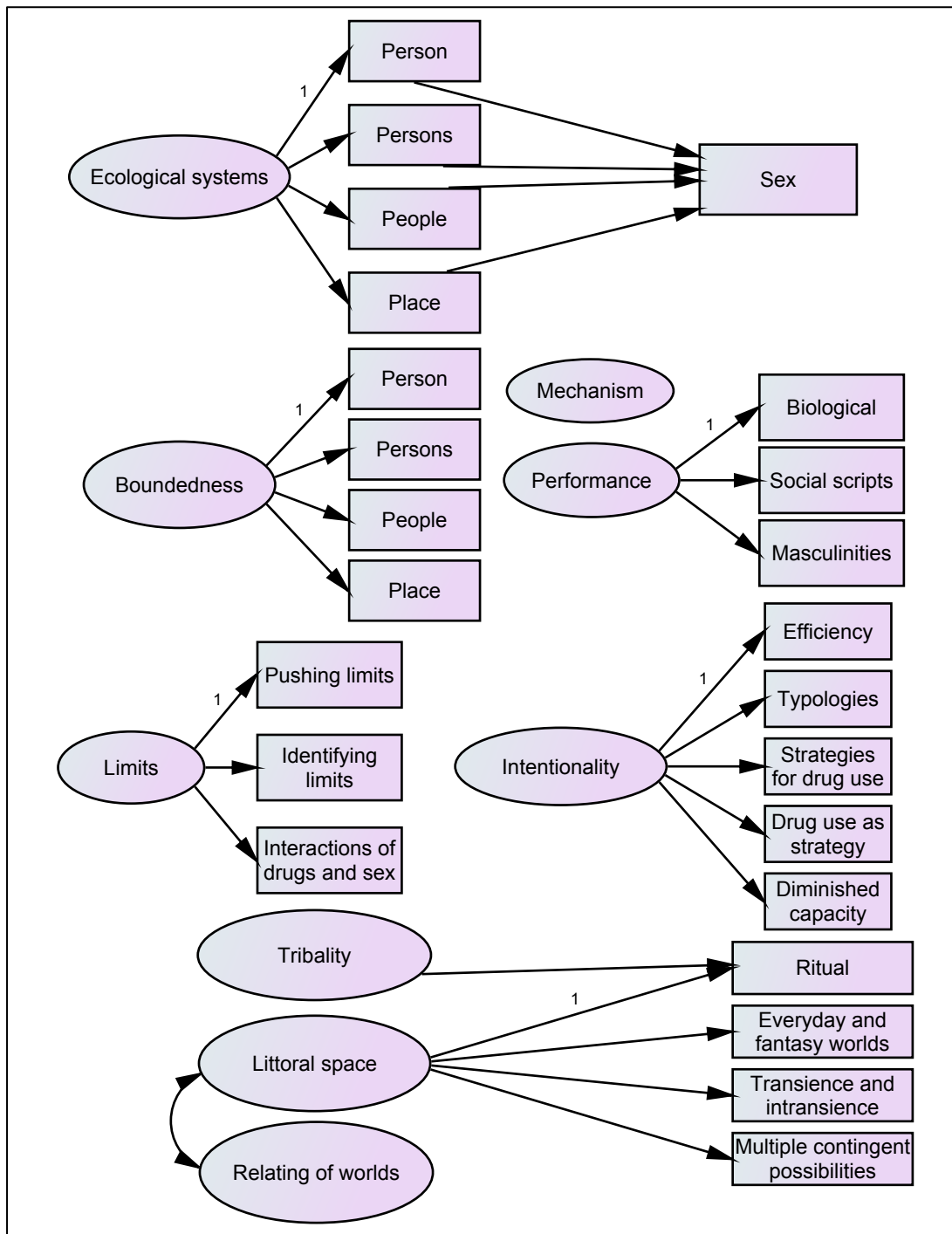


Figure 6.5. Explanatory matrix III.

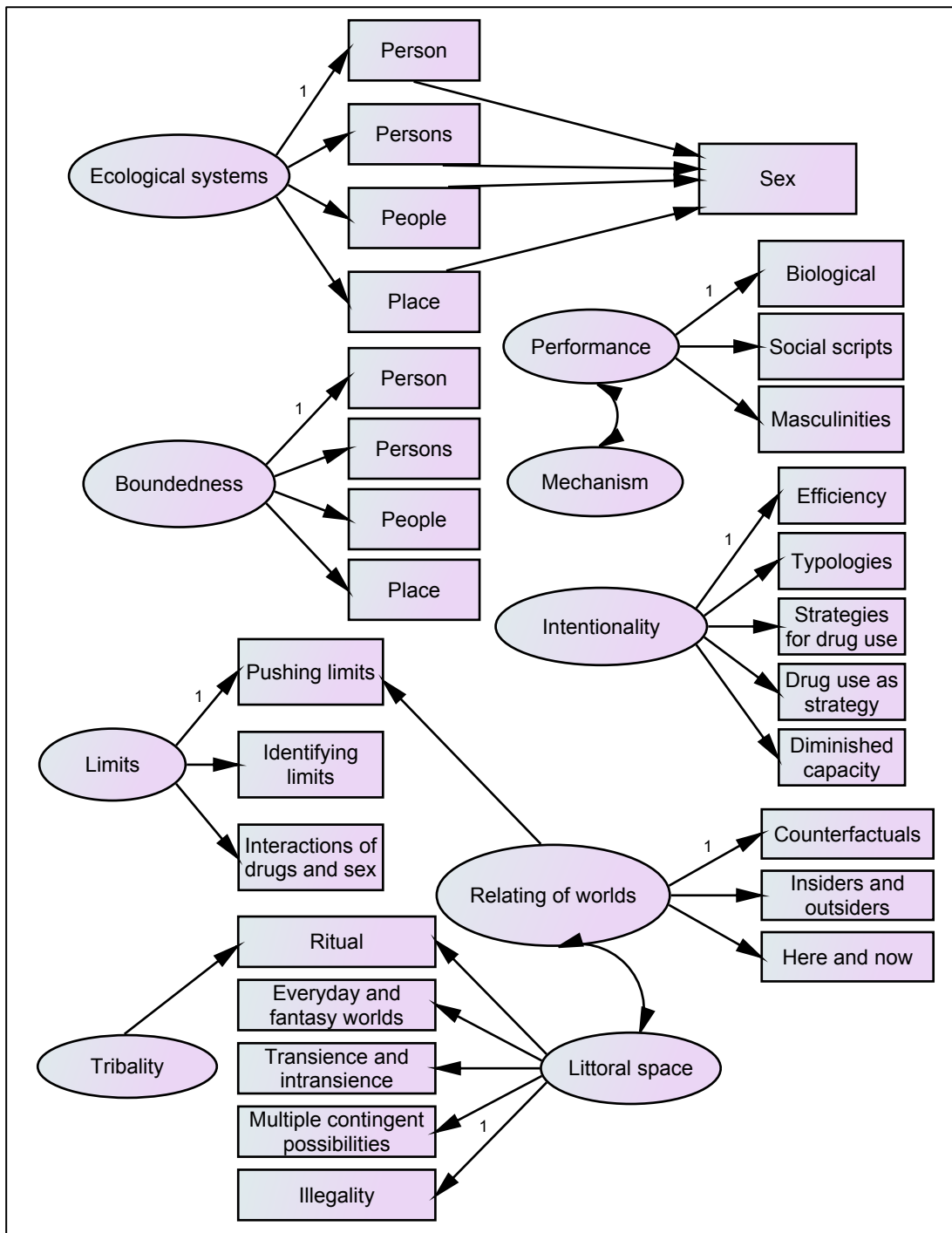


Figure 6.6. Explanatory matrix IV.

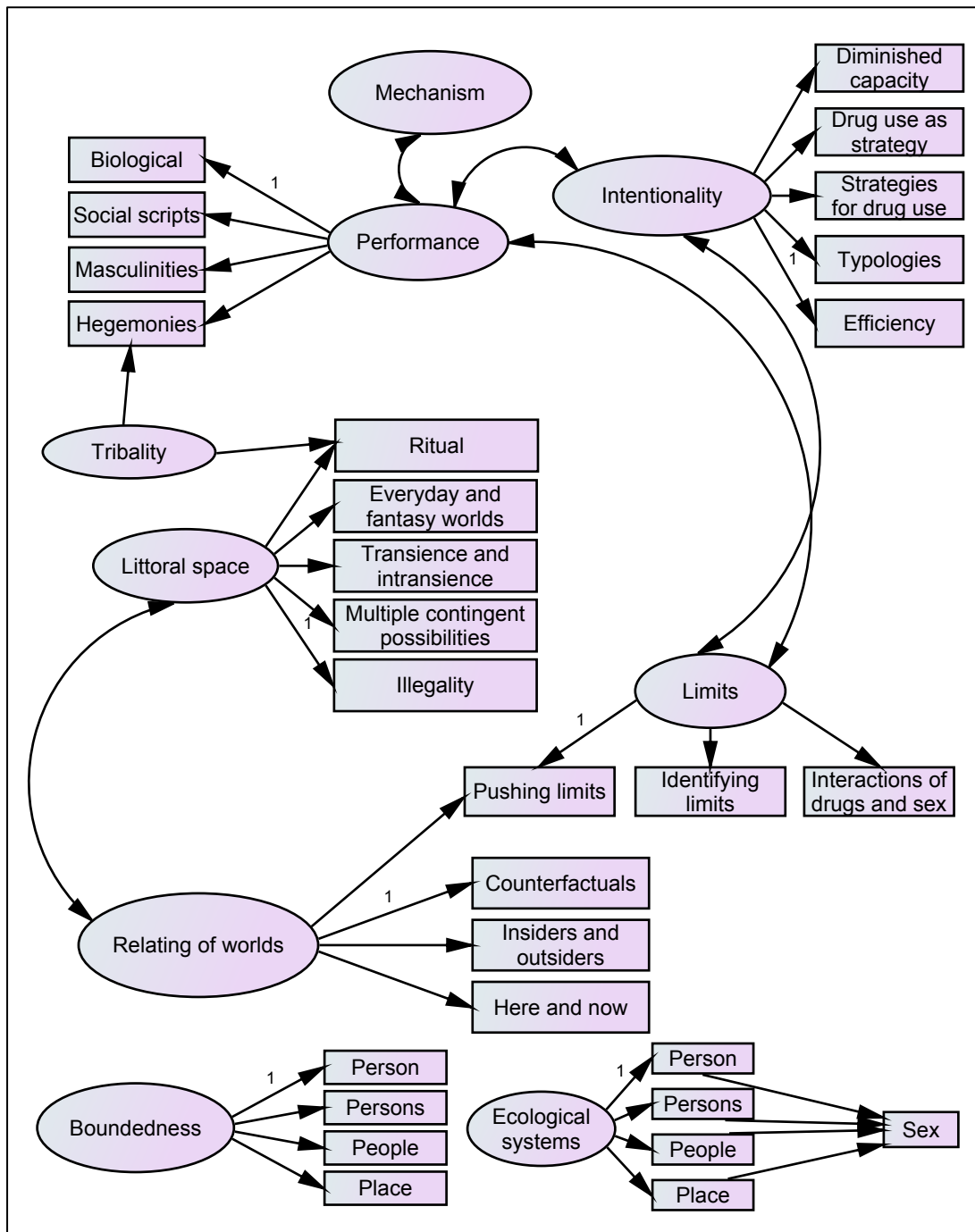


Figure 6.7. Explanatory matrix V.

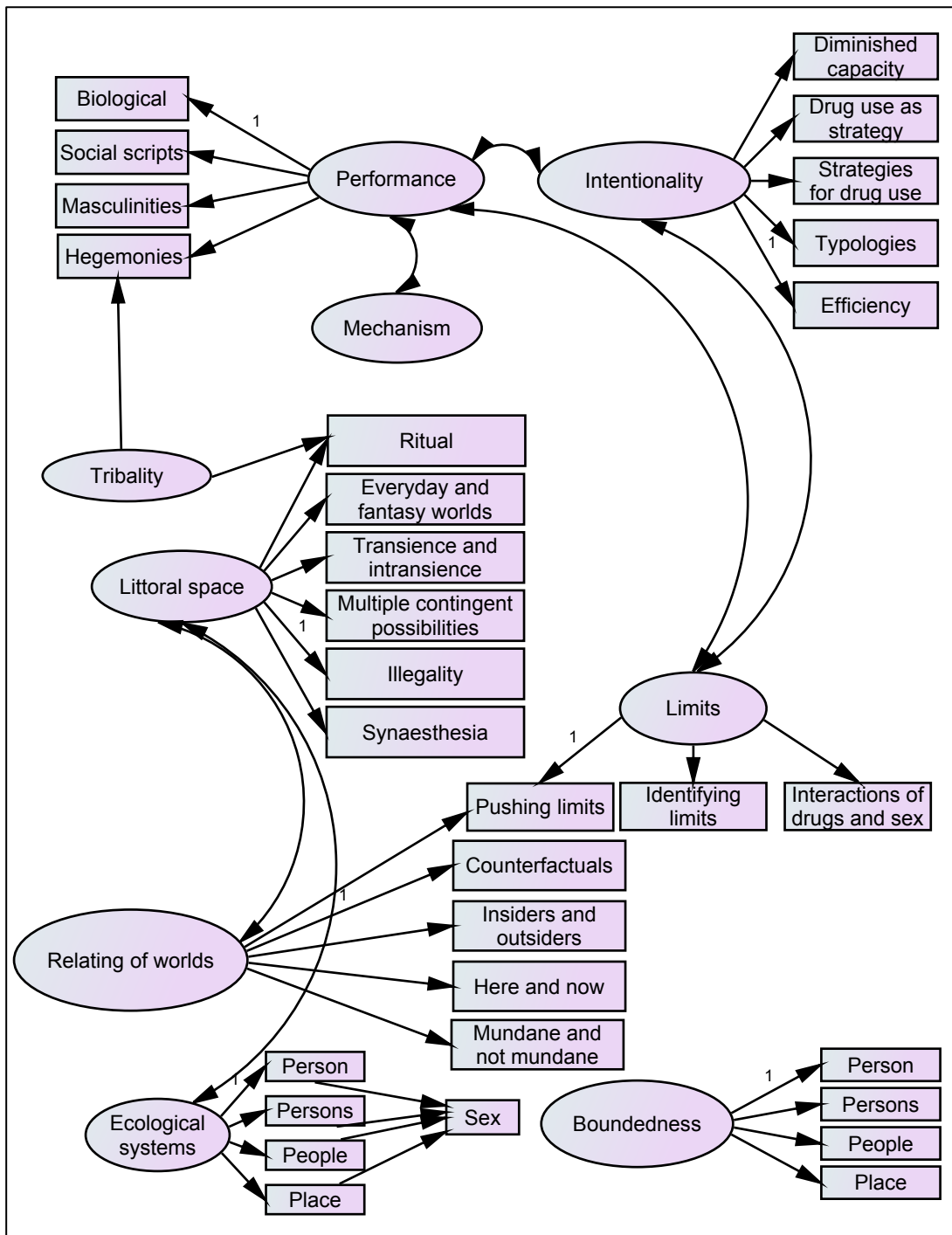


Figure 6.8. Explanatory matrix VI.

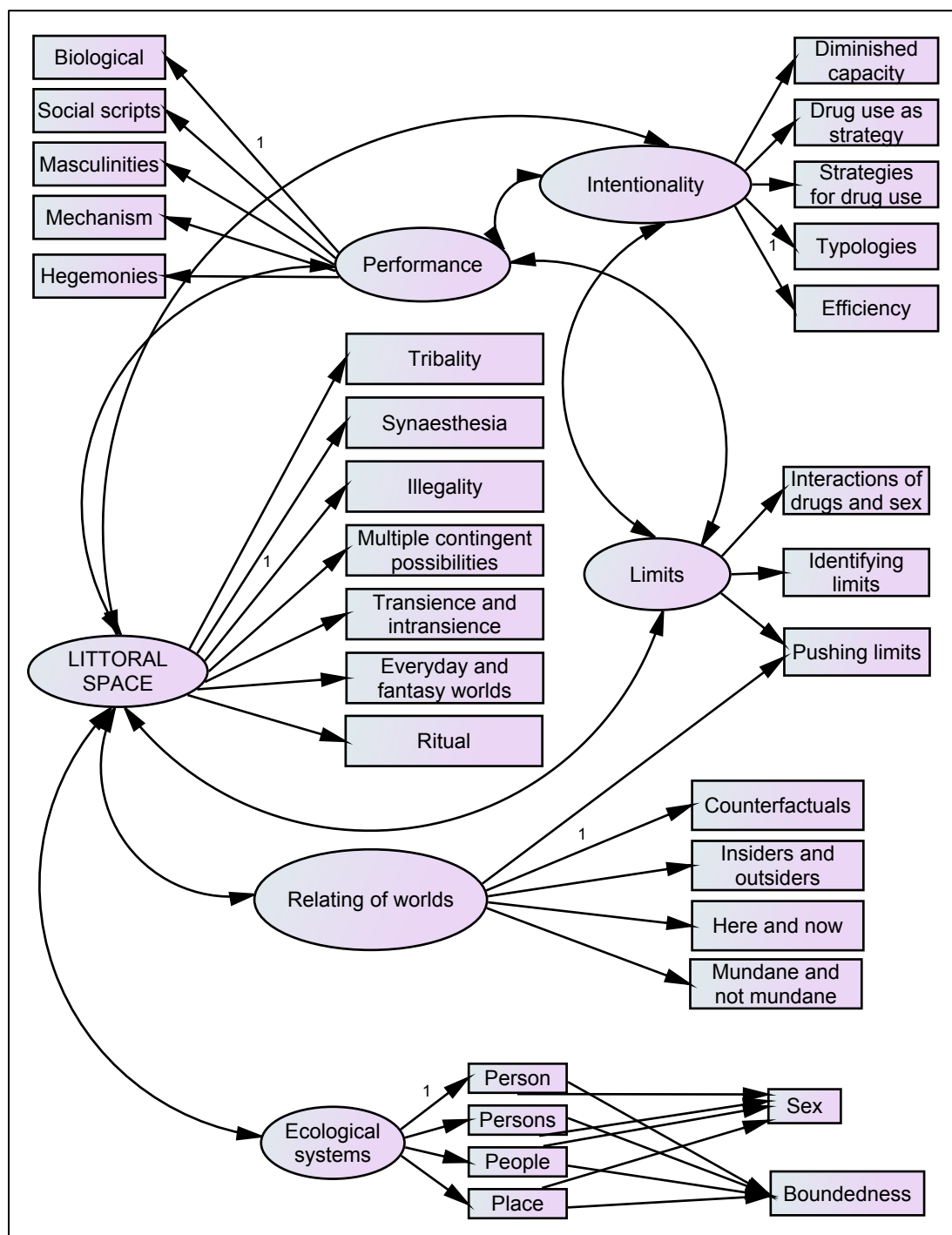


Figure 6.9. Final explanatory matrix—dimensions and properties.

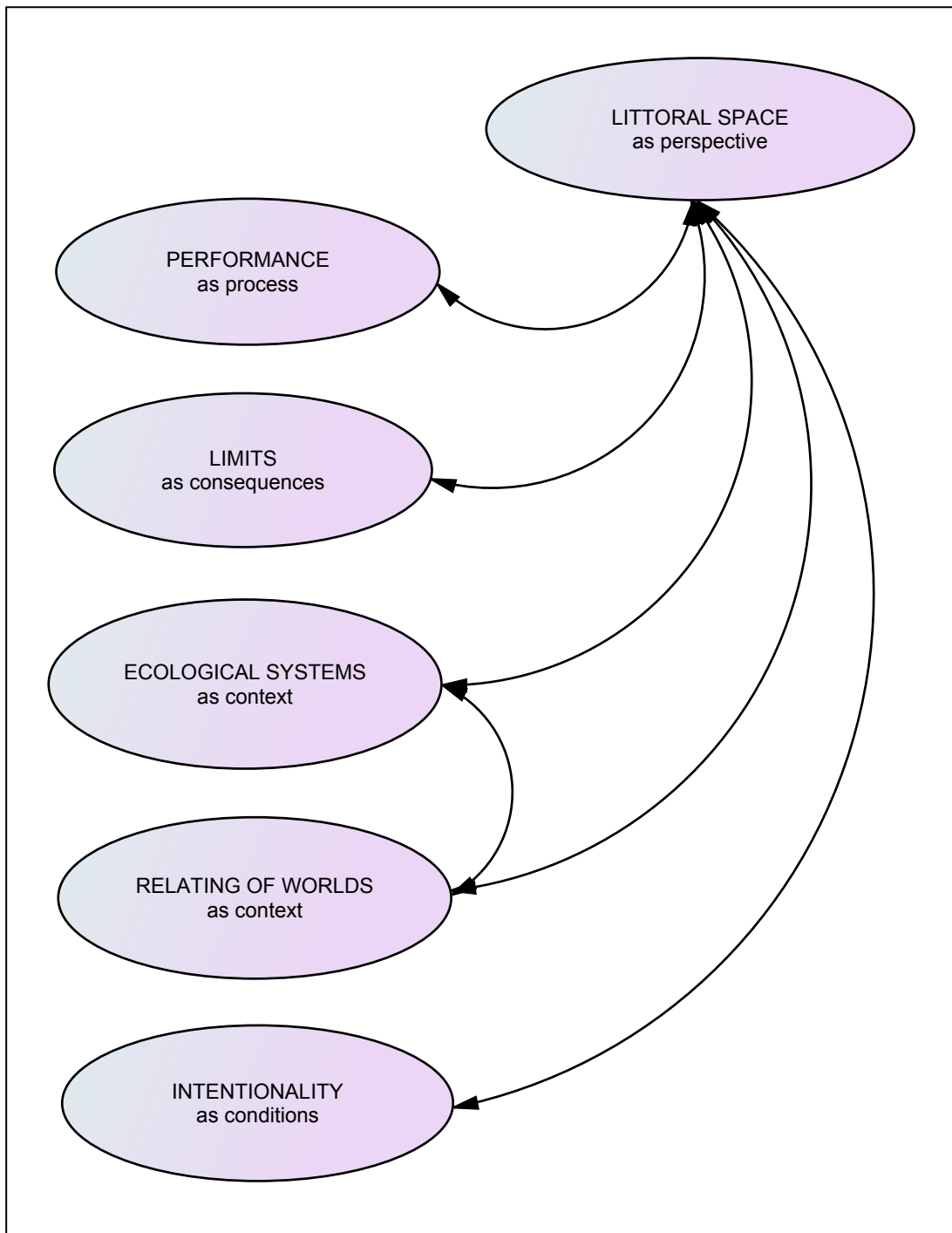


Figure 6.10. Final explanatory matrix—roles of dimensions.

An organising dimension, the perspective of littoral space. The perspective of ‘littoral space’ is the characteristic with maximum explanatory power in addressing the intersection of MSM, their substance use, and the social venues in which MSM use substances. As instantiated here, a littoral space is defined by the tribal nature and ritual of those present in the space, the disruption in normal sensory perception, the multiple endpoints of engaging the littoral space, and the frisson of illegality. It is a transient, temporarily transformative tear in the fabric of everyday experience. This dimension was supported by thematic and descriptive evidence from all included studies.

Theoretical framework. The dimension of ‘littoral space’ takes, as a starting point, ‘liminality’, or the condition of transformation between one identity and another (van Gennep, 1909). Van Gennep’s (1909) original description of liminality and the ‘liminal zone’ arose out of his work on rites of passage. Specifically, he named this specific period of identity transition as the ‘liminal space’ in which rituals and rites of passage transform the participant into a new state. The notion of liminality was later revived by Turner (1969) as he extended Van Gennep’s work to contextualise liminality in the idea of ‘communitas’, or the most fundamental ties holding a group of people together. Two included studies (Slavin, 2004; Weems, 2007) cited this analysis. In his early work on African societies, Turner (1957) foregrounded his work on liminality by observing rituals deployed to move from crisis to post-crisis resolution, with those rituals—and the society performing them—residing in the liminal state. Later, Turner (1982) observed that the idea of liminality could exist at multiple levels, from individuals to entire nations. In Turner’s analysis, liminality is a type of ‘communitas’ in which social boundaries dissolve, the group becomes homogeneous, and all partake in the liminal experience together.

Extending van Gennep (1909), Turner (1969) describes the liminal process as one of being ‘betwixt and between’ different stages or experiences of life. He also named experiences that were not completely liminal, but shared some of the transformative characteristics of liminal experiences, as ‘liminoid’ (Turner, 1969).

The dimension of ‘littoral space’ also takes as a starting point the definition of ‘space’ developed by De Certeau (2011), and later Slavin (2004), in his included ethnography—‘space’ as union of physical place, people in the place, and their interactions with the place. A symbolic interactionist reading (Blumer, 1992) of De Certeau (2011) would nuance the ‘stability’ that De Certeau implies as being a part of space as constantly evolving whilst social relations in the space unfold. Slavin (2004) arrives at a similar conclusion, defining ‘space’ as unstable by referring to its ‘multivocality’ and constant change. Where the present analysis differs is that it does not frame the evolving, context-specific nature of the practices of space through its exogenous instability defined by closing hours, the biochemical instability of substance use, or interpersonal instability defined by the space’s marginality. Instead, it frames the practice of space, and the space’s instability, through evolving experiences, and possibilities defined by how participants’ meanings evolve as they engage each other and the place.

From liminality to littorality. Just as ‘space’, as used here, is a rereading of earlier conceptions of ‘space’, ‘littorality’ is a rereading of liminality. Liminality implies linearity of process: the entity moves from a pre-liminal state, through the liminal period, and into a post-liminal state in which identity is transformed. Indeed, in the two included studies (Slavin, 2004; Weems, 2007) that cite Turner (1969), this is how liminal spaces are discussed. Similarly, many of the included studies referred to the spaces in which MSM use substances as ‘marginal’, if not the population of

substance-using MSM as marginal themselves (*inter alia*, Bauermeister, 2007; Brown et al., 2000; Caceres & Cortinas, 1996; Elwood & Williams, 1998; Green & Halkitis, 2006; Green, 2003; Greenspan et al., 2011; O’Byrne & Holmes, 2011a, 2011b; O’Byrne, 2011; Slavin, 2004; Southgate & Hopwood, 1999b; Westhaver, 2003, 2006).

Instead, ‘littorality’ presumes a different process. The idea of the littoral space builds on the ideas of marginality, and more specifically, liminality. The word ‘littoral’ originally refers to the geographic zone that links the land and the water, much like the beach. To swim too far out past the littoral zone is to risk tremendous danger—and yet for many beachgoers, one of the most enjoyable parts of going to the beach is swimming in the waves, albeit near the shore. The littoral process names the idea of being in a liminoid state, with the experience of tribal identity, solidarity, and disruption of external social structures, as a purposeful, temporary end in itself rather than a ‘passing through’ point. In the littoral state, transformation of the self is possible, but this transformation is neither inevitable nor even desirable to the participant.

Properties of the perspective of littoral space. This discussion now turns to the properties of the littoral space. Throughout, properties that distinguish littoral spaces from liminoid spaces are highlighted.

Tribality. The property of tribality indicates the dissolution of social divisions between persons to form a socially homogeneous group sharing strong affective bonds and a common experience of the littoral space. Notably, this is a feature of liminality as defined by Turner (1969). Several included studies specifically deployed the terms ‘tribe’ or ‘tribal’ to describe the social milieu (Husbands et al., 2004; Klitzman, 2006; Slavin, 2004; Weems, 2007). However,

even those studies that did not specifically use ‘tribality’ reciprocally translated into this property as they referred to how partygoers, both through substance use and for the purpose of substance use, dissolved social bonds. For example, Lewis and Ross (1995, pp. 58–59) discuss how their study respondents created a ‘fraternity network’, with one specific respondent calling those at the party his new ‘immediate family’. Green (2003, p. 438) emphasises how substance use in the social space led to what he terms, after a respondent, ‘insta-community’. Similarly, Cáceres and Cortiñas (1996) describe how alcohol in a Latino gay bar assists in the free, peaceful mixing of several populations, including drag queens, gay men, and heterosexually-identified Latino men and their female partners, that would never intersect, even harmoniously, elsewhere. Substance use in the littoral space is a critical part of the tribal experience. As one respondent explained, referring to a regional community of gay men in New York City whom he perceived to be ‘pretentious’: ‘Gay society can be pretty cold and very superficial. But once everybody’s on E [MDMA], it’s all gone. It’s like a family. Even the pretentious queens in Chelsea really let their guards down’ (Klitzman, 2006, p. 17).

Synaesthesia. A property that points to the disruptive nature of the littoral space is the synaesthetic experiences MSM report with substance use in the littoral space. Authors of included studies observed that many MSM reported shifting and combining sensory perceptions. These combinations develop in ways not attributable solely to substance use, or to the littoral space, but arising out of the embeddedness of substance use in the space. Content from studies addressing synaesthesia reciprocally translated in two main ways. On the one hand, studies described extremely intense experiences that, though often erotic, were not coital in nature. Much of this altered, heightened sensation was attributed to touch, sight, and

sound. O'Byrne (2009, p. 208), highlighting a theme observed across multiple respondents and his own ethnographic observation of a gay circuit party, notes that the combination of substance use and the 'atmosphere' of the gay circuit party leads to an unusual sensory experience defined by loud techno music; the sight of shirtless men; and the pulsing strobe lights—what one respondent summed up as 'testosterone'. In their discussion of hallucinogens at dance parties, Ireland and colleagues (1999, p. 58) tie what a respondent referred to as a 'pre-orgasm orgasm' to the experience of continuous dancing while under the influence of substances. Though this specific description did not generalise across all substances, Ireland and colleagues note that a recurring theme was a heightened, altered sensory experience in how substance-using MSM experience the littoral space.

On the other hand, several authors noted that respondents expressed the synaesthetic aspect of the littoral space not by their ability to describe it, but by their inability to do so. Westhaver (2003, 2005, p. 355) names this the 'ineffability' of the littoral space, what several of his respondents referred to variously as 'coming out of your skin', 'like bliss', how the act and experience of touch feels 'more real'. Husbands and colleagues (2004) acknowledge both of these types of experience in their own analysis of the combination of substance use and the littoral space. In their findings, they refer to this synaesthesia as 'riding the wave' of the 'ambience' of the dance party, whether that ambience is ineffable or defined by touch, sound, and sight (Husbands et al., 2004, p. 17).

Illegality. The illegality of the 'gay place' and substance use formed an important property of the littoral space. In particular, illegality reinforces the littoral quality of the space by underlining the break these spaces, and their embedded practices, represent from everyday life. This 'frisson' of illegality (Slavin, 2004), or

the attendant excitement that comes with the feeling of transgressive substance use behaviour, is both inherent in the activity and reflexively observed by research participants.

Illegality is as inherent to substance use as it is to the littoral space. O'Byrne and Holmes (2011b) note that the line between legality and illegality is among many that MSM who attend circuit parties walk, and often cross. Elwood and Williams (1998), in their discussion of bathhouses, link the frequently hidden, dark, and secluded nature of bathhouses to their role as a setting for substance use. Viewed through their formulation, the disruption of norms of everyday behaviour around sex and sexuality co-occurs with the illegality of substance use behaviours as part of the transgressive nature of the bathhouse. Even when the littoral spaces in which substance use occurs are public, or at least in the open, the illegality of the substance use in the littoral space is a critical bonding mechanism that sets apart the space from everyday life. Westhaver (2003) and Weems (2007) point out that substance use—and, as they both emphasise, illegal substance use—is a specific bonding mechanism. Westhaver (2003, p. 106) quotes one of his participants as saying 'we're all doing something illegal—but we all feel good about it'—a tacit observation, to extend Westhaver's analysis, that the illegality of substance use itself demarks the non-littoral space and the littoral space. Similarly, Husbands and colleagues (2004, p. 9) note one participant as saying 'I guess there's sort of an air of, of naughtiness to it, you know. I mean you shouldn't be taking drugs and uhm so I mean there's sort of a danger aspect to it...' This 'danger' is the frisson of illegality.

In contrast, Weems (2007) links the early illegality of gay clubs and bars in the United States, particularly in the era before the Stonewall riots that to many historians marked the start of the 'gay liberation movement', to the persistent use of

illegal substances in gay circuit parties. In this vein, as Weems (2007) points out, illegality is a critical part of the littoral space. Southgate and Hopwood (1999a) observe that when the planners of a gay circuit party in Australia released a statement against the use of illegal drugs at its headline party, several of the prevailing ‘counter-discourses’ against this statement pointed to the use of specifically illegal substances as an oppositional behaviour that partygoers used to distinguish their practices in this ‘space of pleasure’ from the non-littoral. In some cases, illegality went beyond substance use to encompass the entire gathering itself. Same-sex sexual activity was not legal across Australia until 1997. In light of this, Lewis and Ross (1995) observe that many of the gay dance parties of the early 1990s occurred in ‘underground’ spaces and posed major challenges around substance use and homosexuality with local authorities.

Multiple contingent possibilities. Nearly all studies highlighted the multiple endpoints linked to engaging the littoral space. However, these possibilities infrequently resulted in a lasting change to the self. It is the impermanence, multiplicity, and lack of inevitability of any of these possibilities that makes the space ‘littoral’ rather than ‘liminoid’. Indeed, participants often characterised a successful engagement of the littoral space by a return to normal life without any lasting change or damage—after O’Byrne and Holmes (2011b, p. 1517), that men could ‘return to their routine lives and selves unscathed’.

On the one hand, these possibilities may be neutral, if not positive. Many MSM who engage the littoral space return to non-littoral everyday lives with little difficulty, as in the gay bar Cáceres and Cortiñas (1996) studied. Many studies also discussed how intense, transcendental, one-time sexual experiences with partners met in the social venue were a valued outcome of the littoral space. Green and

Halkitis (2006) triangulate substance use and sexual relations in the bathhouse by pointing to the final climax and ejaculation as a critical, desired possibility. They substantiate this claim by quoting a participant: '[o]ne of the interesting things I found about crystal [methamphetamine]... is for me it takes the edge off the project of cumming. It turns the sexual experience, for me, much more about having physical sensations, pleasurable, physical sensations, than it is about cumming' (A. I. Green & Halkitis, 2006, p. 323). One positive possibility reported frequently in the data was the process of 'self-discovery'—as several authors noted, research participants sometimes described the littoral space, specifically the gay circuit party, as when they finally accepted their gay identity. Green (2003, p. 437) notes that one participant said he finally found his 'niche' in the gay party scene, whereas Weems (2007) describes how his first experience at a circuit party was connected to his own coming out process. This was neither universal, however, nor definitive of MSM's experiences in the littoral space, nor was it clear across studies how this self-actualisation was permanent, or carried into everyday life.

Negative possibilities lurk in the littoral space, possibly with a lasting effect—to extend the littoral metaphor, like swimming out past what is safe, if not survivable. In discussing one negative possibility emerging from the littoral space, Klitzman (2006) points to the challenge of the 'suicide Tuesday' some MSM encounter in overcoming the hangover from substance use after weekend-long partying. Another temporary but problematic possibility is a negative substance use experience in the littoral space itself—for example, when an overdose of ketamine results in the user falling into a 'K-hole', or a profoundly distressing dissociative experience (Klitzman, 2006; Slavin, 2004; Southgate & Hopwood, 1999b; Weems, 2007; Westhaver, 2003). When substance use crosses from the littoral space to

become a non-littoral behaviour, it can escalate to the level of dependence and disorder, with clear effects for functionality (Greenspan et al., 2011; Husbands et al., 2004; Weems, 2007; P. A. Wilson, 2004). While patterns of dependence were mentioned across the included studies, by and large most MSM characterised their substance use as episodic, limited to the littoral space, and tightly controlled (A. I. Green & Halkitis, 2006; A. I. Green, 2003; O’Byrne & Holmes, 2011a, 2011b; O’Byrne, 2009; Slavin, 2004).

Another negative possibility with long-lasting ramifications is the possibility of HIV transmission as a result of unprotected anal intercourse. Qualitatively, studies did not report that substance use in the main led to risky sex in a causal sense by way of disinhibition—as in, risky sex generally did not occur as an unanticipated and undesired outcome by those taking the substance. Across those studies examining the link between these two behaviours, substance use and risky sex were associated—either one as ‘allowing’ the participant to engage in risky sex (Caceres & Cortinas, 1996; A. I. Green & Halkitis, 2006; O’Byrne & Holmes, 2011a, 2011b; O’Byrne, 2009), or both behaviours taken together with substance use increasing sensation (A. I. Green & Halkitis, 2006; Husbands et al., 2004; Ireland et al., 1999; Southgate & Hopwood, 1999b). Regardless of whether substance use causes risky sex, both are linked to each other and to the littoral space.

Transience and intransience, everyday and fantasy worlds. The property of transience and intransience captures one of the essential distinctions between the littoral space and the non-littoral space. It also distinguishes the littoral space from a space that is liminal. In this context, littoral spaces are transient whereas non-littoral spaces are intransient, somewhat permanent fixtures that form the context for the littoral space. A close corollary to this dimension is the littoral space as fantasy

world. These properties are presented together, as they frequently co-occurred in the data. These properties point to similar, but separate, characteristics of this dimension.

Cáceres and Cortiñas (1996) deployed the phrase ‘fantasy world’ to describe the Latino gay bar that they studied. In characterising the events of the gay bar as an ‘oasis’ from everyday life, they point to the intersecting roles of alcohol and the gay bar—two features that determine the other in this littoral space—as specifying a space where homosocial and homoerotic behaviours can be enacted in ways socially proscribed elsewhere. Similarly, O’Byrne (2009, p. 228) calls the act of attending a gay circuit party a ‘pre-determined, temporary leave from regular life’, where the entering of a littoral space is conditional on a return to the workaday world.

To the extent that MSM do not live in bathhouses or dancehalls or constantly surrounded by partygoers, or to the extent that the effects of substance use last only as long as biochemically determined, the fantasy world is transient. Slavin (2004, p. 290) underscores this difference by quoting his subject, who points to his experiences in the dance club he frequents as ‘about the drug, not about reality’, while another research participant describing a weekend at a circuit party notes his experience taking crystal methamphetamine ‘was just a party weekend, and that’s all it was meant for’ (A. I. Green & Halkitis, 2006, p. 325). Some study authors saw this transience reflected in the superficiality of the relationships (Husbands et al., 2004; Natale, 2008; O’Byrne, 2011; Westhaver, 2003, 2006). Westhaver (2003, p. 108) reflects these ‘superficialities’ in the comments of one participant, who notes that many of the substance-fuelled social connections formed in the circuit party ‘show a lot more warmth that we wouldn’t necessarily otherwise show’.

Ritual. Finally, the property of ritual characterises an aspect of the littoral space that is shared with Turner's (1969) conception of liminality. This emerged as a reciprocal translation across studies. Both aspects of the property of ritual—the routine and the religious—point to the importance of a staged and sequential series of events used to engage episodically the littoral space. Whether in the stages of preparing for substance use, the process of using substances as a part of the littoral space, or the actual 'ritual' of dancing and being in the littoral space, the notion of a process by which the littoral space is episodically engaged is present throughout included studies. In particular, the episodic aspect of ritual is key to the littoral space.

Many authors deployed the word 'ritual', often as inspired by the language of their own participants (Elwood & Williams, 1998; Green & Halkitis, 2006; Green, 2003; Husbands et al., 2004; Klitzman, 2006; Lewis & Ross, 1995, 1996; Slavin, 2004; Weems, 2007; Westhaver, 2003, 2006). In some cases, 'ritual' referred to the specific routines MSM used to prepare for and engage the littoral space, with these routines both individual (Elwood & Williams, 1998; A. I. Green & Halkitis, 2006; A. I. Green, 2003; Husbands et al., 2004) and yet common across MSM (Ireland et al., 1999). For example, Ireland and colleagues (1999) trace the 'drug use event' through preparing for the party through the procurement of substances, the development of a plan for the sequential consumption of those substances, and the achievement of a state of communion with other members of the littoral space. More generally, Husbands and colleagues (2004) describe how the process of substance consumption is 'ritualised' for many MSM who attend dance parties.

In contrast, several authors (Klitzman, 2006; Lewis & Ross, 1995; Slavin, 2004; Weems, 2007; Westhaver, 2003, 2006) draw on the language of religious

ritual, akin to Turner (1969), to describe the process of the littoral space. These descriptions focus less on substance use as behaviour and more on the intersection of MSM, their substance use, and the place. Whereas Weems (2007) calls the act of MSM dancing together under the influence of substances a ‘spiritual ritual’ relatable to indigenous peoples’ traditions, Westhaver (2003) and Klitzman (2006) draw on the language of their sources. Westhaver (2003, p. 138, 2006, p. 612) connects the description of a circuit party by one gay men’s magazine as ‘ritual dance’ with a fuller ‘actualis[ation]’ of the self as gay man and as person, at least in the transience of the littoral space. On the other hand, Klitzman (2006, p. 15) observes that one respondent referred to dance parties as ‘big gay male bonding rituals’ in which collective dancing and substance use provided ‘affirmation’.

A dimension of actions, the process of performance. The dimension of performance addresses the ‘process’, or the meanings of the actions in which the persons under study engage. In this analysis, the process that emerged was one of ‘performance’, in which participants used substances in order to perform in the littoral space. This performance was both biological—substances used to make the body perform as desired—and aimed at enacting social scripts, ‘achieving’ masculinities, and working within hegemonic conceptions of the littoral space and its occupants. Performance was also part of substance use consumption itself, as the most accomplished ‘performers’ negotiated a line between self-destruction and littoral pleasures. This dimension was supported by both thematic and descriptive evidence from every included study.

Theoretical framework. This analysis begins with two different, yet complementary, conceptions of ‘performance’. First, Goffman (1959), one of the most significant figures in the history of symbolic interactionism, posits that human

interaction can be viewed as a stage performance. In communicating with others, the person uses ‘assemblages of sign-equipment’ (Goffman, 1959, p. 33)—or the surroundings, tools, and other implements, as they are available—together with verbal communication and habitus to present a cohesive ‘front’ to the spectator. Goffman calls the person’s use of sign-equipment and emotional ‘front’ in the context of the developing performance the ‘dramatic realisation’ (Goffman, 1959, p. 38). The person generally follows several constructed archetypes to guide the performance, from which deviation can damage to the credibility of the person’s competence in fulfilling the role. Goffman (1959) points out that the construction of the performance around an archetype ‘conceals’ the preparatory work for the performance, including the procurement of knowledge or skills for performance and the person’s earlier mistakes in prior attempts to accomplish the performance. Because what the receiver of the performance sees is the finished product, rather than the underlying preparation, small discrepancies between archetype and performance become substantial clues to the performer’s fitness for the chosen role. Goffman’s innovative analysis drew on a wide variety of sociological sources from around the world and the subdisciplines of sociology. As one of the first theorists to use the idea of ‘performance’ to organise symbolic interactionist approaches to qualitative research, Goffman helped pave the way for novel methodological contributions in ethnomethodology and urban ethnography (Denzin, 2002).

Thirty years later, Butler offered a definition of performance and its complement, ‘performativity’, that focused on the social construction of sex and gender. Butler characterises performativity as an expression in the hope of fulfilling a certain goal: as regards gender, the idea that ‘anticipation will conjure its object’ (Butler, 1999, p. xv). Butler expands from this to point out that performativity is a

multiply reiterated process over time—a ‘sustained set of acts’, and a process with both history and future, whose cultural repetition acts to ensure and to move towards that future. As Butler (2009) later summarised performativity, whereas performance might be considered the enactment, the nature of performativity as a process connects that ‘enactment’ with its anticipated conclusion—as Butler originally posited, the achievement of a specific gender identity. The converse of this is the situation in which the inability to perform is to be in a situation of ‘precarity’, in which vulnerability to sanction and marginalisation is high (Butler, 2009).

The connections and intersections between Butler and Goffman are too multiple and complex to address comprehensively here, but several points are worth noting. Goffman’s precedence to Butler invites a reading of Butler’s work through Goffman’s symbolic interactionist approach, particularly as both point to the ‘normative order’—Goffman through describing the performance of archetypes, Butler through observing that certain produced genders are more acceptable than others (Hancock & Garner, 2011). Here, Goffman and Butler complement each other—whereas Goffman takes a micro-sociological approach to his work, using individual exchanges to make broader statements about societal structures (R. Collins, 1981), Butler takes a macro-sociological approach, starting with broad observation to interpret individual behaviours (Butler, 2009; Gregson & Rose, 2000).

Properties of the process of performance.

Biological. Content on biological limits reciprocally translated across most included studies. Authors consistently observed that MSM used substances to meet the physical demands of the littoral space—as O’Byrne and Holmes (2011a, p. 7) term one of the major themes they explore, ‘substance use to overcome physical limitations’. These limitations, as reflected in all studies that discussed this, were

ones of endurance—the ability to dance for an entire night or an entire weekend, or to maintain extended sexual contact with multiple partners in the course of an evening. This is ‘performance’ in its most literal form.

As Ireland and colleagues (1999) point out, complexity of polydrug combinations is associated with length of engagement of the littoral space. This suggests that the need for endurance, and to evoke certain effects at different points in the process, is a key motivator for substance use. Later, they quote one participant, who observes about his use of amphetamines at a dance party:

‘[Speed]... gave me a lot more energy to dance, like dance and dance and dance, just this tremendous surge of adrenalin’ (Ireland et al., 1999, p. 56). The need to use substances to ‘survive’ a weekend-long circuit party is consistently reflected across studies (*inter alia*, Husbands et al., 2004; Klitzman, 2006; O’Byrne, 2009; Weems, 2007; Westhaver, 2003).

When sexual encounters happen in the context of these littoral settings—and particularly in social settings where sex is the goal, such as bathhouses or sex clubs—substance use helps enhance and prolong sexual contact. This finding was reported across all studies that addressed sex in the context of substance use and space. Bauermeister (2007, p. 121) categorises amphetamine-group substances and sildenafil as useful for heightening the sensation of sex, while crystal methamphetamine specifically is helpful in allowing the user to participate in more strenuous sexual activities, like bondage. O’Byrne and Holmes (2011a, p. 8) describe the ways in which substances assist in overcoming sexual limitations as ‘overcoming pain’ and ‘diminishing sensation’ to prolong sex. In discussing the theme ‘drugs for sexual performance’, one participant observes that ‘at a certain point... you’re getting fisted [the introduction of an arm into the rectal cavity] and

you have to do poppers or ten lines of blow to get someone's arm up your ass' (A. I. Green, 2003, p. 436). 'Poppers', which relax the anal sphincter, can increase the number of partners for insertive anal intercourse in a drug use event (Bauermeister, 2007; Elwood & Williams, 1998; A. I. Green, 2003; O'Byrne & Holmes, 2011a).

Social scripts, masculinities. As important as biological dimensions of performance is these substances' role in allowing MSM to enact the social scripts of the littoral space. Often described by authors as lowering inhibitions for social contact, another interpretation through the lens of 'performance' views substance use as conferring the ability to act socially as expected, if not required, for the littoral space. Bauermeister (2007, p. 118) discusses how substance use makes the MSM who consume them more 'sociable and talkative', while another study discusses how a motivation for substance use is the desire 'to socialize with other men' (G. Brown et al., 2000, p. 6). Cáceres and Cortiñas (1996) explain how substance use lubricates social interactions between men in the gay bar by allowing them to draw closer and experience transgressive homoerotic encounters. In terms of social scripts of sexuality, biological performance meets social performance as MSM in the littoral space move past physical and psychosocial barriers to risky, challenging sexual behaviours (Elwood & Williams, 1998; A. I. Green & Halkitis, 2006; A. I. Green, 2003; P. A. Wilson, 2004). In a quote that unifies these social scripts, one participant describes of his use of crystal methamphetamine: 'so like I can allow myself—they want a pig [a very sexually active man who enjoys unprotected anal intercourse], I can be a pig ... That means I can get into, I can have sex with a group more easily—even if I am not attracted to some of the people in the group' (A. I. Green & Halkitis, 2006, p. 324).

One particularly important social script enacted by substance use, itself a property, is the social script of masculinity, which substance use in the littoral space allows men to perform. This relates partly to the property of tribality introduced earlier, and is also a reciprocal translation across different studies. Slavin (2004, p. 283) describes how substance use facilitates homosocial, but not necessarily homoerotic, bonds as he quotes his informant describing the chemically induced feeling in the club as one of ‘brotherhood’. Here ‘brotherhood’ assumes a certain type of masculinity found in the essential maleness of the men gathered in the club. Substance use and masculinity converge in the littoral space, as when circuit parties require a hegemonic ‘look’ of their participants—described variously as ‘beefy tough macho’ and ‘Abercrombie and Fitch’ (Westhaver, 2003, p. 271, 2006, p. 625). The social script of masculinity is central to Weems’ (2007) thesis: that the inextricable components of the circuit party, including substance use, require performance of a ‘nonviolent masculinity’ from which solidarity, like Slavin’s (2004, p. 283) ‘brotherhood’, arises. But that is not to say that the social script of masculinity is homosocial alone. The convergence of substance use and masculinity lead to a ‘collective eroticism’ that Green (2003, p. 438), quoting one of his participants, describes as the ‘group of half-naked men, celebrating [...] all the sexual energy’. Viewed in this light, the performance of substance use is a practice that is engaged with the ritualistic fantasy world of the littoral space.

Mechanism. Substance use reciprocally translated across included studies as a marker of performance itself. Put otherwise, the ability to skilfully manage polydrug combinations, and the use of substances in a public setting, indicates that the participant himself can negotiate the littoral space. Viewed from a Goffmanian perspective, substance use becomes the ‘sign-equipment’ (Goffman, 1959) used to

indicate belonging; from a Butlerian standpoint, substance use is the performative act that creates the anticipated belongingness in the littoral space. O’Byrne and Holmes (2011b) call this the ‘boundary play’ of substance use—as MSM use substances, their negotiation of the edge between pleasure and destruction becomes part of the performance. The role of substance use as a mechanism also manifests in the ‘folk pharmacologies’ and harm reduction practices that readily develop in groups (Greenspan et al., 2011; Ireland et al., 1999; O’Byrne, 2009; Southgate & Hopwood, 1999b; Westhaver, 2003). For example, Southgate and Hopwood (1999b) discuss how ‘network nannies’ facilitate exchange of information regarding safer substance use practices. Groups of friends, or even bystanders, at a dance party may know what to do if someone is believed to have overdosed (Greenspan et al., 2011). As Klitzman (2006) points out, these practices of ‘taking care of each other’ are ritualistic as they are performative. The ‘taking care of each other’ through drug use events expresses the tribal nature of the littoral space through performance.

Hegemonies. The hegemony of the littoral space compels the otherwise recalcitrant participant towards substance use. From a performance perspective, this ‘precarious’ position (Butler, 2009) puts the abstinent partygoer at risk of temporary social marginalisation. Southgate and Hopwood (1999a) describe a counter-discourse espoused by gay men in Australia to the prevailing view of substances as harmful as that MSM should make their own ‘informed decision’ about substance use. But in reality, that decision is determined by the littoral space. Slavin (2004) observes that he could not imagine surviving in the world of the underground dance club over an extended period without substance use. Husbands and colleagues (2004, p. 21) cite how substance use is demanded by these littoral spaces as they quote a participant who describes walking into a club sober: ‘they are just dancing

and hopping and going crazy and I'm just standing there and like, oh my God, actually this is not going to work'. Elsewhere, they quote another participant who, in the face of his venture into a dance party without substance use, describes being 'like an outcast' (Husbands et al., 2004, p. 16). In part, the participant who abstains from substance use marginalises himself from the 'headspace' of the club (Slavin, 2004), from the opportunity of 'fitting in' with others (Husbands et al., 2004), or from the 'insta-community' that develops (A. I. Green, 2003).

A dimension of outcomes, limits as consequences. Consequences of the process of performance can be viewed as 'limits', or points beyond which substance use behaviours in the littoral space would lead to self-destruction—the creation of those limits, the reaching of limits, and the pushing of biological and social limits. The limits participants in the littoral space experienced were organised in the included studies around substance use and sex.

Properties of limits as consequences.

Interactions of substances and sex with limits. Though substances enhanced biological performance, authors noted that participants eventually reached limits in both substance use and sex. In most accounts across included studies, these limits were reached when the supply of substances ran out, or when the event was over (Husbands et al., 2004; Ireland et al., 1999; Natale, 2008; P. A. Wilson, 2004). Sometimes the limits were a question of reaching the natural conclusion of the drug use event (Ireland et al., 1999), or the conclusion of post-club festivities, whether a trip to the bathhouse or the 'recovery party', an event often held after a major dance party to prolong festivities and allow participants to come down from their high (A. I. Green & Halkitis, 2006; Husbands et al., 2004; Southgate & Hopwood, 1999b;

Weems, 2007; Westhaver, 2003). Across included studies, reaching the limits marked the return to the non-littoral space, or the everyday, intransient world.

Identifying limits. While those limits might have occurred naturally or structurally, as a result of the event's conclusion, it was also common across included studies for participants to state that they knew when they had reached their own limits (Greenspan et al., 2011; Husbands et al., 2004; Ireland et al., 1999; Klitzman, 2006; O'Byrne & Holmes, 2011b; Slavin, 2004; Southgate & Hopwood, 1999a). These limits were both identified beforehand and also in the moment. When identified in the moment, the identification of limits is one of 'boundary play', as O'Byrne and Holmes (2011b) name it. This implies not only the performative process leading to limit identification, but variations between persons in the points at which those limits are identified—in some cases around the onset of adverse effects (Greenspan et al., 2011). Knowing what these limits were assisted the partygoer in controlling and planning substance use and sexual activity—as one participant observed, 'But know what you're doing and know your limits, or know THE limits' (O'Byrne & Holmes, 2011a, p. 1515). In the same project, another participant observed, 'I think it MIGHT kind of get rid of SOME inhibitions, but I don't think that it actually changes your values' (O'Byrne & Holmes, 2011b, p. 6). These participants point to negotiation of limits that is both *in vivo* and informed by sober reflection. In another study, participants responded selecting specific substances with which they were familiar both as a harm reduction strategy and a recognition of their physical limits (Greenspan et al., 2011), where other participants timed their substance use to keep them near, but not beyond, their limits (Ireland et al., 1999). Similarly, while Cáceres and Cortiñas (1996) point out that bar patrons' intoxication

was a source of ‘collective amusement’, bystanders acted to sanction those whose behaviour was perceived as out of control.

Even when substance use was employed as part of sexual performance, all authors addressing sexual limits observed that participants reported having *some* prior limits, particularly around safer sex and esotery of sex acts (A. I. Green & Halkitis, 2006; A. I. Green, 2003; Greenspan et al., 2011; Husbands et al., 2004; Ireland et al., 1999; O’Byrne & Holmes, 2011a, 2011b; Slavin, 2004). For example, in a quote that also reflects the tribal and mechanistic dimensions of substance use and performance in the littoral space, one participant reports about being with his friends: ‘I wouldn’t want to go home with someone I didn’t really like. So I know that if I have them there, it’s like the barrier’ (Husbands et al., 2004, p. 8).

Pushing limits. Another consequence of the process of performance is that those limits of substance use or sexual intercourse are pushed once partygoers are under the influence. Indeed, the pushing of limits not only is invited by the multiple contingent possibilities of the littoral space, but also reflects on the failure of performance when negative outcomes result. These negative possibilities abound in substance use, including intense negative reactions to GHB and ‘k-holes’, or profound dissociative states associated with ketamine use (Ireland et al., 1999). Several studies reported limit-pushing experiences resulting in fear of impending death (Southgate & Hopwood, 1999b) or ‘bargaining with God’ after consuming a poorly calculated polydrug cocktail (Westhaver, 2005, p. 356). Green and Halkitis (2006, p. 326) observe that substance use can make ragged the edges of physical survival—they point to one participant who injured himself during receptive anal intercourse, and to another who described feeling ‘indestructible’, despite suffering a concussion during a violent sexual encounter. Many study authors highlight their

participants' reports that sober limits fell away under the influence of substances, whether intentionally or in a process of disinhibition (G. Brown et al., 2000; Elwood & Williams, 1998; A. I. Green & Halkitis, 2006; A. I. Green, 2003; Husbands et al., 2004; O'Byrne & Holmes, 2011a, 2011b). A major finding of one study is that the challenges of 'negotiation' of sexual practices meant that substance-using partygoers were more likely to engage in unprotected intercourse (G. Brown et al., 2000).

A dimension of preparation, the conditions of intentionality. Underlying the process of performance is the condition of 'intentionality'—how the totality of forethought, planning, accumulation of knowledge and 'sign-equipment' of substance use creates the conditions for performance in the littoral space. This intentionality is characterised by the efficiency of substance use, substance use as strategy for performance in the littoral space, typologies and associated strategies for substance use, and 'diminished capacity' as intentional argument.

Properties of the conditions of intentionality.

Efficiency. If the performance inherent in substance use is shaped by the hegemonies of the littoral space, then an efficient approach to the littoral space is to use substances. This property reciprocally translated across all included studies, in which authors highlighted that participants reported purposively using substances to enhance and improve their experiences in these social settings—to improve socialisation, overcome social anxieties, and fit in (*inter alia*, Bauermeister, 2007; Brown et al., 2000; Husbands et al., 2004); to improve sex (Ireland et al., 1999; Klitzman, 2006; Slavin, 2004); and to experience completely the visual and aural effects of the party ambience, particularly in circuit parties, where stage shows and light arrays interplay with participants' mentally altered states (Lewis & Ross, 1995; O'Byrne, 2009; Weems, 2007; Westhaver, 2003). In short, as these authors point

out, substance use maximises the individual experience of the social setting. One participant ties these considerations together: ‘If I meet someone out at a club or online and they are doing coke or crystal I know I’m going to have a great time’ (A. I. Green, 2003, pp. 433–434). Much like Butler’s (1999) conception of performativity is grounded in the anticipated reality, the intentionality of substances is rooted in the knowledge that it will have the desired effects in allowing the participant to maximise his experience.

The strategy of substance use. Examining efficiency alone as the strategy of substance use ignores that the person is not alone in the littoral space. Substance use itself is a strategy for negotiating the littoral space, the anticipation of which negotiation informs participants’ decisions to use substances. This is, in part, a reciprocal translation of the property of substance use as a mechanism, discussed above as part of the dimension of performance. Cáceres and Cortiñas (1996) observe that purchasing a drink for another man in the gay bar was a way of indicating social, perhaps romantic, interest. In a circuit party, the provision of MDMA to a newly initiated partygoer and the attached promise to ‘take care of’ the partygoer throughout the event points to substance use’s role as an intentional instrument for developing homosocial bonds in the littoral space (Westhaver, 2003).

Strategies for substance use and its typologies. A key aspect of the intentionality of substance use is the acquisition and deployment of specific strategies around the planning of the substance use for a specific event. If substance use is rarely accidental and often planned in advance, as all studies reported, then the planning of substance use involves the use of practices designed to choreograph more or less carefully the drug use event in the littoral space. These strategies ranged from having a drug dealer on speed dial to facilitate easy pickup (Slavin,

2004) to lay harm reduction strategies employed to prepare for a drug use event (Greenspan et al., 2011; Husbands et al., 2004; Ireland et al., 1999). Forays into the littoral space, with attendant drug use events, are ‘scheduled’ to ensure that the participant is prepared for them (A. I. Green & Halkitis, 2006; O’Byrne & Holmes, 2011a; O’Byrne, 2009). Similarly, many authors report that the partygoer’s return from the littoral space is planned to ensure it is as smooth as possible (Husbands et al., 2004; Ireland et al., 1999; Klitzman, 2006; Slavin, 2004). One participant describes a specific set of strategies that he uses to ‘come down’, starting with a small amount of Rohypnol, a dissociative sedative, to ‘...just kind of ease it down a bit. [...] Sometimes if I have three to five hours sleep, and if I don’t, I just make cups of tea and just soft music and just relax totally...’ (Ireland et al., 1999, p. 79). The property of ‘typologies of substance use’ points to a specific set of strategies for polydrug combinations that partygoers use over the course of an evening. A full discussion and cataloguing of these combinations would be beyond this review’s scope. This set of strategies indicates that the partygoer plans and modifies the combination of substances in response to the characteristics of the anticipated and encountered littoral space (*inter alia*, Green & Halkitis, 2006; Green, 2003; Greenspan et al., 2011; Husbands et al., 2004; Ireland et al., 1999; Lewis & Ross, 1995; O’Byrne, 2009; Slavin, 2004; Southgate & Hopwood, 1999b; Wilson, 2004).

Diminished capacity. O’Byrne and Holmes (2011a; O’Byrne, 2009) strongly underscored the use of substances to excuse risky behaviour, particularly risky sex, after the engagement with the littoral space. This is closely connected to ‘pushing limits’—the idea of diminished capacity points both to an intentional desire to push limits, and to address the instantiation of a negative contingent possibility of the littoral space arising out of limit-pushing. This theme reoccurred across different

studies, particularly as participants tried to make sense of the discrepancies between their ‘sober’ safer sex negotiation strategies and the actuality of unsafe sex while using substances (G. Brown et al., 2000; Caceres & Cortinas, 1996; Elwood & Williams, 1998; A. I. Green & Halkitis, 2006; Husbands et al., 2004; Ireland et al., 1999; Lewis & Ross, 1995; P. A. Wilson, 2004). Wilson (2004) deploys the framework of cognitive escape (McKirnan et al., 1996) to describe this ‘cognitive distancing’, in which the Latino MSM he studied used crystal methamphetamine in social settings to separate from the non-littoral space and then excuse their behaviour by this separation. To illustrate this, he quotes a participant who inconsistently uses condoms: ‘And I know about HIV and what not, and I don’t even know why I randomly use condoms. Because under the influence of the drug, you know, my thinking was totally different’ (P. A. Wilson, 2004, p. 107). The underlying question is one of motivation: if substance-using MSM are not dependent on substances, and they observe the correlation between riskier sexual behaviours and substance use, then why do they continue to use these substances (A. I. Green & Halkitis, 2006)? The enjoyment of the ‘diminished capacity’ arising from substance use is one possible answer.

A dimension of viewpoint and epistemology, the context of relating of worlds. Across studies, participants and researchers used a variety of methods to contextualise, understand, and integrate the distinct substance use experiences participants had in the littoral space with their non-littoral lives. These sense-making processes form the frame that ease partygoers’ transitions between spaces.

Properties of the context of relating of worlds.

Pushing limits. The pushing of limits, discussed above, also forms an important part of relating of worlds. How do MSM know that they have pushed their

limits without appraisal after the fact? While this property will not be rehashed here, that participants understand that they crossed limits indicates their appraisal of their littoral practices through a non-littoral lens.

Counterfactuals. Several authors and their participants described what a circuit party or a dance club would be like without drugs to underline the centrality of substance use to the littoral space. Green (2003, p. 441) calls this the ‘counterfactual’, noting that a dance party without drugs would exhibit significantly less bonhomie. As other authors observe, participants faced with the question of what a circuit party would be like without substance use were unable to answer the question. This points to the inextricability of substance use from the littoral space. In considering this counterfactual, Westhaver (2003) and Lewis and Ross (1995) draw on interviews with participants exploring this counterfactual to conclude that substance use is critical to the circuit party scene. Cáceres and Cortiñas (1996) note that alcohol and the gay bar are inextricably linked—one could not exist without the other.

Insiders and outsiders. The device of ‘insiders and outsiders’ refers to the specific approach researchers take to relate themselves to their work. Understanding this device is especially critical in the general absence of reflexive discussion in the included studies. On the one hand, several projects were ‘embedded ethnographies’, in which researchers wrote as ‘insiders’ about the littoral space from their own direct observation. The tone of these projects varied greatly—O’Byrne (2009), like Cáceres and Cortiñas (1996), wrote as ‘outsiders inside’, taking a reflexively nuanced approach that still on the whole refrained from discussing their own relations to the space in such a way as to make their experiences an essential part of the analysis. In contrast, two other ethnographers (Weems, 2007; Westhaver, 2003)

wrote from a position of being active participants—perhaps celebrants—of circuit parties. Slavin (2004) wrote from somewhere in the middle: though he acknowledges the centrality of his own relationships to the creation of his ethnography, he avoids writing from his own experience, instead focusing on observation. Other included projects were interview-based, evoking a certain distance between the researcher and the experiences interviewees describe. In these projects, the individual researchers' beliefs or experiences were not addressed or acknowledged in the analysis.

Here and now, mundane and not mundane. Two distinct, diverging devices were used to describe littoral experiences and practices. On the one hand, as explained above in the discussion of the littoral space, participants point to the 'ineffability' of the littoral space—as Westhaver (2005, p. 356) explains, that the experience 'resists interpretation'. This is both a property of the littoral space and a way of relating these worlds, of distinguishing the 'here and now' quality of the space from other experiences. This inability to characterise the littoral space from the distance of sober reflection is, across studies, a substantial dividing line between littoral and non-littoral.

On the other hand, participants, and authors writing about their interviews with participants, regularly drew parallels to the mundane 'everyday world' to illustrate similarities and differences between this world and the 'fantasy world' of the littoral space. Illustrating the euphoria of MDMA use, Klitzman (2006, p. 16) takes as a starting point the experience of one man, who described the 'celebrating' atmosphere of partygoers in a gay dance club as like being given '100 million dollars, tax free'. Several authors and their participants used specific examples along the axis of sexual orientation to describe what makes the gay littoral space, and

practices of that littoral space, different from others. For example, to illustrate how important crystal meth has become to his bathhouse experience, one man notes that sex without this substance ‘is like having sex with a straight man [...] who is having sex for the very first time. This isn’t very interesting; it’s not very developed’ (A. I. Green & Halkitis, 2006, p. 323). Westhaver (2003, p. 97) uses a gay circuit party attendee’s observation that ‘when straight boys go out they beat the shit out of each other and trash the place’ to explain that gay men partying ‘are a different gender’. Like Slavin (2004), who contextualises ‘gay spaces’ in the heterosexual landscape of Sydney nightlife, and Weems (2007), who compares the masculinity of the gay circuit party to the masculinities of soldiers and terrorists, these accounts use comparisons between observations of gay men’s substance use behaviours in the littoral space and straight men’s behaviours elsewhere to approximate that of the littoral space which sets it apart from other spaces.

A dimension of viewpoint, the context of ecological systems. A final dimension of ‘ecological systems’ emerged from the data as a latent organising schema that reciprocally translated across all studies. This dimension helps in understanding the littoral space, and the various systems embedded in it, categorised here as *person*; *persons*, or a small clique or group of individuals; *people*, or all individuals and groups of individuals at a specific event; and *place*, the geographical location that bounds the people.

These systems interact dynamically to shape and to bound substance use and sexual behaviours in the littoral space. For example, the flashing lights and techno music of the place suggests that a person might take substances as a way to more intense experiences; likewise, the atmosphere created by the people in the club—perhaps through close touching, or dancing together—suggests substance use would

be an appropriate behaviour. A group of persons might share between them illicit substances, but might also bound substance use by withholding or counselling as to adverse effects. Similarly, norms held by the people as to what constitutes inappropriate drug use might prevent reckless, life-threatening behaviours. All events and parties bound substance use by coming to an end. The individual person ultimately decides and desires to use substances, but might know his own limits or come up against them involuntarily to bound his own substance use.

Chapter 7. Discussion

In this systematic review and qualitative metasynthesis, qualitative studies with content connecting MSM, substance use, and social venues were systematically and rigorously searched, retrieved, and appraised. These studies' findings were analysed line-by-line using dimensional analysis (Schatzman, 1991) to develop a theoretically saturated grounded theory. Insights from theories of liminality (Turner, 1969; van Gennep, 1909), space (De Certeau, 2011), performance (Goffman, 1959), and performativity (Butler, 1999) emerged as particularly relevant to understanding the emergent dimensions of the grounded theory. The final grounded theory was integrated and arranged into an explanatory matrix to outline explicitly relationships between dimensions.

This grounded theory used the idea of 'littoral spaces' as a key organising perspective by which to understand the roles of performance, identification and pushing of limits, intentionality, relating of worlds, and the ecological systems context in constructing the meaning of MSM's substance use in relation to the social space. Specifically, the 'littoral space' is characterised as different from everyday life, in which social boundaries and sensory perception are altered; defined by its illegal, subaltern qualities; and described as 'tribal' and 'ritual'. What makes this space 'littoral' rather than 'liminal' is the repeated, episodic nature of the person's interaction with the space, and the purportedly and preferably impermanent effects of this interaction (for example, the ability to wake up after a weekend of partying and go to work). Substance use behaviours are situated within this littoral space as a performative regime—that is, not only does the space require substance use behaviours 'required', but as a mechanism, these behaviours allow MSM to enact the biological (e.g., dancing all night) and social (e.g., facile conversation with strangers)

expectations of the space. These behaviours were motivated by the intentionality MSM displayed in the complex mechanisms for knowledge generation and sharing around substance use and the desire to maximise the efficiency of the transient experience in the space. These behaviours concluded when MSM felt they had reached their pre-specified limits, sexually or in substances consumed—or when MSM involuntarily came up against biological limits. To make sense of these behaviours, MSM and the researchers who studied them used a variety of methods, including counterfactuals and analogies. Finally, the different aspects of the littoral space, and the processes occurring within it, were classifiable as ‘ecological systems’, in which person, persons, people, and place all interacted to shape and bound substance use behaviours.

Verification of the grounded theory

Throughout analysis, hypotheses developed from the data regarding different dimensions and their differentiation were tested for disconfirming data and inductively elaborated (Heath & Cowley, 2004) with the goal of developing a saturated grounded theory—that is, a grounded theory that encompasses the complexity of the data and explains variation within it (Corbin & Strauss, 2008). In accordance with the dimensional analysis method outlined earlier, the grounded theory needed to demonstrate ‘fit’ with both the participant experiences (first-order constructs) when quotes were provided, and the researchers’ interpretations (second-order constructs). At the conclusion of analysis, the grounded theory presented here was determined to fit the data well. This grounded theory describes variation (e.g., possible links between substance use and risky sex) and provides participant quotes and researcher interpretations to support hypotheses. Critically, sensitivity analysis to epistemologies and approaches used in studies and study quality yielded the

finding that dimensions and their properties were largely durable to these variables, except where properties (such as ‘insiders and outsiders’ in the dimension of relating of worlds) explicitly built on these variables as part of the grounded theory.

Reflexive comments

When I began this project, I was a novice to qualitative research, but I had some experience of its critical appraisal. In the course of my practice as a registered nurse, I had often met both MSM and persons who use substances. This, combined with awareness of the inadequacy of existing health promotion theories to account for substance use in these social settings, piqued my interest in the subject. As a straight-identified, non-substance-using man with a normative gender identity, it was a challenge to interpret the material in both participant quotes and researcher interpretations. This was, in part, due to my clinical orientation as a nurse. Moving away from the rational, illness-driven approach to understanding human behaviour that the health professions encourage was difficult, particularly in light of descriptions of behaviours that any clinician would find alarming. However, the humanistic ethic and importance of generating better knowledge for practice that piqued my interest in this project helped me to interact closely with the data and the analysis.

Over the course of the project, I recorded my own reactions to the data through several drafts of this work and through capturing the evolution of the project through memos (Charmaz, 2006). These memos aided in tracking my own analytic process and in writing the grounded theory. I tracked how I grew into both the symbolic interactionist frame and grounded theory methodology through several drafts of this work. This helped me to assess my own biases and assumptions through ‘epistemological’ and ‘positional reflexivity’ (Dowling, 2006).

Strengths and limitations of this project

Studies included in this project drew from myriad qualitative designs, epistemologies, and methodologies. Included studies sampled a variety of social spaces, substance use patterns, and particular populations. The emergence of a grounded theory durable to the variation these variables represent is a major strength of this metasynthesis, suggesting a level of conceptual generalizability (Mills et al., 2010; Small, 2009) important for the creation of theory. Systematic review methodology ensured that all available journal-level evidence was considered. The line-by-line dimensional analysis procedure ensured a rigorous, comprehensive reciprocal translation and a grounded theory with explicitly defined parts.

However, studies were limited in the locations they examined to North America and Australia. Moreover, within these countries, several key populations were under-sampled. Despite several authors' efforts to 'oversample' underrepresented ethnic groups (Greenspan et al., 2011; Husbands et al., 2004; Natale, 2008) and several authors' focus on Latino MSM (Bauermeister, 2007; Caceres & Cortinas, 1996; P. A. Wilson, 2004), the experiences of ethnic minority MSM were inadequately represented. Critically, this metasynthesis did not include any studies from MSM in the United Kingdom, data from which population form the basis for the additional empirical work in this thesis.

Because this is a metasynthesis of qualitative data, generalizability in the 'traditional' sense—i.e., statistical generalizability—cannot be ascertained, nor is statistical generalizability necessarily desirable or appropriate for an interpretive study. While the results of this metasynthesis may be conceptually generalizable—that is, useful in interpreting specific instantiations of space and substance use that may not have been specifically treated here—the 'tentative' nature of qualitative data

analysis (Charmaz, 2006) points to the shifting realities and interpretations of participants, researchers, and metasynthesists. This metasynthesis could be described through Sandelowski's (2008) description of the systematic review as a 'highly disciplined, albeit subjective' endeavour. A different review team might well have come to a different interpretation, from study screening through to the final higher-order constructs. Finally, as the social landscapes and substance use patterns of MSM both within and across specific evolve, this metasynthesis might become irrelevant.

Contribution to knowledge

As mentioned in the introduction to this thesis, this is the first known qualitative metasynthesis of the relationship between MSM and social substance use. This project contributes to enhanced understandings of the cultural contexts of social substance use by MSM and the negative consequences of this substance use, to the systematic reviewing of qualitative knowledge regarding health behaviours in MSM and to the generation of intervention approaches for substance use, risky sex, and MSM. This project demonstrates and elaborates, for the first time, a dimensional analysis approach to the lines-of-argument synthesis for theory-building.

Implications for public health practice

This metasynthesis furthers the project of developing health behaviour theories that more adequately reflect the specific cultural and social milieu of MSM (O'Byrne, 2009, 2011; Westhaver, 2003)—a project critical to break the gridlock on structural-level HIV prevention for MSM (Beyrer et al., 2012; Kalichman, Cain, Carey, Carey, & Simbayi, 2013; Kalichman, 2010). By outlining and describing how substance use unfolds in the social space that invites, if not demands, substance

use, this grounded theory generates new intervention targets for individual and structural interventions.

Individual interventions. The episodic nature of interactions with the littoral space suggests a harm reduction approach to substance use and risky sex. This might include inviting participants to reflect on the link between risky sex, substance use, and their own practices of both, and draw their own resolutions for change. Of course, an underlying issue in planning interventions for the littoral space is the conceit that this space represents—which is that it is as far away as possible from the realities of everyday life. Therefore, intervention approaches might focus on developing individual change plans that are able to cross the barrier from the everyday to the littoral space—plans that are ‘durable’ and that account for context and not just actions. Inviting participants to interrogate the ‘multiple contingent possibilities’ (e.g. sexual encounters, overdoses, HIV transmission), of their engagements with the littoral space could produce positive change. As regards the possible harms of substance use, interventions to help MSM negotiate their substance use limits before entering the social space can also serve to reinforce positive ‘folk pharmacologies’ and harm reduction approaches (Greenspan et al., 2011; Ireland et al., 1999), and dispel inaccuracies.

Currently, interventions have not met the need to contextualise these behaviours in space. Work from a recent systematic review (Melendez-Torres & Bonell, 2013) demonstrates that few interventions for episodic, non-dependent MSM currently address this need for individual planning exclusively (Mansergh et al., 2010) or even extensively (Koblin, Chesney, & Coates, 2004), with no interventions demonstrating clinically or statistically significant effects over assessment-only controls. Both of these types of interventions specifically focus on ‘heat of the

moment' sexual negotiation, which may be too late to avert negative outcomes. It may prove more effective for MSM to consider plans, intentions, and acceptable consequences before entering the social space—not just before entering a sexual encounter. This is amenable to several intervention modalities. For example, a motivational interviewing approach might suggest formulating a durable plan and then executing it, whereas a cognitive behavioural approach might focus on developing the skills necessary to carry out such a durable plan.

Structural interventions. The role of place in this grounded theory suggests that structural interventions are important, and also why they may be ineffective. Changing littoral spaces to make them less attractive for substance use is a potential, but probably unsuccessful, intervention target—partly because substance use itself induces pleasurable effects, with enhanced lights and music only part of the rationale for substance use (Lewis & Ross, 1995). A feasible intervention approach may be to incorporate information and harm reduction paraphernalia—whether testing kits for the safety of specific substances, safer sex supplies, or other similar equipment—into the social space, or the distribution of specific information and reminders at the venue. It is likely that local AIDS service organisations and gay men's groups are already carrying out these interventions in some form or another. However, these interventions have been poorly evaluated, if they have been evaluated through a randomised controlled trial at all—only one such randomised intervention evaluation targeting substance-using MSM is known to exist, with little significant effect (Croff, Clapp, Chambers, Woodruff, & Strathdee, 2012). If substance use behaviours are carefully pre-planned and choreographed prior to engaging the littoral space, then it is unclear if these at-venue interventions will actually be effective. A structural intervention approach should focus on harm reduction at the event itself, through,

perhaps, the provision of HIV testing, of services regarding the suitability and safety of specific substances and polydrug combinations, and of specific strategies to counteract common adverse effects of substance use (e.g. water for dehydration experienced by MDMA users). Anecdotally, some of these services are currently provided at circuit parties (Westhaver, 2003), but it is unclear if they have been evaluated.

Another approach involves bringing peer-led education into the milieu of the littoral space. However, the suitability of public opinion leader interventions (Kalichman, 2010; Kelly, 2004; Kelly et al., 1992, 1997; Sikkema, 2005) is questionable, as the intervention logic would dictate that a public opinion leader would himself need to use substances. Indeed, the sensory disruption and suspension of rational faculties in the littoral space clarifies why replications of public opinion leader interventions for gay men in different settings have frequently been unsuccessful. These specific problems have been reported by peer-led education interventions in British gay bars (Bonell, Strange, Allen, & Barnett-Page, 2006; Elford, Hart, & Sherr, 2002). However, public opinion leader interventions outside the littoral space can help disseminate information so that partygoers might be encouraged to plan more health-promoting behaviours.

Finally, a broader structural approach places the littoral space in its larger context. This metasyntesis points to the littoral space as a unifying aspect of urban gay men's sociality—yet this may not always be so. Historically, these littoral spaces emerged out of a history of marginalisation and illegality of homosexual contact (Lewis & Ross, 1995; Southgate & Hopwood, 1999a; Weems, 2007). A broader range of venues where MSM can socialise, and that discourage substance use, may help transform sociality away from health-damaging behaviours (Sigma

Research Group, 2011). As examined in the discussion of ‘counterfactuals’ above, many MSM interviewed felt that social spaces without substance use would not be as exciting or pleasurable. While little will stop those who enjoy recreational drug use, the growing political and social emancipation of LGBT populations only creates opportunities for alternative socialities outside performative regimes of substance use.

Implications for research

This grounded theory also draws attention to a different role for place in theories of health promotion. First, it suggests that the deployment of critical theoretical approaches, particularly as surround group social behaviours in place, have a role in understanding public health and health promotion. Broadly, this project suggests that critical theories can be useful ‘interpretive frames’ (Alasuutari, 1996) by which to generate novel insights for intervention development and health promotion—a critical approach as part of public health, not simply in examining public health practice.

Second, this grounded theory points to a new conception of place in health promotion. Currently, theories linking health and place generally fall into one of two categories. In one group, these theories relate health to the built environment—e.g. how the availability of play spaces impacts child health and development (Blacksher & Lovasi, 2012). In the other group, these theories tie the social and structural characteristics of place-bounded groups of people, such as communities, to risk and protective factors for health and wellbeing above and beyond individual determinants. Ideas from these theories include ‘neighbourhood effects’, or the ecological and reciprocal effects of living in a specific community (Brooks-Gunn, Duncan, & Klebanov, 1993), and more generally, social determinants of health, or

how the social and structural conditions in which people live affect their health (Baral, Logie, Grosso, Wirtz, & Beyrer, 2013; Blakely & Woodward, 2000; D. Cohen, Farley, & Mason, 2003).

This metasynthesis both integrates these perspectives and moves beyond them to examine how a person's episodic, planned interaction with place is enmeshed with and results in specific health behaviours. This grounded theory and the dimensional analysis used to generate it model this reciprocal determinism and unpack the interactions between the constituent components of the phenomenon. By unifying person, place, and practice in the 'space' (De Certeau, 2011), this grounded theory opens up a new avenue in understanding how, for example, temporary groups of people in transient social communion can produce substantial effects on health behaviours. The grounded theory, when reread through the perspectives of health and place, illuminates how, for example, the characteristics of lights and music or the clandestine locale of some dance parties (the 'built environment' of the littoral space) can encourage substance use behaviours, and how certain place-level and people-level characteristics might predispose someone to engage the littoral space through substance use (the 'social determinants' of substance use in the space). The integrated explanation the grounded theory offers examines the interplay between the littoral space and the performative regimes that make coming up against human limits through substance use possible.

Moreover, this metasynthesis acknowledges the link between substance use and sexual risk behaviour and the multiple pathways by which substance use and risky sexual behaviour are connected. This ambiguity is 'built in' to the metasynthesis—for example, through the property of 'multiple contingent possibilities'. The statistical and qualitative characterisation of that relationship as

causal, correlational, mediational, or a combination therein, as has been variously suggested across both the included studies and the broader evidence, is still an open question deserving of its own metasynthesis.

Following on from this, the organising perspective of the ‘littoral space’ is at home in perspectives of cognitive escape and sensation seeking alike, though to each this perspective contributes the need to examine interactions between substance use and location in shaping expectancies of sexual pleasure and participation. In particular, cognitive escape translates well with the properties of the littoral space, especially as ‘everyday and fantasy worlds’ reflects the abandonment of safer sex norms that characterises this understanding of relationships between substance use and sexual risk. Drug use as a strategy and diminished capacity, as a properties of the dimension of intentionality, confirm the use of substances as tools for the attainment of sexual outcomes otherwise impossible under sober judgment. Indeed, Wilson (2004) uses the framework of cognitive escape (McKirnan et al., 1996) to contextualise and frame his findings in this regard.

Sensation seeking also has a clear translation into the findings of this study. Specifically, findings regarding the pushing of limits in the pursuit of sensory experiences reflect the underlying personality traits associated with sensation seeking. The ‘efficiency’ of substance use and the biological characteristics of performance could also be expectancies shared by those MSM with high levels of sensation seeking as they approach substance use in social spaces.

Finally, a corollary of the project of developing culturally appropriate health promotion theories is the examination of how the included studies map against several theories of health promotion. One way to do this is to use extant theories of health behaviours (e.g. the health behaviour model, etc.) to recast the results of the

metasynthesis as a ‘grounded theory in the emergent fit mode’ (Artinian, Giske, & Cone, 2009), in which the data are analysed as they relate to, elaborate, or disconfirm an existing theory. Another way is to test this grounded theory through primary qualitative research.

Conclusion

This grounded theory of meanings of MSM’s substance use in social venues deploys the dimension of ‘littoral space’ to provide a starting point for research and practice that innovatively accounts for the role of place, practice, and person in health promotion, particularly in a population at high risk for negative health outcomes. By demonstrating a novel approach to the metasynthesis of qualitative data, this project also expands the possibilities of systematic reviews and analyses of qualitative research in developing more substantive, useful findings for research and practice. While several questions are left unanswered by this metasynthesis, important next steps include the theory’s use in guiding intervention development and its verification through primary research.

SECTION 3. Systematic review of event-level situational characteristics in multiple-event analyses of sexual encounters of MSM

Chapter 8. Systematic review methods

Because a registry does not currently exist for systematic reviews addressing non-interventional questions, this review protocol was unregistered. However, the review team agreed to inclusion and exclusion criteria *a priori* and, in all cases, an auditable methodological trial was recorded.

Criteria for considering studies for this review

Studies were considered eligible for this review if they met each of the following criteria. First, included studies reported analyses conducted only on data from MSM. This included transmen as well. This criterion served to limit included studies only to those addressing the population of interest because of the specific contexts of HIV transmission and sexual sociality among MSM.

Second, included studies collected all data after 1996, the year in which highly active antiretroviral therapy first became widely available. The advent of HAART appears to have marked a major watershed in sexual behaviour risk patterns and transmissibility of HIV. Several qualitative studies suggest that, after 1996, the landscape of sexual sociality shifted among MSM in populations with access to HAART (Balan et al., 2013; Dowsett, 2003, 2009).

Third, included studies collected multiple sexual events per respondent and analysed them as separate events. This is a central feature of the study design assessed in this review. For example, studies that collected multiple events per person and then tested for correlation between summary measures of all events would not be included, but studies that tested for differences between events would be included.

Fourth, included studies presented data on situational, behavioural and partner characteristics and analysed these in relation to sexual outcomes and, in

particular, sexual risk behaviours. Put otherwise, studies were excluded if they examined emotional states or affect as predictors of sexual outcomes, as these studies addressed psychological constructs that were not central to the quantitative work this review was carried out to inform.

Fifth, included studies were reported as full-length articles, dissertations, or reports. This means that conference abstracts alone were not eligible. This was done because it was believed unlikely that studies reported in conference abstracts were not reported in full-length studies.

Search methods for study identification

On 9 July 2013, the following databases were searched: MEDLINE with MEDLINE In-Process & Other Non-Indexed Citations (from 1946 to 8 July 2013), PsycINFO (from 1987 to July week 1 2013), and Embase (from 1974 to 8 July 2013), all on OvidSP; CINAHL on EBSCO; ISI Web of Science; and Sociological Abstracts, ASSIA, and Dissertations and Theses A&I, all on ProQuest. A search string comprising terms for population, study design, outcome, and timespan was adapted to each platform's specifications regarding truncation, study fields, and formatting. Population and outcome terms are consistent with those used in other search strategies in this dissertation. The search string for MEDLINE, Embase, and PsycINFO was as follows:

1. (gay or bisexual or homosexual or queer or LGBT* or men who have sex with men or MSM).mp. or exp homosexuality/ or exp homosexuality, male/ or exp bisexuality/ or exp transsexualism/ or exp transvestism/
2. (event\$ or encounter\$ or episode\$ or (critical adj2 incident) or conditional logistic regression or multi-day or multiday or diary or association\$).mp.

3. (HIV or condom or (safe* adj2 sex*) or (unsafe* adj2 sex*) or (unprotected adj3 intercourse*) or (protected adj3 intercourse*) or risky sex*).mp. or exp sexually transmitted diseases/ or exp safe sex/ or exp sexual behavior/ or exp HIV infections/ or exp Acquired Immunodeficiency Syndrome/
4. 1 AND 2 AND 3
5. limit 4 to yr="1996–Current"

All other search strings, with number of hits by string, can be found in Appendix 4.

Additional search strategies were also used to locate studies. A systematic review of event-level studies of associations between substance use and sexual risk behaviours in MSM (Vosburgh et al., 2012) was hand-searched, as were the journals *AIDS and Behavior* and *Sexually Transmitted Infections* from 1996 through online articles posted by 9 July 2013. Finally, the reference lists of included studies were reviewed for any potential citations.

Study selection and data extraction

Abstracts generated from database searches were exported to Mendeley (Mendeley Ltd & Glyph & Cog LLC, 2014) and deduplicated. Two reviewers, working independently, screened abstracts and titles for eligibility against inclusion criteria to assess for ‘definite’ exclusion—that is, if studies definitively did not meet at least one inclusion criterion. Full-text versions of screened records were then obtained, to which both reviewers applied the inclusion criteria independently. Differences at each stage were resolved by discussion, with reference to a third reviewer when necessary.

The first reviewer, working independently, extracted data from each study on study sample and design. Additionally, data were extracted for statistical models treating sexual risk behaviour as a dependent variable, including analytic method,

specific outcome variables, event-level variables and covariates, and person-level variables and covariates. Extraction was checked by the second reviewer.

Quality assessment

Because of the lack of widely accepted critical appraisal guidance capturing the breadth of designs covered here and to capture the broadest possible range of studies, quality assessment was not undertaken *a priori*.

Data analysis

Study-level findings were synthesised narratively. Because of the diversity of study designs and analytic methods and heterogeneity in event-level variables and covariates, study-level findings were not meta-analysed.

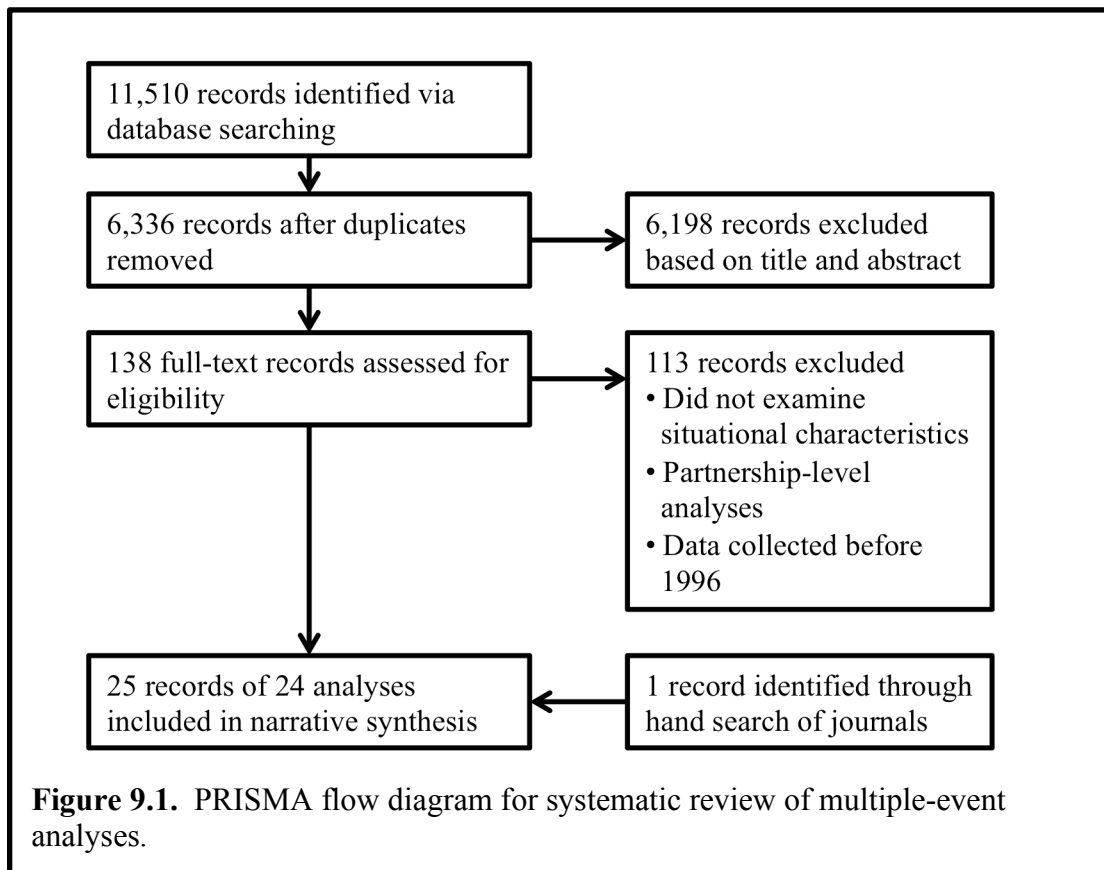
Chapter 9. Results of the systematic review

Database searches yielded 11,510 records. After deduplication, 6,336 records remained. Screening led to the exclusion of 6,198 records, with 138 records remaining. Assessment for inclusion with full-text documents led to a total of 25 records, with one additional article (Parsons, Lelutiu-Weinberger, Botsko, & Golub, 2012) identified by hand search of journals. See Figure 9.1 for a PRISMA flow diagram.

Of the 26 included records, three (Horvath, 2005; Newcomb, 2012; P. A. Wilson, 2004) were dissertations. Two reported analyses in corresponding full-text articles (Newcomb & Mustanski, 2013; Newcomb, 2013; P. A. Wilson, Díaz, Yoshikawa, Shrout, & Diaz, 2009), though one analysis in Wilson (2004) was not published in journal form and is thus included separately. In three cases, multiple papers arose from the same project: a project examining sexual risk behaviours in Brazilian, Colombian and Dominican immigrant MSM (Reisen, Iracheta, Zea, Bianchi, & Poppen, 2010; Zea, Reisen, Poppen, & Bianchi, 2009), a project collecting information on MSM via online web diary (Mustanski, 2007a, 2008) and the Health in Men cohort study (Prestage et al., 2005; in part, Zablotska et al., 2009). One record (Kott, 2012), a brief secondary news report of a primary study (Hensel, Rosenberger, Novak, & Reece, 2012), was set aside and not counted. Therefore, in total, 25 records representing 24 analyses were included from 21 sources of data.

Studies awaiting classification and excluded studies

There are no studies awaiting classification. Excluded studies generally analysed reports of risky sexual behaviour across subjects, and did not analyse sexual encounters separately. For example, three studies counted the number of risky sexual behaviours within partnerships and treated partnerships as the unit of analysis



(Clerkin, Newcomb, & Mustanski, 2011; Mustanski, Newcomb, & Clerkin, 2011; Newcomb et al., 2011). Another study used the frequency of UAI at each follow-up point as the unit of analysis (Halkitis, Mukherjee, & Palamar, 2009). Finally, other studies treated affective states (for example, negative or positive emotions) at the time of the sexual encounter as variables to predict sexual risk (Mustanski, 2007b). These studies were excluded as well, as they did not address situational, behavioural, or partner characteristics.

Studies of interest that did not meet the inclusion criteria are discussed later.

Characteristics of included studies

Residence and recruitment of samples. Of the 24 analyses included here, 17 were conducted on samples of MSM recruited in the United States, of which 10 studies included participants from New York City (see Table 9.1). One study (Colfax et al., 2001) was conducted on a sample from San Francisco, and an

additional study (Hensel et al., 2012) focused only on men who were resident in the United States and users of an online sex website for gay men. Five studies (Horvath, 2005; Mustanski, 2007a, 2008; Newcomb & Mustanski, 2013; Newcomb, 2013) focused internet-based recruitment exclusively in the United States, but did not explicitly state residence as an inclusion criterion.

A total of five studies were conducted in Australia (Lyons, Smith, Grierson, & von Doussa, 2010; Minichiello, Marino, Khan, & Browne, 2003; Prestage et al., 2005; A. M. A. Smith, Grierson, Pitts, & Pattison, 2006; Zablotska et al., 2009). One study was conducted in the Netherlands (Van der Bij et al., 2007) and one study was conducted in Peru (Nagaraj et al., 2013).

Year of data collection and collection method. Data for included studies were collected between 1998 and 2010. Studies demonstrated a wide variety of data collection methods, including five studies with computer-based interviewing, 11 studies including in-person or telephone interviews of respondents and nine studies that used internet sex diaries. Sex diaries were either weekly (four studies), daily (four studies) or at the level of the encounter (one study).

Sample sizes and specific populations. Included studies often conducted the relevant multiple-event analyses on a subgroup of the study sample. Here, only sample sizes reflecting those subgroups are included. The sample sizes of 15 of the 24 analyses included here ranged between 100 and 300 participants. Two studies had unusually large sample sizes: one study included reports from 1,225 MSM (Colfax et al., 2004) and one study included reports from 3,877 MSM (Hensel et al., 2012). Five studies analysed sample sizes between 315 and 735 MSM (Nagaraj et al., 2013; Reisen et al., 2010; Van der Bij et al., 2007; Zablotska et al., 2009; Zea et

al., 2009). Two studies included samples of fewer than 50 MSM (Horvath, 2005; Irwin, Morgenstern, Parsons, Wainberg, & Labouvie, 2006).

Many studies collected data on specific populations of MSM. Six studies collected data on HIV-negative MSM and one study (Parsons, Lelutiu-Weinberger, et al., 2012) collected data on MSM who did not have partners living with HIV. Two studies focused only on MSM living with HIV (Boone, Cook, & Wilson, 2013; P. A. Wilson, Cook, McGaskey, Rowe, & Dennis, 2008). Additionally, two studies stratified respondents by HIV status and analysed the events they reported separately (Van der Bij et al., 2007; Zablotska et al., 2009). Four studies analysed Latino MSM only (Reisen et al., 2010; P. A. Wilson et al., 2009; P. A. Wilson, 2004; Zea et al., 2009). Three studies were 'venue/modality-based'. That is, they undertook to study sexual behaviour through specific venues or modalities, including internet sex-seeking (Horvath, 2005), circuit parties (Colfax et al., 2001) and sex-on-premises venues (Lyons et al., 2010).

Encounter definition. Encounters of interest were primarily defined in one of two ways: either as any sexual behaviour with a partner or as any anal intercourse with a partner. Studies using the first definition then generally tested differences between UAI encounters and non-UAI encounters, while studies using the second definition tested differences between UAI encounters and encounters with protected anal intercourse. One study (Colfax et al., 2004) defined sexual behaviours specifically as including either anal intercourse or oral intercourse. Another study (Parsons, Lelutiu-Weinberger, et al., 2012) looked at day-level sexual behaviours (i.e. did unprotected anal intercourse happen on that day or did it not?).

The number of encounters collected in each study was associated with data collection methods. Studies that used retrospective interviews or questionnaires

generally captured a specific number of encounters (for example, conditional logistic regression studies that examined last sexual events with and without a condom). The two exceptions to this were studies with interview-based data collection involving a timeline follow-back procedure to capture sexual encounters retrospectively (Irwin et al., 2006; Parsons, Lelutiu-Weinberger, et al., 2012). In contrast, studies that prospectively enrolled diary participants (even though, strictly speaking, reporting of the encounters themselves was of course retrospective) captured sexual behaviours on a daily or weekly basis, so that in some studies the hypothetical maximum number of sexual encounters included was equal to the number of days for which the diaries collected data.

Study foci. Of the 24 studies included, 11 had identifiable foci on substance use behaviours and sexual risk. Three studies (Nagaraj et al., 2013; Van der Bij et al., 2007; Zablotska et al., 2009) focused on partner HIV status and five studies (Colfax et al., 2001; Horvath, 2005; Lyons et al., 2010; Mustanski, 2007a; Reisen et al., 2010) were primarily interested in the venue where either the sexual encounter occurred or the partner was met. Other studies addressed a panoply of independent variables without a key predictor of interest.

Outcomes and analytic methods

As would be expected, all studies primarily took as the outcome of interest UAI, either as compared to any sexual activity or to protected anal intercourse specifically. Three studies examined as well whether or not anal intercourse occurred at all (Colfax et al., 2001; Horvath, 2005; Van der Bij et al., 2007). Four studies examined seroconcordant UAI as an outcome (Boone et al., 2013; Colfax et al., 2001, 2004; P. A. Wilson et al., 2008) and two examined seroconcordant UAI as an outcome (Colfax et al., 2001; Van der Bij et al., 2007). Four studies examined

insertive UAI and receptive UAI separately (Hensel et al., 2012; Horvath, 2005; Irwin et al., 2006; Lyons et al., 2010). Two studies from the same project (Newcomb & Mustanski, 2013; Newcomb, 2013) analysed unprotected anal and vaginal intercourse episodes together. Critically, while several studies tested associations between situational characteristics—for example, a study that tested associations between location of sex and substance use in male sex workers (Minichiello et al., 2003)—the only sexual outcomes that study authors identified and tested related to sexual repertoire.

Analytic methods. Analytic methods could be described as being broadly in three classes: within-subjects comparisons, population-average models and cluster-adjusted models. Each will be addressed in turn.

Within-subjects comparisons. Models using within-subjects comparisons used either generalised linear mixed effects models, conditional logistic regressions, McNemar’s test or paired *t*-tests to examine associations between sexual risk outcomes and situational characteristics. Each of the first three methods takes as its unit of analysis the individual encounter in order to examine how changing the value of an independent variable changes the odds of an outcome within a specific respondent. The conditional logistic regression, like McNemar’s test, requires at least one observation to have a different value on the outcome than other observations. However, unlike McNemar’s test, more than two encounters can be analysed per respondent and predictors need not be dichotomous. Paired *t*-tests, in contrast, were used by two studies (Horvath, 2005; Irwin et al., 2006) to compare whether proportions of events involving sexual risk were similar between exposures. The interpretation is not one of odds of outcome, but rather of probability of outcome given a certain exposure.

Population-average models. Studies using population-average comparisons used generalised estimating equations with exchangeable correlation matrices to adjust both coefficients and standard errors for clustering of responses by participants. Instead of comparing encounters within respondents, these models generate ‘population averages’ over the population of encounters with specific associations. Collecting multiple encounters per person and averaging across encounters leads to ‘stabilised’ estimates including information across a range of encounters for each respondent.

Cluster adjusted models. Two studies (Nagaraj et al., 2013; Zablotska et al., 2009) did not adjust coefficient estimates for clustering, but adjusted standard errors for clustering using sandwich variance estimation. Interpretation of these models is similar to population-average models, but in a ‘weaker’ form in which person-level confounding is not addressed in parameter estimation.

Model-building procedures and reporting. On the whole, studies poorly reported model-building procedures. Two studies (A. M. A. Smith et al., 2006; Van der Bij et al., 2007) used stepwise selection to create final multivariate models. Other studies (Koblin et al., 2007; P. A. Wilson et al., 2008, 2009; P. A. Wilson, 2004) used a *p*-value cut-off from univariate models for including independent variables in multivariate models. Only two studies (Mustanski, 2008; Zea et al., 2009) reported conducting explicitly hypothesis-driven analyses in testing combinations of variables. It should be noted that studies using McNemar’s test (Prestage et al., 2005; Reisen et al., 2010) or paired *t*-tests (Horvath, 2005; Irwin et al., 2006) were limited to univariate analysis.

Almost all studies reported testing independent variables in univariate models before testing multivariate models, but in several cases these univariate models were

not reported (Hensel et al., 2012; Lyons et al., 2010; Newcomb & Mustanski, 2013; Newcomb, 2013; A. M. A. Smith et al., 2006). In contrast, one study (P. A. Wilson et al., 2008) presented complete results only from univariate models, while presenting only whether or not independent variables were statistically significant in multivariate models. Several studies (Boone et al., 2013; Koblin et al., 2007; Van der Bij et al., 2007; P. A. Wilson et al., 2008) tested multivariate models but did not report coefficient estimates for several of the covariates tested.

Narrative synthesis of study results and measurement issues

Study analyses of interest are narratively synthesised by four groups of independent variables: substance use, seroconcordance, venue of sex, and partner relationship or meeting point. Where appropriate, measurement issues are addressed as well. Details of statistical models discussed here can be found in Table 9.2.

Substance use. Together, the 17 studies that addressed substance use suggest an event-level association between substance use and sexual risk behaviours, both within subjects and in the population average of encounters. However, this conclusion is tempered by measurement issues in capturing substance use, heterogeneity of study design, and poor evidence at the level of specific substances.

Measurement of substance use. Substance use was often measured as a binary phenomenon—either respondents engaged in substance use or they did not. Moreover, definitions of substance use were inconsistent and unclear across studies. In three cases (Colfax et al., 2004; Lyons et al., 2010; Newcomb, 2013), alcohol and other substances were measured separately, with ‘other substances’ measured as a binary. The one exception to this is alcohol, in that two studies (Mustanski, 2007a; Newcomb, 2013) treated alcohol use as a continuous variable (i.e., number of drinks) and one study (Colfax et al., 2004) treated alcohol use as an ordinal variable. All

studies examining substance use examined respondent substance use, except for one study (Lyons et al., 2010) that looked at partner substance use alone. An additional six studies (Colfax et al., 2004; Minichiello et al., 2003; A. M. A. Smith et al., 2006; P. A. Wilson et al., 2008, 2009; P. A. Wilson, 2004) examined partner substance use as well, of which only three studies, all by Wilson and colleagues, examined the interaction between respondent and partner substance use. Three studies (Boone et al., 2013; Colfax et al., 2001; Minichiello et al., 2003) examined polysubstance use specifically.

Evidence for associations between any substance use and sexual risk.

Evidence for an association between any substance use and sexual risk was inconsistent across studies and outcomes. Though evidence strongly suggests that any respondent substance use and UAI risk are positively associated at least at the univariate level, the evidence is less clear for associations with serononconcordant UAI, for participant substance use, and for specific substances, in part because of small numbers of studies.

Evidence for associations: any respondent substance use. All evidence testing associations between any respondent substance use and risk of UAI came from within-subjects comparisons, except where noted otherwise (see Figure 9.2). In models controlling for respondent age and race, Boone and colleagues (2013) found in their study of MSM living with HIV that any respondent substance use was significantly associated with increased odds of UAI both overall and with non-primary partners specifically, but also that any substance use was not associated with increased odds of serononconcordant UAI. Similarly, Wilson and colleagues (2008) found in univariate models that respondent substance use in MSM living with HIV was significantly associated with increased odds of UAI but not serononconcordant

UAI. However, the significant association became non-significant in multivariate models controlling for other contextual factors. Two other studies found that respondent non-alcohol substance use predicted increased odds of unprotected anal or vaginal intercourse in multivariate models (Newcomb, 2013) and, in univariate and multivariate models, of seronegative UAI (Colfax et al., 2004). In their study of encounters reported by male sex workers, Minichiello and colleagues (2003) found that encounters with no respondent substance use were associated with a statistically significant decrease in risk of 'unsafe sex' from 11.1% to 5.9%. Zea and colleagues (2009) found that in a model controlling for respondent condom self-efficacy, substance use predicted increased odds of UAI. Though Smith and colleagues (2006) also examined respondent substance use, they do not report univariate associations or a multivariate model including this independent variable. Because of their model selection process, this implies that respondent substance use was not a significant correlate in a multivariate model. Wilson and colleagues (2009) also did not find a statistically association between UAI and respondent substance use in univariate models. In both univariate and multivariate population-average models, Parsons and colleagues (Parsons, Lelutiu-Weinberger, et al., 2012) found that any respondent substance use was associated with increased odds of UAI.

Two studies (Prestage et al., 2005; Zablotska et al., 2009) that defined substance use as 'other' categories besides alcohol, poppers and sildenafil use yielded mixed evidence. In one study (Prestage et al., 2005), within-subjects comparisons did not yield statistically significant associations with UAI. In cluster-adjusted regressions in another study (Zablotska et al., 2009), use of other drugs was not associated with UAI in HIV seronegative men, but use of other substances was associated with decreased risk of UAI in univariate models in MSM living with HIV.

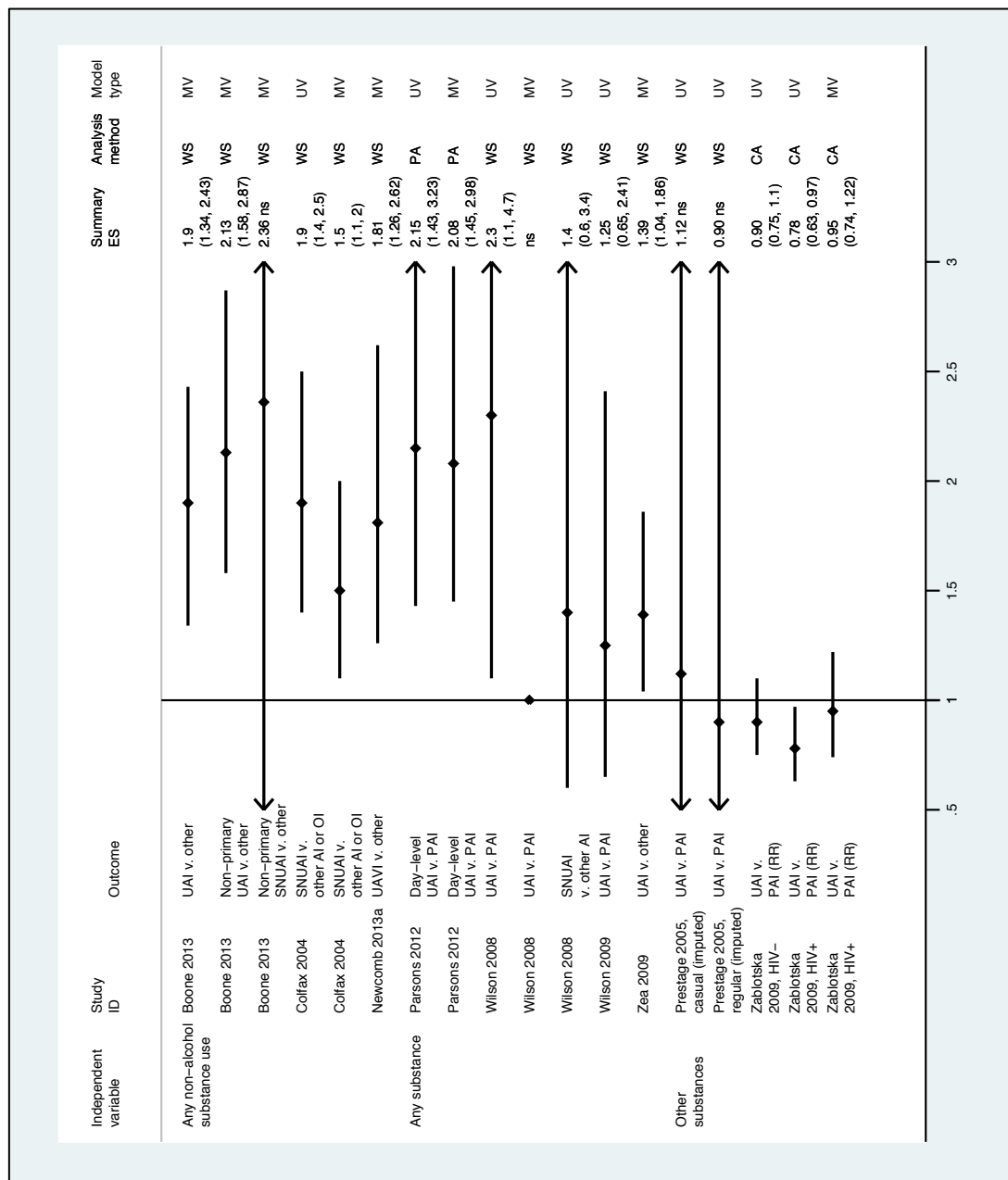


Figure 9.2. Associations between any respondent substance use and sexual risk behaviours. *Because measures of respondent substance use were not included in the final model, results from Smith et al. (2006) are not included. Minichiello and colleagues' (2003) study also did not provide sufficient information to calculate a summary effect size for respondent substance use and sexual risk.*

Outcomes: SNUAI is serononconcordant UAI, OI is oral intercourse, PAI is protected anal intercourse, and RR is rate ratio.

Analysis method: WS is within-subjects, PA is population-average, and CA is cluster-adjusted.

Model type: MV is multivariate and UV is univariate.

Evidence for associations: respondent polysubstance use. The body of evidence for associations between polysubstance use and UAI is small and inconsistent. In within-subjects comparisons controlling for respondent age and race, each additional substance consumed by the respondent was associated with increased odds of UAI in MSM living with HIV (Boone et al., 2013). While similar associations for male sex workers and their clients were found in univariate models, Minichiello and colleagues (2003) did not include these in their final multivariate within-subjects comparisons through an unclear model-building procedure. In a multivariate population-average model, increasing number of substances did not significantly account for increased odds of UAI, though this model also controlled for venue of sex (circuit party, dance club or home) and use of specific substances (Colfax et al., 2001).

Evidence for associations: any partner substance use. Evidence for associations between any partner substance use and sexual risk was inconsistent (see Figure 9.3). In multivariate cluster-adjusted models, non-alcohol partner substance use was not associated with increased risk of UAI, any anal intercourse or any anal intercourse by positionality in encounters held in sex-on-premises venues (Lyons et al., 2010). However, both non-alcohol partner substance use and being unsure if partner had used substances were statistically associated with increased odds of seroconcordant UAI in univariate and multivariate within-subjects comparisons in Colfax and colleagues' (2004) study, but not in Wilson and colleagues' (2008) study of MSM living with HIV. In Smith and colleagues' (2006) study, partner substance use was not in the final within-subjects comparison multivariate model comparing UAI with no anal intercourse, though any partner substance use was associated with increased odds of protected anal intercourse as compared to no anal

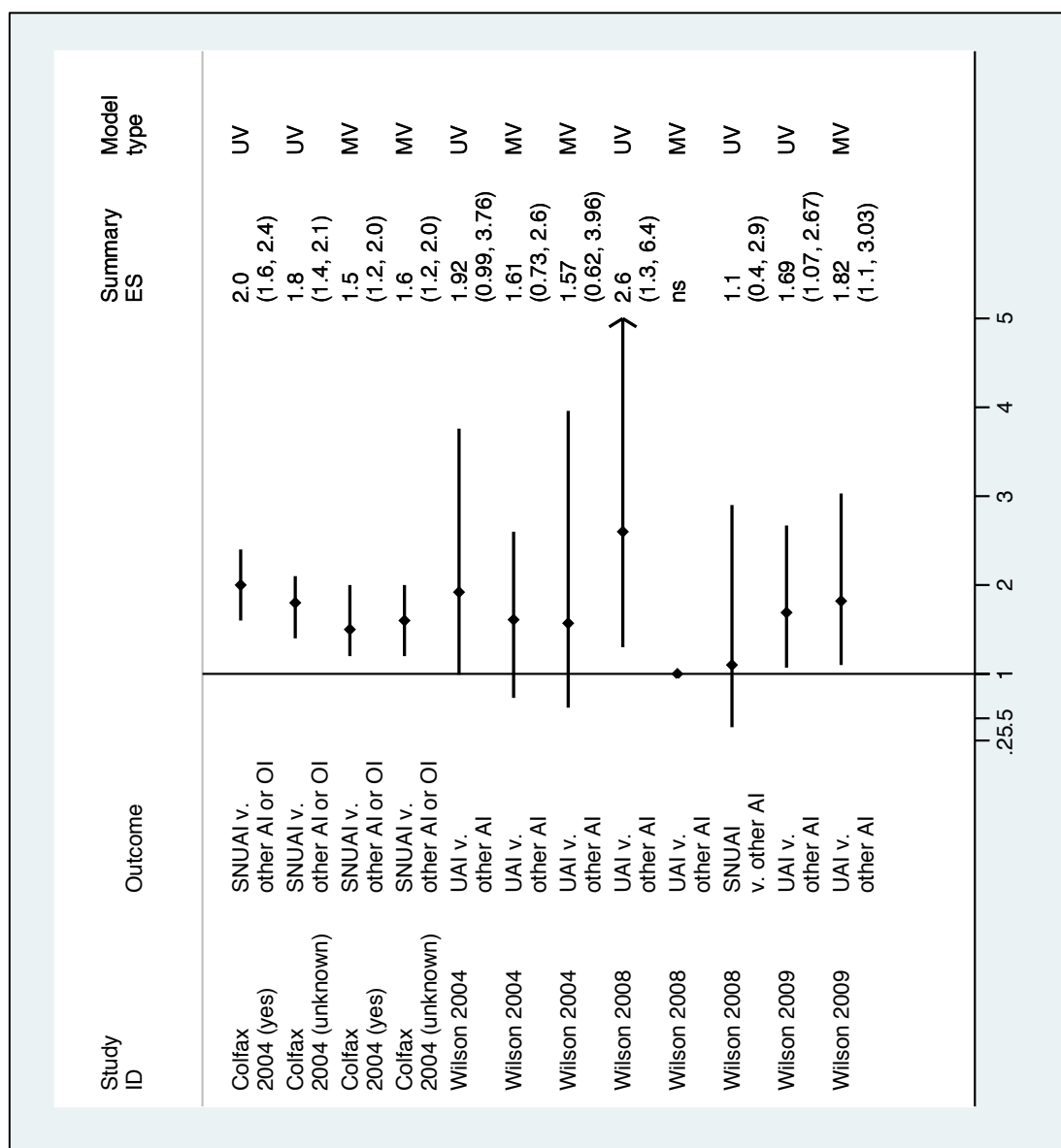


Figure 9.3. Associations between any partner substance use and sexual risk behaviours. *Because measures of any partner substance use were not included in the final model, results from Smith et al. (2006) are not included. Neither Minichiello and colleagues (2003) nor Lyons and colleagues (2010) provided sufficient information to calculate a summary effect size for partner substance use and sexual risk.*

Outcomes: SNUAI is serononconcordant UAI, OI is oral intercourse, PAI is protected anal intercourse, and RR is rate ratio.

Analysis method: WS is within-subjects, PA is population-average, and CA is cluster-adjusted.

Model type: MV is multivariate and UV is univariate.

intercourse. In two studies of Latino MSM (P. A. Wilson et al., 2009; P. A. Wilson, 2004) and one study of MSM living with HIV (P. A. Wilson et al., 2008), partner substance use was associated with increased odds of UAI in all three univariate within-subjects comparisons, but only in one multivariate model (P. A. Wilson et al., 2009).

Evidence for associations: respondent and partner substance use. Across the three studies (P. A. Wilson et al., 2008, 2009; P. A. Wilson, 2004) assessing the combination of respondent and partner substance use in within-subjects comparisons, evidence for associations between respondent and partner substance use and UAI is inconsistent in univariate models and uniformly not statistically significant in multivariate models.

Evidence for associations between use of specific substances and sexual risk. Evidence is inconsistent across substances and outcomes for associations between use of specific substances and outcomes. Because few studies addressed each substance, discussion will focus on use of alcohol, amphetamine-group substances, poppers, erectile dysfunction medications and cocaine (including crack cocaine). Results for other substances were reported in one or two studies, so they are not treated specifically here.

Evidence for associations between alcohol use and sexual risk. Evidence for an association between alcohol use and sexual risk was mixed and inconsistent across studies (see Figure 9.4). In within-subjects comparisons examining binary alcohol use on the part of the respondent, neither Boone and colleagues (2013) nor Prestage and colleagues (2005) found evidence of a statistically significant association with UAI in MSM living with HIV and in HIV seronegative MSM respectively. However, Irwin and colleagues (2006) found that while the probability

of UAI during alcohol encounters (60%) was significantly different from the probability of UAI during non-alcohol encounters (47%) in HIV seronegative MSM, this difference may have been explained by a significant difference in probabilities for unprotected receptive anal intercourse (64% with alcohol, 45% without), as the difference in probabilities for unprotected insertive anal intercourse (59% with alcohol v. 58% without) was not statistically significant. In clustered regression models, Zablotska and colleagues (2009) found that no alcohol use was associated with increased UAI risk in HIV seronegative, but not HIV seropositive, MSM.

Evidence examining alcohol use as an ordinal or continuous variable was also mixed. Colfax and colleagues (2004) found in univariate within-subjects comparison models that while low levels of drinking (1-2 drinks) were not associated with serononconcordant UAI, high (3-5 drinks) or binge (6 or more drinks) drinking were associated with this outcome. In multivariate models, only binge drinking was significantly associated with serononconcordant UAI. Neither Mustanski (2008) nor Newcomb (2013) found statistically significant ‘main effects’ for HIV seronegative MSM in associations between number of drinks and, respectively, UAI or unprotected anal or vaginal intercourse. However, they both did find significant interaction effects with age of respondent—though the first study suggested that the association between number of drinks and increased odds of UAI grew larger with age of respondent, while the second study suggested the converse. It should be noted that Mustanski (2008) found a significant main effect of number of drinks and increased sexual risk in an omnibus measure of day-level sexual risk, with this association increasing in magnitude with respondent age.

Finally, evidence for associations between partner alcohol use and sexual risk is slim. In one study’s (Colfax et al., 2004) multivariate within-subjects comparison

model, partner alcohol use was associated with increased odds of serononconcordant UAI. In another study's (Lyons et al., 2010) clustered regression model, partner alcohol use was significantly associated with increased odds of UAI in encounters occurring in sex-on-premises venues, but not significantly associated with protected anal intercourse or anal intercourse by positionality.

Evidence for associations between amphetamine-group substances and sexual risk. Evidence for an association between use of amphetamine-group substances and sexual risk was fairly consistent across studies (see Figure 9.5). In univariate and multivariate within-subjects comparisons, Koblin and colleagues (2007) found that amphetamine use (including crystal methamphetamine) was associated with increased odds of UAI. Boone and colleagues (2013) found similarly in their study of MSM living with HIV for respondent methamphetamine use and respondent 'club drug' use (including MDMA, an amphetamine-group substance). However, Wilson (2004) did not find a significant association in his study of Latino MSM, though all episodes examined in his study included some form of substance use. In population-average models, Parsons and colleagues (2012) found significant associations in HIV seronegative young MSM between crystal methamphetamine use and increased odds of UAI and Colfax and colleagues (2001) found the same for serononconcordant UAI in circuit party attenders. However, Parsons and colleagues (2012) did not find a significant association for MDMA.

Evidence for associations between poppers and sexual risk. Evidence for an association between poppers use and sexual risk was inconsistent across the few studies that examined use of this substance specifically. In a multivariate population-average model controlling for venue of sex and other substance use, Colfax and colleagues (2001) found a statistically significant association between

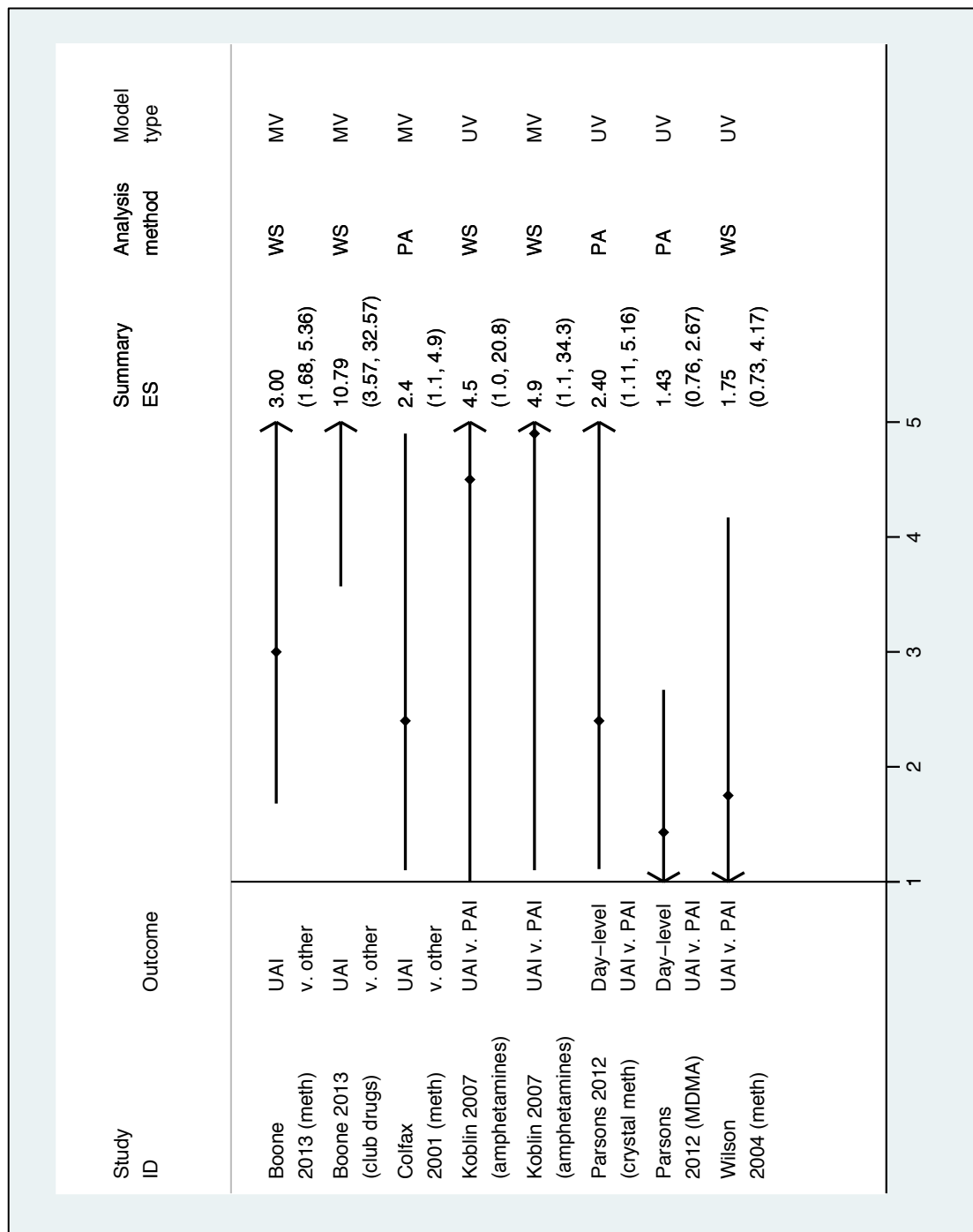


Figure 9.5. Associations between use of amphetamine-group substances and sexual risk behaviours.

Outcomes: PAI is protected anal intercourse.

Analysis method: WS is within-subjects, and PA is population-average.

Model type: MV is multivariate and UV is univariate.

poppers use and increased odds of seronegative UAI. Boone and colleagues (2013) also found a statistically significant within-subjects association between poppers use and UAI in MSM living with HIV. However, Prestage and colleagues (2005) did not find a within-subjects association for either casual or regular partners in HIV seronegative MSM. Multivariate clustered regression models also did not find an association between poppers use and risk of UAI in either MSM living with HIV or HIV seronegative MSM (Zablotska et al., 2009).

Evidence for associations between erectile dysfunction medication use and sexual risk. Neither Zablotska and colleagues (2009) nor Prestage and colleagues (2005) found significant associations in their analyses between erectile dysfunction medication use and risk of UAI. However, one study (Colfax et al., 2001) found a significant association between sildenafil use and odds of UAI in a multivariate population-average model.

Evidence for associations between cocaine/crack use and sexual risk. Boone and colleagues (2013) examined cocaine use and crack use separately in within-subjects comparisons and found significant associations between use of cocaine and crack and UAI in MSM living with HIV. Similarly, in a univariate population-average model, cocaine was significantly associated with increased odds of UAI in young HIV seronegative MSM (Parsons, Lelutiu-Weinberger, et al., 2012). However, in a within-subjects comparison of UAI and protected anal intercourse encounters both characterised by stimulant use, cocaine or crack use measured together were not significantly associated with odds of UAI (P. A. Wilson, 2004).

Seroconcordance and HIV serostatus of sexual partners. The 11 included studies that address partner HIV serostatus point to an association with sexual risk. Clear statements based on the evidence are difficult to make because of significant

issues in measurement. After addressing measurement issues, evidence for associations between HIV serostatus of sexual partners and sexual risk will be discussed: for samples of respondents where seroconcordance can be directly inferred; for mixed serostatus study samples; and finally for associations measured by constructs related to partner HIV serostatus.

Measurement. Only two studies (Van der Bij et al., 2007; Zea et al., 2009) tested seroconcordance of sexual partner directly. Three studies (Lyons et al., 2010; Nagaraj et al., 2013; A. M. A. Smith et al., 2006) divided sexual partners into seropositive, seronegative, and serostatus unknown partners, while one study (Newcomb & Mustanski, 2013) treated partner HIV status as a five-point Likert scale expressing certainty about a partner's HIV serostatus from certainty of the partner's HIV seronegative status to certainty of the partner's HIV seropositive status and another study (Prestage et al., 2005) asked whether the partner was assumed to be HIV seropositive or to be HIV seronegative. Finally, four studies (Prestage et al., 2005; P. A. Wilson et al., 2009; P. A. Wilson, 2004; Zablotska et al., 2009) asked whether partner HIV serostatus was known prior to sexual intercourse.

Evidence for associations between partner HIV serostatus and sexual risk in studies with directly inferred serostatus. Evidence for an association between partner HIV serostatus and sexual risk in study samples where partner seroconcordance can be directly inferred is uneven and inconclusive. In an HIV seronegative sample, Nagaraj and colleagues (2013) found no statistically significant associations between partner HIV serostatus and UAI in a univariate cluster-adjusted regression model. Newcomb and Mustanski (2013) also found no statistically significant association in a multivariate within-subjects comparison between increasing certainty of partner HIV seropositive status and unprotected anal or

vaginal intercourse. Yet both having an HIV seronegative partner and knowing partner serostatus prior to sex predicted UAI as compared to PAI in univariate within-subjects comparisons (Prestage et al., 2005). In a mixed serostatus sample, Zea and colleagues (2009) found that seroconcordance was associated with increased odds of UAI while controlling for respondent depression in a within-subjects comparison.

In univariate population-average models, partner seroconcordance was significantly associated with increased odds of UAI relative to either serodiscordance or unknown partner serostatus for traceable partners, but not for anonymous partners, as reported by HIV seronegative MSM (Van der Bij et al., 2007). In their analyses of HIV seropositive MSM, Van der Bij and colleagues (2007) only tested associations for encounters with traceable partners. In a univariate population-average analysis of 'lower-risk' HIV seropositive MSM, differences in odds of UAI were not significant by partner seroconcordance, though partner seroconcordance was associated with higher odds of UAI in 'higher-risk' HIV seropositive MSM.

Evidence for associations between partner HIV serostatus and sexual risk in mixed serostatus study samples. Though one study (A. M. A. Smith et al., 2006) found in a within-subjects comparison that believing a partner to be HIV seropositive was associated with decreased odds of UAI, another study (Lyons et al., 2010) found in multivariate cluster-adjusted regression models that partner HIV seropositive status predicted *increased* odds of UAI compared to other sexual behaviours in encounters in sex-on-premises venues. However, Lyons and colleagues (2010) point out that this may be explained by the practice of 'seropositioning', since while insertive anal intercourse was associated with partner HIV seropositive status, no respondents reported receptive anal intercourse with HIV seropositive partners.

Evidence for associations between knowing partner HIV serostatus and sexual risk were mixed. Univariate within-subjects comparisons in two studies (P. A. Wilson et al., 2009; P. A. Wilson, 2004) did not show a statistically significant association with UAI as compared to protected anal intercourse. However, univariate and multivariate cluster-adjusted regression models in one study (Zablotska et al., 2009) showed that regardless of respondent HIV serostatus, both knowing or discussing partner serostatus, and assuming partner serostatus, were associated with increased risk of UAI as compared to protected anal intercourse.

Constructs related to decision-making and partner HIV serostatus. In three within-subjects comparisons, discussing condoms or HIV status was associated with decreased odds of UAI as compared to protected anal intercourse (P. A. Wilson et al., 2008, 2009; P. A. Wilson, 2004). This difference remained significant in multivariate models. However, condom discussions were not associated with odds of serononconcordant UAI (P. A. Wilson et al., 2008). In another within-subjects comparison controlling for respondent depression, concern about contracting a sexually transmitted infection was associated with decreased odds of UAI (Zea et al., 2009).

Venue of partner meeting and partner relationship. Evidence presented here addresses two key partner characteristics: where the respondent met his partner and how he described his relationship to his partner. Evidence for associations between UAI and both venue of partner meeting and partner relationship is inconsistent and unclear. Measurement of partner relationship was captured in two ways: previous sexual experience with partner and classification of partner relationship by general frequency of sexual contact (i.e., main or casual partner). Evidence for associations between venue of partner meeting will be discussed first,

followed by evidence for associations between previous sexual experience and sexual risk and finally evidence for associations between partner relationship and sexual risk.

Evidence for associations between venue of partner meeting and sexual risk. Four included studies (Horvath, 2005; Mustanski, 2007a; Prestage et al., 2005; P. A. Wilson et al., 2008) examined venue of partner meeting. While each of these studies examined whether meeting a partner on the internet was associated with sexual risk, only one study (Prestage et al., 2005) examined whether meeting a partner in other venues was associated with sexual risk. Evidence for associations was sparse, inconsistent and unclear (see Figure 9.6). All evidence treated here comes from within-subjects comparisons.

Horvath (2005) did not find any evidence for an association between meeting a partner on the internet and probability of any anal intercourse, probability of any anal intercourse by positionality or probability of any UAI by positionality. However, in models controlling for age of respondent, Mustanski (2007a) found that meeting a partner online was significantly associated with decreased odds of UAI as compared to all other sexual behaviours. This association was not statistically significant when UAI was compared against only protected anal intercourse. Comparing casual anal intercourse encounters in HIV seronegative MSM, Prestage and colleagues (2005) found no statistically significant association between meeting a partner on the internet and UAI. Conversely, when Wilson (2008) examined anal intercourse events in MSM living with HIV, he found that meeting a partner online was associated both with increased odds of UAI and with increased odds of serononconcordant UAI. These associations were significant in both univariate and multivariate models.

In other comparisons, Prestage and colleagues (2005) found no statistically significant association between meeting a partner through friends, sex-on-premises venues or gay bars and sexual risk.

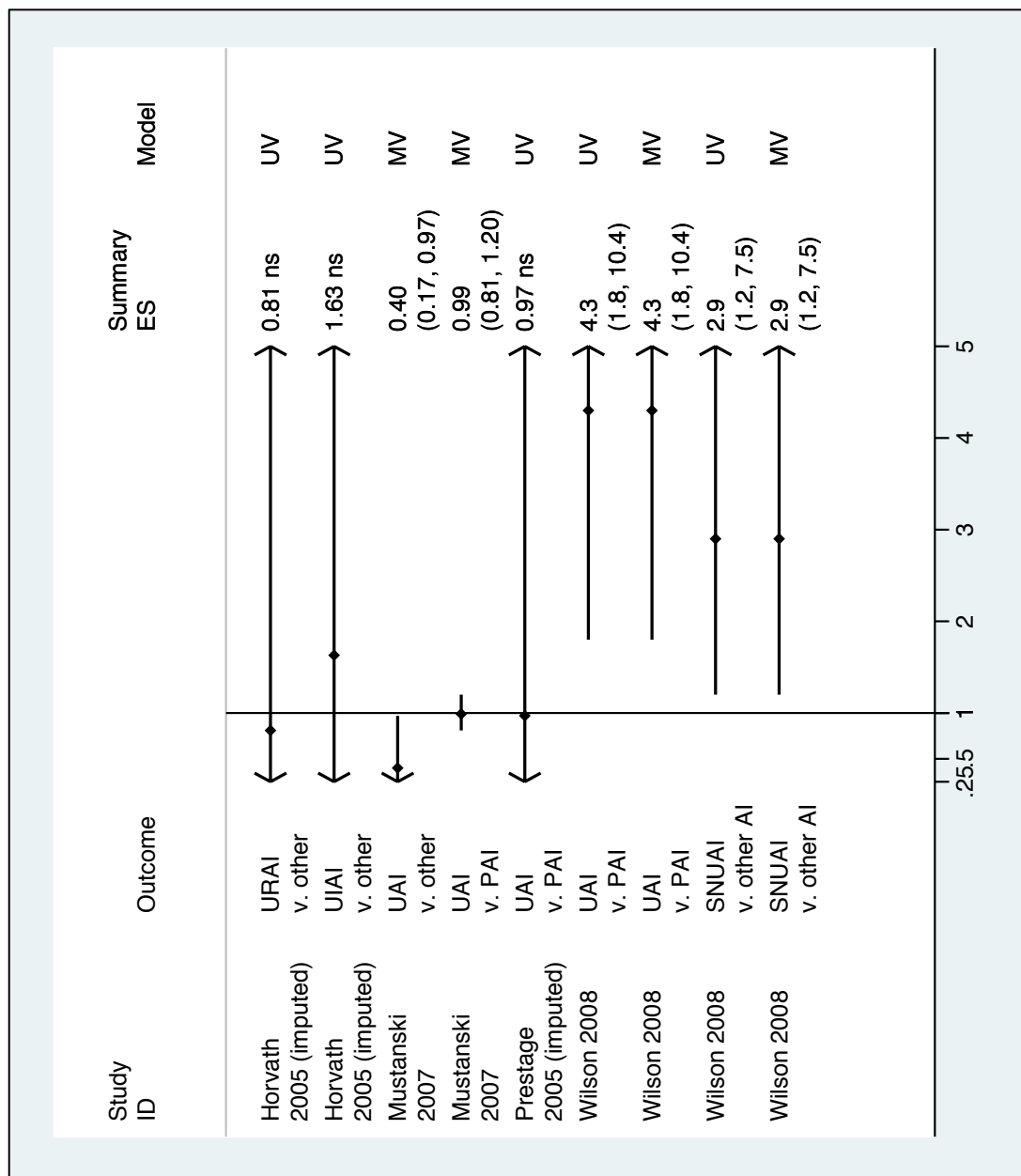


Figure 9.6. Associations between meeting partners on the internet and sexual risk behaviours. All analyses come from within-subjects comparisons.

Outcomes: SNUAI is serononconcordant UAI, OI is oral intercourse, PAI is protected anal intercourse, and URAI and UIAI are unprotected receptive or insertive anal intercourse respectively.

Model type: MV is multivariate and UV is univariate.

Evidence for associations between previous sexual experience with partner and sexual risk. The four included studies (Colfax et al., 2004; Mustanski, 2008; Newcomb & Mustanski, 2013; Newcomb, 2013) that addressed associations between previous sexual experience with partner and sexual risk measured previous sexual experience in three different ways. All evidence treated here comes from within-subjects comparisons. In the main, there is no evidence of an association between previous sexual experience and sexual risk.

While Colfax and colleagues (2004) found that five or more previous encounters with a partner in the six months before data collection was associated with increased odds of serodiscordant UAI in a univariate model, this relationship was not significant in a multivariate model. Similarly, in a model controlling for number of drinks of alcohol and age of respondent, sex with a new partner was not associated with day-level sexual risk (Mustanski, 2008). No statistically significant associations were found between number of previous encounters with a partner and odds of unprotected anal or vaginal intercourse in multivariate models across two studies (Newcomb & Mustanski, 2013; Newcomb, 2013).

Evidence for associations between partner relationship and sexual risk. Evidence for associations between partner relationship and sexual risk was inconsistent, though it generally supported an association between casual partners and decreased odds of UAI (see Figure 9.7). Clearer conclusions were impeded by different measurement approaches and outcomes in the included studies.

Measurement issues. Five studies (Hensel et al., 2012; Parsons, Lelutiu-Weinberger, et al., 2012; Van der Bij et al., 2007; P. A. Wilson et al., 2009; P. A. Wilson, 2004) treated partner relationship as a binary construct (i.e., main or casual). Of these five studies, two examined ‘risk reduction’ outcomes. In one study (Hensel

et al., 2012), all other sexual behaviours were compared against protected anal intercourse by positionality. In another study (Van der Bij et al., 2007), seroconcordant UAI was the outcome of interest. Two studies treated partner relationship as a ternary construct: either primary, steady non-primary, or non-steady partner (Colfax et al., 2004) or regular, occasional or casual partner (A. M. A. Smith et al., 2006). One study (Koblin et al., 2007) tested associations between partner type and UAI in multivariate within-subjects comparisons but did not report results.

Evidence for associations. As compared to encounters with primary partners, encounters with non-steady partners were significantly associated with increased odds of seroconcordant UAI in within-subjects univariate comparisons, but not in multivariate within-subjects comparisons controlling for substance use, venue of sex and number of encounters with partner (Colfax et al., 2004). Smith and colleagues (2006) found in their multivariate within-subjects comparisons that compared to encounters with regular partners, encounters with both occasional and casual partners were associated with increased odds of protected anal intercourse but decreased odds of UAI compared to no anal intercourse. Though Wilson's (2004) study comparing anal intercourse episodes with substance use in Latino MSM did not find a significant association between partner relationship and sexual risk, Wilson and colleagues (2009) found that encounters with regular partners were significantly associated with increased odds of UAI in univariate, but not multivariate, within-subjects comparisons. In univariate and multivariate population-average models of encounters reported by young HIV seronegative MSM, Parsons and colleagues (Parsons, Lelutiu-Weinberger, et al., 2012) found that encounters with main partners were associated with increased odds of UAI, though an inclusion criterion for the study was that respondents' main partners could not be HIV seropositive.

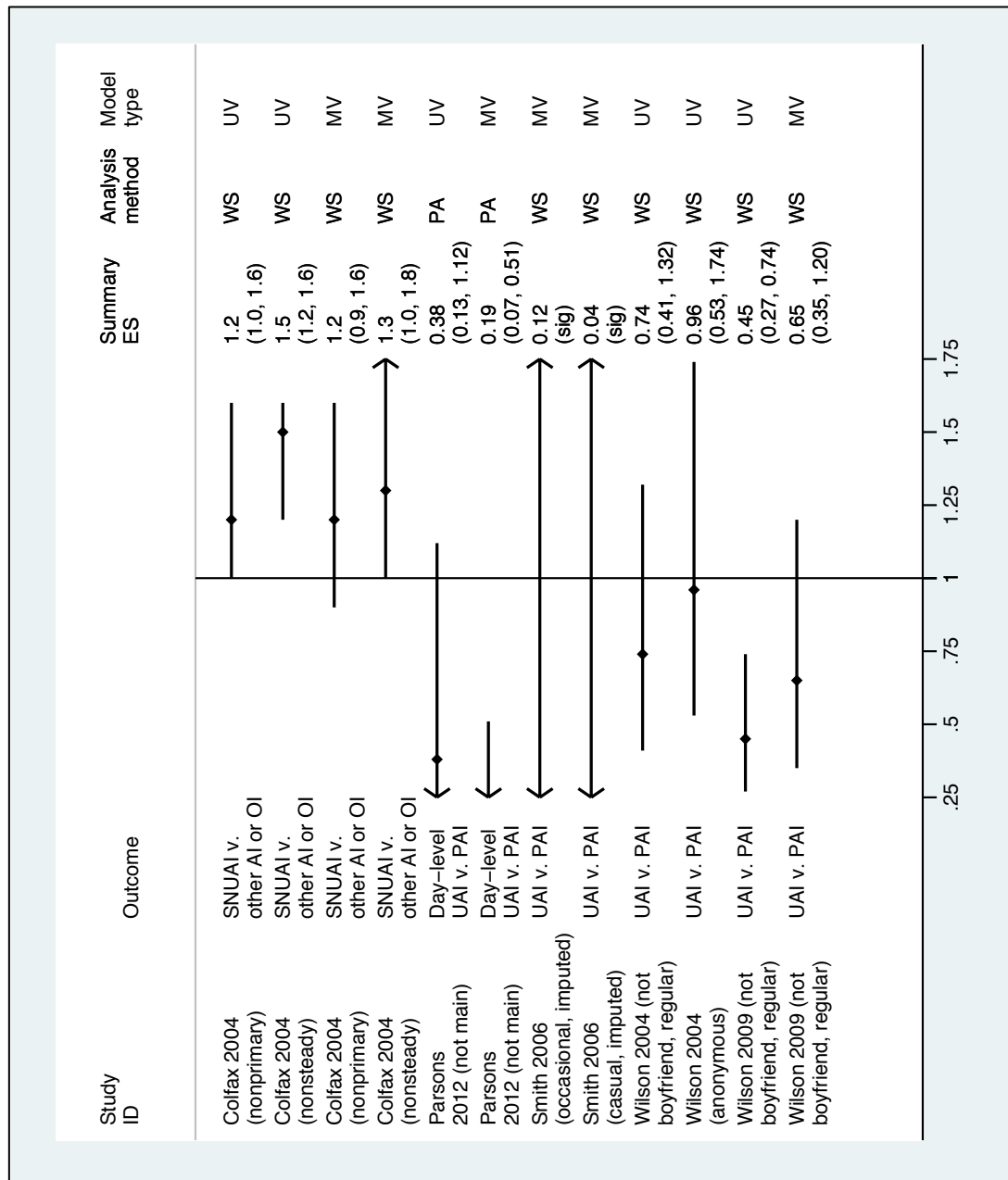


Figure 9.7. Associations between partner type and sexual risk behaviours. *All analyses are presented with regular partners, boyfriend, or other long-term relationship type with implied regular sexual contact as the comparison category.*

Outcomes: SNUAI is serononconcordant UAI, OI is oral intercourse, and PAI is protected anal intercourse.

Analysis method: WS is within-subjects and PA is population-average.

Model type: MV is multivariate and UV is univariate.

In multivariate population-average models, Hensel and colleagues (2012) found statistically significant associations between encounters with casual partners and both condom use with receptive anal intercourse and insertive anal intercourse. Because this study compares condom use against all other sexual behaviours, it is impossible to tell if this is attributable to decreased odds of anal intercourse generally with non-main partners. Similarly, though Van der Bij and colleagues (2007) found that encounters with main partners were associated with increased odds of concordant UAI among encounters with traceable partners, this does not explain if encounters with main partners regardless of seroconcordance are more likely to include UAI.

Location of sex. Evidence regarding associations between location of sex and sexual risk was inconsistent and unclear. This was in part due to complications in measurement.

Measurement issues. Of the eight studies that examined associations between location of sex and sexual risk, two studies (Prestage et al., 2005; P. A. Wilson, 2004) compared respondent home, partner home, and sex-on-premises venue. A third study (A. M. A. Smith et al., 2006) included categories for cruising location, for sauna, or for other locations not covered. Two studies compared encounters in any residence to encounters in other locations (Hensel et al., 2012) and to encounters in sex-on-premises venues and in other locations (Colfax et al., 2004). One study (P. A. Wilson et al., 2008) compared sex party or bathhouse (sauna) encounters to all other encounters, one study compared circuit party encounters to all other encounters (Colfax et al., 2001) and finally, one study compared ‘public’ encounters to encounters held in ‘private’ (i.e., in a residence or a motel) (Reisen et al., 2010).

Evidence for associations. Neither Prestage and colleagues (2005), Wilson (2004) or Wilson and colleagues (2008) found in within-subjects comparisons that encounters were differentially associated by venue with UAI as compared to protected anal intercourse. However, Reisen and colleagues (2010) found that both anal intercourse and UAI were more common in private settings than in public settings as compared to all other sexual behaviours. In another study (A. M. A. Smith et al., 2006), encounters in sex-on-premises venues, but not in partner's home, saunas or cruising locations, were associated with increased odds of UAI as compared to no anal intercourse, though encounters at cruising locations were associated with decreased odds of protected anal intercourse while encounters at saunas were associated with increased odds of the same. Yet in multivariate population-average models adjusting for additional situational characteristics, Hensel and colleagues (2012) did not find an association between encounters at respondent homes and condom use (2012) with receptive or insertive anal intercourse. This may be because Hensel and colleagues examined uptake of a specific safer sex behaviour rather than a risk behaviour as measured in other studies.

As compared to encounters at dance clubs, encounters at circuit parties were associated with increased odds of serononconcordant UAI and of multiple episodes of UAI in univariate population-average models, though in a multivariate model controlling for substance use, location of sex no longer predicted serononconcordant UAI (Colfax et al., 2001). However, Wilson and colleagues (2008) did find in univariate and multivariate within-subjects comparison models that relative to encounters in other locations, encounters at sex parties or in bathhouses were associated with increased odds of serononconcordant UAI. Colfax and colleagues (2004) found similarly in univariate models. In multivariate models, encounters in

locations that were not homes, sex clubs or bathhouses were associated with decreased odds of serononconcordant UAI.

Chapter 10. Discussion

This systematic review of multiple-event analyses grouped event-level situational, behavioural and partner characteristics into four categories: substance use behaviours, seroconcordance of partner, partner relationship, and location of sex. Few clear conclusions could be reached by examining the 24 sets of analyses collected through systematic search and appraisal.

Overview of findings

Broadly, respondent substance use appeared to be related to sexual risk at the event level, including within respondents. Substance use was also never a protective factor for UAI, with the exception of one study examining encounters in sex-on-premises venues (Lyons et al., 2010). However, few specific substances were addressed in enough studies to draw firm conclusions with the exception of crystal methamphetamine, which appeared to be singularly related to increased odds of UAI. This could reflect that crystal methamphetamine has similar social meanings, expectancies and contexts of use across cultures, or that it may operate more by biologically mediated mechanisms of disinhibition than other substances with less consistent effects. It would be impossible to draw these conclusions, however, with such slim evidence for each substance.

Similarly, it was difficult to draw firm conclusions on associations between perceived partner seroconcordance and UAI. This may have been because studies asked about partner HIV status rather than about the key decision-making processes that link HIV status perception to sexual behaviours. In this regard, studies conducted by Wilson (P. A. Wilson et al., 2008, 2009; P. A. Wilson, 2004) address a critical gap in the evidence. In each of these studies, having discussions about condom use was associated with decreased odds of UAI. These studies suggest that

associations between serodiscordance and condom use may be best understood as a behavioural process through which risks and benefits are weighed up in relation to what is known by each partner about the other's HIV status (Bauermeister, Carballo-Diéguez, Ventuneac, & Dolezal, 2009; Dowsett, 2009; Natale, 2008).

Increased familiarity and bonding with partner appeared to be associated with increased odds of UAI, but this relationship was again inconsistent. Location of sex did not have a clear relationship to UAI, though evidence addressing location of sex was especially confused by inconsistent measurement. Associations between sexual risk behaviour and non-private (i.e., not at home or at a hotel) venues may be moderated by local contextual and cultural factors. Sexual practices across the range of sex-on-premises venues may be shaped by any number of factors, from architecture of the bathhouse to the legal status of the institution, and the cultural significance of a venue or class of venues at a specific point in time (Elwood, Greene, & Carter, 2003; Grov & Crow, 2012; Van Beneden et al., 2002).

In addition to inconsistent measurement across studies, model building and key methodological decisions were poorly reported. For example, several study authors made methodological and publication decisions that hampered meaningful interpretation. One study (A. M. A. Smith et al., 2006) used a multinomial regression approach to compare encounters with no anal intercourse, with protected anal intercourse and with UAI. All comparisons were parameterised with no anal intercourse as reference category. However, a comparison of interest in weighing up against other studies would have been to parameterise a contrast between UAI and PAI in order to specifically target the difference between deciding to have anal intercourse and deciding to have UAI. Two additional studies (Koblin et al., 2007;

Minichiello et al., 2003) tested relevant event-level covariates but did not report model results for many of them.

Many studies did not report unadjusted associations between event-level factors and sexual risk behaviours, which made it impossible to interpret potential confounding. On the whole, model building procedures and discussions of multivariate models did not meaningfully attend to differences between confounding and mediation. No studies formally tested mediation, and changes in significance of predictors between univariate and multivariate models were not discussed across studies. Presentation of correlation matrices would have been of help in understanding potential confounding and mediation relationships.

In relation to previous evidence

This systematic review overlapped in part with two previous systematic reviews: one of event-level studies testing associations between substance use and sexual risk behaviours (Vosburgh et al., 2012) and one of causal associations between ‘club drugs’ and HIV transmission in MSM (Drumright, Patterson, et al., 2006). For reasons that are unclear, the current systematic review retrieved and included several multiple-event analyses (Irwin et al., 2006; Zablotska et al., 2009; Zea et al., 2009) that were not analysed by the previous systematic review. The current systematic review also includes several new studies addressing substance use and sexual risk (Boone et al., 2013; Newcomb, 2013; Parsons, Lelutiu-Weinberger, et al., 2012) that were published after the last search date of the previous review. Unlike Vosburgh and colleagues’ (2012) conclusion, the studies contained in this review did not point to an association between binge drinking, or alcohol use generally, and sexual risk behaviours. However, this systematic review did suggest a relationship between crystal methamphetamine and sexual risk—a relationship

suggested both by Vosburgh and colleagues (2012) and by Drumright and colleagues (2006). In contrast to Drumright and colleagues' (2006) conclusion, the current systematic review did not lead to a conclusive association between use of poppers and HIV risk. However, Drumright and colleagues (2006) took a broader view of the evidence than did this review, including analyses that were not at the event level.

Excluded studies in relation to evidence

Several key studies also deserve mention, including several studies detected in our search that collected data before the 1996 cut-off and that addressed closely related questions but that were ultimately ineligible (see Table 10.1). Three studies (Dolezal, Carballo-Diequez, Nieves-Rosa, & Diaz, 2000; Gillmore et al., 2002; Myers et al., 1999) were excluded because they collected data before 1996. In univariate within-subjects comparisons, Myers and colleagues (1999) found that UAI and anal intercourse generally were less likely with casual partners than with main or steady partners. Dolezal and colleagues (2000) did not find any relationships between UAI as compared to protected anal intercourse and substance use in their sample of Latino men resident in New York City. In one of the first studies to use prospective enrolment for diary-based data collection, Gillmore and colleagues (2002) did not find an association for either alcohol or other substance use and UAI in anal intercourse episodes.

Finally, three studies by Drumright and colleagues (Drumright et al., 2007; Drumright, Gorbach, Little, & Strathdee, 2009; Drumright, Little, et al., 2006) were among the first to comprehensively examine associations between specific substance use and risk of UAI in multiple-partner analyses among MSM. However, like other later excluded studies (Clerkin et al., 2011; Newcomb et al., 2011), their analyses examined frequency of sexual risk in a partnership and compared partnerships within

respondents. In within-subjects comparisons, Drumright and colleagues (Drumright, Little, et al., 2006) found that use of crystal methamphetamine, marijuana and erectile dysfunction medications when used with a main partner were associated with increased odds of UAI in their sample of recently HIV seropositive MSM. In this analysis, polysubstance use, measured as a binary construct, was also associated with increased odds of UAI.

Gaps in the evidence and future research

This systematic review reveals several key gaps in the evidence that future research should seek to address. To begin, the inconsistency in results across many analyses suggests two complementary possibilities. The first is that more research is needed on event-level associations in analyses that address person-level confounding factors. This research should involve transparently reported results from robustly analysed datasets where outcomes and model building approaches are clearly stated. Furthermore, this research should include a range of measures addressing the same phenomenon, especially as regards substance use, in an effort to ‘triangulate’ across potential differences in measurement. In particular, more research should examine specific substances, as the evidence base for associations between specific substances and sexual risk compared across multiple events per person is slim.

The second possibility that this inconsistency suggests is that relationships are highly sample-specific and idiographic. By way of corollary, all multiple-event analyses appeared to originate from samples based predominantly in the United States and Australia. This leaves untouched many populations of MSM—including those in the UK—to which results of previous studies may not generalise meaningfully. Cultures and norms around substance use are dissimilar over time and location, as the recent anecdotal surge in injecting crystal methamphetamine use

among UK MSM has demonstrated (Kirby & Thornber-Dunwell, 2013a, 2013b). The behaviours and phenomena examined in included studies are bounded by space, time and evolving cultural norms and may be limited in generalizability to inform health promotion interventions in times and locations different from the study's origin.

Moreover, included studies did not adequately address non-coital sexual outcomes. Studies did not examine how participants felt about encounters after the fact, or did not examine intended or possible behavioural or situational goals aside from coital repertoire. This is especially in light of the key outcomes of substance use flagged by the qualitative metasynthesis, including pleasure arising from sexual contact and strategies of substance use.

Finally, included studies did not meaningfully attend to potential interactions between situational characteristics. While one study (Newcomb & Mustanski, 2013) did address interactions between partner characteristics (e.g. age and race) and associations with sexual risk, studies did not examine how substance use and location of sex or how respondent and partner substance use interacted in associations with UAI. Interactions between characteristics can help to better characterise event-level predictors of sexual risk behaviours.

Strengths and limitations of this review

A key strength of this review was its exhaustive, systematic and sensitive search strategy. Study inclusion criteria were broad to allow a range of evidence. The absence of *a priori* critical appraisal criteria also meant that this review included all available evidence meeting the design and population criteria.

However, search methods may not be perfect and studies may have been excluded, though this was believed to be unlikely. Publication bias may also have

meant that some analyses, and more specifically null findings, relating to the situational characteristics described above were not reported. Though almost all studies examined UAI in MSM, two included studies (Newcomb & Mustanski, 2013; Newcomb, 2013) also examined vaginal intercourse, and analyses were not presented separately for each type of intercourse. Moreover, the few numbers of studies for each specific substance examined made it difficult to draw firm conclusions for many substances. Cocaine and crack use, though different in contexts and methods of use, were grouped together in the above synthesis.

Finally, the syntheses above should be interpreted with caution as they span a wide timeframe and a diversity of locales, though limited. Cultural shifts and changes in substance use trends may change the relevance and generalizability of these studies. More generally, the reliability of this synthesis is predicated on the reliability of included studies. As reported above, study quality was highly variable. As more rigorously reported studies emerge, conclusions may change.

Conclusion

This systematic review of multiple-event analyses revealed issues in measurement of situational characteristics across included studies. Few firm conclusions were possible regarding the evidence for associations between situational characteristics and sexual risk, though respondent substance use and respondent use of amphetamine-group substances specifically, and less consistently so seroconcordance of partner, all appeared to be associated with increased sexual risk. Generalizability of studies may be limited by context and cultural norms.

**SECTION 4. Multiple-event analyses
of substance use, situational
characteristics and sexual outcomes in
MSM**

Chapter 11. Introduction to analyses

The three studies presented subsequently are introduced here. This describes the aims of the three studies, including how these aims developed as a result of both the systematic review of multiple-event analyses and the qualitative metasynthesis presented prior. The three studies reported here are multiple-event analyses of a) multipartner encounters, b) encounters with new partners, and c) single-partner encounters. Because of the way in which data were collected in The Sigma Panel 2011, the sample of new partner encounters does not overlap with the sample of single-partner encounters. Data on new partner encounters were collected separately from data on single-partner encounters, though the sample of single-partner encounters also includes encounters in which the respondent reported not having previous sexual experience with the partner.

Aim 1: to describe associations between substance use and sexual outcomes

The initial and central aim of these studies was to describe within-subjects and population-average associations between substance use and UAI in MSM living in England. No multiple-events analysis evidence currently exists for UK MSM. As highlighted in the first chapter of this dissertation, case-crossover analyses—and, more broadly, multilevel models—can be used to compare encounters within persons. These analyses are more helpful than global association or situational association studies in understanding event-level relationships (Leigh & Stall, 1993), and particularly where substance use is not best characterised through patterns of addiction and dependence. Moreover, population average models are of use in situations where within-subjects comparisons are specious or inappropriate—that is, where the average number of observations per respondent is less than two. In these analyses, population-average models provide associations that may be more reliable

than single-event analyses in that person-level confounding is treated as a nuisance parameter and is addressed in estimation.

Aim 2: to describe associations with UAI, control, and pleasure

A critical way in which the qualitative metasynthesis and systematic review of multiple-event analyses together shaped the studies reported here is through broadening the scope of the outcomes tested. Findings from the metasynthesis suggested strongly that additional parallel sexual outcomes—specifically, pleasure in the sexual encounters and control over sexual outcomes—are key determinants of the nature, extent and duration of substance use behaviours MSM perform in these social spaces. Specifically, pleasure, and the ways in which pleasure was bound up with social spaces and substance use, formed a major motivation for substance use. Moreover, participants in qualitative studies reported that they largely stayed in control of themselves and their behaviours and plans, though an element of ‘diminished capacity’ was evident as a theme emerging from substance use. The systematic review of multiple-event analyses revealed that these outcomes were unexplored in the body of evidence. While the studies reported here were unable to validate the scales used for measurement of pleasure and control, these analyses are the first step towards studying additional sexual outcomes besides coital repertoire and sexual risk behaviour.

Aim 3: to describe associations between specific situational characteristics—location of sex, partner serodiscordance, and partner type—and sexual outcomes

The systematic review of multiple-event analyses revealed several key ‘areas of contestation’ in the body of evidence about potentially important event-level associations with UAI in MSM. These areas were identified as having been tested

by several included studies, though without a firm conclusion emerging across the body of evidence. These specific situational characteristics included location of sex, partner serodiscordance and partner type. In the study of multipartner encounters, number of partners was tested to complement the ‘partner type’ characteristic analysed in the single-partner encounter studies. Because The Sigma Panel 2011 collected data on each of these key situational characteristics, they were included in multivariate model building.

Aim 4: to develop a typology of risk contexts and sexual outcomes

The large sample size of single-partner encounters made it possible to use multilevel latent class analysis to develop a ‘typology’ of situational characteristics. This is of particular interest to examine how situational characteristics co-occur, and how these co-occurrences relate to different sexual outcomes. As related in the qualitative metasynthesis, location, substance use and partner characteristics are all important ways by which context shapes sexual outcomes. A next step is to determine what discrete ‘contexts’ might be.

Aim 5: to test interactions between respondent substance use and partner substance use in associations with sexual outcomes, and

Aim 6: to test interactions between respondent substance use and location of sex in associations with sexual outcomes

Results from the qualitative metasynthesis suggest that patterns of respondent and partner substance use may be mutually constitutive and in interaction with each other in the production of sexual outcomes. Additionally, though the qualitative metasynthesis addressed social spaces specifically, these analyses allow us to test the degree to which substance use is differentially associated by venue of encounter with the sexual outcomes tested here.

Specifically, evidence from the section on ‘ecological systems’, which points out that strategies of substance use and sexual behaviours are reciprocally determined, and evidence from the sections on ‘pushing limits’ and ‘tribality’, which point to common regimes of substance use in specific social spaces, reinforce that substance use does not occur independent of peers and sexual partners. These findings from the qualitative metasynthesis—along with the discussion of performance to the littoral space more generally—also suggest that sexual contexts and substance use may interact in the production of sexual outcomes. It would be inaccurate to say that these interactions are just ‘tests’ of quantitative hypotheses derived from qualitative data—rather, the quantitative results from these interaction tests will be compared with the context-specific qualitative metasynthesis as complement and counterpoint.

Chapter 12. Survey background and statistical methods

This chapter first presents information on the design and execution of The Sigma Panel 2011. It then moves to outlining variable construction approaches, discussing statistical methods used in these multiple-event analyses, explaining the model building and selection protocols specified for these analyses and, finally, setting out the analysis plan for each of the three studies presented here.

Survey background

The Sigma Panel 2011 was a longitudinal survey of MSM in England conducted by the Sigma Research Group at the London School of Hygiene and Tropical Medicine. The survey was administered completely online, and a convenience sample of participants was recruited both via websites for MSM and via contacts with local voluntary organisations. The Sigma Panel 2011 was funded by CHAPS, a national programme coordinated by the Terrence Higgins Trust and funded by the UK Department of Health that undertook HIV prevention and sexual health provision for MSM in England.

Recruitment. Recruitment occurred opportunistically through multiple channels. On 20 December 2010, invitations to the survey were sent to men who completed the European MSM Internet Survey in its English-language version in July and August 2010 and who provided an email address to be contacted for further research. Users of two gay-themed dating websites, ManHunt and Gaydar, who reported residing in England received invitations via instant message that endorsed the project and led to the enrolment survey. ManHunt contacted users on 31 December 2010, and Gaydar contacted users on 26 January 2011. Gaydar also featured banner advertisement between 26 January 2011 and 14 February 2011, which coincided with the last three weeks of recruitment. Two non-governmental

organisations, NAM and the Lesbian and Gay Foundation, advertised the survey in email bulletins on 5 February 2011 and 8 February 2011 respectively. All those completing the enrolment survey were asked to invite via email three people who they knew might also wish to take part.

Eligibility and survey schedule. Participants were eligible if they identified as males living in England aged 16 years and over. Participants needed to be 16 years of age or older, able to supply an email address to be contacted, and willing to complete monthly surveys over the 13 months following the enrolment survey. Participants completed an enrolment survey (month 0), which was made available between 20 December 2010 and 14 February 2011. The first of 13 monthly surveys was sent out on 1 February 2011 and the last was sent out on 1 February 2012. Each monthly survey was open for about two weeks to allow for completion. Participants were sent a link via email to the survey and reminded by email ten days after survey opening. If participants wished to no longer complete surveys, they could ask to be unsubscribed.

Data security and ethics. All surveys were hosted by Demographix (www.demographix.com), where data was also stored securely. Names, addresses, full postcodes, and dates of birth were not collected from respondents. Only emails were anonymously linked to data provided. At enrolment, participants were asked to consent to providing sexual health and history information. The ethics board at the London School of Hygiene and Tropical Medicine initially approved this survey. The departmental research ethics committee in the Department of Social Policy and Intervention at the University of Oxford further approved the analyses undertaken here.

Survey structure. The relevant survey text is included in Appendix 5. After the enrolment survey, each month's survey contained core repeating content on participant feedback and suggestions, HIV and STI testing in the last month, general questions about sex with men in the last month and general questions about sex with women in the last month. Month-specific content included questions on sexual functioning derived from the National Survey of Sexual Attitudes and Lifestyles (Natsal), STI knowledge and coverage of specific health promotion interventions.

The focus of the present analyses is a set of repeating questions addressing last sexual session. Questions about last sexual session with a new male partner were asked in months 1 and 3, and questions about last sexual session with any male partner were asked in months 2, 5, 7, 10 and 13. Both sets of questions followed a similar pattern. Questions asked included:

- number of partners involved, including number of men participating in a multipartner encounter;
- relationship to partners;
- location of sex;
- what partners knew about the respondent's HIV status and what the respondent knew about partner's or partners' status;
- sexual behaviours in last sexual session, including mutual masturbation, fellatio, anilingus, interfemoral intercourse, fisting and anal intercourse;
- condom use and ejaculation in anal intercourse and fellatio;
- use of substances by self or partner; and
- situational variables, including self-reported control over sex, perception of HIV transmission and pleasure.

Issues with survey data collection. Questions were asked for multipartner encounters and single partner encounters separately in distinct sets of questions. Examination of the data on last sexual session revealed that survey data were corrupted for multipartner encounters in months 2, 3 and 5 due to critical errors in survey logic and construction. As a result of this, analyses were stratified by number of partners. Analyses on data from last sexual session with a new male partner (months 1 and 3) were analysed with single partner encounters only. Analyses on data from last sexual session with any male partner were divided into analyses on multipartner encounters (months 7, 10 and 13), and analyses on single partner encounters (months 2, 5, 7, 10 and 13). This was done to facilitate more reliable comparisons between encounters, especially when within-subjects comparisons were planned, as with conditional logistic regressions and generalised linear mixed effects models.

Variable construction

This section outlines how independent, dependent and descriptive variables were created from the data in The Sigma Panel 2011. Not every variable described is in every set of analyses. References to question numbers are as in the text of the survey (see Appendix 5). Questions with an item stem beginning with the letter ‘L’ refer to items in surveys about multipartner encounters and the ‘main’ single-partner encounter analyses. Unless noted otherwise, questions in surveys querying new partner encounters are analogous to those in the other surveys, with items indexed with the letter ‘N’ instead of the letter ‘L’.

Independent variables.

Any substance use by self/partner. These variables are drawn directly from question L45, which asked about substance use by self: ‘Did you use any alcohol or

drugs before sex?', and question L47 asking about substance use by partner: 'Did he use any alcohol or drugs before sex?'. Responses for question L45 are in yes/no format. Responses for question L47 contain four possible responses:

- 'No, I think he had taken no alcohol or drugs before sex',
- 'I don't know whether he'd taken anything or not',
- 'Yes, but I don't know what he'd taken', and
- 'Yes, and I've an idea what he'd taken'.

Responses to question L45 were edited to account for poppers use, as discussed below. In surveys collecting data on encounters with new partners, only questions about substance use by self were asked in both months in which these data were collected.

Specific substances. These variables were drawn directly from questions asking about specific substance use by self (L44, L46_1 to L46_14) and questions asking about specific substance use by partner (L48_1 to L48_14). Question L44 asks about poppers use by self. Questions L46_1 to L46_14 and questions L48_1 to L48_14 ask about self or partner use of the following substances, in order:

- alcohol,
- erectile dysfunction medications,
- cannabis,
- MDMA,
- amphetamine,
- crystal methamphetamine,
- heroin,
- mephedrone,
- GHB or GBL (gamma-hydroxybutyric acid),

- ketamine,
- LSD,
- cocaine,
- crack cocaine and
- any other drug (with the opportunity to enter via free text response what that other drug was).

As above, only questions relating to specific substance use by self were asked in both months in which data on new partner encounters were collected.

Exceptionally, the survey asked about poppers use by self separately from other substances, and before asking about overall alcohol and substance use. Response options were ‘yes’, ‘no’ and ‘don’t remember’. Because the number of respondents replying ‘don’t remember’ totalled nine or fewer in any wave of data collection,¹ ‘don’t remember’ responses were set to missing. Due to this ordering of questions, missingness patterns are slightly different between L44 and L46_1 to L46_14. Responses to question L45 were recoded to ‘yes’ if respondents reported poppers use.

Respondents were presented with questions L46_1 to L46_14 after replying affirmatively to question L45. They were allowed to tick as many as applied of the 14 choices listed. Similarly, respondents were presented with questions L48_1 to L48_14 after replying ‘yes, and I’ve an idea what he’d taken’ to question L47.

Number of substances used by self/partner. A variable for number of substances used by self was created by summing the number of items endorsed in questions L44 and L46_1 through L46_14. Because of the slightly different missingness patterns between questions L44 and L46_1 through L46_14 described

¹ 9 in month 2—0.52% for this wave of data collection, 2 in month 5—0.13%, 5 in month 7—0.34%, 3 in month 10—0.22%, 6 in month 13—0.41%.

above, the number of observations for number of substances used by self is fewer than the number of observations either for poppers use alone or for any of the other substances used. Similarly, a variable for number of substances used by partner was created by summing the number of items endorsed in questions L48_1 through L48_14.

Because the survey asked about 14 different substances with an additional catchall for ‘any other drug’, this variable may not be reliable as a measure of ‘all substances taken’, but rather as a variable indexing the number of substances used from a list of the most common substances of use and abuse.

Number of male participants. This variable, used only in analyses of multipartner encounters, was constructed from questions L2 and L18. Question L2 asked whether respondents’ last sexual session was with one man, a threesome, or a larger group. Number of male participants was set to equal two if the last sexual session was described as a threesome. Otherwise, values inputted by participants in responses to question L18, ‘How many different men were you having sex with?’, were used as values for this variable. Responses to question L18 of ‘100 or more’ would have been set to missing, though this was unnecessary.

Location of sex. A variable for location of sex was created using responses to questions L6 for single-partner encounters and L22 for multipartner encounters, each of which presented ten options for location of sex. Location of sex was classified as *private* if sex occurred at the respondent’s home, the partner’s home, a friend’s home, or a hotel; as *sex-on-premises venue* if sex occurred in a space like the ‘backroom of a bar, gay sex club, or public sex party’, or ‘a gay sex party in a private home’, ‘a gay sauna’, or ‘a porn cinema’, and as *cruising or public location* if respondents reported a cruising location, other non-commercial venue, or outdoors

location as the last location of sex. Gay sex parties in private homes were classed as sex-on-premises venues because of the semi-public nature of these encounters and the resultant risky shift that might have occurred in a highly stimulating sexual context (McKirnan et al., 1996).

The responses of those selecting ‘elsewhere’ and providing a free-text response (L7 for single-partner encounters, L23 for multipartner encounters) were recoded as either *private*, *sex-on-premises venue*, or *cruising or public location* depending on the setting of sex. If the locations participants reported suggested that there was a reasonable expectation of privacy (e.g., a private office, a holiday cottage, or a vacation home), then these locales were coded as *private*. Responses naming a specific locale that was not a home or private holiday setting and that was described as a sex-on-premises venue—for example, a gym or a sauna—were coded as *sex-on-premises venue*. Non-private locations for which the ostensible purpose of being there would not be sexual contact—e.g. a toilet block, a park, the woods, a car—were coded as *cruising or public location*. The number of responses in each wave of data collection answering ‘elsewhere’ was between 1.3% and 2.2% of responses in each wave.² While there is the possibility of differential misclassification of responses, it would be inappropriate to discard these data, especially when responses are amenable to classification in this three-part scheme.

Relationship to partner. A variable for relationship to partner was constructed using responses to questions L3 and L4. Partners were categorised as:

- *regular and steady* if participants responded in L3 that the sex partner was ‘life partner or husband’ or ‘current boyfriend’,

² 23 in month 2—1.34% for that wave of data collection, 29 in month 5—1.88%, 30 in month 7—2.05%, 21 in month 10—1.51%, 31 in month 13—2.12%.

- *regular and non-steady* if participants responded in L3 that the sex partner was ‘a regular but infrequent sex partner’ or a person with whom the respondent is ‘(or might be) starting a relationship’, or
- *opportunity-anonymous* if participants responded in L3 that the sex partner was ‘a one night stand’, ‘an on-the-spot opportunity’, or a person whom the participant ‘was paying to have sex’ or with whom the participant was being paid to have sex.

As above, responses were recoded where possible when participants selected ‘other’ to describe relationship and supplied free-text answers in L4. Free-text responses to relationship with partner were straightforward to classify. Responses were recoded as *regular and steady* if free-text responses indicated an ongoing romantic relationship at the time of the sexual encounter (e.g. ‘he was my boyfriend at the time’) or sexual contact described by respondents as frequent and familiar (e.g. ‘He is just a friend who comes round every day to fuck my arse’ or ‘He is not my life partner but he is a regular and frequent sex partner’). Free-text responses were recoded as *regular and non-steady* if responses indicated familiarity with the respondent but not frequent sexual contact (e.g. ‘First time meeting - and not the last’ or ‘He was a colleague with whom I might or might not do it again’), or if the partner was an ex-boyfriend with whom the respondent did not report a relationship at the time of the encounter. Finally, free-text responses were recoded as *opportunity-anonymous* if responses indicated a one-off encounter with an anonymous partner (e.g. ‘Met in a gay sauna’, ‘I met him in a cruising ground’).

Serodiscordance. This variable captured respondent and partner perceptions of HIV status and was based on responses to questions L8 through L11 for single-partner encounters, and L24 through L27 for multipartner encounters. Questions L8

and L24 asked about what partners knew about the respondents' HIV status, with options:

- 'He/they knew I am HIV negative',
- 'He/they knew I am HIV positive',
- 'He/they knew I did not know my status',
- 'He/they knew nothing about my HIV status',
- 'I don't know what he/they knew about my HIV status',
- and, for L24, 'It varied for different men'.

Participants also were able to supply free-text responses by selecting 'other answer' for L8 or L24 and answering L9 or L25 respectively.

Questions L10 and L26 asked about what respondents knew about their partner's (or partners') HIV status. Response options were:

- 'I knew or thought he/they was/were HIV negative',
- 'I knew or thought he/they was/were HIV positive',
- for L26, 'I knew or thought they had varied HIV statuses',
- 'I thought about his/their HIV status but had no idea what it was',
- 'I didn't have any thoughts about their HIV status', and
- 'I don't remember'.

Participants also were able to supply free-text responses by selecting 'other answer' for L10 or L26 and answering L11 or L27 respectively.

Encounters were classified into one of three categories:

- *seroconcordant*, when participants reported that their partner or partners matched their serostatus (e.g. 'I knew or thought he was HIV negative' and 'He knew I was HIV negative');

- *unknown*, when participants reported that they, their partners, or both they and their partners did not know, think about, or remember HIV status; and
- *serodiscordant*, when participants reported that their partner or partners had different HIV serostatus. In the case of multipartner encounters, a response of ‘It varied for different men’ to L10 or ‘I knew or thought they had varied HIV statuses’ to L26 resulted in the encounter being classed as serodiscordant.

Free-text responses were recoded at the question level rather than at the level of this newly created variable. Again, recoding of responses was straightforward. When free-text responses indicated the respondent assumed a partner had a specific status, the question (either L10 or L26) was recoded accordingly. Similarly, when participants indicated not having asked or not having reported HIV status (e.g. ‘it has never been discussed’) or not having perceived a need to report status (e.g. ‘Safe non penetrative [sic] sex’), the response to the original question was recoded to produce an encounter classified as *unknown*.

Encounters in which either a) respondents reported knowing their partners’ HIV status but respondents did not report what their partners knew about respondents’ status or b) respondents reported that their partners knew about respondents’ HIV status but respondents did not report what they knew about partners’ HIV status were labelled as missing on this variable.

Perceived HIV transmission risk. This variable was taken directly from question N52, which asked ‘How much risk of HIV transmission was there?’. Responses were ‘no risk’, ‘low risk’, ‘some risk’, ‘high risk’.

Month of response. This variable was constructed from the wave of data collection in which the encounter was reported.

Outcome variables.

Unprotected anal intercourse (UAI). This variable was based on responses to these questions:

- L30_7 or L37_7, ‘You were “active” in anal intercourse (you fucked him)’;
- L30_8 or L37_8, ‘You were “passive” in anal intercourse (he fucked you)’;
- L33 or L40, ‘You used a condom when you were active in AI’; and
- L35 or L42, ‘He/they used a condom when you were passive in AI’.

Respondents endorsing items L30_7 or L30_8 for single-partner encounters or items L37_7 or L37_8 for multipartner encounters, and also endorsing inconsistent or no condom use (or not remembering condom use) in items L33 or L35 for single-partner encounters or items L40 or L42 for multipartner encounters during the concomitant activities, were considered to have engaged in UAI.

Respondents reporting having engaged in anal intercourse but consistent condom use, or reporting not having engaged in anal intercourse, were considered not to have engaged in UAI. Two types of encounters with incomplete information were labelled as missing on this variable: a) a response for the items for anal intercourse was recorded but no response for either of the condom use items was recorded, or b) a response of protected anal intercourse was recorded for either ‘active’ or ‘passive’ anal intercourse, but while anal intercourse was recorded for the other type of anal intercourse, information on condom use was missing on that item.

Control. This variable dichotomises responses to question L50, which asked ‘How much control over what happened did you have?’. Responses were originally ‘I was in total control’, ‘I was mostly in control’, ‘I had some control’ and ‘I had no control over what happened’. This was divided with the top two options (most or total control) forming one category and the options representing least control

forming the second category. This dichotomisation was done to facilitate conditional logistic regression and to improve interpretability of the variable.

Pleasure. This variable is taken directly from L56, which asks ‘How good was the sex (on a scale from 1 to 10)?’. Higher values indicated better sex.

Descriptive variables.

Enrolment survey variables. Most descriptive variables were taken from the enrolment survey at the start of data collection for The Sigma Panel 2011. **Gender** was taken from question M0C11. **Age** was taken from question M0C15 (continuous) and from the Sigma-constructed variable M0agein10s (age groups by decade).

Education was taken from the Sigma-constructed variable M0C43x3, which was based on question M0C43 on highest education qualification. **Ethnic group** is taken from the Sigma-constructed variable M0C47x5, which classifies the responses to question M0C47 on ethnic group into five major categories. **Relationship status** is derived from questions M0C55_1 to M0C55_5, which query different relationship types. **Strategic health authority of residence** is based on place of residence as mapped by Sigma. **Gender of attraction** is based on the question M0C26. **Sexual orientation** is based on survey question M0C29, which was recoded into the Sigma-constructed dichotomous variable M0C29x2. Finally, **outness** is based on question M0C28, which was recoded into the Sigma-constructed dichotomous variable M0C28x2.

Sexual health and history variables. Demographic variables addressing sexual health and history are more complicated, since these questions were not asked during the enrolment survey. Thus, since not all respondents complete each survey, data may not exist at the first time the question is asked of respondents. To circumvent this, two variables were constructed for the two sexual health and history

variables included in this analysis which captured data at first report on these two variables—that is, taking as the ‘baseline observation’ the first point at which data are recorded for these variables. The variable addressing **ever receiving an HIV test result** is based on question H2, repeated in each of the 13 waves of data collection after the enrolment survey. The variable addressing **receiving a positive STI test result** is based on questions R1 through R9, also repeated in each of the 13 waves of data collection. A response indicating a positive test on any of the 7 STIs for which questions were repeated each month (syphilis, gonorrhoea, chlamydia, genital warts, genital herpes, hepatitis A, or hepatitis B) was noted as a positive STI test.

Statistical methods

This section summarises the key statistical methods used in this project: conditional logistic regression, random intercept models, generalised estimating equations and multilevel latent class analysis with a distal outcome. A rationale for the missing data strategy used here, pairwise deletion, is also presented.

Conditional logistic regressions, random intercept models and generalised estimating equations—as well as all descriptive statistics—were calculated using StataMP 13 (StataCorp, 2013). Multilevel latent class analyses were executed using *Mplus* version 7 (B. O. Muthén & Muthén, 2012).

Conditional logistic regression.

Description. Originally developed to analyse data for case-control studies, conditional logistic regression (CLR) is a mainstay of event-level case-crossover analyses with binary outcomes (Maclure & Mittleman, 2000; Maclure, 1991). Case-crossover analyses are analogous to case-control studies where both case and control observations come from the same person (Maclure, 1991). In a matched case-control

study, cases and controls are matched on one or more stratification variables. But in a case-crossover analysis, the stratification variable is the person from which observations are drawn. In a CLR, parameters are estimated using a likelihood function that is conditional on the matched pair (Agresti, 2007; Hosmer Jr., Lemeshow, & Sturdivant, 2013). Put otherwise, strata are treated as nuisance parameters to be ‘decomposed out’ of the likelihood function by parsing the likelihood function into a conditional component and a marginal component, where the marginal component is used to estimate model parameters (Qin & Zhang, 2005).

As an analysis method, the use of CLR has several benefits. First, unlike ‘standard’ logistic regression, CLR allows for within-subject comparisons by comparing events within the same person (Hosmer Jr. et al., 2013). This means that statistical inference can be made as to whether a particular independent variable is correlated with a change in the event-level outcome within the same person. This is helpful for case-crossover analyses, where the goal is to understand whether differences between different events reported by the same person are due to event-level factors. Second, CLR is more efficient than controlling for stratifying variables in a logistic regression. It avoids the ‘over-controlling’ that would occur when person-level identification numbers, for example, are entered as dummy variables into a logistic regression (M. Connolly & Liang, 1988).

However, CLR requires at least one ‘discordant’ observation in each stratum. Put otherwise, when a person reports two or more events, all events cannot include the same outcome. Thus, in a survey like The Sigma Panel 2011, data from persons who report only encounters with protected anal intercourse or only encounters with unprotected anal intercourse will be excluded from the analysis. Second, because likelihood is conditional on the person nuisance parameter, no intercept is generated

in the model. This precludes the interpretation of whether change in a independent variable affects ‘baseline’ risk in a clinically significant way. Finally, sparse data structures (e.g. very small cell sizes in a predictor-outcome contingency table) can lead to odds ratios being biased upwards (Greenland, Schwartzbaum, & Finkle, 2000).

Model estimation and comparison. CLR models were estimated using Stata command `—clogit—`. CLR models testing interactions were compared against main effects models using a likelihood ratio test based on the difference between values used for the overall Wald test of each model’s significance. A significant likelihood ratio test indicated that the model with interaction terms explained significantly more variance in the dependent variable than the main effects model. A similar test was used to compare different nested multivariate models as appropriate. Multivariate models were compared using the Akaike information criterion, a penalised log likelihood measure used in overall model selection to capture the trade-off between fit and model complexity.

Generalised estimating equations.

Description. Generalised estimating equations (GEEs) are an extension of the generalised linear model for the analysis of data where observations are not independent (Liang & Zeger, 1986; Zeger & Liang, 1986). It is an alternative method to generalised linear mixed effects models in that GEEs estimate population-average, or marginal, parameters instead of within-subject parameters. Put otherwise, the interpretation of coefficients generated by GEEs in this study compares how, across the population of respondents and sexual encounters, a change in the predictor variable would change the average outcome for encounters (A. E. Hubbard et al., 2010). Thus, GEEs are of interest when the goal is to generalise

across a population of encounters rather than to compare encounters within people. In the strictest sense, GEEs refer to a type of quasi-likelihood estimation by which model parameters can be derived for either within-subjects or population-average models (Zeger, Liang, & Albert, 1988). However, GEEs are used here only to refer to a method of generating population-average estimates, in particular because most modern statistical software offers more robust methods of estimating generalised linear mixed effects models (e.g. adaptive Gauss-Hermite quadrature).

Specification of GEE models. Specification of a GEE model proceeds similarly to that of a ‘standard’ ordinary least-squares or logistic regression model for uncorrelated data. However, two additional model components must be specified—a link function and a working correlation matrix.

First, a link function must be named to describe the mathematical relationship between predictors and outcome (Agresti, 2007). For most analyses, this is straightforward: continuous, non-count outcomes generally use an ‘identity’ link function, in which the value generated by the regression function equals the predicted value on the outcome and binary outcomes use a logistic link function, which mirrors the interpretation given to outcomes in a logistic regression.

Second, a working correlation matrix must be declared to describe the hypothesised correlations between observations coming from the same cluster—in this case, encounters from the same respondent (Liang & Zeger, 1986; Zeger et al., 1988; Zeger & Liang, 1986). Correlation matrices are *independent*, which assumes that observations are not meaningfully correlated and which is the correlation matrix that would be used in regression models for uncorrelated data; *exchangeable*, which assumes that observations are similarly correlated across persons; *unstructured*, which assumes that correlations are different for each person; *autoregressive*, which

implies that there is a meaningful and analytically consequential time-ordering of observations; and *analyst-specified*, which allows the analyst to specify a correlation matrix (Hanley, Negassa, Edwardes, & Forrester, 2003; Hu, Goldberg, Hedeker, Flay, & Pentz, 1998). Of note is that exchangeable correlation matrices are the same type of correlation matrix used in generalised linear mixed effects models with random intercepts and compound symmetry covariance structures, leading to roughly similar parameter estimates for continuous outcomes, but not for binary outcomes (A. E. Hubbard et al., 2010).

Finally, standard errors used to generate confidence intervals of regression parameters are either ‘model-based’ or ‘empirically based’ (Hanley et al., 2003). Model-based standard errors presume that the specified correlation matrix and mean structure are correctly specified, whereas empirical standard errors are robust to misspecification of the correlation matrix (e.g. situations where an unstructured correlation matrix would have been more appropriate than an exchangeable correlation matrix) (Skrondal & Rabe-Hesketh, 2004).

Model specification and comparison. GEEs were estimated using Stata commands `–xtset–` and `–xtgee–`. Models specified and estimated in these analyses used ‘canonical’ link functions—an identity link for pleasure analyses and logit link for UAI and control analyses.

Model specification. Each analysis used an exchangeable working correlation matrix, because previous event-level analyses demonstrated that encounters are correlated within respondents in ways that are similar across respondents. Moreover, Agresti (2007) suggests that if data are assumed to be correlated, then an exchangeable correlation matrix is frequently the best option in the face of the often substantial penalty in model complexity an unstructured

correlation matrix would cause. Thus, unstructured correlation matrices were not used because the large number of parameters this would have added to the model would have destabilised model estimation, particularly given the low ratio of encounters to respondents in each analysis. Because independent correlation matrices would have been similar to hypothesising that encounters were not correlated between respondents, this was not a viable option for working correlation matrices used here. Autoregressive correlation matrices were not used because neither was time ordering of encounters an analytic focus nor were specific time-dependent relationships hypothesised.

Because exchangeable correlation matrices were the only viable correlation structure that could be hypothesised in these analyses, model-based standard errors are reported for each GEE-based analysis. Model-based standard errors are also reported because model-based standard errors may be more reliable than empirically based standard errors when very few observations are reported for each cluster (Hanley et al., 2003)—put otherwise, as in this case, where few encounters are reported for each respondent. One limitation of this methodological decision is that empirically based standard errors may be more conservative (i.e. wider) than model-based standard errors and thus reported confidence intervals for these analyses may be insufficiently conservative.

Model comparison. An overall Wald test for model significance was computed for each model. Because GEE models are not estimated using maximum likelihood estimation, tests such as the likelihood ratio test are not available for comparing models (Hanley et al., 2003; Hu et al., 1998).

Models were compared using the quasi-Akaike information criterion (estimated using Stata command `-qic-`), or QIC, an information criterion analogous

to the Akaike information criterion used to compare models estimated with maximum likelihood methods (Pan, 2001). Like maximum likelihood-based information criteria, the QIC can be used to compare non-nested models, is a measure that is penalised based on model complexity (including complexity of the working correlation matrix) and captures how well the model approximates the data. Because QIC values cannot be tested against each other, they were compared qualitatively to understand which model suggested the best fit in light of trade-offs between complexity and optimal fit. When used to compare pairs of main effects models and interactions models, the QIC was examined jointly with whether interaction terms were statistically significant.

Random intercept models, a subset of generalised linear mixed effects models. Generalised linear mixed effects models, which are also known as multilevel models or hierarchical linear models, are a class of regression models that partition and model variation on the dependent variable across two or more ‘levels’ in nested data (Raudenbush & Bryk, 2002; Snijders & Bosker, 2011). Generalised linear mixed effects models are frequently used for longitudinal data and other data structures where several observations are captured per respondent—or where observations are dependent for other similar reasons. They are called ‘mixed effects’ models because they may include both fixed effects, or first-level coefficients that account for the outcome, and random effects, or higher-level coefficients that help in explaining heterogeneity in the outcome between persons (or between other higher-level units) (Skrondal & Rabe-Hesketh, 2004). For the sake of clarity, ‘first-level’ refers to the lowest level of data, which in this case is a specific sexual encounter, and ‘second-level’ refers to the next lowest level of data, which in this case is the respondent.

Random intercept models are a specific subset of generalised linear mixed effects model where higher-level variation is accounted for as a ‘random intercept’ and first-level coefficients have the same value across clusters (Snijders & Bosker, 2011). For example, while each respondent may have a different ‘baseline risk’ for an encounter-specific outcome, how the level of an independent, first-level variable predicts the outcome for a specific sexual encounter is assumed to be identical across encounters.

A key strength of generalised linear mixed effects models is that they allow for within-subject comparisons. That is, first-level coefficients can be interpreted as predicting a change within a person on an encounter-specific outcome (A. E. Hubbard et al., 2010). Thus, random intercept models are commonly used in event-level analyses to compare encounters within persons (Boone et al., 2013; Drumright, Little, et al., 2006; Gillmore et al., 2002; Mustanski, 2008; P. A. Wilson et al., 2008). Unlike CLRs (and, as described above, generalised estimating equations), random intercept models and generalised linear mixed effects models overall explicitly model higher-level variation. A corollary of this feature of random intercept models is that observations within persons need not be discordant on at least one outcome for observations corresponding to that person to be informative and included in the model.

Several extensions related to generalised linear mixed effects models were not pursued in these analyses. Because these analyses were not aimed at investigating the impact of person-level characteristics on encounter-level outcomes, no second-level predictors were hypothesised or included in these models. Moreover, random slope components—which capture how first-level coefficients vary in magnitude between persons—were not tested, since the low numbers of

observations in each cluster would have left these analyses grossly underpowered (Snijders & Bosker, 2011).

Model estimation and comparison. Models with binary dependent variables were fit using Stata command `–melogit–`, whereas models with continuous dependent variables were fit using Stata command `–mixed–`. Mean-variance adaptive Gauss-Hermite quadrature, the default in Stata, was used in numerical integration of the likelihood function for estimation of model parameters. This method is less biased than penalised quasi-likelihood as implemented in other statistical programmes (Rabe-Hesketh, Skrondal, & Pickles, 2002, 2005).

Random intercept models testing main effects were compared against random intercept models testing interaction effects using a likelihood ratio test based on the difference between values used for the overall Wald test of each model's significance. Nested multivariate models were also tested against each other using a similar likelihood ratio test. As with CLRs, multivariate models were compared using the Akaike information criterion. Finally, each random intercept model was compared against a simple logistic regression model that did not account for random intercepts using a likelihood ratio test.

Multilevel latent class analysis. This discussion of multilevel latent class analysis begins with latent class analysis, and then discusses extension to a multilevel context and finally incorporation of a distal outcome.

Latent class analysis. Latent class analysis is a specific type of latent variable model that describes exhaustive and probabilistic classes to which individual observations belong (Henry & Muthén, 2010; Vermunt, 2003). Unlike factor analysis, which describes relationships among variables, latent class analysis is a 'person-centred' approach that aims to classify observations based on observed

indicators that are generally categorical in nature (L. M. Collins & Lanza, 2010). Latent class analysis can be viewed as a multinomial logistic regression framework, in which solutions are characterised both by the number of outcomes and how different values on the manifest indicators predict each class (L. K. Muthén & Muthén, 2012). This probabilistic approach means that latent classes are interpreted based on conditional probabilities, or the probabilities for the value of each indicator conditional on membership to that class. Moreover, individual observations have posterior probabilities of belonging to each class that are calculated based on their observed responses (L. M. Collins & Lanza, 2010). An important extension to latent class analysis is latent class analysis with a covariate, in which a variable is tested for its ability to predict class membership.

Latent class solutions are appraised on several characteristics. First, to what degree do latent classes meaningfully distinguish between persons? This is characterised as latent class separation, and is examined by comparing response patterns across hypothesised classes and assessing whether different classes have distinct response patterns (L. M. Collins & Lanza, 2010). Second, are observations classified accurately into the appropriate latent classes? This is assessed by examining the ‘scaled relative entropy’, which can be understood as a sort of R^2 measure in that it ranges from zero to one and captures the degree to which observations’ posterior probabilities for one class are close to 1 (S. L. Clark & Muthén, 2009). Moreover, comparing both the average classification probabilities for each most likely class and the average classification probability for each observation weighted by each class-specific probability is informative in assessing whether models usefully classify observations. Third, and most importantly, are latent classes theoretically interpretable? This is a substantive question and one best

answered by examining the conditional probabilities corresponding to each latent class.

Multilevel latent class analysis. Multilevel latent class analysis extends latent class analysis to nested data. In this context, it is possible to specify first-level classes, second-level classes and classes extending between levels (Henry & Muthén, 2010; Vermunt, 2003). Here, multilevel latent class analysis is used in an approach very similar to that used in random intercept models. Classes are specified using first-level indicators, with variance in the probabilities of encounters belonging to each latent classes partitioned into that explained by the conditional probabilities and that explained by individual characteristics (L. K. Muthén & Muthén, 2012). Finally, the highly collinear random intercepts of each latent class are correlated in models (Henry & Muthén, 2010). Latent classes are appraised as in a single-level latent class analysis.

Latent class analysis with distal outcomes. One of the most substantial ongoing areas of research in latent class models, a distal outcome in a latent class analysis refers to a variable whose outcome is predicted by a latent class, instead of forming a manifest indicator for those latent classes (Asparouhov & Muthén, 2013; S. L. Clark & Muthén, 2009; Vermunt, 2010). While Muthén and Muthén (2012) observe that information on a distal outcome might reasonably be included to inform the creation of latent classes, they acknowledge that several substantive concerns—such as, for example, the substantial alteration of the interpretation and formation of latent classes by inclusion of the distal outcome as a manifest indicator—might preclude its inclusion. This is the approach taken here, especially since several distal outcomes are to be evaluated.

The question is, then, how to account for the ability of classes to predict distal outcomes if these distal outcomes are not included as manifest indicators? A common approach is the ‘most likely class regression’ approach, in which either the most likely class assignments or the natural logs of the posterior probabilities of each class for each observation are used as predictors in a separate model (Bakk, Tekle, & Vermunt, 2013; S. L. Clark & Muthén, 2009). However, these approaches by definition underestimate classification error and thus may provide misleading and ‘overconfident’ estimates of relationships between classes and outcomes (Asparouhov & Muthén, 2013; S. L. Clark & Muthén, 2009; Lanza, Tan, & Bray, 2013). Additional approaches include the ‘flexible model-based approach’ (Lanza et al., 2013), which is not yet implementable for multilevel latent class analyses and the pseudo-class draws method (Asparouhov & Muthén, 2010, 2013), which is implementable for these models and thus is the approach used here. The underlying logic of this approach is that classification probabilities for each observation themselves form a distribution from which can be drawn a series of estimates of ‘most likely classes’ (Wang, Brown, & Bandeen-Roche, 2005). The average value on the outcome for each class is stored for each draw and combined across draws using Rubin’s rules for combining data across multiple imputations (Gelman, Carlin, Stern, & Rubin, 2003). These estimates are then compared between each pair of classes using a Wald test (Asparouhov & Muthén, 2010).

Model comparison and fit. Latent class models were fit using *Mplus*. First, models were checked to examine that log likelihood values for model parameters had been replicated. This was essential to ensure that parameters were estimated on the maximum likelihood. Models were compared based on scaled relative entropy and information criteria, including the Akaike information criterion, the Bayesian

information criterion and the sample size-adjusted Bayesian information criterion. Both the Bayesian information criterion and the sample size-adjusted Bayesian information criterion fulfil functions similar to that of the Akaike information criterion, and can be helpful as ‘tie-breakers’ (L. M. Collins & Lanza, 2010). Additionally, the Vuong-Lo-Mendell-Rubin likelihood ratio test was used to compare the explanatory power of each latent class solution against the solution with one less latent class (Ram & Grimm, 2009). These data taken together informed the decision as to which latent class solution was optimal to explain encounter-specific response patterns on the manifest indicators.

Missing data methods. To the extent that different numbers of encounters reported per person and their month of reporting may impact person-specific risk for an outcome, these differences are captured and controlled out in two ways. First, differences in outcomes by month of reporting are tested in each set of analyses and dependent variables. Second, different person-specific ‘baseline risk’ levels are modelled in random intercept models and in conditional logistic regression and, in generalised estimating equations, intra-individual correlation is factored in as a nuisance parameter.

Encounters were eligible for inclusion if respondents reported at least one sexual behaviour at last sexual session. With the exception of the multilevel latent class analysis, observations with missing data on independent or dependent variables were handled using pairwise deletion. This was done for several reasons. All models specified using generalised estimating equations or random intercept models had less than 5% of units excluded on either persons or encounters. It is acceptable to address low levels of missingness with pairwise deletion (Schafer & Graham, 2002). A commonly cited rule of thumb is that pairwise deletion is acceptable with

missingness under 5% of observations (Dong & Peng, 2013). Though strictly speaking, this method only produces unbiased parameter estimates when data are missing completely at random, pairwise deletion can produce unbiased parameter estimates in some cases where data are missing at random—i.e. in a way that is predicted by other covariates and not by the value of the variable itself (Allison, 2002). Moreover, multiple imputation models require the specification of an imputation model that is ‘congenial’ to the analysis model—that is, a set of variables used to inform the imputations that are assumed to be related in some meaningful way to the variables to be imputed and to the outcome (Allison, 2002). This is impossible to do *a priori* in an analysis such as this one, which combines exploratory and hypothesis-driven elements in model building as discussed below. Multiple imputation as a method is also suboptimal when most variables are categorical. Finally, missing data methods for conditional logistic regression analyses are poorly understood and are handled in the main by using pairwise deletion (Allison, 2002; Lipsitz, Parzen, & Ewell, 1998), which some simulation-based evidence, though dated, suggests may work better than imputation-based methods (Gibbons & Hosmer, 1991). To circumvent this issue in model comparison, likelihood ratio tests (and, for generalised estimating equations, the QIC values) for models to be compared were based on log likelihood estimates derived from the same set of observations.

However, the multilevel latent class analysis addressed missing data using full information maximum likelihood, in which model parameters are estimated using all possible information (Dong & Peng, 2013). Full information maximum likelihood, which assumes that data are missing at random, is typical in structural equation modelling applications, and is not a method of replacing values *per se*, but

of using the information that items with incomplete data yield (Allison, 2002). Full information maximum likelihood is not readily available for use in multilevel models in Stata, where all other models were estimated.

Model building and selection

Because of the lack of evidence on event-level analyses of MSM and sexual risk in the UK context, an important consideration in planning analyses was balancing theoretical and exploratory goals. To prevent spurious testing, a comprehensive model building and selection process was specified before beginning analysis.

Initial ‘univariate’ models. Analyses for each dependent variable and statistical estimation method were undertaken separately. Initially, each independent variable was entered into a univariate model. When independent variables were polytomous categorical variables, these were recoded into dummies, with ‘groups’ of dummies corresponding to each independent variable entered into each univariate model. Independent variables were tested for significance at $\alpha = 0.05$ and retained if, in the case of continuous and binary variables, the independent variable was statistically significant or, in the case of polytomous variables, at least one dummy was statistically significant. In the event that two dummies from a polytomous variable had effects with different signs, but that were each statistically not significant from the reference categories, the coefficients from these two dummies would have been tested against each other for statistically significant differences.

However, specific substances used by self and specific substances used by partner were entered as blocks. This was done because use of specific substances was not exclusive of use of other substances, to reduce the probability of a misleading non-significant effect due to the effects of other substances and to isolate

better the effects of specific substances in light of the frequency of polysubstance combinations. Finally, because some substances were used less than others, controlling for some of the variation in encounters not reporting use of ‘less common’ substances would help in deriving more reliable estimates of the actual impact of those substances above and beyond other substances on the dependent variable of interest. Following on from this, specific substances either used by self or used by partner that tested statistically significant were included in a multivariate model.

Interaction terms. Several interaction tests were hypothesised *a priori* for each dependent variable and estimation method. Conditional on each independent variable to be included in the interaction being statistically significant in univariate models, the following two-way interactions were hypothesised:

- any substance use by self by any substance use by partner,
- any substance use by self by location of sex,
- number of substances used by self by number used by partner, and
- number of substances used by self by location of sex.

When interaction models were estimated using generalised estimating equation, interaction models were compared against the main effects models by testing interaction terms for significance and by the model fit index (QIC). When interaction models were estimated using maximum likelihood, interaction models were compared against main effects models by testing interaction terms for significance and by a likelihood-ratio deviance test (Jaccard, 2001).

Conditional on each of the pairwise interactions tested above being statistically significant, the following three-way interactions were hypothesised:

- any substance use by self by any substance use by partner by location of sex, and
- number of substances used by self by number used by partner by location of sex.

This analysis did not, as a rule, endeavour to test interactions between substances both because of the lack of specific theoretically or empirically guided hypotheses to guide these tests and in order to avoid spurious and excessive multiple testing.

Multivariate models. Statistically significant independent variables—and, when statistically significant, interactions between independent variables—were then included in multivariate models. Separate multivariate models were built for any substance use by self or partner, number of substances used by self or partner and specific substances used by self or partner. Because of the high collinearity anticipated with ‘paired’ measures of substance use by self and partner, multivariate models with no interaction between self and partner substance use and statistically non-significant terms for partner substance use, either polytomous or continuous, were compared against multivariate models without terms for partner substance use using overall model fit indices. This was done to improve interpretability, predictive ability and reliability of the final model (Tabachnick & Fidell, 2012).

Analysis plan

Descriptive statistics. Person-level descriptive statistics were computed for the survey sample overall and for each analysis sample. Descriptive statistics were tested for differences between each analysis sample and those not included in the analysis sample using the chi-square test or, where cell sizes in frequency tables were fewer than five, Fisher’s exact test. Differences in average age for each analysis

sample and those not included were tested using the Kruskal-Wallis test for equality of distributions.

Subsequently, for each analysis sample and set of independent variables, encounter-level and person-level descriptive statistics were calculated. Person-level descriptive statistics are averages at the level of each respondent of the encounters each respondent has reported. Put otherwise, for categorical variables, they are the probability that a person would report an encounter in each specific category; for continuous variables, they are the average on that variable across that person's encounters.

For each analysis sample, specific substances were chosen for analysis if encounters with respondents reporting use of that substance comprised at least 10 cases and were at least 1% of the analysis sample. This guideline, while arbitrary, was chosen to prevent spurious findings and model instability and is based in part on the rule of ten observations for each covariate in a regression (Tabachnick & Fidell, 2012). In the largest analysis samples (i.e. analyses on new partner encounters and single-partner encounters), requiring at least 1% of the analysis sample of encounters to have respondents report use of that substance was a helpful guideline to ensure that a meaningful number of encounters included use of specific substances analysed.

Finally, naïve univariate correlation matrices were calculated for the group of sexual outcomes and situational characteristics tested in each of the three samples of encounters. This was done to examine potential confounding effects and correlations between independent variables if necessary.

Multipartner encounter analyses and new partner encounter analyses.

Conditional logistic regression models and generalised estimating equations were planned for both the analysis of multipartner encounters and the analysis of new

partner encounters. Models testing UAI and control in conditional logistic regressions were specified with panel identification number as the grouping variable. Models testing UAI and control as dependent variables were estimated as generalised estimating equations with panel identification number as the grouping variable, a binomial link function, an exchangeable correlation matrix and model-based standard errors. Models testing pleasure as a dependent variable were estimated as generalised estimating equations with a Gaussian link function, an exchangeable correlation matrix and model-based standard errors. Analysis proceeded as described above with the independent variables for each analysis sample as described in Table 12.1.

Random intercept models were not estimated for these analyses because average number of encounters per respondent in both sets of analyses was fewer than two. This would have made within-subjects comparisons specious.

Single-partner encounter analyses. Conditional logistic regression models and random intercept models were planned for the analysis of single-partner encounters. Conditional logistic regression models testing UAI and control as dependent variables were specified with panel identification number as the grouping variable. Random intercept models testing UAI, pleasure and control as dependent variables were specified as random intercept models with panel identification number as the grouping variable and with a variance components, or independent, covariance structure. Random intercept models were used here because the average number of encounters per respondent was above two, enabling meaningful interpretation of within-subject comparisons.

Subsequently, a multilevel latent class analysis model was specified with manifest indicators a) total number of substances used by self, b) relationship to

partner, c) location of sex and d) serodiscordance. Month of encounter was used as a dummy covariate to adjust for differential reporting patterns across months. UAI, pleasure and control were included as distal outcome variables that were not used in estimation of the latent class model. Panel identification number was the between-level grouping variable for respondents. Random means for the latent classes were modelled at the second level, where initially a continuous latent variable was modelled on the latent class random intercepts (i.e. when three or more latent classes were tested) to stabilise the model, address collinearity between random intercepts and speed computation time (Henry & Muthén, 2010). Furthermore, variances for continuous manifest indicators were held constant between classes, again to stabilise the model. When a model was selected based on these initial tests, the model was rerun with random means correlated instead of modelled on a factor variable to reap any benefits in fit.

Models were run with 20 default random starts and ten of those random starts followed through to likelihood maximisation. Parameter values for those random starts with replicated log likelihoods preserved in the final analysis. The method of maximum likelihood estimation with robust standard errors was implemented with numerical integration (L. K. Muthén & Muthén, 2012). Robust standard errors account for non-normality of variables. Missing values on manifest indicators were imputed using full information maximum likelihood. Models were compared based on the Bayesian information criterion, the Vuong-Lo-Mendell-Rubin likelihood ratio test and scaled relative entropy. Conditional probabilities were computed for each manifest indicator in each class. Covariates were tested for prediction of latent class membership by calculating the odds ratio of an encounter belonging to one class compared to a reference class at each level of the covariate.

Finally, for each distal outcome, equality of means was tested both across all classes and across pairs of classes using a Wald test on the chi-square distribution with degrees of freedom equal to the number of classes being compared minus one, with class means being derived using pseudo-class imputation (Asparouhov & Muthén, 2010; Wang et al., 2005).

Chapter 13. Describing The Sigma Panel 2011

Of 3,587 enrolment surveys submitted, a total of 3,390 men were eligible for The Sigma Panel 2011 and completed the enrolment survey, of which 3,386 enrolled in the study. The number of respondents completing the monthly survey dropped to 1,823 men in month 1, representing 53.8% of enrolment survey completers.

Numbers of completed surveys steadily declined over months (see Table 13.1).

About three quarters of men (76%, or 2,559 men) completing the enrolment survey completed at least one monthly survey. In total, 595 men (18% of enrolled) completed all monthly surveys and 827 men (24.4%) of enrolled did not complete any monthly surveys after enrolment. Numbers of eligible encounters included in each analysis by month of reporting are discussed in the descriptive statistics for each of the three projects.

Demographic statistics at enrolment

At enrolment, eligible respondents to The Sigma Panel 2011 overwhelmingly identified as cisgender men (99.6%), with the remainder identifying as transmen (0.4%) (see Table 13.2). On average, enrolled men were 41.0 years of age (SD=12.0), with range from 16 to 83 years of age. The sample was on the whole well educated, with almost half (45.8%) of respondents possessing a university degree and 34.3% of respondents possessing A-levels or higher education below degree level.

Because income data was only collected categorically, it is difficult to describe the specific details of distribution of income among respondents. Though 7.5% of respondents refused to provide income data, 20.7% of respondents made at least £40,000 per annum in gross income. About a third of respondents reported earning between £15,000 and £30,000 per year.

The vast majority of respondents (80.6%) identified their ethnic group as White British. An additional 12.8% identified as White other. All together, Black and Asian respondents and respondents identifying with other ethnic groups comprised 6.6% of the enrolment sample.

A third of respondents (33.1%) reported London as their strategic health authority of residence. An additional 12.1% lived in the North West of England, with the remainder of respondents spread among the remaining strategic health authorities.

Sexual health and history

For those respondents for whom information was available, almost two thirds (66.1%) last received a negative HIV test result at first report (see Table 13.3). Roughly equal numbers had never received an HIV test result (15.9%) and had received a positive test result (18.0%) at first report of last test. Only 3.0% of respondents received a positive test for a non-HIV STI at first report.

Relationships and gender orientation

At enrolment, 54.3% of respondents reported being single and 37.3% reported being in a relationship with one man only (see Table 13.3). The remaining respondents were either in relationships with multiple men but no women (2.9%) or in relationships with one or more women (5.5%). Four out of every five respondents (80.3%) reported their gender of attraction as men only, while 13.6% of respondents reported attraction mostly to men. The remainder were either attracted to both men and women (4.3%) or mostly to women (1.8%). Most respondents (84.3%) defined their sexual orientation as gay or homosexual. Of enrolment survey respondents, 84.4% were out to some or all of their friends and family.

Chapter 14. Analyses of multipartner encounters

This chapter outlines the results of the analyses of multipartner encounters as executed according to the analysis plan. Descriptive statistics for respondents and encounters are presented first, followed by models estimated for UAI, pleasure and control. The chapter concludes with a summary of findings.

Descriptive statistics

Respondent characteristics. A total of 321 respondents reported 438 included encounters. On average, included respondents reported 1.36 encounters (SD=0.61).

Demographic characteristics. Respondents with multipartner encounters included in this analysis were almost all cisgender men (99.7%), which was not significantly different from those not included ($p=1.000$) (see Table 14.1). Included respondents also were older, both on average (44.6, SD=10.5 included; 40.6, SD=12.1 excluded) and categorically ($p<0.0001$ for both tests). Respondents were more likely to have a university degree (53.0% vs. 45.0%, $p=0.003$) and, categorically measured, to have higher incomes than those not included, though this last difference was not statistically significant ($p=0.10$). Included respondents did not differ on ethnic group composition ($p=0.90$), with 79.3% of included respondents reporting White British ethnicity (vs. 80.8% of those excluded). Included respondents also did not differ by strategic health authority of residence ($p=0.22$), though 39.7% of included respondents reported living in the London strategic health authority compared to 32.4% of those excluded.

Sexual health and history. At first report, more included respondents reported positive HIV tests (26.8% vs. 16.8%) and fewer reported no HIV testing (8.7% vs. 16.9%) than those not included ($p<0.001$) (see Table 14.2). However,

positive non-HIV STI test at first report was not significantly different between those included and those not included (4.4% vs. 2.8%, $p=0.11$).

Relationships and gender orientation. Included respondents were less likely to be single at enrolment (44.8% vs. 55.3%, $p=0.001$), but gender of attraction did not differ significantly ($p=0.28$) between included respondents and those not included, nor did included respondents differ on sexual orientation ($p=0.95$) or outness ($p=0.79$) (see Table 14.2).

Encounter characteristics. Of included encounters, 37.7% recorded UAI. In 87.2% of encounters, respondents felt mostly or totally in control (see Table 14.3). On average, respondents' encounters were rated 6.8 for quality of the sex (SD=1.6). Person-level characteristics on these outcomes and all encounter characteristics were not substantially different, indicating that respondents reporting more encounters do not report different frequencies on these characteristics as compared to respondents reporting fewer encounters. The naïve correlation matrix for this sample of encounters can be found in Appendix 6.

Substance use by respondent. In 67.7% of encounters, respondents reported some substance use, with an average of 1.6 substances used (SD=1.8, indicating a right-skewed distribution). The most commonly used specific substances were poppers (45.4% of encounters), alcohol (38.0%) and erectile dysfunction medications (26.3%). Other specific substances used in multipartner encounters included cannabis (5.3%), MDMA (7.8%), crystal methamphetamine (8.0% of encounters), mephedrone (7.3%), GHB (9.2%), ketamine (6.0%) and cocaine (7.1%). Variables for amphetamine (speed), heroin, LSD, crack and any other specific substances were not included in the analyses on multipartner encounters because five or fewer encounters involved the use of each of these substances.

Substance use by partners. In 29.1% of encounters, respondents reported knowing the substances their partners were taking. In 14.2% of encounters respondents reported knowing their partners had consumed substances but not which substances had been consumed. In 25.9% of encounters respondents reported not knowing if their partners had used substances. Finally, in 30.7% of encounters respondents reported that their partners did not use substances. Consistent with respondents' reports of fewer encounters with partners' substance use than encounters with respondent substance use, respondents reported that their partners on average used about 0.8 (SD=1.6) specific substances during the encounter. Though poppers use was not measured for partners, alcohol (21.8% of encounters) and erectile dysfunction medications (13.8%) were the two most common substances reported. Included variables for partners' use of specific substances were the same as for respondent substance use, with frequencies ranging from 7.3% of encounters for GHB to 3.9% of encounters for cannabis.

Situational characteristics. Number of male partners ranged from 1 to 50, with an average of 3.7 (SD=4.3). As expected, this was a right-skewed variable. The majority of encounters (74.9%) included partners for which serostatus was unclear, unknown, or forgotten. In total, 21.7% of encounters consisted of seroconcordant partners and 3.5% of encounters included serodiscordant partners. The majority of encounters (51.6%) took place in private settings, with just over a third (37.8%) occurring in sex-on-premises venues. The remainder (10.8% of encounters) occurred in cruising or outdoors locations.

Month of reporting. Roughly equal numbers of encounters were reported across all three months of reporting, with 35.6% of encounters originating from

reports in month 7, 30.4% of encounters from reports in month 10 and 34.0% of encounters from reports in month 13.

Models testing associations with UAI

Initial models. Each substance use and situational characteristic measure was tested in univariate models, except for specific substances, for which included substances were entered as a block both for respondent substance use and for partners' substance use. Though planned *a priori*, conditional logistic regressions (CLRs) were not estimated because models for UAI would have included only 47 encounters from 22 respondents.

Respondent substance use. Measures for any substance use and for number of substances used were both significantly associated with UAI ($p < 0.05$ and $p < 0.001$, respectively) (see Table 14.4). Use of any substances was associated with increased odds of UAI (OR=1.73, 95% CI [1.12, 2.70]). Each additional substance consumed by respondents was associated, on average, with increased odds of UAI (1.24, [1.11, 1.40]). Only two specific substances were significantly associated with UAI (both $ps < 0.05$) while controlling for other specific substances—erectile dysfunction medications (2.23, [1.26, 3.96]) and crystal methamphetamine (3.18, [1.19, 8.48]). No other included specific substances yielded statistically significant effects (all $ps > 0.10$).

Partners' substance use. Of the three dummies generated for the categorical measure of any substance use by partners, only specific knowledge of partners' substance use was associated, on average, with increased odds of UAI with no substance use by partners as the reference category (OR=1.71, 95% CI [1.03, 2.83]). Dummies for not knowing partners' substance use and not knowing specific substances taken by partners were not significantly associated with UAI (both

$p>0.10$). Each additional substance reported used by partners was associated with increased odds of UAI (1.14, [1.02, 1.28]). As with respondent's specific substance use, partners' use of erectile dysfunction medications (2.68, [1.20, 6.01]) and crystal methamphetamine (3.21, [1.05, 9.82]) were both associated with increased risk of UAI when other specific substances were included in the model. Though no other specific substances had effects that reached statistical significance, estimated associations between partners' GHB use and UAI (0.42, $p>0.10$) and between partners' ketamine use and UAI (0.91, $p>0.10$) both tended to be associated with reduced odds of UAI.

Situational characteristics. Number of male participants was not significantly associated with UAI (OR=1.04, 95% CI [0.99, 1.08]). Relative to encounters where all partners were believed to be seroconcordant, encounters with partners of unclear serostatus were, on average, less likely to involve UAI (0.39, [0.25, 0.63]), but the same association was not found for serodiscordant multipartner encounters (0.62, [0.21, 1.81]).

Location of sex was not associated with differential odds of UAI relative to encounters held in private settings. However, because effects for both sex-on-premises venues and cruising and outdoors locations were similar in magnitude (OR=0.74 and 0.71, respectively, both $p>0.10$) an exploratory model comparing multipartner encounters in private with all those not held in private (i.e., either in sex-on-premises venues or in cruising and outdoors locations) also yielded a similar and statistically non-significant effect for the population-averaged association of 'non-private' settings and UAI (OR=0.73, 95% CI [0.49, 1.09], $p>0.10$), suggesting that combining these two categories would not itself result in a different interpretation of these results.

Associations with other outcomes. Encounters in which respondents reported being mostly or totally in control of sexual outcomes were associated with lower odds of UAI (OR=0.54, 95% CI [0.31, 0.94]). Each additional ‘point’ of pleasure reported by respondents was associated on average with a 17% increase in the odds of UAI ([1.04, 1.32]).

Month of reporting. Odds of UAI were not significantly different between encounters reported in month 7 and encounters reported in month 10 (OR=1.03, 95% CI [0.71, 1.49], $p>0.10$), but encounters reported in month 13 were associated with increased odds of UAI relative to encounters reported in month 7 (1.43, [1.01, 2.03]).

Multivariate models with categorical measures of any substance use.

Models testing interactions between respondent substance use and encounter venue were not estimated, as encounter venue was not statistically associated with UAI. Other interaction tests proceeded as specified *a priori*.

Interaction models. Models including main effects for any substance use by respondent and any substance use by partners yielded no statistically significant effects for substance use and a statistically non-significant model overall ($\chi^2(4)=6.86$, $p=0.14$, QIC=581.56) (see Table 14.5).

An interaction model was specified between categorical measures of respondent’s substance use and partners’ substance use, which also yielded a statistically non-significant model ($\chi^2(7)=11.54$, $p=0.12$, QIC=584.40) and a higher QIC values, indicating that a model with interaction terms is less preferable than a model with main effects alone.

Multivariate models. Having set aside an interaction between categorical measures of respondent and partners’ substance use, two multivariate models were fit: one including categorical measures of respondent and partners’ substance use,

serodiscordance and month of reporting, and one including categorical measures of respondent substance use alone, serodiscordance and month of reporting. Both models included effects for serodiscordance similar in magnitude and direction to those seen in initial models, including statistically significant associations with unknown partners' serostatus and UAI. However, only the second model included a statistically significant association between respondent substance use and odds of UAI (OR=1.67, 95% CI [1.06, 2.62]). Comparison between QIC values for the first model including partners' substance use (557.41) and for the second model with respondent substance use alone (556.26) indicates that the second model is preferable, though only slightly.

Multivariate models with continuous measures of substance use. Because encounter venue was not statistically associated with UAI, models testing an interaction between number of substances used and encounter venue were not estimated. Other interaction tests proceeded as specified *a priori*.

Interaction models. Models including main effects for number of substances used by respondent and number of substances used by partners yielded a statistically significant association between respondent substance use and UAI (OR=1.24, 95% CI [1.07, 1.44]), but not between partners' substance use and UAI (0.99, [0.84, 1.17]) (see Table 14.6).

However, a model including an interaction between these two continuous measures of substance use yielded both significant main effects for respondent substance use (OR=1.39, 95% CI [1.17, 1.65]) and for partners' substance use (1.31, [1.02, 1.68]), as well as for an interaction between these two terms (0.93, [0.88, 0.98]). This suggests that, on average, increased numbers of substances used by both respondent and partners are associated with increased odds of UAI, but that as

number of substances used by partners increase, the association between each additional substance used by the respondent and odds of UAI is attenuated. The model containing the interaction term between measures of substance use had a lower QIC value (549.30) than the model containing only main effects (558.30), indicating that the interaction model would be preferable.

Multivariate model. The model containing both continuous measures of substance use, their interaction, and variables for serodiscordance and month of reporting again yielded a statistically significant interaction between the continuous measures of substance use (OR=0.94, 95% CI [0.89, 0.99]), and effects for serodiscordance similar in magnitude, direction and significance to the initial model. Dummy variables for month of reporting were no longer statistically significant (both $ps > 0.10$).

Multivariate models with categorical measures of specific substances. Models with variables only for those specific substances that yielded statistically significant effects in initial models demonstrated statistically significant associations between UAI and both erectile dysfunction medication use by respondent (OR=2.00, 95% CI [1.18, 3.40]) and crystal methamphetamine use by respondent (2.52, [1.10, 11.28]) (see Table 14.7). These effects are similar in magnitude, direction and significance to those seen in the initial models. However, effects for partners' use of erectile dysfunction medications and partners' use of crystal methamphetamine were not statistically significant (both $ps > 0.10$).

A multivariate model that also included variables for serodiscordance and month of reporting yielded consistent associations between specific substances and UAI, as well as estimates for the association between serodiscordance and UAI

consistent with initial models. Month of reporting was not significant in this model (both $ps > 0.10$).

Models testing associations with pleasure

Initial models. As above, each substance use and situational characteristic measure was tested in univariate models, except for specific substances, for which included substances were entered as a block both for respondent substance use and for partners' substance use.

Respondent substance use. Though any substance use by respondent was not associated with pleasure ($p > 0.10$), each additional substance a respondent reported having used was associated with increased pleasure ($\beta = 0.14$, 95% CI [0.05, 0.23]) (see Table 14.8). When controlling for all specific substances included in these analyses, only use of poppers was marginally associated ($p < 0.10$, but not $p < 0.05$) with increased pleasure (0.32, [-0.02, 0.65]).

Partners' substance use. Relative to no substance by partners, not knowing if partners had used substances was associated with decreased pleasure ($\beta = -0.50$, 95% CI [-0.91, -0.09]), but while both responses reflecting substance use by partners were associated with increased pleasure relative to no substance use, neither was statistically significant (both $ps > 0.10$). Neither number of substances used by partners nor specific substances used by partners were associated with pleasure (all $ps > 0.10$).

Situational characteristics, control as outcome and month of reporting.

Each additional participant was associated on average with an increase in pleasure of 0.05 points (95% CI [0.02, 0.09]). Relative to encounters where all partners were believed to be seroconcordant, encounters with unclear or unknown partners' serostatuses were, on average, associated with less pleasure (-0.38, [-0.76, -0.001]),

though serodiscordant encounters were not statistically different from seroconcordant encounters. On average, multipartner encounters in cruising or outdoors locations were less pleasurable than encounters in private settings (-1.02, [-1.54, -0.50]), but encounters in sex-on-premises venues were not statistically different in this regard from private encounters ($p>0.10$). Perceived control over sexual outcomes was not significantly associated with pleasure, nor was month of reporting (all $ps>0.10$).

Multivariate models with continuous measures of substance use. Because associations between partners' substance use and pleasure were not statistically significant, interactions between respondent and partner substance use were not tested. Other interaction tests proceeded as specified *a priori*.

Interaction models. Models with main effects for number of substances used by respondent and location of sex yielded associations of similar magnitude, direction and significance as associations from initial models (see Table 14.9).

A model including an interaction between substance use and location of sex also resulted in a statistically significant interaction between number of substances used by the respondent and sex in a cruising location ($\beta=-0.53$, 95% CI [-0.97, -0.08]), though the interaction between number of substances and sex in a sex-on-premises venue was not statistically significant (-0.07, [-0.26, 0.11]). Put otherwise, while additional substances are associated on average with increased pleasure in private encounters (and, possibly, in sex-on-premises venues), additional substances are associated with decreased pleasure in encounters held in cruising locations. Comparison between the QIC value for the main effects model (1104.79) and the interaction model (1095.05) showed that the interaction model provided a better fit to the data while accounting for increased model complexity.

Multivariate model. Adding terms for number of male partners and serodiscordance resulted in similar associations for the substance use and location of sex terms, as well as their interactions. The association of number of male partners with increased pleasure was similar to the association in initial models. However, while associations between serodiscordance variables and pleasure were more extreme in magnitude as compared to associations in initial models, encounters with unclear or unknown partners' serostatuses were no longer statistically associated on average with decreased pleasure ($p>0.10$).

Models testing associations with control

Initial models. As above, each substance use and situational characteristic measure was tested in univariate models, except for specific substances, for which included substances were entered as a block both for respondent substance use. Block entry was not done for partners' substance use as explained below. Though planned *a priori*, CLRs were not estimated because models for control would have included only 30 encounters from 14 respondents.

Respondent substance use. Neither any substance use by respondent nor number of substances used by respondent were associated with reporting being in total or complete control of sexual outcomes (both $ps<0.10$), though as expected, both associations were negative in direction (see Table 14.10). A model including all specific substances in this analysis only yielded a significant association between crystal methamphetamine and reduced odds of control (OR=0.15, 95% CI [0.05, 0.53]), though cocaine was marginally associated ($p<0.10$, but $p>0.05$) with reduced odds of control (0.37, [0.13, 1.03]). All other specific substances except for alcohol appeared to be associated with *increased* odds of control, though confidence intervals were wide in all accounts.

Partners' substance use. Neither the categorical measure of partners' substance use nor number of substances used by partners was significantly associated with odds of control. However, knowing that partners had consumed substances while also not knowing which specific substances were consumed was marginally associated with reduced odds of control (OR=0.47, 95% CI [0.19, 1.13]).

Partners' specific substance use. The model testing specific substances used by partners together as a block was unstable and did not converge. Thus, each specific substance was tested individually in univariate models. No specific substances were significantly associated with control (all $ps > 0.10$), though all encounters including MDMA were reported by respondents as characterised by control over outcomes, making this odds ratio incalculable.

Situational characteristics and month of reporting. No situational characteristics were significantly associated with odds of control (all $ps > 0.10$). Month of reporting was not significantly associated with odds of control (all $ps > 0.10$).

Exploratory test of quadratic relationship. A counterintuitive finding was that while knowing which specific substances partners had taken was associated with decreased odds of control, each additional substance partners had consumed was associated with increased odds of control. This could suggest a non-linear relationship between number of substances consumed by partners and odds of reporting being mostly or totally in control of sexual outcomes. An exploratory model fitting a quadratic term for number of substances used by partners yielded a statistically significant result for both the linear term (OR=0.46, 95% CI [0.24, 0.86]) and the quadratic term (1.24, [1.03, 1.49]). This suggests that while each additional substance used by partners is associated with decreased odds of reporting control

over sexual outcomes, each additional substance consumed by partners after three substances is actually associated with *increased* odds of control over sexual outcome. Similar tests on number of substances used by respondents did not yield any statistically significant associations.

Summary of findings

Relative to the whole sample of respondents to The Sigma Panel 2011, respondents reporting multipartner encounters were older, better educated and more likely to be in a relationship. Subjectively, these differences were substantial, but not extremely large, and were balanced by the many characteristics on which the two groups of respondents were not significantly different.

On average, overall respondent substance use in multipartner encounters was significantly associated with increased odds of UAI and increased pleasure, but generally not with control. In particular, while both any substance use and polysubstance use as measured by a continuous variable were associated with increased UAI, only the continuous measure of substance use was significantly associated with pleasure. Evidence for associations with specific substances was sparse. Use of erectile dysfunction medication and use of crystal methamphetamine were both associated with UAI, but no specific substance use was associated with pleasure. Only use of crystal methamphetamine was significantly associated with decreased odds of control in multipartner encounters.

On average, overall partner substance use was significantly associated with increased odds of UAI, though associations with pleasure and control were less straightforward. While both knowledge of specific substance use by partners and number of substances consumed by partners were associated with increased odds of UAI, the only significant association with pleasure was a negative association

with not knowing if partners had used substances. Interestingly, a quadratic relationship emerged between number of substances used by partners and control. High levels of polysubstance use by partners appear to be associated with increased odds of control over sexual outcomes.

Associations for use of specific substances by partners reflected those for use of specific substances by respondents, though in a multivariate model including use of specific substances by both respondents and partners, specific partner substance use was not statistically significant. No specific substance use by partners was significantly associated with either pleasure or control, though these findings were affected by the ‘sparse cells’ problem and by non-convergence in block entry.

On average, multipartner encounters in cruising locations were associated with decreased pleasure relative to encounters in private locations, though no significant associations were evident for UAI or control. While the direction of effects suggested that UAI was less likely and control more likely in encounters not held in private venues (i.e. at a home or hotel), these differences were not statistically significant. However, multipartner cruising or outdoors encounters, though not encounters in sex-on-premises venues, were less pleasurable than multipartner private encounters.

On average, multipartner encounters with partners where serostatus was unclear were associated with decreased odds of UAI and decreased pleasure as compared to encounters with seroconcordant partners, but not with control. Findings for UAI remained significant in multivariate models. However, findings for pleasure were not significant in multivariate models. Encounters with serodiscordant partners were not significantly associated with UAI or pleasure.

On average, number of partners was significantly associated with increased pleasure, but not with UAI or control. This finding persisted in multivariate models, indicating that it reflected a unique source of variance relative to other variables.

Number of substances used by respondent and partners interacted to moderate associations with UAI. While increasing numbers of substances used by respondent or partners were associated with increased odds of UAI, this relationship was attenuated as each additional substance was consumed. Notably, interactions between categorical measures of substance use were not statistically significant.

Number of substances used by respondent and location interacted to moderate associations with pleasure. Specifically, in initial and main effects models each additional substance used by respondent was associated with increased pleasure and encounters in cruising or outdoors locations were associated with decreased pleasure. However, an interaction test revealed that each additional substance consumed in multipartner encounters in cruising locations was associated with decreased pleasure.

Chapter 15. Analyses of new partner encounters

This chapter outlines the results of the analyses of new partner encounters as executed according to the analysis plan. Descriptive statistics for respondents and encounters are presented first, followed by models estimated for UAI, pleasure and control. The chapter concludes with a summary of findings.

Descriptive statistics

Respondent characteristics. In total, 2,913 eligible encounters were reported by 1,879 respondents, with an average of 1.55 encounters per respondent ($SD=0.50$). CLR models estimated for UAI as outcome included 364 encounters reported by 182 respondents and CLR models estimated for control as outcome included 226 encounters reported by 113 respondents.

Because pairs of encounters included in CLRs need to have different values on the outcomes, the analysis samples for each outcome tested are different (and, in both cases, much smaller) than the whole sample. Discussion of descriptive statistics will focus on the whole sample of new partner encounters.

Demographic characteristics. Respondents with eligible encounters were almost all men, which was not significantly different from those not included (99.6% included vs. 99.7% excluded, $p=0.78$) (see Table 15.1). Both categorically ($p<0.001$) and on average, respondents with eligible encounters were older than those not included (42.2, $SD=11.9$ vs. 39.5, $SD=12.0$, $p<0.001$). Of note, however, is that those included in the CLRs with control as outcome appeared to be younger on average than those not included, though this difference was not statistically significant (39.5, $SD=11.7$ vs. 41.0, $SD=12.0$, $p=0.17$). Exactly half of respondents included in the new partner encounter analyses had a university degree, a higher proportion than those not included ($p<0.001$). This trend was reflected in both CLR

analyses, but was not statistically significant for either sample (both $ps>0.05$). Gross income per annum was significantly different ($p<0.001$) between respondents reporting new partner encounters and excluded respondents, but this difference was not systematic in any direction across item categories and was not significant for either of the CLR samples (both $ps>0.10$). Respondents reporting new partner encounters were slightly more likely to report being White British (81.7% vs. 79.2%, $p=0.03$) but this difference was small. While the sample for CLR analyses of UAI matched this trend (though $p=0.43$), the sample for CLR analyses of control was less likely to be White British (75.2% vs. 80.8%, though $p=0.49$). New partner encounter respondents were more likely to live in London (35.1% vs. 30.5%) and less likely to live in the North West (10.4% vs. 14.2%) ($p=0.008$), but new partner encounter respondents in the CLR analysis sample for UAI as outcome were more likely to live in the South West (14.7% vs. 8.1%) and South Central (9.6% vs. 6.1%) and less likely to live in North West (6.2% vs. 12.4%).

Sexual health and history. Though respondents for the total sample of new partner encounters were not significantly different from those not included in HIV test result at first report ($p=0.30$), respondents in the analysis sample for CLRs with UAI as outcome were, with marginal statistical significance, more likely to report testing positive (24.2% included vs. 17.8% excluded, $p=0.07$) (see Table 15.2). Respondents in the analysis sample for CLRs testing associations with control were more likely to have never received an HIV test result (23.9% vs. 15.5%, $p=0.04$). None of the analysis samples were different from those excluded on positive tests for non-HIV STIs at first report.

Relationships and gender orientation. Respondents included in the total new partner sample were somewhat more likely to be in relationships with one man

only at baseline (38.5% included vs. 35.7% excluded, $p=0.02$), to be attracted to men only (82.5% vs. 77.5%, $p<0.001$), to identify as gay or homosexual (85.9% vs. 82.2%, $p=0.003$), and to be out to some or all friends and family (86.1% vs. 82.3%, $p=0.003$) than those not included. Neither of the CLR samples were statistically significant across any of these characteristics (all $ps>0.10$), with the exception of gender of attraction in CLRs testing associations with control, where respondents were less likely to report being attracted to men only (76.1% vs. 80.4%) and more likely to report being attracted to both men and women (10.6% vs. 4.1%), with $p=0.01$.

Encounter characteristics. Across all new partner encounters, 21.2% of encounters included UAI (see Table 15.3). Respondents reported being totally or mostly in control of sexual outcomes in 90.3% of included encounters. The mean reported pleasure of encounters was 6.3 out of 10 ($SD=1.9$). In the analysis sample for CLRs testing associations with UAI, 87.2% of encounters included respondents reporting being mostly or totally in control of sexual outcomes. On average respondents rated the sex as being 6.4 out of 10 ($SD=2.0$). In the analysis sample for CLRs testing associations with control, 23.9% of encounters included UAI. On average respondents rated the sex as being 6.1 out of 10 ($SD=2.1$). The naïve correlation matrix for this sample of encounters can be found in Appendix 6.

Substance use by respondent. Across all new partner encounters, just over half (51.5%) of encounters involved substance use by respondent. On average, respondents used 0.8 substances ($SD=1.0$). These measures were consistent across both CLR analysis samples and at the individual level.

The most commonly reported specific substances used by respondents across all new partner encounters were poppers (22.1% of encounters), alcohol (30.1%) and

erectile dysfunction medications (10.7%). In addition, cannabis (3.8%), MDMA (1.8%), crystal methamphetamine (1.2%), GHB (1.8%), ketamine (2.0%) and cocaine (2.6%) were included in analyses of the whole sample of new partner encounters. Specific substances that were left out of analyses of the whole sample included amphetamine, heroin, mephedrone, LSD, crack and any other drug.

Patterns of specific substance use in the analysis sample for CLRs testing associations with UAI were similar to those in the whole sample of new partner encounters, but only variables for poppers, alcohol, erectile dysfunction medications, cannabis and cocaine could be included.

Patterns of specific substance use in the analysis sample for CLRs testing associations with control reflected a lower prevalence of poppers use (17.7%) but slightly higher rates of alcohol use (33.6%) and of erectile dysfunction medication use (11.1%). These three substances were the only ones included in these CLR analyses.

Location of sex. The vast majority of encounters (82.3%) in the whole sample of new partner encounters occurred in private settings, with 12.9% occurring in sex-on-premises venues and 4.8% occurring in cruising or outdoors locations. This pattern was similar in the analysis sample of CLRs testing associations with UAI, but the analysis sample of CLRs testing associations with control included fewer encounters in sex-on-premises venues (8.4%) and more encounters in cruising or outdoors locations (5.8%).

Month of reporting. In the whole sample of new partner encounters, month of reporting was evenly split with 51.5% of encounters reported in month 1 and 48.5% reported in month 3.

Perceived HIV transmission risk. While the majority of encounters (54.6%) in the sample of new partner encounters were perceived to have low risk, perceptions of risk tended to be higher in both CLR analysis samples, with respondents reporting more encounters as ‘some risk’ or ‘high risk’ and fewer encounters as ‘no risk’.

Models testing associations with UAI

Initial models. Binary and continuous measures for substance use by respondent and the variables for location of sex, for pleasure, for control and for perceived HIV transmission risk were each tested in initial models. Specific substances were entered as a block.

Conditional logistic regressions. Conditional logistic regressions did not produce any statistically significant findings on situational characteristics. Analyses are described in Appendix 7.

Generalised estimating equations. Models estimated as CLRs with a limited sample were then re-estimated as generalised estimating equations with the entire analysis sample (see Table 15.4).

Respondent substance use. Any substance use by respondent was associated with increased odds of UAI (OR=1.57, 95% CI [1.31, 1.88]). The continuous measure of substance use was similarly associated, with each additional substance associated with an increase in odds of UAI of 32% ([1.22, 1.43]). Of specific substances tested, only poppers were significantly associated with UAI (1.79, [1.45, 2.21]), though crystal methamphetamine, ketamine and cocaine were all marginally associated ($p < 0.10$ but $p > 0.05$) with increased odds of UAI.

Location of sex. While encounters in cruising locations were not associated with UAI as compared to encounters in private locations, encounters in sex-on-

premises venues were associated with lower odds of UAI (OR=0.69, 95% CI [0.52, 0.91]).

Associations with other outcomes. Encounters in which the respondent reported being mostly or totally in control of sexual outcomes were associated with decreased odds of UAI (OR=0.51, 95% CI [0.12, 0.75]). Each additional ‘point’ of pleasure a respondent accorded to a sexual encounter was associated with higher odds of UAI (1.25, [1.19, 1.31]).

Perceived HIV transmission risk. Relative to encounters perceived as having no HIV transmission risk, encounters with low HIV transmission risk were not associated with odds of UAI ($p>0.10$) but encounters with some perceived HIV transmission risk (OR=11.18, 95% CI [8.29, 15.09]) and high perceived risk (78.95, [33.69, 185.00]) were associated with increased odds of UAI.

Month of reporting. Month of reporting was not significantly associated with differential odds of UAI ($p>0.10$).

Interactions between substance use measures and location of sex. Three interactions were tested: an *a priori* model of the interaction of binary overall substance use measure with location of sex, an *a priori* model of the interaction of number of substances used with location of sex, and an exploratory model of the interaction of poppers use, the only specific substance with a statistically significant association, with location of sex.

Interaction between binary substance use measure and location of sex. The main effects model for the binary substance use measure and location of sex yielded a statistically significant model ($\chi^2(3)=29.96$, $p<0.001$, QIC=2957.00) with associations for each variable similar in magnitude, direction, and significance to associations in the initial models (see Table 15.5).

An interaction model was also statistically significant ($\chi^2(5)=33.52, p<0.001$, QIC=2954.28), with a lower QIC value indicating that the model yielded an improved fit despite its greater complexity. This was reflected in a statistically significant interaction between substance use and sex-on-premises venue (OR=2.23, 95% CI [1.21, 4.09]), but an interaction between substance use and cruising location (0.73, [0.30, 1.75]) that was not statistically significant. When interpreted with the main effects in the interaction model for substance use (1.47, [1.21, 1.79]) and for sex-on-premises venues relative to private locations for sex (0.43, [0.26, 0.72]), this model indicates that while sex-on-premises venues are themselves associated with lower risk of UAI in the presence of no substance use, respondent substance use in an encounter located in a sex-on-premises venue was associated with increased odds of UAI 123% greater than would be the case in an encounter in a private location.

Interaction between number of substances used and location of sex. The main effects model for number of substances used and location of sex yielded a statistically significant model ($\chi^2(3)=52.29, p<0.001$, QIC=2884.28) (see Table 15.6). While associations for location of sex were similar in magnitude, direction and significance to associations in initial models, the association between number of substances used and odds of UAI was attenuated in magnitude (OR=1.33, 95% CI [1.22, 1.44]), though still significant at the $p<0.001$ level.

While an interaction model also was statistically significant ($\chi^2(5)=53.25, p<0.001$, QIC=2889.26), the interaction terms themselves were not ($p>0.10$) and the increased QIC value as compared to the main effects models indicates that the main effects model is preferable.

Exploratory interaction between poppers use and location of sex. An initial model testing just the association of poppers use with UAI yielded a statistically

significant association (OR=1.93, 95% CI [1.57, 2.37]) (see Table 15.7). Inclusion of location of sex in a subsequent model yielded effects similar in magnitude, direction and significance both to the initial model for location of sex and to the ‘poppers-only’ model for poppers use. This model, which was statistically significant ($\chi^2(3)=46.18$, $p<0.001$, QIC=2904.01), was compared against a model including an interaction between poppers use and location of sex ($\chi^2(5)=49.09$, $p<0.001$, QIC=2898.90). The decreased QIC value indicates improved fit, which is reflected in the statistically significant interaction between poppers use and encounters in sex-on-premises venues (1.98, [1.08, 3.62]), though the interaction term between poppers use and encounters in cruising locations (1.24, [0.47, 3.22]) was not statistically significant. This interaction is similar in interpretation to the interaction found between binary overall substance use and location of sex.

Models testing associations with pleasure

Initial models. Binary and continuous measures for substance use by respondent and the variables for location of sex, for control and for perceived HIV transmission risk were each tested in initial models. Specific substances were entered as a block.

Respondent substance use. Any substance use by the respondent was associated with increased reported pleasure in the sexual encounter ($\beta=0.18$, 95% CI [0.04, 0.32]) (see Table 15.8). Similarly, each additional substance reported consumed by the respondent was associated with increased reported pleasure (0.17, [0.10, 0.24]). When entered as a block, several specific substances were positively associated with reported pleasure: poppers (0.27, [0.09, 0.45]), alcohol (0.17, [0.01, 0.33]), crystal methamphetamine (0.83, [0.10, 1.55]), and ketamine (0.82, [0.26, 1.39]). No other specific substances were associated with pleasure (all $ps>0.10$).

Location of sex. Relative to encounters in private locations, both encounters in sex-on-premises venues ($\beta=-0.61$, 95% CI [-0.82, -0.40]) and encounters in cruising locations ($\beta=-0.42$, 95% CI [-0.74, -0.09]) were associated with decreased pleasure.

Association with control. Reported control over sexual outcomes was not associated with pleasure ($\beta=0.10$, 95% CI [-0.15, 0.34]).

Perceived HIV transmission risk. Relative to encounters in which respondents reported no perceived HIV transmission risk, encounters in which respondents reported either low risk or some risk were not associated with differential reported pleasure. However, encounters in which respondents reported high perceived HIV transmission risk were associated with more pleasure ($\beta=0.72$, 95% CI [0.27, 1.17]) than encounters with no perceived HIV transmission risk.

Month of reporting. Encounters reported in month 3 were on average associated with more pleasure ($\beta=0.26$, 95% CI [0.14, 0.38]). Because including month of reporting in subsequent multivariate models did not substantially change any results, this variable is excluded from further analysis.

Multivariate models. Models testing interactions between the binary overall measure of substance use and location of sex and between number of substances consumed by respondent and location of sex were estimated. In addition, a multivariate model with specific substances and location of sex was estimated.

Interaction between binary substance use measure and location of sex. The main effects model including variables both for any substance use by self and location of sex yielded a statistically significant model ($\chi^2(3)=39.33$, $p<0.001$, QIC=10759.00) with associations between included variables and reported pleasure

similar in magnitude, direction and significance to associations in initial models (see Table 15.9).

While the model including an interaction term between overall substance use and location of sex was also statistically significant ($\chi^2(5)=42.45, p<0.001$, QIC=10754.86) and included a lower QIC indicating better model fit, the interaction terms were not statistically significant ($p<0.10$), suggesting that the main effects model would be better suited to interpreting the data.

Interaction between number of substances used and location of sex. The main effects model including variables both for number of substances used and for location of sex yielded a statistically significant model ($\chi^2(3)=55.76, p<0.001$, QIC=10573.61) with associations similar in magnitude, direction, and significance to those in the initial models (see Table 15.10). However, the negative association between encounters in cruising locations and reported pleasure was attenuated ($\beta=-0.34$, 95% CI [-0.68, -0.01]) as compared to the same effect in initial models ($\beta=-0.42$).

While the model including an interaction term ($\chi^2(5)=59.45, p<0.001$, QIC=10564.52) appeared to fit the data better, neither interaction term was statistically significant (both $ps<0.10$). As above, this suggests that the main effects model would be better suited to interpreting the data.

Multivariate models with categorical measures of specific substances. A model containing variables only for those specific substances with statistically significant associations in initial models yielded similar associations for poppers use, crystal meth use and ketamine use, but alcohol use was only marginally significant ($p<0.10$, but $p>0.05$), though the association remained similar in magnitude ($\beta=0.16$, 95% CI [-0.001, 0.32]) (see Table 15.11). Including location of sex in the model

attenuated associations between crystal meth use and reported pleasure ($\beta=0.84$, 95% CI [0.14, 1.54]), and between encounters in cruising locations and reported pleasure ($\beta=-0.36$, 95% CI [-0.69, -0.03]), and resulted in an association for alcohol use with reported pleasure that was not statistically significant ($\beta=0.12$, 95% CI [-0.04, 0.28]).

Models testing associations with control

Initial models. Binary and continuous measures for substance use by respondent and the variables for location of sex, for pleasure, for control and for perceived HIV transmission risk were each tested in initial models. Specific substances were entered as a block.

Conditional logistic regressions and generalised estimating equations.

Conditional logistic regressions did not produce any statistically significant findings on situational characteristics. Analyses are described in Appendix 6. Models estimated as CLRs with a limited sample were then re-estimated as generalised estimating equations with the entire analysis sample (see Table 15.12).

Respondent substance use. No statistically significant associations were found between substance use and perceived control for the binary overall measure of substance use, number of substances consumed by respondent or specific substances, though a marginally significant ($p<0.10$) association was found between alcohol use and decreased odds of reporting being totally or mostly in control of sexual outcomes (OR=0.77, 95% CI [0.59, 1.01]).

Location of sex. No statistically significant associations were found between location of sex and perceived control, though a marginally significant ($p<0.10$) association between encounters in sex-on-premises venues relative to venues in private locations and increased odds of reporting being totally or mostly in control (OR=1.49, 95% CI [0.98, 2.27]) was found.

Perceived HIV transmission risk. Relative to encounters in which participants reported no perceived HIV transmission risk, encounters with some perceived HIV transmission risk (OR=0.33, 95% CI [0.22, 0.48]) and high perceived HIV transmission risk (0.27, [0.15, 0.49]) were associated with decreased odds of perceived control, though the association between low perceived risk and control (0.80, [0.59, 1.10]) was not statistically significant ($p>0.10$).

Month of reporting. Month of reporting was not significantly associated with differential odds of control ($p>0.10$).

Summary of findings

Discussion of analyses of new partner encounters will focus on the generalised estimating equations models. Respondents included in the complete sample of new partner encounters were older. Included respondents were more likely to be better educated, to have higher incomes, to be White British and to live in London. They were more likely to be in relationships with one man only, to be attracted to men only, to identify as gay or homosexual and to be out to some or all friends and family. Subjectively, these differences did not appear to be extremely large across response categories, except perhaps in differences in education.

On average, overall respondent substance use in encounters with new partners were associated with increased odds of UAI and increased pleasure, but not with control. Both binary and continuous measures of respondent substance use were associated with increased odds of UAI. Only respondent use of poppers yielded a significant finding for an association with UAI, though use of each of crystal methamphetamine, ketamine and cocaine was marginally associated with UAI. Use of each of poppers, alcohol, crystal methamphetamine, and ketamine was associated with increased pleasure.

On average, encounters with new partners in sex-on-premises venues were associated with decreased odds of UAI compared to encounters in private locations, while encounters with new partners in non-private locations generally were associated with decreased pleasure. As above, there were no significant associations between location of sex and control. It appears that encounters in sex-on-premises venues were less pleasurable than encounters in cruising locations, though this was not formally tested through linear combinations of coefficients.

Any respondent substance use, but not number of substances used, moderated the relationship between encounters with new partners in sex-on-premises venues and UAI risk, while there was no evidence of moderation between venue of sex and substance use in associations with pleasure. In other words, while ‘sober’ encounters in sex-on-premises venues were associated with decreased odds of UAI, encounters in sex-on-premises venues where the respondent reported substance use were associated with increased UAI odds. This was further buttressed by the statistically significant interaction between use of poppers and sex-on-premises venues, which yielded a substantively similar interpretation. Additional moderation effects between specific substances and venue of sex were not tested due to initial models yielding no additional statistically significant associations for use of specific substances. Finally, in the main effects models, coefficients for substance use and location of sex did not appear to substantially confound each other.

Increasing perceptions of HIV transmission risk were associated with increased odds of UAI, increased pleasure, and decreased odds of control. As expected, respondents judged that increased HIV transmission risk and UAI were associated. However, associations also suggested that only in encounters with highest perceived HIV transmission risk was pleasure significantly higher.

Associations also suggested that either some or high HIV transmission risk was associated with decreased odds of control, with effect sizes fairly similar for both significant differences.

Chapter 16. Analyses of single-partner encounters

This chapter outlines the results of the analyses of the sample of single-partner encounters as executed according to the analysis plan. Descriptive statistics for respondents and encounters are presented first, followed by models estimated for UAI, pleasure and control. The results of the multilevel latent class analysis are then presented. The chapter concludes with a summary of findings.

Descriptive statistics

Respondent characteristics. A total of 2,142 respondents reported 6,742 eligible encounters. On average, each respondent reported 3.14 encounters (SD=1.54). In total, 639 respondents reported 2,546 encounters in the analysis sample for CLRs testing associations with UAI. The analysis sample for CLRs testing associations with control consisted of 1,246 encounters reported by 308 respondents.

Because groups of encounters included in CLRs need to have different values on the outcomes for each respondent, the analysis samples for each outcome tested are different (and, in both cases, much smaller) than the analysis sample of all single-partner encounters. Discussion of descriptive statistics will focus on the whole sample of new partner encounters, but descriptive statistics for both CLR samples and the whole sample can be found in Table 16.1.

Demographic characteristics. Included respondents in all analysis samples were not more likely to be cisgender men than those not included (99.6% included vs. 99.7% excluded, $p=0.78$). Both on average and categorically (both $ps<0.001$), respondents in the total analysis sample were older (42.5, SD=11.9 vs. 38.3, SD=11.7) than those not included. This pattern held for both CLR analysis samples, though it only rose to statistical significance for CLRs testing associations with UAI

($p=0.03$). More respondents in the total analysis sample had university degrees (49.6% vs. 39.1%, $p<0.001$). Again, this pattern held for both CLR analysis samples, but was only statistically significant for CLRs testing associations with UAI ($p<0.001$).

Gross income per annum had different categorical frequencies in the total analysis sample as compared to those not included ($p<0.001$), but there was no specific pattern in differences. Respondents in the total analysis sample were more likely to be White British (81.5% included vs. 79.2% excluded, $p=0.007$) or another White-identified ethnicity (13.0% vs. 12.3%). None of these differences were statistically significant for either CLR analysis sample (all $ps>0.05$). Across all analysis samples, there were no statistically significant differences between those included in each sample and those not included on strategic health authority of residence (all $ps>0.05$).

Sexual health and history. There were no statistically significant differences in HIV test result at first report between those included and those not included for either the total analysis sample or the CLR analysis sample for testing associations with control (both $ps>0.10$) (see Table 16.2). However, those in the CLR analysis sample for testing associations with UAI were more likely to have a negative test result at last test (70.4% included vs. 64.6% excluded, $p<0.001$) and less likely to not have ever received an HIV test result (10.3% vs. 17.7%). Respondents in the total analysis sample were more likely to have had a non-reactive test for non-HIV STIs at first report (97.4% vs. 94.7%, $p=0.01$). This difference was not statistically significant for either CLR analysis sample (both $ps>0.10$).

Relationships and gender orientation. Respondents included in the total analysis sample were more likely to be in a relationship with one man only (40.0%

included vs. 32.5% excluded, $p<0.001$). This difference was more pronounced in direction and significance for the CLR analysis sample testing associations with UAI (45.8% vs. 35.3%, $p<0.001$). However, though this difference did not rise to statistical significance ($p>0.10$), respondents in the CLR analysis sample testing associations with control were more likely to be single (57.4% vs. 54.0%).

Respondents included in the total analysis sample were more likely to be attracted to men only (81.4% included vs. 78.5% excluded, $p<0.001$) or mostly to men (13.8% vs. 13.2 %) than those not included. They were also more likely to describe their sexual orientation as gay or homosexual (85.5% vs. 82.2%, $p=0.01$) and to be out to some or all of their family and friends (86.0% vs. 81.6%, $p=0.001$). Differences were similar for those included in the CLR analysis sample testing associations with UAI (all $ps\leq 0.001$). No differences on these descriptive statistics were statistically significant in the CLR analysis sample for testing associations with control (all $ps>0.05$), but all differences trended in the opposite direction from those differences between respondents in the total analysis sample and respondents not included.

Encounter characteristics. Of included encounters, 30.9% included UAI (see Table 16.3). On average, respondents' encounters were rated 6.5 out of 10 ($SD=1.9$) for quality of sex. In 91.4% of encounters, respondents reported feeling totally or mostly in control of sexual outcomes.

Second, in the CLR analysis sample testing associations with UAI, 46.1% of encounters included UAI. On average, respondents rated their encounters 6.5 out of 10 ($SD=1.9$) for quality of sex. In 90.1% of encounters in this sample, respondents reported feeling totally or mostly in control of sexual outcomes.

Finally, in the CLR analysis sample testing associations with control, 6.4 % of encounters included UAI. On average, respondents rated their encounters 6.3 out of 10 (SD=1.9) for quality of sex. In 64.5% of encounters, respondents reported feeling totally or mostly in control of sexual outcomes.

Person-level characteristics on these outcomes, and all encounter characteristics, were not substantially different, indicating that respondents reporting more encounters do not report different frequencies on these characteristics as compared to respondents reporting fewer encounters. The naïve correlation matrix for this sample of encounters can be found in Appendix 6.

Substance use by respondent. Respondents reported any substance use in 42.9% of encounters. On average, respondents used 0.7 substances (SD=1.0) in an encounter. This was constant across all analysis samples.

In all encounters, the most common specific substances used were alcohol (26.5%), poppers (20.5% of encounters) and erectile dysfunction medications (7.2%). Additional specific substances included in analyses on the total sample of encounters were cannabis (3.9%), cocaine (2.1%), ketamine (1.8%), MDMA (1.7%), GHB (1.4%) and crystal methamphetamine (1.1%). Specific substances that were excluded from analyses on the total sample of encounters were amphetamine, heroin, mephedrone, LSD, crack and any other drug.

Frequencies of use of specific substances were similar in the CLR analysis sample for testing associations with UAI, and the same specific substances were used in these analyses. As compared to frequencies in the total analysis sample (and with the exception of poppers and alcohol), frequencies of specific substances were lower in the CLR analysis sample for testing associations with control. Thus, specific

substances included in analyses on this sample also did not include GHB or crystal methamphetamine.

Substance use by partner. Respondents in the total analysis sample reported that their partners did not use any substance use in 64.0% of encounters. They reported not knowing if their partners used substances in 7.9% of encounters and knowing that their partners used substances (but not which specific substances) in 3.8% of encounters. Finally, respondents reported knowing the specific substances their partners consumed before or during sex in 24.4% of encounters. On average, respondents reported that their partners used 0.3 substances during sex (SD=0.7). These measures were fairly constant across analysis samples.

Alcohol was by far the most common specific substance partners were reported to have used (20.9% of encounters). As above, other specific substances included in these analyses were cannabis (3.1%), erectile dysfunction medications (2.5%), cocaine (1.8%), ketamine (1.4%), MDMA (1.2%), GHB (1.2%) and heroin (0.9%). Despite not representing 1% of all cases, heroin was included exceptionally to mirror analyses of respondent specific substance use.

Patterns of frequency of specific substance use were generally similar across both CLR analysis samples. As above, ketamine (0.8% of encounters) was included exceptionally in CLR analyses testing associations of control to mirror analysis of respondent specific substance use on this sample.

Situational characteristics. About seven in every eight encounters (87.2%) occurred in a private residence. Respondents reported that 7.3% of encounters occurred in sex-on-premises venues and that 5.5% occurred in cruising or outdoors locations. This was consistent across analysis samples.

Respondents reported that 32.3% of encounters involved regular and steady partners and that 26.3% involved regular but non-steady partners. Encounters with opportunity and anonymous partners comprised 41.4% of the sample. This was consistent across analysis samples.

In the total analysis sample, 43.0% of encounters were with partners believed to be of the same HIV serostatus as the respondent. Half of all encounters (50.0%) were with partners with whom a serostatus match was unknown, unclear or forgotten. Just 7.0% of encounters were with serodiscordant partners. This overall pattern was not consistent across analysis samples. In the CLR sample testing associations with UAI, almost half of encounters (49.0%) were with seroconcordant partners; 43.8% with partners with whom a serostatus match was unknown, unclear or forgotten; and 7.2% with serodiscordant partners. Conversely, in the CLR sample testing associations with control, fewer encounters (39.1%) were with seroconcordant partners. In this analysis sample, 52.6% of encounters were with partners with whom a serostatus match was unknown, unclear or forgotten and 8.3% of encounters were with serodiscordant partners.

Month of reporting. Month of reporting of encounters was distributed roughly evenly across all five months. The first wave of data collection, which occurred in month 2 of the survey, yielded the most encounters (22.7%). The fourth and second-to-last wave of data collection, in month 10 of the survey, yielded the fewest encounters (18.6%). This roughly even distribution was similar across all analysis samples.

Models testing associations with UAI

Results from CLRs are presented first before results from random intercept models on the entire sample of encounters.

Conditional logistic regressions. As specified in the *a priori* model building and selection rules, associations between each of substance use and situational characteristics and UAI were first tested in initial models. Multivariate and interaction models were then specified using the *a priori* model building and selection rules.

Initial models. Binary and continuous measures for substance use by respondent and partner and the variables for location of sex, relationship with partner, serodiscordance and month of reporting, for pleasure and for control were each tested separately in initial models. Specific substances were entered as a block.

Respondent substance use. Compared within respondents to no substance use, any substance use by the respondent was associated with increased odds of UAI (OR=1.79, 95% CI [1.42, 2.26]) (see Table 16.4). Similarly, each additional substance consumed by the respondent was associated with increased odds of UAI (1.46, [1.30, 1.65]). Of specific substances tested, only use of poppers (1.79, [1.32, 2.41]) and of erectile dysfunction medications (2.51, [1.55, 4.08]) were significantly associated with increased odds of UAI. Cocaine was associated with a marginally significant ($p < 0.10$ but $p > 0.05$) increase in odds of UAI (2.18, [0.91, 5.24]).

Partner substance use. Compared within respondents to no partner substance use, knowledge of specific substance use by partner was associated with increased odds of UAI (OR=1.60, 95% CI [1.24, 2.05]). Encounters in which the respondent did not know if his partner had used substances or in which the respondent was aware of partner substance use but not specific substances used were not significantly different in odds of UAI from encounters in which the respondent's partner did not use substances. Each additional specific substance a respondent

reported his partner having used was associated with increased odds of UAI (1.44, [1.25, 1.66]).

Of specific substances tested, only partner use of erectile dysfunction medications was associated with increased odds of UAI (OR=2.84, 95% CI [1.29, 6.24]). Use of alcohol had a marginally significant association with increased odds of UAI (1.30, [0.99, 1.70]). Though this relationship did not rise to statistical significance, partner use of ketamine was associated with *decreased* odds of UAI (0.56, [0.23, 1.35]).

Situational characteristics. Compared within respondents to encounters in private locations, encounters in sex-on-premises venues (OR=0.59, 95% CI [0.38, 0.91]) and in cruising or outdoors locations (0.28, [0.16, 0.47]) were associated with decreased odds of UAI. Similarly, compared within respondents to encounters with regular and steady partners, encounters with regular and non-steady partners (0.50, [0.36, 0.70]) and with opportunity or anonymous partners (0.23, [0.17, 0.31]) were both associated with decreased odds of UAI.

Compared within respondents to encounters with seroconcordant partners, encounters with partners in which serostatus match was unknown, unclear or forgotten were associated with decreased odds of UAI (OR=0.24, 95% CI [0.18, 0.31]). A similar association was present for encounters with serodiscordant partners (0.32, [0.20, 0.51]).

Associations with other outcomes. Compared within respondents to encounters in which the respondent reported not being mostly or totally in control, encounters where respondents reported control over outcomes were associated with decreased odds of UAI (OR=0.50, 95% CI [0.35, 0.70]). For each additional ‘point’

of pleasure respondents assigned to a sexual encounter, odds of UAI increased by 38% ([1.30, 1.47]).

Month of encounter. Month of encounter was not significantly associated with odds of UAI (all $ps > 0.10$).

Multivariate models with categorical measures of substance use.

Interactions specified *a priori* between categorical measures of any substance use by respondent or partner and between respondent substance use and location of sex were first tested before building multivariate models using the *a priori* model building and selection procedure.

Interaction between categorical measures of any substance use. A main effects model including categorical measures for respondent and partner substance use yielded an attenuated association between any respondent substance use and increased odds of UAI (OR=1.70, 95% CI [1.30, 2.23]) and a statistically non-significant association between respondent substance use and UAI (see Table 16.5). A model including an interaction between categorical measures for respondent and partner substance use did not yield any statistically significant interaction terms and, as expected, did not have a statistically significant deviance test as compared to the main effects model ($\chi^2(3)=2.14, p=0.54$). This indicates that the hypothesised interaction is unhelpful in explaining the data.

Interaction between respondent substance use and location of sex. A main effects model including both the categorical measure for any respondent substance use and variables for location of encounter yielded associations with UAI for each variable similar in magnitude, direction and significance to associations in initial models. A model containing an interaction between the categorical measure of respondent substance use and location of encounter did not yield any statistically

significant interaction terms and did not have a statistically significant deviance test as compared to the main effects model ($\chi^2(2)=0.30, p=0.86$). This indicates that the hypothesised interaction is unhelpful in explaining the data.

Multivariate models with categorical measures of substance use. A

multivariate model containing categorical measures for respondent and partner substance use and variables for location of sex, relationship status with partner and serodiscordance yielded an attenuated association between respondent substance use and increased odds of UAI (OR=1.57, 95% CI [1.17, 2.09]) and statistically non-significant associations between partner substance use and UAI (see Table 16.6). Compared within respondents to encounters in private locations, encounters in sex-on-premises venues were no longer negatively associated with odds of UAI but encounters in cruising or outdoors locations remained negatively associated with decreased odds of UAI (0.39, [0.21, 0.71]). The negative associations with UAI found for serodiscordance in initial models remained statistically significant, though the association between unknown serostatus match and decreased odds of UAI was slightly attenuated in one instance (0.37, [0.27, 0.51]).

This first multivariate model was compared against a second multivariate model in which the categorical measure of partner substance use was removed. In this multivariate model, the association between the categorical measure of respondent substance use and increased odds of UAI (OR=1.66, 95% CI [1.30, 2.13]) was still attenuated from the initial model. Other associations were similar between both multivariate models, with the exception of the attenuated association between encounters in cruising or outdoors locations and decreased odds of UAI (0.44, [0.24, 0.78]). A deviance test comparing this second model to the first multivariate model

was not statistically significant ($\chi^2(3)=2.01, p=0.57$). This indicates that the simpler model may be preferable in explaining the data.

Multivariate models with continuous measures of substance use.

Interactions specified *a priori* between number of substances used by respondent and number of substances used by partner and between respondent substance use and location of sex were first tested before building multivariate models using the *a priori* model building and selection procedure.

Interaction between continuous measures of substance use. A main effects model containing variables for number of substances used by respondent and partner yielded an attenuated association between number of substances used by respondent and increased odds of UAI (OR=1.39, 95% CI [1.20, 1.62]) and a statistically non-significant association between number of substances used by partner and UAI (see Table 16.7). A model containing an interaction between these two independent variables yielded a statistically non-significant interaction term and a statistically non-significant improvement in fit ($\chi^2(1)=0.27, p=0.60$). This indicates that the hypothesised interaction is unhelpful in explaining the data.

Interaction between respondent substance use and location of sex. As with the main effects and interaction model using the categorical measure of respondent substance use, the main effects models yielded associations with UAI similar in magnitude, direction and significance to associations in initial models. A model containing an interaction yielded neither statistically significant interaction terms nor statistically significant improvements in fit ($\chi^2(2)=2.51, p=0.28$).

Multivariate models with continuous measures of substance use. Two multivariate models were estimated: one including variables for number of substances used by respondent and partner, for location of sex, for relationship to

partner and for serodiscordance and one model including the same variables except for number of substances used by partner (see Table 16.8). A likelihood ratio test comparing both models indicated that the second, simpler model did not differ significantly in fit from the first model ($\chi^2(1)=0.82, p=0.37$). In the second model, the association between number of substances used by respondent and increased odds of UAI (OR=1.39, 95% CI [1.22, 1.58]) was slightly attenuated from the initial model, as were the association between unknown serostatus match and decreased odds of UAI (0.37, [0.27, 0.50]) and, relative to encounters with regular and steady partners, the association between encounters with regular and non-steady partners and decreased odds of UAI (0.65, [0.45, 0.93]) and with opportunity or anonymous partners and decreased odds of UAI (0.34, [0.24, 0.49]). As in previous multivariate models, the association between encounters in sex-on-premises venues and UAI was not statistically significant and the association between encounters cruising and outdoors locations and decreased odds of UAI (0.45, [0.25, 0.81]) was attenuated.

Multivariate models with categorical measures of specific substance use. A model with variables only for those specific substances with statistically significant associations with UAI in initial models—poppers use by respondent, erectile dysfunction medication use by respondent and erectile dysfunction medication use by partner—yielded associations similar in magnitude, direction and significance to associations in initial models, though the association between poppers use and increased odds of UAI was somewhat greater in magnitude (OR=1.87, 95% CI [1.38, 2.53]) (see Table 16.9). Adding variables for location of encounter, relationship with partner and serodiscordance yielded an association between poppers use and increased odds of UAI (1.77, [1.29, 2.45]) similar to the association seen in initial models, an attenuated association between erectile dysfunction medication use by

respondent and increased odds of UAI (2.22, [1.36, 3.63]) and an association between erectile dysfunction medication use by partner and increased odds of UAI that was of greater magnitude (3.06, [1.37, 6.83]). Associations between other variables and UAI were similar, if not identical, in magnitude, direction and significance to associations found in other multivariate models testing associations with UAI.

Random intercept models. As above, associations between each substance use and situational characteristic and UAI were first tested in initial models. Multivariate and interaction models were then specified using the *a priori* model building and selection rules.

Null model and specifications. A null model was first fit to the data to establish the presence of statistically significant variation between respondents. Between level variance was statistically significant (6.63, 95% CI [5.59, 7.87]) and ICC was 66.8% (see Table 16.10). Accordingly, Hausman tests comparing random effects models with fixed effects models were statistically significant ($p < 0.001$) for all random intercept models specified here.

Initial models. Binary and continuous measures for substance use by respondent and partner and the variables for location of sex, relationship with partner, serodiscordance and month of reporting, for pleasure and for control were each tested separately in initial models. Specific substances were entered as a block.

Respondent substance use. Compared within respondents to encounters with no substance use, encounters with any substance use by the respondent were significantly associated with increased odds of UAI (OR=2.02, 95% CI [1.67, 2.45]). Similarly, each additional substance consumed by the respondent was associated with an increase in odds of UAI of 64% ([1.49, 180]). While the use of any specific

substances tested except for alcohol by the respondent was associated with increased odds of UAI, use of poppers (2.35, [1.84, 3.00]), of erectile dysfunction medications (3.14, [2.12, 4.67]), of crystal methamphetamine (3.14, [1.18, 8.36]) and of GHB (2.32, [1.02, 5.29]) were all significantly associated with increased odds of UAI. Use of cannabis was associated with increased odds of UAI (1.59, [0.95, 2.65]) at marginal significance ($p < 0.10$).

Partner substance use. Compared within respondents to encounters with no partner substance use, encounters where it was unclear whether the partner used substances were associated with decreased odds of UAI (OR=0.68, 95% CI [0.48, 0.97]). Encounters where the respondent knew specific details of the partner's substance use were associated with increased odds of UAI (1.61, [1.29, 1.99]). Encounters where partner substance use, but not specific substances used, was known to the respondent were associated at marginal significance with increased odds of UAI (1.53, [0.99, 2.36]). Specific substances for which partner use was associated with increased odds of UAI were erectile dysfunction medications (4.27, [2.19, 8.34]), cannabis (1.87, [1.10, 3.18]), crystal methamphetamine (2.91, [1.00, 8.46]) and GHB (3.07, [1.24, 7.64]). Specific substances associated with increased odds of UAI at marginal significance ($p < 0.10$) were MDMA (2.09, [0.88, 4.95]) and cocaine (1.84, [0.91, 3.70]).

Situational characteristics. Compared within respondents to encounters in private venues, encounters in sex-on-premises venues (OR=0.48, 95% CI [0.33, 0.70]) and in cruising or outdoors locations (0.29, [0.19, 0.46]) were both associated with decreased odds of UAI.

Encounters with regular, non-steady partners were associated with decreased odds of UAI (OR=0.41, 95% CI [0.32, 0.53]) as compared within respondents to

encounters with regular, steady partners. Encounters with opportunity or anonymous partners were also associated with decreased odds of UAI (0.16, [0.12, 0.21]).

Within respondents, encounters with serodiscordant partners were associated with decreased odds of UAI (0.31, [0.21, 0.46]) as compared to encounters with seroconcordant partners. Similarly, encounters with an unknown, unclear or forgotten serostatus match were associated with decreased odds of UAI (0.17, [0.14, 0.22]).

Associations with other outcomes. Encounters in which respondents reported being totally or mostly in control of sexual outcomes were associated with decreased odds of UAI (OR=0.39, 95% CI [0.29, 0.53]) as compared within respondents to encounters not characterised by being in control of sexual outcomes. Each additional point added to a respondent's rating of the encounter's pleasure was associated with a 47% increase in odds of UAI ([1.40, 0.156]).

Month of encounter. Relative to encounters in month 2, encounters in month 13 and the last wave of data collection were associated with decreased odds of UAI (OR=0.79, 95% CI [0.63, 1.00]). Month of reporting was otherwise not significantly associated with odds of UAI.

Multivariate models with categorical measures of substance use.

Interaction models between categorical measures of substance use and between respondent substance use and location of sex were tested as specified *a priori* in the model building and selection rule.

Interaction between categorical measures of any substance use. Associations with UAI in a main effects model containing categorical measures for both respondent and partner substance use were similar to the initial model for respondent substance use, but not for partner substance use (see Table 16.11). While encounters

in which the respondent did not know if the partner had used substances remained similarly and negatively associated with UAI (OR=0.60, 95% CI [0.42, 0.86]), neither knowing specifics of partner substance use nor knowing that the partner had used substances but not which substances were associated with UAI (both p s>0.10).

A model including an interaction term between categorical measures of respondent and partner substance use did not demonstrate any significant interaction terms and did not fit the model better as evidenced by a statistically non-significant likelihood ratio test ($\chi^2(3)=2.48, p=0.48$). This indicates that the interaction model is statistically no better at explaining the data than the main effects model alone.

Interaction between respondent substance use and location of sex.

Associations with UAI in a main effects model containing a categorical measure for respondent substance use and variables for location of sex were similar in magnitude, direction and significance to associations from initial models. A model containing an interaction between the categorical measure of respondent substance use and location of sex did not include any statistically significant interaction terms and did not result in a statistically significant likelihood ratio test ($\chi^2(2)=0.54, p=0.77$). The main effects model appears to be preferable to the interaction model in explaining the data.

Multivariate model with categorical measures of substance use. A multivariate model with variables for categorical measures of respondent and partner substance use, for location of sex, relationship with partner and serodiscordance and for month of reporting resulted in associations different in magnitude and significance from associations in initial models (see Table 16.12).

While the positive association between respondent substance use and UAI (OR=2.15, 95% CI [1.69, 2.74]) was similar to the association found in the initial

univariate model, associations between partner substance use and UAI changed substantially. Compared to encounters with no partner substance use, encounters where the respondent knew of partner substance use but not specific details of that use were associated with increased odds of UAI (1.63, [1.01, 2.61]), while neither encounters where the respondent reported knowing specific details of partner substance use nor encounters where the respondent reported not knowing of partner substance use were significantly associated with UAI (both $ps > 0.10$). Moreover, the direction of the association between not knowing of partner substance use and UAI (1.35, [0.91, 2.01]) was ‘flipped’ from a negative association found in the initial model.

Encounters in sex-on-premises venues were no longer significantly associated with UAI, though encounters in cruising or outdoors locations retained a significant negative association with UAI (OR=0.55, 95% CI [0.34, 0.90]). Compared to encounters with regular, steady partners, associations between decreased odds of UAI and encounters with regular, non-steady partners (0.54, [0.41, 0.71]) and encounters with opportunity or anonymous partners (0.25, [0.19, 0.34]) remained statistically significant. Finally, compared to encounters with seroconcordant partners, encounters with unknown, unclear or forgotten serostatus matches retained a smaller negative association with UAI (0.27, [0.21, 0.35]) while the association between encounters with serodiscordant partners and UAI remained similar (0.30, [0.20, 0.45]).

Associations between month of reporting and UAI were similar to associations in initial models.

Multivariate models with continuous measures of substance use. As above, interaction models between continuous measures of substance use by respondent and

partner and between respondent substance use and location of sex were tested as specified *a priori* in the model building and selection rule.

Interaction between continuous measures of substance use. A main effects model with variables for number of substances used by respondent and partner included an attenuated association between number of substances used by respondent and increased odds of UAI (OR=1.54, 95% CI [1.36, 1.74]) and a non-significant association between number of substances used by partner and odds of UAI (see Table 16.13). A model that added an interaction term between the two independent variables showed an interaction effect that was not statistically significant ($p < 0.05$) and a marginally significant likelihood ratio test ($\chi^2(1) = 3.18, p = 0.07$). The interaction is dropped from further analyses, though the marginally significant likelihood ratio test suggests that an interaction could possibly be helpful in understanding the data.

Interaction between respondent substance use and location of sex. A main effects model with variables for number of substances used by respondent and for location of sex estimated associations between included variables and UAI that were similar in magnitude, size and direction to associations found in initial models. A model including an interaction between number of substances used by respondent and location of sex yielded neither statistically significant interaction terms nor a statistically significant likelihood ratio test as compared to the main effects model ($\chi^2(2) = 3.04, p = 0.22$). This suggests that there is no evidence for an interaction in this analysis.

Multivariate models with continuous measures of substance use. A multivariate model was specified with independent variables for number of substances used by respondent and partner, for location of sex, relationship to partner

and serodiscordance and for month of reporting (see Table 16.14). A second model was specified with the same independent variables save for number of substances used by partner. The second, simpler model did not fit the data significantly worse than the first model as evidenced by a non-significant likelihood ratio test ($\chi^2(1)=0.03, p=0.86$). This is unsurprising as the association between number of substances used by partner and UAI was not statistically significant in the first model (OR=1.02, 95% CI [0.86, 1.20]).

In the second multivariate model, the positive association between number of substances used by respondent and UAI was similar in magnitude, direction and significance to the association found in the initial univariate model. Location of sex was no longer significantly associated with UAI, though relative to encounters in private locations, encounters in cruising or outdoors locations were associated at marginal significance ($p<0.10$) with decreased odds of UAI (OR=0.63, 95% CI [0.39, 1.01]). Associations between encounters with regular, non-steady partners and decreased odds of UAI (0.52, 95% CI [0.40, 0.69]) and between encounters with opportunity or anonymous partners and decreased odds of UAI (0.25, [0.19, 0.34]) as compared to encounters with regular, steady partners were smaller in magnitude than associations from the initial model testing this relationship. Finally, relative to encounters with seroconcordant partners, associations between encounters with unknown serostatus match and decreased odds of UAI (0.28, [0.22, 0.36]), and between encounters with serodiscordant partners and decreased odds of UAI (0.28, [0.18, 0.42]) were similar in magnitude. The association between encounters with unknown serostatus match and UAI was smaller in magnitude than in initial models testing this relationship.

Associations between month of reporting and odds of UAI were not statistically significant.

Multivariate models with categorical measures of specific substance use. A model with variables only for specific substances the use of which was associated with UAI included poppers use, erectile dysfunction medication use, crystal methamphetamine use and GHB use by respondent, and erectile dysfunction medication use, cannabis use, crystal methamphetamine use and GHB use by partner (see Table 16.15). The association between poppers use by respondent and UAI was similar to the association found in the initial model, but associations between erectile dysfunction medication use by respondent (OR=2.70, 95% CI [1.82, 4.00]) and by partner (2.87, [1.48, 5.58]), and increased odds of UAI were both attenuated as compared to each initial model. An association between cannabis use by partner and increased odds of UAI (1.73, [1.01, 2.94]) was slightly smaller in magnitude as compared to the initial model. Other associations were not statistically significant, though the association between crystal methamphetamine use by respondent and UAI (3.33, [0.96, 11.52]) was marginally significant ($p<0.10$).

A second multivariate model also including variables for location of sex, relationship with partner and serodiscordance and for month of reporting demonstrated significant associations for poppers use by respondent and increased odds of UAI (OR=2.59, 95% CI [2.01, 3.34]), and for erectile dysfunction medication use by respondent and increased odds of UAI (2.78, [1.85, 4.19]), both of which were larger in magnitude than in the first multivariate model. In this model, cannabis use by partner was no longer significantly associated with UAI and the positive association between erectile dysfunction and odds of UAI was attenuated (2.74, [1.37, 5.47]). All other associations remained statistically non-significant.

Associations between each of location of sex, relationship with partner and serodiscordance and odds of UAI were similar to those found in the second multivariate model with continuous measures of substance use, but the association between encounters in cruising or outdoors locations and decreased odds of UAI was statistically significant (0.61, [0.38, 0.97]). Associations between month of reporting and odds of UAI were similar to those found in initial models.

Models testing associations with pleasure

Null model and specifications. A null model was first fit to the data to establish the presence of statistically significant variation between respondents. Between level variance was statistically significant (1.40, 95% CI [1.27, 1.54]) and ICC was 38.3% (see Table 16.16). Accordingly, Hausman tests comparing random effects models with fixed effects models were statistically significant ($p < 0.001$) for all random intercept models specified here.

Initial models. Binary and continuous measures for substance use by respondent and partner, and the variables for location of sex, relationship with partner, serodiscordance and month of reporting and for control were each tested separately in initial random intercept models. Specific substances were entered as a block.

Respondent substance use. Compared within respondents to encounters with no respondent substance use, encounters with substance use were associated with greater pleasure ($\beta = 0.24$, 95% CI [0.15, 0.34]). Each additional substance consumed was also associated with greater pleasure (0.19, [0.04, 0.32]). Specific substances the use of which was significantly associated with greater pleasure were poppers (0.31, [0.19, 0.43]), erectile dysfunction medications (0.33, [0.14, 0.53]), cannabis (0.42, [0.16, 0.68]) and crystal methamphetamine (0.76, [0.29, 1.23]). GHB was

associated with greater pleasure (0.37, [-0.05, 0.78]) at marginal significance ($p < 0.10$).

Partner substance use. Compared within respondents to encounters with no partner substance use, encounters where the respondent did not know if his partner had used substances were associated with decreased pleasure ($\beta = -0.62$, 95% CI [-0.79, -0.46]), with a similar negative association marginally significant for encounters in which respondents knew partners had consumed substances, but not which substances specifically (-0.21, [-0.44, 0.01]). Encounters in which the respondent knew which substances his partner had taken were associated with greater pleasure (0.19, [0.08, 0.29]).

Specific substances for which the partner's use was associated with greater pleasure were alcohol ($\beta = 0.13$, 95% CI [0.02, 0.25]), erectile dysfunction medications (0.73, [0.41, 1.05]) and cannabis (0.28, [0.003, 0.55]). Use of MDMA was associated with greater pleasure (0.39, [-0.05, 0.82]) at marginal significance ($p < 0.10$).

Situational characteristics. Compared within respondents to encounters with regular, steady partners, encounters with regular, non-steady partners are associated with less pleasure ($\beta = -0.11$, 95% CI [-0.24, 0.01]) at marginal significance ($p < 0.10$). However, encounters with opportunity or anonymous partners were significantly associated with decreased pleasure (-0.76, [-0.88, -0.64]).

Compared within respondents to encounters with seroconcordant partners, encounters with serodiscordant partners were not significantly different in pleasure. However, encounters where serostatus match was unknown, unclear or forgotten were associated with less pleasure ($\beta = -0.61$, 95% CI [-0.71, -0.51]).

Finally, as compared within respondents to encounters in private venues, encounters in sex-on-premises venues ($\beta=-0.64$, 95% CI [-0.81, -0.46]) and in cruising or outdoors locations (-0.74, [-0.94, -0.54]) were both associated with decreased pleasure.

Associations with control. Compared within respondents to encounters in which respondents reported not being in control, encounters characterised by control over sexual outcomes were more pleasurable ($\beta=0.16$, 95% CI [0.004, 0.32]).

Month of encounter. Compared to encounters reported in month 2, only encounters reported in month 10 were associated with differential (and in this case, greater) pleasure ($\beta=0.13$, 95% CI [0.01, 0.25]).

Multivariate models with categorical measures of substance use.

Interactions specified *a priori* between categorical measures of any substance use by respondent or partner, and between respondent substance use and location of sex were first tested before building multivariate models using the *a priori* model building and selection procedure.

Interaction between categorical measures of any substance use. A main effects model containing categorical measures of respondent and partner substance use yielded an association between respondent substance use and increased pleasure similar in magnitude, direction and significance to the association found in the initial model (see Table 16.17). However, while the negative association between not knowing whether or not the partner used substances and pleasure was similar to the association in the initial model, the negative association between knowing partner substance use but not knowing specific substances and pleasure increased in magnitude and became statistically significant ($\beta=-0.35$, 95% CI [-0.58, -0.12]), and the positive association between knowing specific substances used by a partner and

pleasure became statistically non-significant. A model including an interaction term between categorical measures of respondent and partner substance use yielded no statistically significant interaction terms and a non-significant likelihood ratio test ($\chi^2(3)=2.57, p=0.46$). This indicates that the interaction model does not fit the data significantly better than the main effects alone.

Interaction between respondent substance use and location of sex. A main effects model with the categorical measure of respondent substance use and variables for location of encounter yielded associations similar in magnitude, direction and significance as associations from the initial models. A model with an interaction between respondent substance use and location of encounter did not result in any statistically significant interaction terms. A likelihood ratio test did not demonstrate a statistically significant difference between the main effects and interaction models ($\chi^2(2)=3.60, p=0.17$). This indicates that the interaction model does not fit the data significantly better than the main effects alone.

Multivariate model with categorical measures of substance use. A model with categorical measures of respondent and partner substance use and variables for location of sex, relationship status with partner, serodiscordance and month of reporting yielded an association between respondent substance use and pleasure similar in magnitude, direction and significance to the association found in the initial model (see Table 16.18).

However, all other statistically significant associations were lesser in magnitude as compared to associations in initial models. Compared within respondents to encounters with no partner substance use, encounters where partner substance use was unknown were associated with decreased pleasure ($\beta=-0.29$, 95% CI [-0.46, -0.12]), an association that is attenuated from the initial model. Neither

knowing a partner's specific substance use nor being aware of a partner's substance use but not knowing specific substances taken were significantly associated with pleasure. Negative associations, relative to encounters in private locations, between sex-on-premises venues and pleasure ($\beta=-0.20$, 95% CI [-0.39, -0.02]), and between cruising or outdoors locations and pleasure ($\beta=-0.37$, 95% CI [-0.58, -0.17]) were lesser in magnitude as compared to associations in initial models. Compared to encounters with regular, steady partners, encounters with opportunity or anonymous partners were associated with decreased pleasure ($\beta=-0.51$, 95% CI [-0.64, -0.38]) but encounters with regular, non-steady partners were not significantly associated with pleasure.

Multivariate models with continuous measures of substance use.

Interactions specified *a priori* between number of substances used by respondent and number of substances used by partner, and between respondent substance use and location of sex, were first tested before building multivariate models using the *a priori* model building and selection procedure.

Interaction between continuous measures of substance use. A main effects model with continuous measures of substance use showed statistically significant associations for both variables—for number of substances used by respondent ($\beta=0.15$, 95% CI [0.09, 0.21]) and for number of substances used by partner ($\beta=0.09$, 95% CI [0.004, 0.17])—albeit smaller in magnitude as compared to associations in initial models (see Table 16.19). A model including an interaction between these two variables also resulted in an improvement in fit as shown by a significant likelihood ratio test ($\chi^2(1)=5.63$, $p=0.02$). In this interaction model, the association between number of substances used by the respondent and pleasure (0.12, [0.06, 0.19]) is moderated by the association between number of substances used by partner

and pleasure (-0.004, [-0.11, 0.11]), with the moderation effect (0.03, [0.01, 0.06]) indicating that as the number of substances a partner consumes increases, each additional substance consumed by the respondent results in a larger increase in reported pleasure.

Interaction between respondent substance use and location of sex. A main effects model with variables for number of substances used by respondent and for location of sex demonstrated associations similar in magnitude, direction and significance to associations in initial models. A model testing an interaction between number of substances used by respondent and location of sex did not contain any statistically significant interaction terms and did not demonstrate a statistically significant improvement in fit, as shown by a likelihood ratio test ($\chi^2(2)=1.40$, $p=0.50$). This indicates that the main effects model may be preferable to understand the data.

Multivariate models with continuous measures of substance use. A multivariate model with variables for number of substances used by respondent, number of substances used by partner and the interaction of these two terms, for location of sex, relationship status with partner and serodiscordance and for month of reporting, resulted in substantively different associations for all included variables save month of reporting (see table 16.20).

The main association between number of substances used by respondent and pleasure ($\beta=0.15$, 95% CI [0.09, 0.22]) is conditional on the association between number of substances used by partner (-0.08, [-0.18, 0.03]), with a moderation coefficient (0.03, [0.003, 0.06]) similar to the initial interaction model. As in the ‘interaction-only’ model discussed just above, this indicates that the magnitude of the positive association between number of substances used by respondent and pleasure,

which is conditional on number of substances used by partner, increases in magnitude as the number of substances used by partner increases. On the other side, the interaction indicates that while, at low numbers of respondent substance use, the association between number of substances used by partner and pleasure is a negative one, after about three substances consumed by respondent, this association becomes a positive one.

In this multivariate model, encounters in sex-on-premises venues are not significantly associated with pleasure as compared to encounters in private locations, but encounters in cruising or opportunity locations remained negatively associated with pleasure ($\beta=-0.52$, 95% CI [-0.66, -0.39]). The magnitude of this association was smaller than that of the association in the initial model. Moreover, while encounters with serodiscordant partners still do not have a statistically significant association with pleasure as compared to encounters with seroconcordant partners, encounters with an unknown, unclear or forgotten serostatus match were associated with less pleasure (-0.34, [-0.46, -0.24]).

Multivariate models with categorical measures of specific substance use.

A first multivariate model with variables for those specific substances with statistically significant effects in initial models resulted in associations with pleasure similar in magnitude, direction and significance to initial models for poppers use by respondent, cannabis use by respondent, crystal methamphetamine use by respondent and alcohol use by partner (see Table 16.21). The positive association between erectile dysfunction medication use by respondent and pleasure ($\beta=0.21$, 95% CI [0.01, 0.41]) was smaller in magnitude than in initial models, as it was for the positive association between erectile dysfunction medication use by partner and

pleasure (0.55, [0.23, 0.86]). The association between alcohol use by partner and pleasure was not statistically significant.

In a second multivariate model also including variables for location of sex, relationship with partner and serodiscordance, associations between poppers use by respondent, erectile dysfunction medication by respondent and cannabis use by respondent and pleasure were similar to associations in the first multivariate model. Positive associations between crystal methamphetamine use by respondent and pleasure ($\beta=0.67$, 95% CI [0.22, 1.12]), and between erectile dysfunction medication use by partner and pleasure (0.45, [0.14, 0.76]) were smaller in magnitude than in the first multivariate model. Though the negative association between cruising and outdoors locations and pleasure was somewhat larger in magnitude as compared to other multivariate models (-0.50, [-0.72, -0.27]), all other associations between situational characteristics and pleasure were similar to those in the multivariate model with continuous measures of substance use.

Models testing associations with control

Results from CLRs are presented first before results from random intercept models on the entire sample of encounters.

Conditional logistic regressions. As specified in the *a priori* model building and selection rules, associations between each of substance use and situational characteristics and control were first tested in initial CLR models. A multivariate model was built following on from the model building and selection rules specified *a priori*.

Respondent substance use. The categorical measure of any substance use by respondent was not associated with odds of reporting being totally or mostly in control of sexual outcomes (see Table 16.22). However, each additional substance

consumed by respondent during a sexual encounter was associated with decreased odds of control within respondents (OR=0.81, 95% CI [0.67, 0.96]).

Maximum likelihood estimation of the conditional logistic regression with variables for use of specific substances resulted in a singular Hessian matrix due to a non-concave log likelihood function. Visual inspection of model results revealed that the variable for use of ketamine was part of the problem. Dropping the variable for ketamine use from the model and re-estimating yielded no statistically significant associations between use of specific substances and control.

Partner substance use. The categorical measure of partner substance use, number of substances used by partner and partner use of specific substances were not significantly associated with control (all p s>0.05). Use of cocaine had a marginally significant association (p <0.10, but p >0.05) with decreased odds of control (OR=0.37, 95% CI [0.11, 1.19]).

Situational characteristics. There were no statistically significant associations between control and relationship with partner, serodiscordance or location of sex (all p s>0.10).

Month of reporting. Compared within respondents to encounters reported in month 2, encounters reported in month 7 (OR=1.47, 95% CI [1.02, 2.09]), in month 10 (1.47, [1.03, 2.10]) and in month 13 (2.27, [1.55, 3.34]) were associated with increased odds of control. Encounters reported in month 5 were not statistically associated with odds of control relative to encounters reported in month 2.

Multivariate model. A multivariate model incorporating variables for number of substances used by respondent and for month of reporting yielded associations with control similar in magnitude, direction and significance to associations from initial models (see Table 16.23). Comparison between Akaike

information criterion values for the initial model for number of substances used by respondent (897.25) and for the multivariate model (881.76) suggests that the multivariate model offers a better fit to the data, penalised for the increased number of parameters.

Random intercept models. Binary and continuous measures for substance use by respondent and partner and the variables for location of sex, relationship with partner, serodiscordance and month of reporting were each tested separately in random intercept models. Specific substances were entered as a block.

Null model and specifications. A null model was first fit to the data to establish the presence of statistically significant variation between respondents (see Table 16.24). Between level variance was statistically significant (5.07, 95% CI [3.86, 6.68]) and ICC was 60.7%. Accordingly, Hausman tests comparing random effects models with fixed effects models were statistically significant ($p < 0.001$) for all random intercept models specified here.

Respondent substance use. No associations between measures of respondent substance use and control were statistically significant (all $ps > 0.05$). However, number of substances used was associated with decreased odds of control (OR=0.89, 95% CI [0.79, 1.01]) at marginal significance ($p < 0.10$). Use of ketamine was also associated with decreased odds of control (0.41, [0.15, 1.14]) at marginal significance.

Partner substance use. Compared within respondents to encounters in which the partner did not use substances, encounters in which respondents did not know if their partners used substances (OR=0.55, 95% CI [0.36, 0.84]) and encounters in which respondents knew their partners used substances but not which substances (0.52, [0.30, 0.92]) were both associated with decreased odds of control. Encounters

where respondents had knowledge of the specific substances their partners used were not associated with odds of control ($p>0.10$). Number of specific substances used by partner was not associated with odds of control ($p>0.10$). No specific substances were associated with odds of control (all $ps>0.05$). However, partner use of cocaine was associated at marginal significance ($p<0.10$) with decreased odds of control (OR=0.43, 95% CI [0.18, 1.05]).

In light of the significant finding for a quadratic association between number of partner substances used and control in the sample of multipartner encounters, a similar exploratory model was run in the full sample of single-partner encounters. This model was not statistically significant ($p>0.10$).

Situational characteristics. No situational characteristics tested were associated with control (all $ps>0.05$).

Month of reporting. Compared within respondents to encounters reported in month 2, encounters reported in month 7 (OR=1.40, 95% CI [1.01, 1.95]), in month 10 (1.40, [1.06, 2.07]) and in month 13 (2.21, [1.55, 3.17]) were associated with increased odds of control. Encounters reported in month 5 were not statistically associated with odds of control relative to encounters reported in month 2.

Multilevel latent class analysis

Model selection. Three models with two, three and four classes were estimated and their fit indices compared. Each model contained manifest indicators for number of substances used by respondent, location of sex, relationship to partner and serodiscordance. Month of reporting was used as a covariate predicting latent class membership for each encounter. A continuous latent variable was placed on the between-level random means to speed time of computation.

Compared to a two-class model, a three-class model had lower scores on values for both the Akaike information criterion (47754.40 vs. 44954.08) and the Bayesian information criterion (47897.54 vs. 45185.83) (see Table 16.25). Scaled relative entropy also improved in the three-class model as compared to the two-class model (92.1% vs. 90.2%). Finally, the Vuong-Lo-Mendell-Rubin likelihood ratio test found that a three-class model represented a statistically significant improvement in model ‘fit’ as compared to a two-class model ($p < 0.001$). A four-class model did not replicate log likelihood, despite 80 random starts and 40 runs to maximisation. Results generated for a four-class model, however, showed an appreciable decrease in scaled relative entropy as compared to a three-class model and a statistically non-significant Vuong-Lo-Mendell-Rubin likelihood ratio test ($p = 0.25$).

A three-class model was chosen and rerun with correlated between-level random means instead of a factor variable. This model had a marginal increase in scaled relative entropy (92.4% v. 92.1%) and similarly small decreases in values of the Akaike information criterion (44732.05 vs. 44954.08) and the Bayesian information criterion (44970.61 vs. 45185.83). The three-class model with correlated random means was thus chosen.

Model specifications. The three-class model with correlated random means had a condition number for the information matrix of 0.236×10^{-4} , indicating an identified model. The posterior probability of an encounter’s assignment to class 1 was 31.94%, which was closely matched by the percentage of encounters (31.50%) most likely to be assigned to class 1 (see Table 16.26). Class 2 was the most probable class of assignment, with a posterior probability of 61.22% and a similar percentage of encounters (61.81%) with most likely assignment to class 2. Finally,

class 3 comprised the smallest number of encounters with posterior probability 6.85% and most likely class assignment 6.69%.

Examination of mean probabilities for most likely class membership by most likely latent class (see Table 16.27) and of weighted averages for classification probabilities by most likely latent class (see Table 16.28) revealed well-separated latent classes. High probabilities corresponded to each most likely latent class, indicating that encounters were in the main classified in clear, distinct ways. For example, among encounters with most likely class 1, the mean probability of assignment to class 1 was 97.1%. This indicates that for encounters where the highest class probability was for class 1, the average of those probabilities was 97.1%. This was uniformly high across all classes. A high scaled relative entropy (92.4%) supported the accuracy of assignment.

Class descriptions. Based on examination of conditional probabilities, class 1 was identified as ‘regular, steady partners’, class 2 was identified as ‘non-steady partners’ and class 3 was identified as ‘polysubstance use’.

Class 1: regular, steady partners. Encounters in this class were characterised by encounters that were, in the main, with regular and steady partners (conditional probability 94.07%). Encounters were almost always at home (99.12%). Seroconcordance was not especially relevant in this class, though the conditional probability of encounters with unknown, unclear or forgotten serostatus match (68.31%) was larger than in encounters generally unadjusted for clustering (50.0%). Encounters in this class had a low average number of substances used by respondents at 0.41 (SD=0.69), though the distribution of this mean was right-skewed and bounded at zero. Thus, this class likely encompassed encounters with one or two substances used.

Class 2: casual partners. Encounters in this class were characterised by encounters with either regular, non-steady partners (conditional probability 35.93%) or opportunity and anonymous partners (conditional probability 62.84%). Encounters with regular, steady partners only had conditional probability 1.23% in this class. Compared to all encounters, encounters in this class were more likely to be serodiscordant or seroconcordant, and most likely within class 2 to be seroconcordant (conditional probability 73.06%). Whereas 50.0% of all encounters were of unknown, unclear or forgotten serostatus match, the conditional probability of unknown serostatus matches in class 2 encounters was 15.63%. Encounters were less likely to occur in private settings (conditional probability 80.67% vs. 87.2% in the whole sample). Finally, like class 1 encounters, class 2 encounters involved low levels of respondent substance use ($M=0.50$, $SD=0.69$), though as above some polysubstance use was likely included in this class as well.

Class 3: polysubstance use. Encounters in this class were characterised by high polysubstance use. On average, encounters in this class included an average of 3.52 substances used by respondent ($SD=0.69$). These encounters were less likely to include regular, steady partners (conditional probability 22.26%) and more likely to include regular, non-steady partners (conditional probability 37.67%) than the sample of all included encounters. Conditional probabilities for location of sex were not absolutely different from the general sample of encounters, though encounters in cruising or outdoors locations were less likely in class 3 (conditional probability 1.58%) than in the population of encounters generally (5.5%). Encounters in this class had a conditional probability of serodiscordant encounters twice as high as compared to the probability of serodiscordant encounters in the entire sample (14.86% vs. 7.0%).

Distal outcomes. The three outcomes tested in these analyses were analysed for equality between classes using the pseudo-draw method with 20 draws (Asparouhov & Muthén, 2013; Wang et al., 2005).

UAI. On average, encounter assignment to class 2 was associated with a 23.0% probability of UAI (SD=0.7%), whereas encounter assignment to class 1 was associated with a 41.5% probability of UAI (SD=1.1%) and assignment to class 3 was associated with a probability of 52.9% (SD=2.4). An overall test for differences between classes was statistically significant ($\chi^2(2)=312.58, p<0.001$), as were all pairwise tests between classes (see Table 16.29). This indicated that each class was statistically associated with a different probability of UAI.

Pleasure. On average, encounter assignment to class 2 was associated with quality of sex of 6.86 (SD=0.04). Encounter assignment to class 3 was associated with an average quality of sex of 6.79 (SD=0.09) and assignment to class 1 was associated with average quality of sex of 6.22 (SD=0.03). While an overall test for differences between classes was statistically significant ($\chi^2(2)=159.11, p<0.001$), a test for differences in average quality of sex between class 1 and class 3 was not statistically significant ($\chi^2(1)=0.5, p=0.50$). This suggested that while assignment to class 1 or class 3 was not associated with statistically different levels of pleasure, assignment to class 2 was associated with lower levels of quality of sex.

Control. On average, encounter assignment to class 1 was associated with a probability of reporting being totally or mostly in control of sexual outcomes of 92.1% (SD=0.6%), with assignment to class 2 associated with a probability of 91.1% (SD=0.5%) and assignment to class 3 associated with a probability of 90.8% (1.4%). An overall test for differences was not statistically significant ($\chi^2(2)=1.49, p=0.47$).

No pairwise tests were significant either. This indicated that class assignment was not associated with probability of reporting control over sexual outcomes.

Covariate tests. Month of reporting was used as a covariate predicting latent class assignment. Because a three-class solution was selected, the association between covariate and class assignment was parameterised as a multinomial logistic regression with class 3 as the referent class. Relative to encounters reported in month 2, encounters in subsequent months were on the whole more likely to be assigned to class 2 than to class 3, though this association only reached marginal significance for encounters reported in months 5 and 7 (see Table 16.30). Similarly, encounters reported after month 2 were more likely to be classified to month 1 than month 3, though this association reached significance for encounters reported in months 10 (OR=1.88, $p=0.05$) and 13 (OR=2.46, $p=0.01$). On the whole, probability of latent class assignment was unequal across months of reporting.

Summary of findings

Respondents contributing single-partner encounters to the sample were older, better educated, more likely to be White British and to live in London than those respondents not contributing encounters. Differences in income between included and excluded respondents were not clear. Respondents contributing encounters were also more likely to have reported negative HIV tests at first report, be in monogamous relationships, be attracted to men only, identify as gay or homosexual and be out to some or all family and friends. With the exception of education, these differences did not appear to be very large. Null random intercept models established the presence of statistically significant between-level variation in each of the three sexual outcomes examined here.

Compared within respondents, encounters with respondent substance use were associated with increased odds of UAI, increased pleasure and, possibly, decreased odds of control. Both the overall measure of respondent substance use and the continuous measure for number of substances used were associated with increased odds of UAI and increased in all models. However, number of substances used was significantly associated with decreased odds of control only in conditional logistic regressions. This association was only marginally significant in the random intercept models.

Use of poppers, erectile dysfunction medications and, in random intercept models, crystal methamphetamine predicted both increased odds of UAI and increased pleasure, suggesting that these substances have specific relevance for intervention development. Use of GHB was associated with increased odds of UAI in random intercept models only, but only marginally associated with pleasure. Use of cannabis was associated with increased pleasure but only marginally associated with increased odds of UAI in random intercept models. Though use of crystal methamphetamine only occurred in 1.1% of all encounters—or 72 encounters out of 6,731—it clearly had a sufficiently substantial association with UAI to yield a statistically significant effect in random intercept models. By the same token, it is not surprising that GHB, respondent use of which only occurred in 94 encounters (1.4%) in the entire sample, did not yield a statistically significant effect in CLR models.

Compared within respondents to single-partner encounters with no partner substance use, encounters with known partner substance use were associated with increased odds of UAI and increased pleasure, but not control. These findings were consistent across both CLR and random intercept models testing

associations with UAI. Moreover, partner use of erectile dysfunction medications—and in random intercept models, partner use of cannabis, crystal methamphetamine and GHB as well—were associated with increased odds of UAI. However, only partner use of cannabis and partner use of erectile dysfunction medications were associated with increased pleasure, and partner use of alcohol was associated only with increased pleasure. Of interest is that partner use of MDMA was associated at marginal significance with both increased odds of UAI and increased pleasure in random intercept models—possibly due to the small number of encounters (83, or 1.2%) including partner MDMA use. Finally, an exploratory quadratic test for control with number of substances used by partner was not statistically significant, unlike in multipartner encounters.

Compared within respondents to single-partner encounters with no partner substance use, any uncertainty about partner substance use was associated with decreased odds of UAI, decreased pleasure, and decreased odds of control. In the initial random intercept models, encounters in which respondents reported not knowing if their partners had taken substances were associated with less UAI, pleasure, and control. Encounters in which respondents suspected their partners had used substances but could not identify the specific substances used were associated with decreased odds of control and decreased pleasure in initial random intercept models, but with increased odds of UAI in multivariate models specifically.

Associations with overall measures of partner substance use changed across models with UAI and pleasure as outcomes. In all CLR models testing associations between overall respondent and partner substance use, the associations for partner substance use that were statistically significant in initial models were no longer statistically significant and were ultimately eliminated from the final

multivariate models. However, as noted above, initial random intercept models showed a negative association between uncertainty about partner substance use and UAI, and significant positive associations between knowledge of specific partner substance use and increased odds of UAI. In the random intercept model including both respondent and partner substance use, only the association with uncertainty was statistically significant, yet in the final multivariate model, only the association for knowledge of partner substance use without knowing specifics of that use was statistically significant. Finally, in random intercept models testing relationships between categorically measured partner substance use and pleasure, only the negative association between not knowing partner substance use and pleasure remained statistically significant in the final multivariate model including all situational characteristics.

Compared within respondents to single-partner encounters with regular, steady partners, encounters with non-regular and steady partners were associated with decreased odds of UAI and decreased pleasure, but not with control. This relationship exists for both types of non-regular steady partners and UAI, but only encounters with opportunity or anonymous partners were associated with decreased pleasure. All initially significant associations across analyses were attenuated in multivariate models including other situational characteristics. As expected, decreasing familiarity with partners was associated with decreasing risk behaviour.

Compared within respondents to single-partner encounters in private venues, encounters in non-private locations were associated with decreased odds of UAI and decreased pleasure, but not with control. These effects were consistent across both CLR and random intercept models. However, significant

associations seen in initial models between encounters in sex-on-premises venues and decreased odds of UAI became non-significant in multivariate models that included terms for serodiscordance and, perhaps more importantly, partner type. Associations with cruising locations were still statistically significant, but the magnitude of this relationship was attenuated. Similarly, associations between both types of non-private venues and decreased pleasure were attenuated, but still significant, in multivariate models as compared to the initial random intercept model.

Compared within respondents to single-partner encounters with seroconcordant partners, encounters with serononconcordant partners were associated with decreased odds of UAI and decreased pleasure, but not with control. More specifically, the relationship between serononconcordance, both with partners of unknown serostatus match and with serodiscordant partners, and UAI was generally consistent across analyses and models, with some attenuation in effect sizes. However, only encounters with partners of no serostatus match were associated with decreased pleasure relative to seroconcordant encounters. This association was attenuated in multivariate models including substance use, but also relationship status and location of sex.

Evidence of interaction effects. All possible hypothesised two-way interactions were tested in both CLR and random intercept models for UAI, and in random intercept models for pleasure. However, only the association between the interaction between number of substances used by respondent and partner was statistically significant, indicating that each additional substance used by a partner resulted in a larger relationship between substances consumed by respondent and pleasure.

Encounters were readily classifiable into three latent classes. These three classes were characterised by partner type, location of sex, and substance use, and were significantly different on UAI and pleasure, but not on control, as distal outcomes.

Chapter 17. Discussion

The three studies reported here aimed to describe associations between substance use and sexual outcomes; to describe associations between specific situational characteristics and sexual outcomes; to develop a typology of risk contexts and sexual outcomes; and to test interactions between respondent and partner substance use patterns and between respondent substance use and location of sex. The three studies reported here also investigated associations with sexual outcomes beyond sexual risk behaviour, including control and pleasure. Work from the qualitative metasynthesis substantially guided the hypotheses and outcomes tested—in particular, the testing of interactions between substance use and location of sex and the inclusion of pleasure and control as outcomes. Additionally, the systematic review of multiple-event studies clarified areas of contestation in associations between situational characteristics tested and sexual risk behaviours.

To address these aims, sexual encounters reported by MSM in England through The Sigma Panel 2011 were analysed for associations between substance use and other situational characteristics and three key outcomes: unprotected anal intercourse, pleasure and control over sexual outcomes. Analyses were conducted in three groups based on the survey structure: encounters with multiple partners, encounters with new partners and encounters with any single partner. Additionally, a multilevel latent class model examined typologies of situational characteristics in the main sample of single-partner encounters and related the resultant latent classes to each of the three outcomes outlined above.

This chapter will summarise findings by each research aim and outline the specific contribution of this work to research addressing sexual risk in MSM. This discussion will then examine findings for substance use and other situational

characteristics in the context of the systematic review of multiple-event analyses (i.e., in light of prior evidence), assess how findings relate to theories addressing substance use and sexual risk in MSM, and discuss findings ‘in conversation’ with the qualitative metasynthesis undertaken earlier. Finally, this discussion will turn to strengths and limitations of the current research and implications for policy and practice.

Summary of findings by research aims

Aim 1: to describe associations between substance use and sexual outcomes. Across all analyses, respondent substance use was significantly associated with increased odds of UAI and increased pleasure, with very thin findings for control—specifically, only significant associations between crystal methamphetamine and decreased control in multipartner encounters and between polysubstance use and decreased control in single-partner CLR models. Across specific substances for which associations were tested, use of poppers, erectile dysfunction medications and, in random intercept models, crystal methamphetamine predicted both increased odds of UAI and increased pleasure, suggesting that these substances have specific relevance for intervention development.

In both studies reported here where partner substance use was tested, certainty about partner substance use was associated with increased odds of UAI, but not pleasure, in multipartner encounters and with increased odds of UAI and increased pleasure in single-partner encounters. Uncertainty about partner substance use was associated with decreased odds of UAI and decreased odds of control in random intercept models, but not CLR models, on the sample of single-partner encounters and with decreased pleasure in both multipartner and single-partner encounters. One possible reason why this may be is that encounters with lack of

certainty about partner substance use may be characterised by poorer planning, spontaneity and general unfamiliarity with the partner and context of sex.

Findings about pleasure in multipartner encounters. While the binary measure for respondent substance use was not associated with pleasure in multipartner encounters, the continuous measure of respondent substance use was significantly associated. This suggests that the continuous measure of substance use may better capture associations with pleasure. For example, while differences in pleasure may not be significant in comparing encounters with one or two substances to encounters with no substance use, differences in pleasure may become significant at higher levels of substance use—though these encounters were less common than encounters with no substance use, or one or two substances used. Neither overall respondent substance use measure was significantly associated with control, but this could be because MSM reported not being in control of sexual outcomes for a relatively small number of encounters.

Findings about control. On the one hand, the combination of relatively few encounters including use of certain specific substances and relatively few encounters in which respondents reported not being in control meant that analyses of specific substances were likely underpowered for this sexual outcome. On the other hand, this makes the statistically significant finding of crystal methamphetamine in multipartner encounters all the more convincing, particularly given the substantial effect size (OR=0.15). This could reflect a specific dynamic of multipartner encounters that is not addressed in the current quantitative evidence, though a possible explanation for this finding will be discussed below in context of qualitative data.

The difference in significance between the CLR and random intercept models testing respondent polysubstance use was surprising, especially since a better powered analysis would be expected to result in similar coefficients and conclusions about significance. There are several potential mechanisms at play here. First, participants may perceive loss of control to occur only with polysubstance use. Most encounters featured no substance use, or use of one or two substances, whereas an association with loss of control may be reported only with higher numbers of substances consumed. Second, CLR models capture a specific subset of the sample of respondents who report both UAI and protected sexual encounters. This suggests that polysubstance use may only be associated with loss of control in those respondents who a) demonstrate some flexibility in sexual risk behaviours and b) report more than one encounter.

Finally, the relationship between uncertainty about partner substance use and decreased odds of control in random intercept models estimated on the sample of single-partner encounters was somewhat vexing. One possible reason for these findings is the contexts that characterise encounters with uncertainty about partner substance use. The naïve correlation matrix for the sample of single-partner encounters suggested that encounters with uncertainty about partner substance use were also somewhat correlated with non-private venues, unclear serostatus match with partner, and opportunity or anonymous encounters. It could be that the brevity and possible spontaneity of these encounters was associated with decreased control. Put otherwise, uncertainty about partner substance use may reflect a tenuous understanding of the situation in which sexual contact occurs.

Collinearity between respondent and partner substance use measures. As suspected in the formulation of the model selection protocols for the three studies

reported here, partner and respondent substance use measures were highly collinear. Thus, multivariate models for UAI and pleasure including ‘main effects’ for partner and respondent substance use and a non-significant partner substance use term, but not an interaction term between them, were compared against multivariate models without a partner substance use term. In all cases but two—specifically, the multivariate random intercept models testing categorical measures of substance use—exclusion of the partner substance use term did not result in a significantly worse fit. In both of these instances, the terms that remained significant in multivariate model captured some degree of uncertainty about partner substance use. This suggests that respondent substance use and partner substance use together do not explain significantly more variance than respondent substance use alone, across models and estimation methods, but perhaps that uncertainty about partner substance use points to a different situational characteristic as described below. Indeed, the naïve correlation matrices bear out this collinearity. In the sample of single-partner encounters, number of substances used by respondent and partner are highly correlated at $r=0.68$, with any respondent substance use and knowledge of specific partner substance use similarly associated ($r=0.54$).

Confounding and collinearity in single-partner multivariate random intercept models testing categorical measures of substance use and UAI. As observed in the summary of findings for the study of single-partner encounters, associations with overall measures of partner substance use changed across models with UAI as outcome. It is conceivable that the association between suspecting partner substance use and UAI was subject to ‘negative confounding’, or bias away from a significant result, by another factor. For example, in the naïve correlation matrix, suspected partner substance use was somewhat positively correlated with

both encounters in sex-on-premises venues ($r=0.09$) and encounters with opportunity or anonymous partners ($r=0.10$). These two characteristics were associated independently with decreased odds of UAI and were entered into the full multivariate model.

In contrast, not knowing if a partner had consumed substances may have been subject to ‘positive confounding’, or bias towards a significant result, possibly due to the same situational characteristics. Not knowing if a partner had consumed substances was highly correlated with opportunity or anonymous partners ($r=0.26$), with unsure partner serostatus match ($r=0.23$) and with encounters in sex-on-premises venues ($r=0.32$). All of these situational characteristics were present in the final multivariate models for UAI and pleasure with categorical measures of substance use.

Measurement of substance use. One of the opportunities using three different measures of substance use affords is the ability to compare models using each type. The set of analyses for single-partner encounters included multivariate models for UAI and pleasure identical in situational characteristics used as independent variables except for the substance use measure. An initial comparison of models shows that the non-substance use situational characteristics did not vary across multivariate models for any respondent substance use, number of substances used, and specific substances used. This indicates that none of the three types of measures points to a specific confounding mechanism or hidden interaction with the other situational characteristics particular to that measure.

Comparing model fit indices for initial CLR models testing associations between respondent or partner substance use and UAI, it appears that the binary measure is not as informative as the continuous measure or the group of specific

substances. In initial random intercept models for UAI, it becomes clearer that testing specific substances results in better model fit than testing number of substances used. Comparing model fit indices for initial random intercept models testing associations with pleasure shows the same trend for respondent substance use, but indicates that the four-category response option for partner substance use is the most informative of the three measures.

Aim 2: to describe associations with UAI, control, and pleasure. This aim was accomplished via expanding the set of outcomes tested to include both control and pleasure. The remainder of the discussion of results associated with this aim examines the implications of the ICCs for the three outcomes as well as how the outcomes were associated with each other across the three studies reported here.

ICCs and person-level variation. UAI and control were both operationalized as dichotomous variables, while pleasure was operationalized as a scale from 1 to 10, with 10 being the best sex ever and 1 being the worst sex ever. The estimation of null random intercept models in the sample of single-partner encounters provided the opportunity to examine to what degree outcomes are related to person-level variation and to what degree they are related to encounter-level variation. As mentioned in the results section, the ICC of UAI was 66.8%, the ICC of pleasure was 38.3% and the ICC of control was 60.7%. This suggests that at least based on the encounters collected, both UAI and control over sexual outcomes are substantially ‘person-level’ variables, dictated to a greater degree perhaps by personal preferences, characteristics and behavioural regimes than encounter-level characteristics. In contrast, while the ICC of pleasure was still substantial and statistically significant, pleasure appears to exhibit greater variation on an encounter level than at the person level.

Relationships between outcomes. In all analyses reported here, increased control was associated with decreased odds of UAI. Additionally, increased pleasure was associated with increased odds of UAI. Few multiple-event analyses have addressed these situational characteristics, even indirectly. Three studies included in the systematic review of multiple-event analyses (P. A. Wilson et al., 2008, 2009; P. A. Wilson, 2004) examined physical and emotional attraction and UAI in within-subjects comparisons, but only one (P. A. Wilson et al., 2009) found significant associations between both physical and emotional attraction and increased odds of UAI. Another study (Colfax et al., 2004) did not find an association between partner attractiveness and UAI.

It would appear that the three studies reported here are the first multiple-events analyses to test directly relationships between control and pleasure and UAI, though these results are not surprising. A recurring obstacle in HIV prevention is the increased pleasure reported with UAI, both subjectively and qualitatively (Bauermeister et al., 2009; Dowsett, 2009) and empirically, as MSM report greater arousal with UAI on surveys (Calabrese, Rosenberger, Schick, Novak, & Reece, 2013; Mustanski, Newcomb, Du Bois, et al., 2011; Rosenberger et al., 2011; Velter et al., 2013).

However, an unexpected finding that emerged was that control and pleasure were only associated with each other in random intercept models in the sample of single-partner encounters, though findings were broadly consistent with the magnitude, though not the significance, of associations from population-average models in the sample of new partner encounters. In these models, being in control of sexual outcomes was associated with increased pleasure, while each additional point awarded to an encounter's 'pleasure score' was associated with increased odds of

control. These relationships have not been tested in the context of a published multiple-events analysis, and there exists little evidence that control and pleasure are associated at the event level. Rosenberger and colleagues (2011) examined gay and bisexual men's experiences of sexual pleasure at the most recent sexual encounter, though they did not assess event-level characteristics associated with pleasure.

Aim 3: to describe associations between specific situational characteristics—location of sex, partner serodiscordance, and partner type—and sexual outcomes. Each of the three additional situational characteristics tested is summarised below, with discussion of inconsistencies across and within studies. This section closes with a discussion of confounding among these characteristics. It should be noted that none of these characteristics were significantly associated with control as a sexual outcome in any of the models tested in these studies.

Location of sex. Relative to encounters in private locations, encounters in non-private locations (i.e., sex-on-premises venues and cruising or outdoors locations) were associated with decreased odds of UAI in the samples of new partner and single-partner encounters. Location was not associated with UAI in multipartner encounters. Of note is that in multivariate models in the sample of single-partner encounters, encounters in cruising locations, but not in sex-on-premises venues, were significantly associated with decreased odds of UAI. In the sample of new partner encounters, only encounters in sex-on-premises venues were associated with decreased odds of UAI.

One possible explanation for this disparity in findings is the collinearity between intentionality and encounter type. Multipartner encounters may require a specific degree of planning and intentionality that is not present in encounters with one other partner. To this end, location may not be associated with UAI in this

sample of encounters because location may not be relevant in sexual behaviours when multiple partners are involved.

But this does not explain the difference between findings for new partner and single-partner encounters. One possible explanation for this specific difference is the confounding effect of partner familiarity. For example, in the naïve correlation matrix for single-partner encounters, encounters with opportunity or anonymous partners are correlated with encounters in sex-on-premises venues ($r=0.27$) and in cruising or outdoors locations ($r=0.18$). Because the sample of new partner encounters did not, by definition, include sexual encounters with long-term or established partners, a specific association between encounters in sex-on-premises venues and UAI may have emerged conditional on the encounter being with a new partner. What is unusual is the disparity between the new partner and single-partner encounter samples on associations between cruising or outdoors locations and UAI. This may be due to additional confounding variables separating new partners from all other encounters with one additional partner that were not captured in this analysis.

Encounters in non-private locations were also consistently associated with decreased pleasure across models in each of the three studies, though in the sample of multipartner encounters only encounters in cruising or outdoors locations were significantly different from encounters in private locations. This specific difference between studies may be because sex-on-premises venues are a highly sexualised context of choice for establishing multipartner encounters (Bourne et al., 2014; Grov, Hirshfield, Remien, Humberstone, & Chiasson, 2013). Moreover, this finding could be because of the specific contextual challenges of multipartner encounters in cruising locations, such as avoiding detection or legal prosecution, which may not be

problematic in sex-on-premises venues. Of note is that the qualitative data did not illuminate a specific reason why venue might be associated with pleasure. This is a key direction for future research.

Partner serodiscordance. Partner serodiscordance was tested in both multipartner encounters and single-partner encounters. In both studies, partner serononconcordance was associated with decreased odds of UAI and decreased pleasure. However, this difference was limited to unknown serostatus match specifically in multipartner encounters. While associations with UAI persisted in multivariate models, associations with pleasure were not significant when substance use, location of sex and number of partners were included as well. In single-partner encounters, both unknown serostatus match and serodiscordance were associated with decreased UAI, but only unknown serostatus match was associated with decreased pleasure. All significant associations in initial models in the sample of single-partner encounters persisted in multivariate models.

These significant differences for partner serostatus may reflect irrelevance of partners' serostatus—for example, in multipartner encounters where anal intercourse is not expected, or where the participant is planning on condom use and carries out that plan. They are also possible evidence of 'serosorting', or the practice of strategically choosing partners for UAI based on perceived serostatus match (Cassels, Menza, Goodreau, & Golden, 2009). What is surprising is the null finding regarding serodiscordant multipartner encounters. The most likely explanation for this finding is that serodiscordant multipartner encounters only represented 3.5% of the sample, or 15 total encounters, in these analyses. While it is also possible that some respondents had some degree of intentionality in participating in serodiscordant

multipartner encounters (e.g. ‘bug chasing’), it would be impossible to conclude this from such a small number of encounters in this category.

Partner type and number of partners. Partner type was only tested in the sample of single-partner encounters. In the sample of single-partner encounters, encounters both with regular but non-steady partners and with opportunity or anonymous partners were associated with decreased odds of UAI. Only encounters with opportunity or anonymous partners were associated with decreased pleasure. In all cases, associations were still significant in multivariate models, though somewhat attenuated.

Number of partners was tested as an analogue in the sample of multipartner encounters. While it was not associated with UAI, encounters with additional partners were associated with increased pleasure. This finding could reflect the increased erotic stimulation and availability of partners experienced in denser sexual contexts—though if it reflects availability of partners, it is unexpected that increased odds of UAI were not evident in these analyses.

Collinearity and the possibility of confounding. As previously observed, associations seen in initial models for situational characteristics in the sample of single-partner encounters were attenuated in multivariate models testing associations with UAI and pleasure. Though the effect sizes for both overall respondent substance use measures remained largely unchanged throughout multivariate models, each of these three situational characteristics appeared to attenuate somewhat—or, in the case of encounters in sex-on-premises venues, become non-significant—when the other terms were introduced. It appears that relationship status, location of sex and partner serostatus, and to a lesser degree, possibly partner substance use may at least be partially confounding each other as regards odds of UAI and pleasure. This is in

evidence as well from the naïve correlation matrix, in which unclear partner serostatus match, opportunity or anonymous partners, and encounters in sex-on-premises venues or in cruising or outdoors locations appear to be highly correlated with each other.

Aim 4: to develop a typology of risk contexts and sexual outcomes. As described in the results, a multilevel latent class analysis yielded three classes, each characterised by distinct patterns. It appears that encounters with low substance use were effectively partitioned into two classes by partner type and, to a lesser degree, by venue. In class 1, virtually all encounters (99.1% probability) were in private venues and the vast majority (94.1%) were with regular, steady partners. These encounters accounted for 31.5% of all encounters. The majority of encounters (61.8%), however, were with non-regular and steady partners and were more likely than class 1 encounters to occur in non-private settings. Class 3 encounters were characterised by high levels of substance use, with little meaningful separation from other classes by type of encounter or venue of sex.

What is perhaps most interesting is that encounters with high levels of polysubstance use were associated with higher sexual risk than class 1 encounters, but not statistically different in pleasure. Consistent with the pattern of null findings for control in almost every analysis of the previous three studies, there were no statistically significant differences in control between each of the three classes. The model as emerged in the final three-class solution supported confounding between venue and partner type, and to a lesser degree by serodiscordance, as each class appeared to have substantially different conditional probabilities on each and were defined by these characteristics.

Aim 5: to test interactions between respondent substance use and partner substance use in associations with sexual outcomes. Interactions between respondent substance use and partner substance use were tested in the samples of multipartner encounters and single-partner encounters. In models testing associations with UAI, none of the interactions tested were statistically significant save the interaction between continuous measures of substance use in multipartner encounters. In this interaction, increasing numbers of substances used by the partner moderated the otherwise escalating odds of UAI for each substance used by the respondent.

In models testing associations with pleasure, the only interactions tested were in the sample of single-partner encounters. While categorical measures of substance use did not have a statistically significant interaction, the interaction term for continuous measures of substance use was statistically significant, indicating that each additional substance consumed by the partner increased the magnitude of the positive association of additional substances consumed by the respondent and pleasure. As with aim 6, findings are discussed below in the context of the qualitative metasynthesis.

Aim 6: to test interactions between respondent substance use and location of sex in associations with sexual outcomes. Interactions between respondent substance use and location of sex were tested in all three studies. In models testing associations with UAI, the only interactions tested were in the sample of new partner encounters and in the sample of single-partner encounters. No substance use and location interactions were statistically significant in the sample of single-partner encounters. However, both any respondent substance use and respondent poppers use in sex-on-premises venues were associated with increased

odds of UAI relative to encounters in private locations and with no substance use. This is contrast to the ‘main effect’ of sex-on-premises venues, which was a negative association with odds of UAI. These differences may well be due to differences in encounter types between multipartner encounters and encounters with one partner alone. Moreover, the interaction apparent in the sample of new partner encounters may not have been apparent in the sample of single-partner encounters because of the inclusion of encounters with repeat partners and because of the differences in analytic method.

In models testing associations with pleasure in the sample of multipartner encounters, number of substances used by respondent was associated with increased pleasure, except for cruising or outdoors locations where the association was negative. Substance use and location interactions were not statistically significant for pleasure as an outcome in the sample of new partner encounters or in the sample of single-partner encounters.

Contribution to research

The three studies reported here constitute the first known multiple-events analyses, including the first within-subjects comparisons, of substance use and situational characteristics and sexual risk in UK MSM. These are also the first multiple-events analyses to test associations between interactions between substance use and venue of sex, and between partner and respondent substance use, and sexual outcomes. Moreover, these studies examined at the event level non-risk sexual outcomes that are of importance in understanding rationales and effects of substance use in the context of sexual encounters.

Together, these contributions help to establish the evidence base for intervention with UK MSM. They also contribute to understandings of substance

use and sexual behaviour more generally by moving beyond a strictly pathological view of sexual behaviour to one that also seeks to understand how sexual behaviour is shaped by other sexual outcomes. Testing interactions between situational characteristics, and specifically between substance use and location of sex, nuances the perception of substance use as linearly associated with sexual risk. Additionally, the latent class analysis tested for the presence of a contextual ‘typology’ and the extent to which that contextual typology shaped sexual risk and other sexual outcomes. This is an important next step past the univariate and multivariate associations that have defined this body of evidence to date.

Study findings in the context of multiple-event analyses

In this section, findings on sexual risk are grouped by situational characteristic across each of the three studies reported here and compared against the studies identified in the systematic review of multiple-event analyses. Evidence from the systematic review of multiple-event analyses addressing associations between the three sexual outcomes examined in these analyses was discussed earlier.

Respondent and partner substance use. In all analyses and models undertaken here, overall respondent substance use was significantly associated with increased odds of UAI. This relationship was generally unattenuated in multivariate models. These results match with the conclusion of the systematic review.

But in contrast to the inconsistencies highlighted by the systematic review, overall partner substance use was consistently associated in univariate models with increased odds of UAI. Furthermore, the analyses reported here contribute to a fuller understanding of associations with partner substance use by using a variety of response options, including differential amounts of knowledge of partner substance use. Indeed, the random intercept models in the single-partner study revealed that

lack of certainty as to partner substance use was associated with decreased odds of UAI. Another key finding not explicitly noted in previous studies was that with the exception of models with significant interactions between respondent and partner substance use, partner substance use did not generally explain additional variance in multivariate models also containing variables for respondent substance use. This suggests that respondent substance use alone may be an adequate and more direct predictor of sexual risk than partner substance use.

Respondent polysubstance use. However, a key contribution to an area of contestation identified in the systematic review came in the examination of polysubstance use. All analyses reported here identified that increasing numbers of substances consumed was associated with increased odds of UAI, across analytic methods and models. Yet the three studies that examined respondent polysubstance use yielded inconsistent results. One within-subjects comparison study (Boone et al., 2013) found a significant relationship, while two studies with different analytic methods did not (Colfax et al., 2001; Minichiello et al., 2003). Power does not seem to be of help in explaining these differences, as Boone and colleagues' (2013) study included only 405 sexual encounters, while both studies finding non-significant relationships had sample sizes of about 1,011 and 2,087 encounters respectively. One key reason why these analyses demonstrated significant associations may be that the socio-sexual context of MSM in the UK—which, as noted earlier, is poorly understood in the body of evidence—was different from either the United States or Australia, where the three previous studies were conducted.

Specific substance use. Across the analyses conducted here, findings for use of specific substances were inconsistent. Substances are first examined by the

groups identified in the systematic review, with discussion thereafter of the additional substances tested.

Alcohol use. The systematic review identified that results for associations between respondent and partner alcohol use and sexual risk behaviours were inconsistent across studies. The analyses contained here reflect this inconsistency, as neither respondent alcohol use nor partner alcohol use were at any point significantly associated with UAI in any of the analyses. Power would not appear to be at issue, since alcohol was one of the most common substances used before or during sex across each of the three studies reported here.

Crystal methamphetamine use. Associations between respondent and partner use of crystal methamphetamine and UAI were clearer. Though neither the population-average models in the new partner encounters study nor the CLR models in the single-partner encounters study demonstrated statistically significant effects, crystal methamphetamine was associated with UAI in both population-average models for multipartner encounters and random intercept models for single-partner encounters. It is also of note that the studies reported here showed significant associations in light of the relatively infrequent use of this substance. The systematic review concluded that based on the five studies reporting associations (Boone et al., 2013; Colfax et al., 2001; Koblin et al., 2007; Parsons, Lelutiu-Weinberger, et al., 2012; P. A. Wilson, 2004), crystal methamphetamine was the only specific substance for which associations were clear. Nevertheless, these analyses form an important contribution to the small body of multiple-event analyses addressing this drug of substantial public health concern.

Poppers use. In the studies reported here, poppers were associated with increased odds of UAI in new partner encounters and in single-partner encounters

more generally, but not in multipartner encounters. The analyses here suggest that in the UK context, poppers use is associated with UAI in certain types of encounters, but not in others. This nuances the inconsistent findings highlighted in the systematic review, in which two studies examining MSM in the United States (Boone et al., 2013; Colfax et al., 2001) found significant associations, while two Australian studies (Prestage et al., 2005; Zablotska et al., 2009) did not.

Erectile dysfunction medication use. The systematic review identified inconsistent evidence in the three studies examining erectile dysfunction medication use. While respondent and partner use of erectile dysfunction medications was associated with UAI in multipartner encounters and single-partner encounters, respondent use of erectile dysfunction medications did not appear to be associated with UAI in new partner encounters specifically. This difference within the three studies reported here may be due to both the difference in the UK context and also the different encounter types examined in each of the three studies. Put otherwise, erectile dysfunction medications may be of use in multipartner encounters where duration of erection may be an advantage. Moreover, erectile dysfunction medications were associated with UAI in encounters including partners with which the reported encounter is not necessarily the first sexual session. Though they reported a partnership-level analysis, Drumright and colleagues (2006) observed that the relationship between erectile dysfunction medication use and UAI was moderated by whether or not the encounter was with a ‘main’ partner. The association between erectile dysfunction medication use with a non-main partner and UAI was not statistically significant in either CLR or generalised linear mixed effects models, though the association between erectile dysfunction medication use with a main partner and UAI was significant in CLR models.

Cocaine use. Cocaine by either respondent or partner was at no point significantly associated with UAI. This could be due to the relative infrequency of its use, especially since associations with increased odds of UAI were marginally significant in the population-average analysis of new partner encounters and in the CLR models of single-partner encounters. However, it should be noted that the effect size for the association between respondent use and UAI was less than 1 (OR=0.92), suggesting that any effect that might exist is more likely in single-partner encounters than in multipartner encounters.

Use of other substances. Neither ketamine use nor MDMA use were ever significantly associated with UAI in the three studies reported here.

However, there was some evidence from the initial random intercept models in the analysis of single-partner encounters that respondent and partner use of GHB—a substance for which use was not commonly reported—was associated with increased odds of UAI. These effects were not statistically significant in further models, however. One population-average model from a study included in the systematic review found a significant association between ketamine use and increased odds of UAI and between GHB use and increased odds of UAI (Parsons, Lelutiu-Weinberger, et al., 2012). This same study did not find evidence of an association between MDMA and UAI. Boone and colleagues (2013) did find a within-subjects association between use of ‘club drugs’, including MDMA, GHB and ketamine, and UAI.

Finally, there was some evidence from random intercept models that partner cannabis use (and, at marginal significance, respondent cannabis use) was associated with increased odds of UAI. Boone and colleagues (2013) did not find a significant association between respondent marijuana use and UAI, though another study

(Minichiello et al., 2003) found that marijuana use by male sex workers reduced odds of UAI compared to encounters with other types of substance use.

Location of sex. As highlighted in the systematic review, previous multiple-event analyses did not consistently indicate a direction of association between venue of sex and UAI. This was in part due to major differences in measurement that made several studies mutually unintelligible. The studies reported here used a straightforward three-category classification that partitioned encounter venues into private, sex-on-premises venue, and cruising or outdoors locations. Across all analyses, encounters not in private locations were associated with decreased odds of UAI. This relationship was only significant in new partner and single-partner analyses, and in single-partner analyses, persisted only for associations with cruising locations. These overall findings are in agreement with the significant difference between public and private encounters established by Reisen and colleagues (2010), though three other comparable studies (Prestage et al., 2005; P. A. Wilson et al., 2008; P. A. Wilson, 2004) did not find a statistically significant difference between sex-on-premises venues or bathhouses and private locations in odds of UAI.

Seroconcordance of partner. Evidence of associations between partner seroconcordance and sexual risk were tenuous in the systematic review, but tended towards increased odds of UAI with seroconcordant partners. This pattern was broadly reflected in the included analyses. Critically, the approach used in these analyses treated serodiscordance as a behavioural, rather than a biological, construct. Survey questions asked respondents what they knew and believed about partner serostatus, and what partners knew or believed about respondent serostatus, including that serostatus information was unknown or irrelevant. It is possible that this approach comes closer to approximating the cognitive processes underlying

serodiscordance and sexual risk, particularly given that sexual risk is a behavioural variable (Hart & Elford, 2010; McDaid & Hart, 2010b; Thiede et al., 2009). Only one included study (Newcomb & Mustanski, 2013) approximated this approach, using a Likert scale to capture relative certainty as to partner HIV status. In multipartner and single-partner analyses, an unknown serostatus match with partners was associated with decreased odds of UAI. In single-partner analyses, serodiscordance was also significantly associated with decreased odds of UAI. In all cases, associations from initial models persisted in multivariate models.

Partner type. In the single-partner analyses, encounters with partners that were not considered regular and steady (i.e. not a boyfriend or spouse) were associated with decreased UAI. Variable construction partitioned these non-regular and steady encounters into encounters with regular but non-steady partners (e.g. sex buddies or new relationships) and encounters with opportunity or anonymous partners. Encounters with opportunity or anonymous partners were even less likely to include UAI than encounters with regular and non-steady partners. These findings strengthen the tentative finding of the systematic review, that decreasing familiarity with partners is associated with decreased odds of UAI. Furthermore, it adds to the small evidence base of four studies (Parsons, Lelutiu-Weinberger, et al., 2012; A. M. A. Smith et al., 2006; P. A. Wilson et al., 2009; P. A. Wilson, 2004) testing specific partner relationships and UAI, all but one (P. A. Wilson, 2004) of which found significant associations between non-main partners and odds of UAI.

Study findings in theoretical context

Findings from the three studies reported here are discussed in the context of three key approaches to understanding the relationship between substance use and

situational characteristics and sexual behaviour: myopia and disinhibition, sensation seeking and cognitive escape.

Myopia and disinhibition. As discussed in the introduction to this dissertation, myopia and its corollary, disinhibition, emphasise the loss of cognitive foresight and resultant engagement in risky sexual behaviours (Giancola et al., 2010; Steele & Josephs, 1990). The pattern of null findings in associations with control do not support disinhibition as a primary mechanism by which substance use could be causally associated with sexual risk. As discussed below, this is not to say that substance use does not have a disinhibiting effect. Substance use may be consumed as part of a purposive process to overcome limitations or fears about specific activities (Bourne et al., 2014; Halkitis et al., 2003; McKirnan et al., 1996). But this is not the same as substance use leading to ‘regret sex’.

However, the finding regarding the negative association between crystal methamphetamine and control in multipartner encounters but not in single-partner or new partner encounters suggests that there may be some evidence of crystal methamphetamine ‘causing’ disinhibition, but that this disinhibition is moderated by encounter type. As Digiusto and Rawstorne (2013) have observed, there is little evidence of crystal methamphetamine causing sexual risk behaviours in MSM. Yet these findings in multipartner encounters indicate that crystal methamphetamine may cause some degree of loss of control over sexual outcomes.

Sensation seeking. Cross-sectional global association and partnership-level evidence suggests that sensation seeking is associated with substance use and sexual risk behaviour in MSM (Dolezal et al., 2000; Newcomb et al., 2011; Semple, Strathdee, Zians, McQuaid, & Patterson, 2011). Sensation seeking is a personality characteristic in which a person seeks out new, exciting and usually pleasurable

stimuli (Kalichman, Heckman, & Kelly, 1996). The analyses reported here do not directly test sensation seeking, both because respondents did not complete a sensation seeking scale and because these analyses did not set out to test person-level characteristics.

However, these analyses do suggest that substance use behaviours are a plausible basis for sensation seeking, due to their consistent positive association with pleasure. They also create a challenge for understanding location of sex as a means of sensation seeking. Non-private venues were associated in new partner and single-partner encounters with decreased pleasure. Yet qualitative evidence suggests that sex-on-premises venues are key venues for encountering and meeting with new partners (Elwood & Williams, 1998; A. I. Green & Halkitis, 2006; Haubrich, Myers, Calzavara, Ryder, & Medved, 2004). It may be that sensation seeking may not be best characterised by examining pleasure as outcome, but by examining novelty and other aspects of sexual encounters that those exhibiting this personality trait find appealing.

Cognitive escape. Cognitive escape holds that the combination of the enactment of ‘forbidden’ sexual scripts, including sexual risk behaviour, is facilitated by specific sexual event characteristics, including the presence of highly stimulating sexual contexts (McKirnan et al., 1996, 2001; P. A. Wilson, 2004). The pattern of null findings for associations with control confirms the idea that cognitive escape is not a process of loss of control, but of escape from strict norms and expectations around sexual risk behaviour. The pattern of findings for pleasure and UAI also points to potential factors that might create a highly stimulating sexual context: number of partners in multipartner encounters was associated with increased pleasure and substance use was associated with increased odds of UAI. Moreover, the

findings of the multilevel latent class analysis suggest that polysubstance use is enough to create a highly stimulating sexual context, as encounters characterised by polysubstance use had the highest probability of UAI.

Study findings through the lens of qualitative metasynthesis

The results of the three studies reported here are now placed ‘in conversation’ with the qualitative metasynthesis to extend the connections drawn between the qualitative metasynthesis and the research aims defined at the start of the three studies reported here.

Substance use and pleasure. An unequivocal finding from models testing relationships with pleasure is that across all analyses, substance use was associated with increased pleasure. This dovetails closely with the results of the qualitative metasynthesis, in which substance use is used as a tool for pleasure and to push sexual and biological limits. While evidence for specific substances is more tenuous, it is of note that those substances significantly associated with increased pleasure include poppers, erectile dysfunction medications, and crystal methamphetamine. Each of these three substances has main effects that allow for sexual performance beyond what would be ‘naturally’ expected—by permitting more insertive partners, by allowing longer and more durable erections, and by heightening and lengthening sexual intercourse to last over long periods of time. These significant associations reflect the motivation for substance use as a tool for performance, and particularly sexual performance. As several qualitative studies highlighted, crystal methamphetamine use in particular is an important drug both of sociality and of sexuality (A. I. Green & Halkitis, 2006; A. I. Green, 2003; Slavin, 2004).

In particular, polysubstance use was associated with increased pleasure, but only in one model with decreased control. This can be interpreted in light of the

finding of carefully negotiated substance use combinations as a mechanism for the extension of pleasurable contact in social and sexual spaces. As several studies (Greenspan et al., 2011; Husbands et al., 2004; Ireland et al., 1999) observed, the skilful negotiation of polysubstance combinations—i.e. not ‘getting messy’ (Dowsett et al., 2005)—was key to a pleasurable experience.

Finally, the relationships that emerged in the analyses of single-partner encounters regarding uncertainty around partner substance use and decreased pleasure speak to the importance of social scripts and tribality, the second of which was a defining feature of the littoral space. As discussed in the metasynthesis, tribality (Husbands et al., 2004; Klitzman, 2006; Slavin, 2004; Weems, 2007) was the experience of a communally shared experience united by common practices, including substance use. To have a partner ‘standing outside’ the tribe could be associated with decreased pleasure, especially as several studies reported that the experience of not doing substances in situations where this was expected led to anomie and social distance from others (A. I. Green, 2003; Husbands et al., 2004).

Substance use and control. On the one hand, the extensive pattern of null findings for control as outcome is surprising—but on the other hand, it mirrors the results of the qualitative metasynthesis. The problems with the operationalization and power of analyses testing associations with control are addressed elsewhere in this discussion. But it is notable that respondent polysubstance use was associated with decreased odds of control only in certain cases and models, and that across analyses, the only significant association between a specific substance and control was found in the use of crystal methamphetamine in multipartner encounters. Crystal methamphetamine use featured prominently in the qualitative metasynthesis—not just because of its common use in the contexts where studies

were undertaken, but because of its profound effects on sexual performance and arousal in sexually charged social contexts, including sex-on-premises venues.

On the whole, the qualitative metasynthesis discounted the idea of substances having a main effect on sexual risk operating primarily via disinhibition and loss of control. The pattern of null findings around control suggests that control, at least as operationalized here, is not a mediator between substance use and UAI. This pattern also underscores the importance of intentionality in substance use and the expected effects of substances used. However, the metasynthesis did acknowledge in the discussion of ‘diminished capacity’ that a substance user’s ability to distance himself from his own safer sex norms—what Wilson (2004) called ‘cognitive distancing’, and what O’Byrne and Holmes (2011) discussed as ‘boundary play’ and ‘post hoc’ rationalising—may be a key feature. Indeed, the pattern of null findings but for crystal methamphetamine may reflect both evidence against disinhibition and an anticipation of diminished capacity as a desired outcome specific to the effects of crystal methamphetamine in the most highly stimulating sexual contexts.

Evidence of interactions. As previously noted, evidence of interactions for UAI and pleasure, where they were tested, was scant. On the whole, evidence of interactions may have been paltry because within-context, interpretive interactions (i.e., the ‘literal’ interaction of substance use with a specific space) did not generalise between-context, statistical interactions. The qualitative evidence informing these analyses examined a class of social venues and processes within them rather than triangulating between venues to examine how patterns differ between them. It is possible that interactions between space and substance use are similar in other classes of venues, though this was not specifically examined in the qualitative metasynthesis.

However, the significant interaction between substance use and sex-on-premises venues for an association with UAI in the sample of new partner encounters could be read in the context of social scripts and hegemonies, two categories identified under the dimension of performance. In these two categories, the role of substance use is described as allowing for performance to social expectations in the context of ‘fitting in’ (Husbands et al., 2004) and avoiding precarity. Substance use in a sex-on-premises venue may magnify odds of UAI precisely because substance use allows for performance to expectancies of sexual risk in this highly sexualised environment.

Moreover, the notion of ‘headspace’ (especially in Slavin, 2004; but also in Caceres & Cortinas, 1996; Weems, 2008), as reflected in the categories of hegemonies and social scripts, is of use in contextualising the moderation of respondent substance use by partner substance use in associations with pleasure in single-partner encounters and in associations with UAI in multipartner encounters. These interactions may exist because they reflect circumstances in which respondent and his partner or partners share similar typologies or patterns of substance use, and are in agreement as to what sexual goals and expectancies are for the encounter. Put otherwise, it may reflect similarity of strategies for drug use. For example, Slavin (2004) highlights an encounter in which a man agrees to a chemsex encounter explicitly including injection use of crystal methamphetamine in the context of unprotected anal intercourse as part of the initial negotiation of ground rules.

An alternative explanation for the moderating effect of respondent and partners’ substance use on UAI may also reflect ‘getting messy’ (Dowsett et al., 2005), or the inability to perform sexually due to substance overuse as number of substances escalates. Similarly, the unusual quadratic relationship between number

of substances used by partners and control in multipartner encounters could reflect decreasing ability to perform and thus decreased risk of UAI, especially since increased control was associated with decreased odds of UAI.

Ecological systems. As described in the metasynthesis, the dimension of ecological systems described how places and groups of persons shape the contexts in which substance use and sexual encounters occur. As noted in the metasynthesis, aspects of an ecological system reciprocally determine each other and shape expectancies from the space. The results of the multilevel latent class model are a step towards classifying and distinguishing a typology of what these ecological systems are, and what the ensuing expectancies might be. Of particular note was that the latent class characterised by high levels of polysubstance use was not itself tied to specific pattern of location of sex, indicating that perhaps polysubstance encounters cut across venues and partner types or that there were too few polysubstance encounters (especially as encounters in this class comprised such a small proportion of the sample) to distinguish further within them. These polysubstance use encounters were associated with a high probability of UAI relative to the other classes, and levels of pleasure matching encounters with regular, steady partners in private locations, themselves possibly representative of another ‘ecological system’.

Strengths, limitations and an agenda for future research

First, the comparative strengths and limitations of the three studies reported will be addressed before addressing the strengths and limitations of this project as a whole. The section will conclude with suggestions for further research.

Comparative strengths and limitations. Each of the three studies reported here addressed a different type of sexual encounter. This meant that results were able to shed light on different aspects of sexual risk and behaviour. In particular,

associations surrounding multipartner encounters were tested separately from dyadic encounters, which addressed a potential key confounder of associations. Previous studies have aimed to explore dyadic encounters or ignored the specific aspects of multipartner encounters that may be associated with differential risk. Moreover, the data from The Sigma Panel 2011 presented a unique opportunity to examine encounters just with new partners separately from other ‘most recent encounters’. This meant that another potential confounder—previous sexual experience with partner—was addressed in this study. On the other hand, the sample of single-partner encounters allowed for exploration of associations between relationship types and sexual outcomes.

A comparative strength and limitation was that the three studies also were differentially powered. This was both a strength of the large single-partner encounters analysis and a weakness of the multipartner and new partner encounters analyses. The single-partner encounters analysis was the only one that was really able to examine use of specific substances. This difference in power became especially clear when comparing the sample sizes of the CLR models estimated for new partner encounters and for single-partner encounters. Differences in sample sizes also meant that different substances were examined in different analyses—for example, mephedrone was examined in multipartner encounters only.

Finally, errors and additions in the structure of the survey, especially in early months, meant that analyses were often not as complete as they could have been. While the single-partner analysis was perhaps the most ‘complete’ of all analyses, the multipartner analysis suffered from the loss of two months’ data on multipartner encounters. Addition of questions on serodiscordance and partner substance use for new partner encounters occurred after the first wave of data collection. Moreover,

data on multipartner encounters in the new partner sample were corrupted. This prevented the simultaneous examination of these two partner types should the analysis have warranted it.

Overall strengths of this research. A key strength of the studies reported here is the robust and transparent methodology used to analyse The Sigma Panel 2011. Past multiple-event analyses have suffered from unclear reporting of results and unjustified choice of methods, e.g. population-average vs. within-subjects models. Analytic methods were justified and used to generate appropriate and relevant comparisons between events.

Measurement of substance use was another strength of this project. Substance use was measured using three different indices to capture different facets: substance use as an overall categorical variable, to test an overall relationship and to ensure comparability with other studies; substance use as number of substances consumed, to examine polysubstance use and ‘escalating’ risk; and specific substance use, to capture associations with specific substances.

Another strength of these studies is the data from which they were drawn. Rather than drawing from a forensic or clinical sample, data were collected via web survey from a ‘community sample’, which may be more relevant for policy and interventional applications. Those completing this survey were drawn via a range of recruitment methods, and may more closely represent those who would be reached by services and interventions.

A related strength is that these studies were often much better powered than other multiple-event analyses in the extant evidence. The sample size of the largest analyses included more encounters than any of the included studies in the systematic

review, and even the sample of new partner encounters was only surpassed in size by two studies (Colfax et al., 2004; Hensel et al., 2012).

Data collected in this survey may also be less subject to recall error than cross-sectional surveys or surveys collecting data on several encounters at the same time because data collection was more likely to be proximal to the sexual encounter than in cross-sectional surveys. This is a strength shared by all diary-based studies.

Finally, these studies examined important non-risk sexual outcomes that have not previously been examined in the evidence on multiple-events analyses. Additionally, these studies tested hypotheses shaped by qualitative data. Results were also placed ‘in conversation’ with qualitative data to contextualise and nuance quantitative findings.

Limitations of this research. While the sample’s recruitment and composition have previously been highlighted as a strength, these features are also a limitation. Because sampling was essentially via convenience method, it is likely that the respondent sample is demographically and, perhaps, behaviourally different from the population of MSM in the UK. This means that generalizability of these results may be limited to populations poorly covered by this survey, especially marginalised populations that may be in greatest need of intervention and yet not have access to the tools and resources necessary to complete this time-intensive panel survey. Moreover, evidence comparing a community sample with a probability-based sample in surveys on gay men’s sexual health in the UK has suggested that community samples may report higher levels of sexual risk (Dodds et al., 2006).

Moreover, another design problem encountered by all retrospective studies is recall bias. Respondents may have been more likely to recall encounters, or the

details of encounters, with or without substance use. This is relevant especially given the psychotropic effects of many of the substances used. However, as noted above, this may be less of a problem than in studies that require recall of several encounters at once, stretching back farther in time.

Because contexts and meanings of substance use change as the legal, social and supply contexts of substance use and the epidemiologic and social contexts of HIV risk change, it is likely that the studies reported here have limited relevance over time. It is impossible to know what this ‘shelf life’ is, but epidemiologic surveillance will reveal changes over time, which should be compared to the original context of substance use and sexual behaviour.

Though sample sizes in the studies reported here were much larger than in previous analyses, certain aspects of analyses were underpowered due to the ‘sparse cell’ problem. Specifically, analyses of specific substances and of control as an outcome may have been limited by sparseness in the data, despite some evidence that crystal methamphetamine, for example, was specifically associated with decreased odds of control in multipartner encounters. This was not as much a problem for all analyses equally. For example, initial CLR models estimated for the sample of new partner encounters yielded uniformly non-significant results for substance use and situational characteristics, though this was not the case for the models estimated using generalised estimating equations. This disparity could be because of substantial differences in power that were not overcome by the gains in statistical efficiency that CLR models offer. Indeed, CLR models with UAI as outcome in the sample of new partner encounters included 12.5% of all encounters, and CLR models testing associations with control included 7.8% of all encounters. In contrast, the CLR models testing associations with UAI for all single-partner encounters included

37.8% of encounters, a more substantial subsample that led to better powered models.

The operationalization of pleasure and control was also lacking. It was not within the scope of this work to validate and test reliability of measures of pleasure and control, though it would appear that both measures as worded in the questionnaire had face validity. These analyses should be considered as tentative steps towards understanding pleasure and control in the context of multiple-event analyses. There appear to be no validated scales to test these specific properties, and past research assessing pleasure in single-event analyses (Hensel et al., 2012; Rosenberger et al., 2011) has taken a similarly ad hoc approach to operationalization. A more specific problem came in the operationalization of control, which was dichotomised from a four-level ordinal scale. This was done to facilitate the use of logistic regression and to avoid interpretability and convergence problems arising from sparse cells, though even the dichotomised variable was imbalanced. Control, unlike UAI, may be more appropriately measured as a continuous construct.

Another operationalization problem came with number of partners as a variable in the analyses of multipartner encounters. This variable was limited by its uneven distribution. By frequency, 59% of multipartner encounters were threesomes, with about another 30% of multipartner encounters reflecting those with between four and seven total male participants. While number of participants was not a focus of this research, future work may wish to explore whether specific types of multipartner encounters are characterised by different numbers of partners. The ‘long tail’ of the distribution of this variable may also have affected the predictive ability of models for both binary outcomes, especially as the number of encounters

reporting a specific number of male partners became sparser as the number of partners increased.

While the missing data strategy took advantage of the relatively low levels of missingness in encounters for which data existed, this led to some issues in comparing models against each other, especially when testing multivariate models with and without partner substance use. Though this strategy was believed to be appropriate given the types of models estimated, the interactions hypothesised and the relative lack of knowledge about the UK context, future analyses examining UK MSM may wish to build on these analyses by either specifying a multiple imputation model or taking advantage of full information maximum likelihood estimation, should it become readily available in software packages such as Stata.

Moreover, outcomes did not stratify UAI by positionality, choosing instead to examine the composite unprotected anal intercourse variable. It is possible that certain substances (especially poppers and erectile dysfunction medications) may have had different, or more substantial, effects in models stratified by positionality. For example, the systematic review revealed evidence that an association between alcohol use and UAI may be dependent on positionality (Irwin et al., 2006). More generally, MSM may engage in UAI while carefully managing their risk of HIV transmission. On the one hand, UAI is an important outcome, as it is the primary behaviour for sexual transmission in MSM. Yet on the other hand, encounters with long-term monogamous seroconcordant partners will involve significantly lower risk of HIV transmission than encounters with new partners and unknown serostatus match.

One limitation specific to the multilevel latent class model was the robustness of inference about the distal outcomes estimated. Statistical methods are not yet

readily available to test distal outcomes in this context. The pseudo-draw method implemented (Asparouhov & Muthén, 2013; Wang et al., 2005) has several acknowledged limitations discussed previously, and is generally inferior to the flexible model-based approach suggested by Lanza, Tan and Bray (2013). However, methods for the implementation of the flexible model-based approach in the multilevel context do not currently exist. Inference in this implementation of the pseudo-draw approach does not take into account that variance in distal outcomes should be subject to partitioning of variance across the between-respondents level and the within-respondents level. While this partitioning may have been accounted for in some part by the partitioning of variance in latent class models by level, it leaves questions about the degree to which the probabilities, means and variances and chi-square tests for equality were biased by this issue. It may also have been of interest to examine whether or not latent classes exist in the person-level probability of class assignment of individual encounters (i.e. in the random intercepts for latent class assignment) and to test these as between-respondents level differences alongside within-respondents level class assignment, but statistical methods do not currently exist for these analyses.

Finally, several limitations arose from the specific scope of this research. This analysis did not test random slope components in random intercept models. In the first instance, this was because the few and variable number of events per person in random intercept models would have underpowered this analysis. Random slope components are also not generally a feature of multiple-event analyses, especially as only one included study (Zea et al., 2009) in the systematic review tested for the significance of these components. This analysis also did not examine person-level effects, though inclusion of person-level effects was also unusual for within-subjects

comparisons in those studies included in the systematic review absent a specific hypothesis—for example, in tests of the moderating effect of age on the association between alcohol use and UAI (Mustanski, 2008). Because this study did not seek to test hypotheses about person-level effects, these were not included.

Further research. First and most importantly, there is a need for additional multiple-event analyses to examine the UK context, and especially non-England contexts including Wales, Scotland and Northern Ireland. This will become particularly important as contexts of substance use and sexual risk change and evolve, and as structural shifts in the landscape of HIV prevention emerge. For example, pre-exposure prophylaxis may become the next frame-breaking change in the way that the advent of HAART was in 1996 (Elford, Bolding, et al., 2002; Heijman et al., 2012; MacKellar et al., 2011a; Smit et al., 2006). Moreover, contexts of substance use, including popularity and purposes for use, change over time, with anecdotal evidence suggesting that substance use contexts for MSM are currently in a state of rapid change (Kirby & Thornber-Dunwell, 2013a). Ideally, these studies should be located as part of a programme of ongoing surveillance.

Subsequent studies should aim for larger sample sizes of encounters to better power analyses of specific substances. In particular, studies may wish to use a timeline follow-back method as used by Irwin and colleagues (2006) to capture encounters in a single interview as opposed to over time. Alternately, studies may wish to trade off between many respondents and fewer encounters and fewer respondents and many encounters. On the one hand, querying many respondents about their last UAI and non-UAI sexual encounters, as several studies (Koblin et al., 2007; P. A. Wilson et al., 2008, 2009; P. A. Wilson, 2004) did, would result in a well powered CLR-based study. Making fewer demands of participants may allow for a

more representative sample. On the other hand, querying fewer respondents intensively—for example, with longitudinal diaries—to capture many encounters over a longer period of time could allow for testing random slope components and examining how respondent-level characteristics predict event-level relationships.

Additional multiple-event analyses should examine key non-risk outcomes, such as outcomes of pleasure and control tested here. Future multiple-event analyses should also seek to test interactions between different situational characteristics and to discover contextual ‘typologies’, as was done in the multilevel latent class analysis. As the studies reported here are likely the first analyses to test these outcomes and approaches, additional work is needed to develop this body of evidence.

Finally, qualitative research has the potential to illuminate specific findings around pleasure and the situational characteristics discussed here. In particular, and as mentioned above, the relationship between venue and pleasure merits qualitative investigation to understand why encounters that occur even in these erotically charged contexts are associated with decreased pleasure.

Implications for public health and clinical practice

The studies reported here have several implications for public health and clinical practice in HIV and AIDS. The first is that HIV prevention could be meaningfully targeted at the encounter level, instead of focusing on person-level risk patterns, which interventions generally target (Herbst et al., 2007; Johnson et al., 2008; Scott-Sheldon, Fielder, & Carey, 2010). This does need to be balanced with the observation that person-level variation for UAI and control accounted for the majority of variation in this outcome in the sample of single-partner encounters. However, the call to focus on encounter-level relationships is especially supported by

the significant results in the within-subjects comparisons reported here. Addressing specific encounter-level risk behaviours may help MSM receiving these interventions to think critically about the specific conditions under which they engage in sexual risk behaviours. An encounter-level approach could be interpreted as an instantiation of the Rose hypothesis (Rose, 1992), which suggests that the goal of health promotion interventions should be to shift entire risk distributions instead of focusing on the highest-risk cases. Put otherwise, focusing on risky encounters instead of risky ‘people’ has the potential to shift the risk distribution by addressing health behaviours of a population instead of merely targeting those with high levels of risk behaviour. The logic of the Rose hypothesis would suggest that most cases of HIV in MSM are contracted by the percentage of the population that engages in occasional sexual risk behaviour. Targeting encounter-level interventions to the population of MSM could be more effective in preventing HIV transmission than addressing just those with records of substance use and sexual risk.

Moreover, HIV prevention efforts should acknowledge that, as evidenced by the pattern of null findings for associations with control, disinhibition does not appear to be a primary mechanism, except possibly in the case of crystal methamphetamine use and polysubstance use. Rather, an approach that emphasises sexual goals and preferences and awareness of potential cognitive escape (McKirnan et al., 2001) triggers—or, rather, encounter-level antecedents to substance use consumption and associated sexual risk—may be of use. For example, relapse prevention-based approaches in substance use (Rajasingham et al., 2012; Velasquez et al., 2009) emphasise the circumstances in specific situations that might lead someone to desire substance use to facilitate risky sexual behaviour. Though different substances are associated with different risk patterns, it may not be cost-

effective to target interventions to specific substances. Though several specific substances were associated with higher risk of UAI, use of specific substances that were not erectile dysfunction medications, poppers or alcohol was not especially prevalent in the sample of encounters. Additional work should investigate the cost-effectiveness and programmatic efficiency of substance-specific interventions, especially if there are common mechanisms of ‘cognitive escape’ underlying substance use.

Sex-positive HIV prevention seeks not to pathologise or stigmatise sex and pleasure-seeking behaviours, but to emphasise the value of a good sex life in the context of least harms (Bourne et al., 2012; Bourne, 2012). It is of little use to pretend that substance use is associated with decreased pleasure. As emphasised in the discussion of the qualitative metasynthesis, a harm reduction approach should emphasise ‘durable planning’, but also seek to decouple reasonable expectancies of pleasure from sexual risk behaviour. Sex-positive HIV prevention interventions may also emphasise that the most pleasurable sex was with seroconcordant partners that were familiar and known to the respondent, though both of these characteristics were also associated with higher odds of UAI in single-partner encounters.

Venue-based HIV prevention, including interventions in bathhouses or saunas (Buckley et al., 2010), should account for the already decreased odds of UAI in sex-on-premises venues and cruising locations. However, evidence from the analysis of new partner encounters suggests that substance use in sex-on-premises venues may be associated with increased odds of UAI. Health promotion in these venues may wish to address this characteristic of the risk milieu. What is perhaps most interesting is that encounters in the latent classes where encounters were most likely to occur in non-private locations were less subject to sexual risk behaviour

than encounters characterised primarily by polysubstance use. In this regard, HIV prevention interventions may wish to focus specifically on this cluster of high-risk behaviours than on characteristics of a specific venue. This is especially as it appeared that the association between sex-on-premises venues and decreased odds of UAI was better explained by other situational characteristics.

In the UK context specifically, this epidemiologic evidence can be used to support an emerging focus on risk behaviour assessment in sexual health services. A recent audit of UK sexual health clinics indicated that only about half of those clinics audited assess MSM for risky substance use behaviours, and that national or standardised guidance for assessment and intervention in these behaviours is unavailable (Desai et al., 2013). The contextually relevant studies reported here can help guide the development of guidance for assessment.

Also in the UK context, use of crystal methamphetamine and other substances in the context of sexual intercourse has of late attracted a great deal of attention (Bourne et al., 2014; Bourne, 2012; Daly, 2013; Kirby & Thornber-Dunwell, 2013a). In particular, ‘chemsex’ in UK MSM is associated with use of GHB, crystal methamphetamine, and mephedrone, and to a lesser extent with cocaine and ketamine (Bourne et al., 2014). The studies reported here provided some evidence of links between use of GHB and crystal methamphetamine and sexual risk, though associations with mephedrone, ketamine and cocaine—substances also commonly used in chemsex—did not rise to significance. More generally, concern around the widespread use of specific chemsex substances appears not to be substantiated in the frequency of their use in this sample. This may pose issues for the generalizability of this evidence to the highest-risk populations, or it may mean that so-called ‘high risk’ MSM are engaging in few, but very risky, UAI

episodes. It may also mean that a larger sample of ‘high risk’ MSM may be necessary to understand within-subjects relationships between chemsex substances and sexual risk.

Finally, there is evidence in the studies reported here of serosorting or negotiated safety, in that sexual encounters characterised by unknown serostatus matches are less likely to include UAI. On the one hand, as several case-control and cross-sectional studies have suggested, serosorting as an approach is unreliable as a method of HIV prevention (Golden et al., 2012; Golden, Stekler, Hughes, & Wood, 2008; Stolte, Van den Boom, Sandfort, & Davidovich, 2011). On the other hand, dubiety as to partner or respondent HIV status is predictive of decreased sexual risk behaviour, including in multipartner encounters, where the presence of multiple partners introduces more opportunities for risk. HIV prevention efforts may wish to emphasise the unreliable aspects of serosorting approaches as a prevention strategy.

Conclusion

These multiple-event analyses of sexual outcomes reported by MSM in The Sigma Panel 2011 aimed to investigate associations between substance use and sexual risk at the level of the sexual encounter. Informed by systematic reviews of multiple-event analyses and of qualitative research addressing substance use and social spaces in MSM, these analyses investigated associations between additional situational characteristics and the sexual outcomes of UAI, pleasure and control, tested interactions between partner and respondent substance use and between respondent substance use and location of sex, and aimed to derive a typology of sexual contexts. Substance use was consistently associated with increased odds of UAI and increased pleasure, whereas less familiar partners, seroconcordant partners and non-private locations of sex were associated with decreased odds of

UAI and decreased pleasure. Evidence for associations with control was very slim. Moreover, evidence for interactions was scant, though statistically significant interactions reflected key themes from the qualitative metasynthesis. Encounters were readily classifiable into three classes characterised by partner type, location of sex and substance use and with statistically significant differences on UAI and pleasure.

Limitations of this research include a community sample, operationalization of outcomes and generalizability of this research to other contexts, while strengths include robust analytic methods, a large sample size of encounters and several measurement approaches for substance use. Further research should address representative samples, or collect more encounters per respondent, and seek to illuminate qualitatively the connections between pleasure and the situational characteristics tested here.

Tables

A note of guidance on tables

- Throughout the tables presenting statistical results, several conventions are used.
- An asterisk (*) indicates that the result was significant at the $p<0.05$ level.
- Two asterisks (**) indicate that the result was significant at the $p<0.01$ level.
- Three asterisks (***) indicate that the result was significant at the $p<0.001$ level.
- Italicised text indicates that the result was marginally significant—i.e. at the $p<0.10$ level.
- In tables for chapters 14, 15 and 16, ‘SOPV’ refers to ‘sex-on-premises venue’.

Table 3.1. Characteristics of included qualitative metasyntheses.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Agudelo-Suarez et al., 2012	A metasynthesis of qualitative studies regarding opinions and perceptions about barriers and determinants of health services' accessibility in economic migrants.	Health services	27	Y	Databases, search terms (not replicable)	From 1997; appropriate methodological quality; related to health services accessibility by economic migrants (barriers, conditioning, facilitators), but not non-work migrants or from developed countries	Y (Pearson)	Y
Andersen et al., 2012	Meta-synthesis of qualitative research on return to work among employees with common mental disorders.	Mental health	8	Y	Databases, search terms (not replicable), reference chaining	Medium quality or above; focused on return to work, people with common mental disorders, and their perspectives on return	Y (MacEachen et al., Spencer et al., Rocco)	N
Anderson et al., 2012	A review and meta-synthesis of qualitative studies on Myalgic Encephalomyelitis/chronic fatigue syndrome	Chronic illness/disease management	34	Y	Databases, search terms (not replicable)	Methodological rigour; study fit; sufficiently detailed; focus on ME/CFS	Y (unclear)	Y
Bayhakki & Hatthakit, 2012	Lived experiences of patients on hemodialysis: a meta-synthesis.	Chronic illness/disease management	10	Y	Databases, search terms (not replicable)	Qualitative analysis published between 2000 and 2010 addressing lived experience of hemodialysis; in English	Y (Cesario, Morin, and Santa-Donato, 2002)	N
Bennion et al., 2012	What do we know about the experience of age related macular degeneration? A systematic review and meta-synthesis of qualitative research	Chronic illness/disease management	8	Y	Databases, search terms (not replicable), reference chaining	Focus on experiences of living with AMD; participants with AMD	Y (Dixon-Woods et al.)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Birnbaum & Saini, 2012	A qualitative synthesis of children's participation in custody disputes.	Child development	35	Y	Databases, search terms (replicable), reference chaining	In English; focused on children's experiences in separation and divorce; last 20 years	Y (unclear)	N
Borg Xuereb et al., 2012	Patients' and health professionals' views and experiences of atrial fibrillation and oral-anticoagulant therapy: a qualitative meta-synthesis.	Chronic illness/disease management	10	Y	Databases, search terms (replicable), reference chaining, author contacts	Focused on views or experiences of patients or carers or health professionals about fibrillation or oral anti-coagulants	Y (CASP)	N
Bradshaw, Playford, & Riazi, 2012	Living well in care homes: a systematic review of qualitative studies.	Geriatrics	31	Y	Databases, search terms (replicable), reference chaining	In English; exploring the views of residents in care homes; examining factors contributing to care home life	Y (Dixon-Woods et al., Harden et al., Mays and Pope, Spencer et al.)	N
Brohan et al., 2012	Systematic review of beliefs, behaviours and influencing factors associated with disclosure of a mental health problem in the workplace	Mental health	17	Y	Databases, search terms (replicable), reference chaining	People with mental health problems; employment; disclosure beliefs, behaviours, and factors; 1990-2010	Y (Mays and Pope, Popay et al., CASP)	N
K. Brown et al., 2012	Living successfully with aphasia: a qualitative meta-analysis of the perspectives of individuals with aphasia, family members, and speech-language pathologists.	Chronic illness/disease management	3	N		Three studies from the same dissertation: one on speech pathologists, one on those living with aphasia, one on family members	N (unnecessary)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Chenail et al., 2012	Clients' relational conceptions of conjoint couple and family therapy quality: A grounded formal theory	Mental health	49	Y	Databases, search terms (not replicable), reference chaining, hand search	In English; focused on conjoint couple or family therapy with more than one person per session; Good or higher quality	Y (CASP)	Y
Child et al., 2012	Factors influencing the implementation of fall-prevention programmes: a systematic review and synthesis of qualitative studies.	Geriatrics; health services	19	Y	Databases, search terms (replicable)	Qualitative analysis addressing fall prevention for community-dwelling elders; in English; full studies	Y (Wallace, Croucher, Quilgars, and Baldwin, 2004)	N
Clark et al., 2012	A qualitative systematic review of influences on attendance at cardiac rehabilitation programs after referral.	Chronic illness/disease management	90	Y	Databases, search terms (replicable), reference chaining, author contacts	Extractable data relating to attendance or referral to secondary prevention; after 1995; journal articles; older than 18 years old	Y (CASP)	N
Clark, Savard, et al., 2012	Understanding help-seeking decisions in people with heart failure: a qualitative systematic review.	Chronic illness/disease management	58	Y	Databases, search terms (replicable), reference chaining, author contacts	Extractable data relating to heart failure; after 1995; journal articles; older than 18 years old	Y (CASP)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Cohen & Collens, 2012	The Impact of Trauma Work on Trauma Workers: A Metasynthesis on Vicarious Trauma and Vicarious Posttraumatic Growth.	Health services	20	Y	Databases, search terms (replicable)	Qualitative analysis addressing at least partially the impact of trauma work on trauma workers; in a journal; in English; not on difficult clients or immediate reactions	Y (Atkins et al. 2008)	N
Connolly & Joly, 2012	Outreach with street-involved youth: a quantitative and qualitative review of the literature.	Child development	31	Y	Databases, search terms (not replicable), reference chaining	Focus on a specific outreach program; after 1990; in English; street involved-youth specifically; journal article	N (no rationale)	N
Cook, Fay, & Rockwood, 2012	A meta-ethnography of paid dementia care workers' perspectives on their jobs.	Health services	34	Y	Databases, search terms (replicable)	Focus on perspectives of paid dementia carers; in English	Y (Mays and Pope, Spencer)	N
K. Cook, 2012	Neoliberalism, welfare policy and health: A qualitative meta-synthesis of single parents' experience of the transition from welfare to work	Health services	8	Y	Databases, search terms (replicable)	Studies on single motherhood and welfare receipt; substantial content on health	N (no rationale)	N
Corcoran et al., 2012	U.S. Latinas' Knowledge and Attitudes toward Mammography: Meta-synthesis	Health services; women's health	11	Y	Databases, search terms (not replicable), reference chaining, author contacts	Focused on Latinas' knowledge, attitudes, perceptions regarding breast cancer and screening; separate findings regarding breast cancer; in the U.S.; written before 2009	Y (Paterson et al.)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Dillon, Roscoe, & Jenkins, 2012	African Americans and decisions about hospice care: Implications for health message design.	Health services; chronic illness/disease management	12	Y	Search terms (not replicable), reference chaining	In English; focus on African Americans; discuss hospice care decisions	Y (Atkins et al. 2008)	N
Duggleby et al., 2012	Hope, older adults, and chronic illness: A metasynthesis of qualitative research	Geriatrics; chronic illness/disease management	20	Y	Databases, search terms (not replicable), author contacts, hand search	Studies of hope with chronic illness; published in a peer-reviewed setting; between 1980 and 2010	Y (CASP)	N
Finfgeld-Connett, Bloom, & Johnson, 2012	Perceived competency and resolution of homelessness among women with substance abuse problems	Chronic illness/disease management; women's health	60	Y	Databases, search terms (replicable)	Focus on adult women, homelessness, with substance use problems; findings adequately supported	Y (unclear)	N
Flemming et al., 2012	Education in advanced disease	Chronic illness/disease management	17	Y	Databases, search terms (replicable), reference chaining, author contacts	Primary studies in English; examine health professionals' perceived knowledge, attitude, abilities for intervention delivery to patients with HF, CRF, ESRD, NMD; professionals' experiences presented separately	Y (Hawker et al.)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Fletcher et al., 2012	Improving the recruitment activity of clinicians in randomised controlled trials: A systematic review	Health services	11	Y	Databases, search terms (replicable), reference chaining	Between 2001 and 2011; focus on clinicians involved in recruiting to RCTs, and discussion of barriers and facilitation	Y (CASP)	N
Galuska, 2012	Cultivating nursing leadership for our envisioned future	Health services	21	Y	Databases, search terms (not replicable), reference chaining	Focus on development of nurses' leadership; practice context of leadership knowledge; in English	N (no rationale)	N
Garrett et al., 2012	Assessing primary health care: a meta-ethnography of the experiences of British South Asian patients with diabetes, coronary heart disease or a mental health problem.	Health services; chronic illness/disease management	12	Y	Databases, search terms (not replicable), reference chaining	Participants are adults with CHD, DM, MH; UK and in the NHS; British South Asian participants treated separately; discusses access to primary care; adequate methodological quality	Y (CASP)	Y
Gill & Fox, 2012	A qualitative meta-synthesis on the experience of psychotherapy for deaf and hard-of-hearing people.	Mental health	10	Y	Databases, search terms (not replicable), reference chaining, hand search	Published after disability legislation; qualitative studies about therapeutic process; either professionals, SL users, SL interpreters; no mixed methods studies or alternative presentations (e.g. auto-ethnographies), no human participants, or not in English	Y (Sandelowski and Barroso, 2007)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Goethals et al., 2012	Nurses' decision-making in cases of physical restraint: A synthesis of qualitative evidence	Health services	12	Y	Databases, search terms (not replicable), reference chaining	Published between 1990 and 2010; focused on nurses' decision-making regarding physical restraint; in French, Dutch, English, or German; acute and residential care; excluded if focus on feelings towards (rather than decision-making about) restraints, or focused on children, seclusion, or therapeutic treatment, or dissertation	Y (Sandelowski and Barroso, 2002) N	
Heaton, Corden, & Parker, 2012	'Continuity of care': a critical interpretive synthesis of how the concept was elaborated by a national research programme.	Health services	12	N		Studies from the same project and additional reviews from another project	N	N
Heinze & Nolan, 2012	Parental decision making for children with cancer at the end of life: a meta-ethnography.	Child development; chronic illness/disease management	10	Y	Databases, search terms (not replicable), reference chaining	Published in a peer-reviewed journal from 2001 to 2011 in English; sample includes parents of child expected to die from malignancy, and relates to decision-making	N (no rationale)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Hilber et al., 2012	Vaginal practices as women's agency in Sub-Saharan Africa: A synthesis of meaning and motivation through meta-ethnography	Women's health	16	Y	Databases, search terms (not replicable), reference chaining, hand search	In English, French, Spanish, Italian, Dutch, and Portuguese; not topical surveys or thematic surveys; dealing with vaginal practices that are not FGM; sufficient data and good quality	Y (Wallace, Croucher, Quilagars, and Baldwin, 2004)	Y
Hodge et al., 2012	Older adults' spiritual needs in health care settings: A qualitative meta-synthesis.	Geriatrics	9	Y	Databases, search terms (not replicable), reference chaining	Explorations of understandings of older adults' spiritual needs; in health care settings; primarily the views of older adults; peer-reviewed journal; some exceptions; exclusion if brief case study, theoretical framework, focus on professional perspectives, on spiritual coping or non-patient samples	N (no rationale)	N
Hoy, 2012	Beyond men behaving badly: A meta-ethnography of men's perspectives on psychological distress and help seeking.	Mental health	51	Y	Databases, search terms (not replicable), reference chaining	Qualitative studies with men's perspectives addressing mental health or coping; relevant to question; not sexual abuse or serious mental illness	Y (Shek et al., 2005)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Hubbard et al., 2012	Recognition by family members that relatives with neurodegenerative disease are likely to die within a year: A meta-ethnography	Chronic illness/disease management	9	Y	Databases, search terms (replicable)	From family member's perspective; appropriate to topic; addressing MS, PD, MND, at least in part; in English; about adults	N (rationale)	N
Kangasniemi et al., 2012	Duties of the patient: a tentative model based on metasynthesis.	Health services	11	Y	Databases, search terms (replicable), hand search	Explicit focus on patient duties; original scientific paper; qualitative or theoretical method	Y (novel method)	N
Kemp, Griffiths, & Lovell, 2012	Understanding the health and social care needs of people living with IBD: a meta-synthesis of the evidence.	Chronic illness/disease management	7	Y	Databases, search terms (not replicable), reference chaining, hand search	Focus on living with IBD from patient perspective; in English; adults older than 16 years; exclusion if focus on just one area	Y (CASP)	N
Kramer et al., 2012	Youth with disabilities' perspectives of the environment and participation: a qualitative meta-synthesis.	Child development	15	Y	Databases, search terms (not replicable), reference chaining	Samples with youth 3-21 and ASD, developmental disability, deaf/blind, MR/LD, CI; in global west; address participation in home, school, community; exclusion if not in English, not peer-reviewed, adults or youth with LD primary focus, non-research or intervention	Y (Thomas et al.)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Lamb et al., 2012	Access to mental health in primary care: A qualitative meta-synthesis of evidence from the experience of people from 'hard to reach' groups	Mental health; health services	20	Y	Databases, search terms (not replicable), reference chaining	Implicit/explicit discussion of help-seeking, lay referral, engagement with services; relevant to exemplar groups; studies selected inductively for theoretical sampling	Y (Blaxter)	Y
Lawrence et al., 2012	Improving quality of life for people with dementia in care homes: making psychosocial interventions work.	Geriatrics; health services	39	Y	Databases, search terms (not replicable), reference chaining, hand search	In English; focus on use and effectiveness of psychosocial interventions for people with dementia in care homes, from all user/provider perspectives; exclusion if only descriptive	Y (CASP)	N
Lee et al., 2012	Body image of children and adolescents with cancer: a metasynthesis on qualitative research findings.	Child development; chronic illness/disease management	8	Y	Databases, reference chaining, hand search	Studies of children with cancer, aged 6-20 years; body image experience; qualitative studies; high methodological rigour	Y (Joanna Briggs Institute)	Y
Lundgren et al., 2012	'Groping through the fog': a metasynthesis of women's experiences on VBAC (Vaginal birth after Caesarean section)	Women's health	8	Y	Databases, search terms (not replicable), reference chaining	Peer-reviewed; in English; women's perspectives of VBAC; good or high quality; exclusion if mixed studies with methods or event	Y (COREQ, Walsh and Downe)	Y

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Makaroff, 2012	Experiences of kidney failure: a qualitative meta-synthesis	Chronic illness/disease management	13	Y	Databases, search terms (not replicable), reference chaining	In English; qualitative research on the experiences of people with kidney failure, from nursing; conceptual/thematic description or interpretive explanation	Y (Sandelowski and Barroso, 2007)	Y
Malpass et al., 2012	Transforming the perceptual situation: A meta-ethnography of qualitative work reporting patients' experiences of mindfulness-based approaches.	Mental health	14	Y	Databases, search terms (replicable), reference chaining, author contacts	Journal articles; focus on patient experience; relevant to question and 8-week MBSR/MBCT	Y (CASP, Dixon-Woods)	N
Monforte-Royo et al., 2012	What lies behind the wish to hasten death? a systematic review and meta-ethnography from the perspective of patients	Chronic illness/disease management	7	Y	Databases, search terms (replicable), reference chaining, author contacts, hand search	Exclusion if inadequate topic focus, not patient's perspective, non-qualitative analysis	Y (CASP)	N
Nagata, Gatti, & Barg, 2012	Social determinants of iron supplementation among women of reproductive age: a systematic review of qualitative data.	Women's health	12	Y	Databases, search terms (replicable), reference chaining	Studies relevant to research question; focus on women of reproductive age	Y (CASP)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Nelson, 2012	A meta-synthesis related to infant feeding decision making.	Child development, women's health	14	Y	Databases, search terms (not replicable), reference chaining	Qualitative studies in English on infant feeding decision-making	N	N
Neubeck et al., 2012	Participating in cardiac rehabilitation: a systematic review and meta-synthesis of qualitative data.	Chronic illness/disease management	34	Y	Databases, search terms (not replicable), reference chaining, hand search	Empirical studies regarding barriers or enablers for CR or secondary prevention programme	Y (COREQ)	N
Nyman et al., 2012	Emotional well-being and adjustment to vision loss in later life: a meta-synthesis of qualitative studies	Geriatrics; chronic illness/disease management	17	Y	Databases, search terms (replicable), reference chaining	In peer-reviewed journal; focus on older people	Y (CASP)	N
O'Halloran, Grohn, & Worrall, 2012	Environmental factors that influence communication for patients with a communication disability in acute hospital stroke units: A qualitative metasynthesis	Chronic illness/disease management	3	N		Studies from the same project	N (unnecessary)	N
Perry et al., 2012	Older adults' experiences regarding discharge from hospital following orthopaedic intervention: a metasynthesis.	Geriatrics; health services	16	Y	Databases, search terms (not replicable)	In English; mean age < 60 years; focus on the whole discharge process; orthopaedic focus; not a dissertation or thesis	Y (Finfgeld 2003, then CASP)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Reed et al., 2012	Developing stroke rehabilitation and community services: a meta-synthesis of qualitative literature.	Health services	18	Y	Databases, search terms (not replicable), reference chaining	From 1998; no reviews; in English	Y (CASP, Spencer et al.)	Y
Rudolfsson & Berggren, 2012	Nursing students' perspectives on the patient and the impact of the nursing culture: a meta-synthesis.	Health services	17	Y	Databases, search terms (not replicable)	Relevant to question; adequate methodological quality	Y (CASP)	Y
Schmied et al., 2012	Contradictions and conflict: A meta-ethnographic study of migrant women's experiences of breastfeeding in a new country.	Women's health	11	Y	Databases, search terms (not replicable), reference chaining	In English; after 2000; women from LMICs that moved to a HIC; separate out data from migrants and non-migrants; sufficient methodological rigour	Y (CASP)	Y
Schulman-Green et al., 2012	Processes of self-management in chronic illness.	Chronic illness/disease management	101	Y	Databases, search terms (not replicable)	In English; since 2000; exclude if sole focus on MI, SU, or combine CI with other groups, and those without CI, secondary literature, interventions, and dissertations	Y (unclear)	N
M. Smith & Aguirre, 2012	Reproductive attitudes and behaviors in people with sickle cell disease or sickle cell trait: a qualitative interpretive meta-synthesis.	Chronic illness/disease management	3	Y	Databases, search terms (not replicable)	Not mixed method; focus on reproductive attitudes and behaviours rather than awareness of genetic testing, etc.	N (no rationale)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Stankov et al., 2012	Overweight and obese adolescents: What turns them off physical activity?	Child development; chronic illness/disease management	15	Y	Databases, search terms (not replicable), reference chaining, author contacts	Individual or group interviews; 10-20 years of age, or adults reflecting; overweight to obesity with no disabilities; explore experiences; can separate results for youth, of generate findings regarding barriers	Y (CASP)	Y
Steen et al., 2012	Not-patient and not-visitor: A metasynthesis fathers' encounters with pregnancy, birth and maternity care	Women's health	23	Y	Databases, search terms (replicable)	Good quality; high resource settings; discuss fathers' views and experiences up to end of puerperium; from 1999	Y (Walsh and Downe)	Y
Thomas, Jack, & Jinks, 2012	Resilience to care: a systematic review and meta-synthesis of the qualitative literature concerning the experiences of student nurses in adult hospital settings in the UK.	Health services	10	Y	Databases, search terms (not replicable), reference chaining, hand search	Full-time adult pre-registration nursing students in the UK; from 1990; in English	Y (Joanna Briggs Institute)	N
Waibel et al., 2012	What do we know about patients' perceptions of continuity of care? A meta-synthesis of qualitative studies	Chronic illness/disease management	25	Y	Databases, search terms (replicable), reference chaining, hand search	In English, German, or Spanish; relevant to topic in addressing continuity; patient's perspective	Y (Mays and Pope)	N

Table 3.1 continued.

Author and year	Title	Category	How many studies?	Systematic search?	Search methods described?	Inclusion and exclusion criteria?	Studies critically appraised?	Studies eliminated based on appraisal?
Walsh & Devane, 2012	A metasynthesis of midwife-led care	Women's health	11	Y	Databases, search terms (not replicable), author contacts	Sufficient methodological quality; qualitative describing intrapartum care; from 1980; in English; exclusion if not qualitative empirical research	Y (Walsh and Downe)	Y
York & Wiseman, 2012	Gardening as an occupation: A critical review.	Geriatrics	4	Y	Databases, search terms (not replicable), reference chaining	Peer-reviewed from 2003	Y (Letts et al., 2007)	N

Table 3.2. Metasynthetic methods of included qualitative metasyntheses.

Author and year	Which primary metasynthetic method do the authors declare?	How is the metasynthesis done?	Category of reciprocal translation
Agudelo-Suarez et al., 2012	None explicitly; Finfgeld (2003), McInnes and Wimpenny (2008), Zimmer (2006); likely Joanna Briggs Institute	Findings and categories aggregated for synthesised statements; manual analysis for categories; use of QARI software and triangulation by source, methodology, conceptual framework	Data reduction and thematic extraction
Andersen et al., 2012	Noblit and Hare (1988)	Author identifies 'first order concepts' in studies, develops 'second order concepts' between studies, and then reciprocally translates to 'third order concepts', with concepts mapped at every step and authors consorting on map	Visual metaphor
Anderson et al., 2012	Noblit and Hare (1988) referenced	Articles are read, theoretical differences highlighted, identification of themes, synthesis of themes; 'content analysis'	Data reduction and thematic extraction
Bayhakkı & Hatthakit, 2012	Noblit and Hare (1988)	All key information from articles in a spreadsheet; themes compared and combined; themes reciprocally translated (unclear), translations synthesised	Data reduction and thematic extraction
Bennion et al., 2012	Malpass et al. (2009), Noblit and Hare (1988), Braun and Clarke (2006) for thematic analysis	Data are extracted, first and second order constructions are coded, themes are compared across studies in the context of a matrix, third order constructs are completed through thematic analysis	Visual metaphor
Birnbaum & Saini, 2012	Noblit and Hare (1988), Saini and Shlonsky (2012)	After Noblit and Hare (1988)	Key paper approach
Borg Xuereb et al., 2012	Taylor et al. (2011), Malpass et al. (2009)	Data are extracted, first and second order constructions are coded, themes are compared across studies to form second order constructs, third order constructs are completed through consensual mind mapping	Data reduction and thematic extraction, visual metaphor
Bradshaw, Playford, & Riazi, 2012	Thomas and Harden (2008), Noblit and Hare (1988)	Studies are read, coding done line by line, codes organised in a spreadsheet, codes diagrammed, third order constructions formalised	Line-by-line coding
Brohan et al., 2012	Noblit and Hare (1988)	Results and discussion copied into NVivo, examples coded using original study codes, code list reduced, and 'super-ordinate' and 'sub-themes' structured and examples recoded again, with check for reliability and multiple presence	Line-by-line coding
K. Brown et al., 2012	Noblit and Hare (1988), Sandelowski and Barroso (2007)	Studies are read, themes and sub-themes are recorded, juxtaposed, and connected, interpretations are verified by data, new overarching themes are identified; iterative process concludes in Venn diagrams for each theme	Data reduction and thematic extraction
Chenail et al., 2012	Sandelowski and Barroso (2007), Charmaz (2006), Finfgeld (2003)	Data are extracted, 'thematic survey' is undertaken, grounded theoretical methods are undertaken on each article	Data reduction and thematic extraction

Table 3.2 continued.

Author and year	Which primary metasynthetic method do the authors declare?	How is the metasynthesis done?	Category of reciprocal translation
Child et al., 2012	Noblit and Hare (1988), Pope, Mays, Popay (2007) for thematic analysis	Studies are read; quotes relating to programmes extracted; first and second order concepts tabulated; interpretations coded and tabulated to develop third-order concepts; 'meta-ethnography' used to create third order constructs	Visual metaphor, line-by-line coding
Clark et al., 2012	Noblit and Hare (1988)	Data are extracted; examination and discussion of links between concepts; higher order abstractions developed	Data reduction and thematic extraction
Clark, Savard, et al., 2012	Noblit and Hare (1988)	Data are extracted; examination and discussion of links between concepts; higher order abstractions developed as line of arguments	Data reduction and thematic extraction
Cohen & Collens, 2012	Noblit and Hare (1988), Campbell et al. (2003)	Key concepts extracted and listed; themes translated into one another to produce the study's major themes	Data reduction and thematic extraction
Connolly & Joly, 2012	Noblit and Hare (1988)	Extract key themes into a spreadsheet; constant comparison across themes; comparison of common themes; grouping into over-arching domains	Data reduction and thematic extraction
Cook, Fay, & Rockwood, 2012	Noblit and Hare (1988)	Extract key themes into a spreadsheet; constant comparison across themes; grouping into over-arching domains against second-level constructs; feedback at several points from knowledge users	Visual metaphor
K. Cook, 2012	Noblit and Hare (1988)	Lines-of-argument synthesis with integration and comparison, through a framework of neoliberal thought	Data reduction and thematic extraction
Corcoran et al., 2012	Noblit and Hare (1988)	A team of four compare themes from studies against each other and came to consensus; study data categorised into each theme	Data reduction and thematic extraction
Dillon, Roscoe, & Jenkins, 2012	Noblit and Hare (1988), Atkins et al. (2008)	Tabulate first-order constructs (participants) and second-order constructs (themes); constant comparison, mapping of concepts, and coding memos; lines-of-argument synthesis results in third order constructs reflecting all evidence	Visual metaphor
Duggleby et al., 2012	Sandelowski and Barroso (2007)	Findings read; discussed as a team for definition; taxonomical analysis to identify important concepts and relationships between them; constant comparison; reciprocal translation to borrow concepts from other studies	Data reduction and thematic extraction
Finfgeld-Connett, Bloom, & Johnson, 2012	Finfgeld (2003), Noblit and Hare (1988), Corbin and Strauss (2008)	Findings, but not quotes, coded in a constant comparative fashion; coding memos used to develop lines-of-argument synthesis; verification of findings; process continues until clarity achieved; codes reviewed at critical junctures by another author	Line-by-line coding
Flemming et al., 2012	Noblit and Hare (1988)	Data are extracted; determining relations between studies; translate studies into each other; compare translations to see if some encompass others, and develop 'lines of argument'	Data reduction and thematic extraction

Table 3.2 continued.

Author and year	Which primary metasynthetic method do the authors declare?	How is the metasynthesis done?	Category of reciprocal translation
Fletcher et al., 2012	Thomas and Harden (2008)	Findings extracted, descriptive codes applied, analytical themes created, frequency effect sizes calculated	Line-by-line coding
Galuska, 2012	Noblit and Hare (1988)	Studies were mind mapped for each study; studies' maps connected and adjusted throughout translation; themes juxtaposed in a matrix alongside; relations translated into overarching metaphors; translations synthesised	Visual metaphor
Garrett et al., 2012	Noblit and Hare (1988), Atkins et al. (2008)	Findings extracted and tabulated across studies; themes reciprocally translated in chronological order, with attention to emerging patterns; synthetic constructs grouped into categories; categories arranged as lines-of-argument synthesis	Visual metaphor, key paper approach
Gill & Fox, 2012	Sandelowski and Barroso (2007)	Constant targeted comparison between client and therapist studies; reciprocal translation of studies within stakeholder groups	Data reduction and thematic extraction
Goethals et al., 2012	Joanna Briggs Institute, 2008	Level 1 themes identified; themes grouped into categories; categories grouped into synthesised findings; discussed with other authors	Data reduction and thematic extraction
Heaton, Corden, & Parker, 2012	Dixon-Woods et al. (2006), Ritchie and Spencer (1994) for framework analysis	Studies read; concepts listed and described; charts developed for key themes and populated; range of concepts in each chart examined and themes linked	Data reduction and thematic extraction
Heinze & Nolan, 2012	Noblit and Hare (1988), Atkins et al. (2008)	Themes listed, discussed differences and relations, translated, synthesised; '7 steps of meta-ethnography'	Data reduction and thematic extraction
Hilber et al., 2012	Noblit and Hare (1988), Sandelowski and Barroso (2007) for classification	Studies reread for first and second order constructs; relationships according to three synthesis types identified; themes consolidated; identified across cultural/ethnic groups; third order constructions expressed as line of argument; key paper used	Key paper approach, data reduction and thematic extraction
Hodge et al., 2012	Bondas and Hall (2007), Finlayson and Dixon (2008), McCormick et al. (2003)	By first author: read relevant literature; familiarise with studies; examine descriptive and inductive themes and 'client's voice'; create categories within, across studies; develop between-study hypotheses; attempt disconfirmation; construct, express final synthesis; second author reviews	Data reduction and thematic extraction
Hoy, 2012	Noblit and Hare (1988), Malpass et al. 2009, Britten et al. 2002	Quotes and themes extracted; studies summarised and inspected for relationships; common themes extracted and data recorded in support; with newly emergent themes, studies re-read for support	Data reduction and thematic extraction
Hubbard et al., 2012	Noblit and Hare (1988)	Two reviewers: extract quotes, tabulate study themes; reciprocal translation between metaphors; quotations and themes categorised into key themes; translations synthesised; sub-themes introduced into translations	Visual metaphor
Kangasniemi et al., 2012	Noblit and Hare (1988)	Reading for interpretative metaphors for draft of wholeness; juxtaposition of themes for lines-of-argument; studies translated; wholeness created	Data reduction and thematic extraction

Table 3.2 continued.

Author and year	Which primary metasynthetic method do the authors declare?	How is the metasynthesis done?	Category of reciprocal translation
Kemp, Griffiths, & Lovell, 2012	Noblit and Hare (1988) referenced	Rereading until 'argument' developed; first order leads to second order constructs; papers synthesised into one another one at a time chronologically, reciprocally; lines-of-argument developed	Key paper approach
Kramer et al., 2012	Thomas and Harden (2008), Noblit and Hare (1988)	Quotes, then stories coded; methods sections inspected for grounding; provisional code list; then all studies coded with constant comparison; hierarchical structure and pairs of codes examined; study team meets for consensus	Line-by-line coding
Lamb et al., 2012	Noblit and Hare (2008)	Studies sampled; first and second order constructions extracted with primary quotations; experimentation with groupings and arrangements of key concepts and relationships; maps photographed until an adequate network achieved; results verified against studies; organised into third order	Visual metaphor
Lawrence et al., 2012	Noblit and Hare (1988), Sandelowski and Barroso (2003)	Description of main concepts tabulated; examine shared concepts and group for explanatory power; taxonomy of findings developed inductively with constant comparison; all research team members; revised several times for wholeness	Data reduction and thematic extraction
Lee et al., 2012	Joanna Briggs Institute, 2011	Aggregation and synthesis of findings based on similarity of meaning	Data reduction and thematic extraction
Lundgren et al., 2012	Noblit and Hare (1988)	Studies reread; themes systematically juxtaposed for convergence or divergence; themes synthesised and expressed	Data reduction and thematic extraction
Makaroff, 2012	McCormick, Rodney and Varcoe, 2003	Studies reread; themes mapped within studies; themes mapped across studies with attention to in vivo themes that encapsulate others	Visual metaphor
Malpass et al., 2012	Noblit and Hare (1988), Malpass et al. (2009)	First and second order constructs extracted and tabulated chronologically; themes compared across papers and check for representation of paper by construct; lines-of-argument actualised by arranging second order constructs into temporal clusters	Visual metaphor, key paper approach
Monforte-Royo et al., 2012	Noblit and Hare (1988)	Themes from papers identified by discussion; compared across papers chronologically for meaning; translations synthesised by matching with quotations; comparison with texts leads to lines-of-argument; led by first author with whole team	Key paper approach
Nagata, Gatti, & Barg, 2012	Noblit and Hare (1988), Atkins et al. (2008), Sandelowski et al. (1997), Noyes and Popay (2007) for thematic analysis	Thematic analysis for extraction, reviewed chronologically; themes and quotes listed in a grid; studies coded and domains reciprocally translated; use social determinants of health to situate domains, themes, and quotes into lines-of-argument	Visual metaphor, line-by-line coding
Nelson, 2012	Noblit and Hare (1988)	Studies are read, themes extracted and listed, juxtaposition leads to reciprocal synthesis	Data reduction and thematic extraction

Table 3.2 continued.

Author and year	Which primary metasynthetic method do the authors declare?	How is the metasynthesis done?	Category of reciprocal translation
Neubeck et al., 2012	Charmaz (2008)	Themes summarised, then constant comparative approach with line-by-line coding and memoing to illuminate underlying processes	Line-by-line coding
Nyman et al., 2012	Joffe and Yardley (2004), Pope, Mays, and Popay (2007) for thematic analysis	Themes inductively coded, and themes emerging in at least two papers identified; themes were exclusive and manifest; synthesised under higher-order themes	Data reduction and thematic extraction, line-by-line coding
O'Halloran, Grohn, & Worrall, 2012	Noblit and Hare (1988)	Studies read and understood; two people independently compared and contrasted findings of each paper and its relations to create and then compare lists of categories and higher-order categories; reciprocal translation becomes higher order categories	Data reduction and thematic extraction
Perry et al., 2012	None explicitly	Paper coded line by line; text and themes tabulated; components recorded, and papers re-read; themes and analysis emerge from the analysis, and then in conference findings synthesised	Line-by-line coding
Reed et al., 2012	Noblit and Hare (1988)	Studies read and concepts listed; second order constructs compared and contrasted by comparing themes' presence or absence paper by paper chronologically; lines-of-argument synthesis emerges for third-order constructs	Key paper approach
Rudolfsson & Berggren, 2012	Noblit and Hare (1988)	Studies read to identify themes; lines-of-argument decided based on heterogeneity; translated by comparison to form central and key metaphors; overarching metaphor identified to encompass	Data reduction and thematic extraction
Schmied et al., 2012	Noblit and Hare (1988)	Key paper identified; themes listed, and worked in and across first order constructs to develop new second-order constructs and compare second-order constructs for third-order construct; refutational synthesis for clefts in experience	Data reduction and thematic extraction
Schulman-Green et al., 2012	Miles and Huberman (1994)	Themes and subthemes extracted; data display matrix formulated; coding scheme devised from first 10 articles; codes collapsed and clustered	Visual metaphor, line-by-line coding
M. Smith & Aguirre, 2012	Aguirre and Bolton (in press), Noblit and Hare (1988)	Themes extracted with language; identify overarching themes and relations to second order and first order; both triangulate by source and by analyst; produce new, synergistic understanding	Data reduction and thematic extraction
Stankov et al., 2012	Miles and Huberman (1994), Attride-Stirling (2001)	Basic themes grounded in first order constructs; codes compared and contrasted into organising themes; global themes encompass principal metaphors across studies; use conceptually-ordered displays; Bronfenbrenner deductive codes; consensus reached by two reviewers	Visual metaphor, line-by-line coding

Table 3.2 continued.

Author and year	Which primary metasynthetic method do the authors declare?	How is the metasynthesis done?	Category of reciprocal translation
Steen et al., 2012	Noblit and Hare (1988), Walsh and Downe (2005)	Metaphors, ideas, bits and pieces compared and contrasted; undertake reciprocal translation; seek disconfirming data and refutational translation; synthesise themes arising from preceding steps; steps taken in tandem and then consensus	Data reduction and thematic extraction
Thomas, Jack, & Jinks, 2012	Noblit and Hare (1988), Zimmer (2004)	Data extraction; themes identified; using the 'dynamic and iterative process', cross-cutting themes identified; discussed by consensus	Data reduction and thematic extraction
Waibel et al., 2012	Noblit and Hare (1988), content analysis	Studies read; key concepts created as a grid for juxtaposition, with attention to preservation of meaning; themes aggregated and identified	Visual metaphor
Walsh & Devane, 2012	Noblit and Hare (1988)	Metaphors, ideas, bits and pieces compared and contrasted; undertake reciprocal translation; seek disconfirming data and refutational translation; synthesise themes arising from preceding steps; steps taken in tandem and then consensus	Data reduction and thematic extraction
York & Wiseman, 2012	Noblit and Hare (1988), Campbell et al. (2006)	Search across studies to translate metaphors in findings; lines of argument across studies for similarities and dissimilarities	Data reduction and thematic extraction

Table 6.1. Characteristics of included studies.

Author and year	Analytic method	Epistemological orientation	Data used	Study <i>n</i>	Format	Geography	Study timeline	Places discussed	Specific drug?	Specific population?
Bauermeister, 2007	Thematic analysis	None stated	Semi-structured face-to-face interviews	16	Journal article	San Francisco, CA	2003-2004	Dance clubs, sex clubs, gay bars	None stated	Latino gay men
G. Brown et al., 2000	Unclear	None stated	Face-to-face and online focus groups and interviews	16	Monograph	Toronto	Spring 2000	Dance clubs	None stated	Party attenders
Caceres & Cortinas, 1996	Grounded theory, ethnography	Social constructionist	Observation, interviews, historical research	None	Journal article	San Francisco, CA	Sep-Dec 1992	Latino gay bar	Alcohol	Latinos
Elwood & Williams, 1998	Grounded theory	Theory of reasoned action	Structured face-to-face interviews	41	Journal article	Houston, TX	Dec 1995-Feb 1996	Bathhouses	None stated	Bathhouse users
A. I. Green, 2003	Grounded theory	None stated	Semi-structured face-to-face interviews	59	Journal article	New York City	Sep 2000-Nov 2001	Dance clubs, sex clubs, gay bars	Club drugs	None stated
A. I. Green & Halkitis, 2006	Grounded theory	None stated	Semi-structured face-to-face interviews	49	Journal article	New York City	Jan-Feb 2001	Circuit parties, bathhouses, dance clubs, gay bars	Crystal meth	Report recent meth use and sex
Greenspan et al., 2011; Husbands et al., 2004	Thematic analysis	None stated	Semi-structured face-to-face interviews	74	Monograph, journal article	Toronto	Jun-Nov 2003	Dance clubs	Club drugs	Racially diverse clubgoers reporting club drug use

Table 6.1 continued.

Author and year	Analytic method	Epistemological orientation	Data used	Study <i>n</i>	Format	Geography	Study timeline	Places discussed	Specific drug?	Specific population?
Ireland et al., 1999	Grounded theory	None stated per se, but interpretive epistemology (Finch 1988) cited	Semi-structured face-to-face interviews	20	Monograph	Sydney	1997-1998	Gay clubs, dance parties	None stated	MSM living with symptomatic HIV, asymptomatic HIV, or without HIV; injecting and non-injecting drug use
Klitzman, 2006	Grounded theory	None stated	Semi-structured face-to-face interviews	12	Journal article	New York City	1999-2001	Gay clubs, circuit parties	MDMA	MDMA users
Lewis & Ross, 1995	Grounded theory	Social constructionist	Semi-structured face-to-face interviews	16	Journal article	Sydney	1991-1993	Dance parties	Club drugs, alcohol	Partygoers reporting club drug use
Natale, 2008	Ethnography	None stated	Structured face-to-face interviews, focus groups	94	Journal article	Denver, CO	Apr-Jul 2004	Bathhouses, gay bars	None stated	Highest risk: Black, Latino, MSM living with HIV
O'Byrne & Holmes, 2011a, 2011b; O'Byrne, 2009, 2011	Thematic analysis, ethnography	Deleuze & Guattari, Foucault	Semi-structured face-to-face interviews, observation	17	Dissertation, journal articles	Ottawa, Montréal, Toronto	2007	Circuit parties	None stated	Circuit party attendees
Slavin, 2004	Ethnography	Bourdieu, De Certeau	Observation, interviews	1	Journal article	Sydney	Sep 2000-Sep 2002	Dance clubs	None stated	"Grunge" subculture

Table 6.1 continued.

Author and year	Analytic method	Epistemological orientation	Data used	Study <i>n</i>	Format	Geography	Study timeline	Places discussed	Specific drug?	Specific population?
Southgate & Hopwood, 1999b	Unclear	None stated	Focus group, interviews, textual analysis	67	Monograph	Sydney	mid-1997-late 1998	Dance clubs	None stated	Drug users
Southgate & Hopwood, 1999a	Discourse analysis	None stated	Letters to the editor	None	Journal article	Sydney	late 1992-early 1993	Mardi Gras circuit party	None stated	None stated
Weems, 2007, 2008	Ethnography	Somatic studies, Butler	Observation, interviews, historical research	None	Dissertation	North America	1998-2007	Circuit parties	None stated	None stated
Westhaver, 2003, 2005, 2006	Ethnography	Butler, Bourdieu, Honneth	Observation, interviews, participation	35 parties; 17 interviews	Dissertation, journal articles	North America	1998-2002	Circuit parties	None stated	None stated
Wilson, 2004	Grounded theory	Cognitive distancing (McKiman et al.)	Semi-structured face-to-face interviews	38	Dissertation	New York, Los Angeles, San Francisco, Denver, Salt Lake City	Unclear	Dance clubs, sex clubs, gay bars	Crystal meth	Latino MSM

Table 6.2. Critical appraisal of included projects.

Author and year	Steps taken to increase rigour in sampling?*	Steps taken to increase rigour in data collected?*	Steps taken to increase rigour in analysis?*	Findings grounded, supported by data?°	Breadth, depth in findings? ~	Study privileges MSM perspectives, experiences?†	Researcher's perspective shaped data collection and analysis?†	Ethical issues taken into consideration?†	Weight of study findings? reliability, trustworthiness?§	Weight of study findings? usefulness?§	Index paper for open coding?	Order coded
Bauermeister, 2007	++	+	++	++	++	++	.	+++	+	++	No	1
G. Brown et al., 2000	+	.	+	.	+/-	++	.	.	.	.	No	10
Caceres & Cortinas, 1996	++	++	++	+	-/+	++	+	.	++	+	Yes: author 2	2
Elwood & Williams, 1998	+	+	+++	+	+/-	++	.	+	+	.	No	3
A. I. Green, 2003	++	.	.	++	++	++	.	.	+	++	Yes: author 2	4
A. I. Green & Halkitis, 2006	++	+++	+++	++	++	++	.	+	++	+	No	5
Greenspan et al., 2011; Husbands et al., 2004	++	+	+	++	++	++	.	+	+	++	Yes: author 1, Husbands 2004	11
Ireland et al., 1999	++	++	++	++	++	++	++	+++	++	++	No	18
Klitzman, 2006	+	++	+++	++	++	++	.	.	+	+	No	15
Lewis & Ross, 1995	++	+++	+	++	+/-	++	.	+++	+	++	Yes: author 1	8
Natale, 2008	++	+++	+++	++	+/-	++	.	+++	++	+	No	6

Table 6.2 continued.

Author and year	Steps taken to increase rigour in sampling?*	Steps taken to increase rigour in data collected?*	Steps taken to increase rigour in analysis?*	Findings grounded, supported by data?*	Breadth, depth in findings?^	Study privileges MSM perspectives, experiences?†	Researcher's perspective shaped data collection and analysis?†	Ethical issues taken into consideration?†	Weight of study findings?§	Weight of study findings' usefulness?§	Index paper for open coding?	Order coded
O'Byrne & Holmes, 2011a, 2011b; O'Byrne, 2009, 2011	++	+++	+++	++	++	++	+++	+++	++	++	Yes: authors 1 & 2, 2011b	12
Slavin, 2004	+++	+++	+++	++	++	++	+++	+++	++	++	Yes, author 1	7
Southgate & Hopwood, 1999b	+	-	-	+	+/-	+	-	+	-	-	No	16
Southgate & Hopwood, 1999a	-	-	-	-	+/-	+	-	-	-	-	No	17
Weems, 2007, 2008	-	-	-	+	+/-	+	+++	+	-	-	No	14
Westhaver, 2003, 2005, 2006	++	++	+	++	++	+++	+++	+++	+	+	No	9
Wilson, 2004	+++	+++	++	+	+/-	+++	-	+++	+	+	No	13

* Yes, a thorough attempt was made +++

Yes, several steps were taken ++

Yes, a few steps were taken +

No, not at all/Not stated/Can't tell -

°

Findings are well grounded/supported ++

Findings are fairly well grounded/supported +

Limited grounding/support of findings -

†

Not at all (-), A little (+), Somewhat (++)

A lot (++++)

^

Limited breadth or depth -

Good/fair breadth but very little depth +/-

Good/fair depth but very little breadth -/+

Good/fair breadth AND depth ++

§ Low (-), Medium (+), High (++)

Table 9.1. Characteristics of included multiple-event analyses.

ACASI: audio computer-assisted structured interview; CASI: computer-assisted structured interview

AI: anal intercourse; PAI: protected anal intercourse

IBR: internet-based recruitment

Author and year	Location	Years data collected	Collection method	Sample size	Encounter definition	Encounters per person
Boone, Cook, & Wilson, 2013	New York City	2006-2009	Structured weekly internet sex diary for 6 weeks	n=158 HIV+ MSM	Last sexual encounter in the week	405 episodes for 140 sexually active respondents
Colfax et al., 2001	San Francisco	1999	In-person interview	n=295 MSM	Types of weekends: SF circuit party, distant circuit party, dance club, no event	1003 weekends for 295 respondents
Colfax et al., 2004	Boston, Chicago, Denver, New York City, San Francisco, Seattle	1999-2001	ACASI	n=1225 MSM reporting both high-risk and low-risk episodes	Last AI or OI with up to 3 partners	11715 encounters for 4295 MSM; 3597 encounters for 1225 MSM
Hensel, Rosenberger, Novak, & Reece, 2012	United States (IBR)	2010	Structured daily internet sex diary for 30 days	n=3877 HIV- MSM	Day-level sexual behaviour	1392 encounters for 3877 MSM
Horvath, 2005	Western United States (IBR)	Unclear	Structured daily internet sex diary for 28 days	n=29 MSM with both internet and non-internet partners	Sexual behaviour with a partner	Unclear
Irwin, Morgenstern, Parsons, Wainberg, & Labouvie, 2006	New York City	2000-2002	In-person interview; TLFB for 30 days	n=42 HIV- MSM with AI while drinking and while not drinking	AI	14.82 partners on average for all participants
Koblin et al., 2007	New York City	2004-2005	In-person interview	n=243 MSM reporting both UAI and PAI	Last 2 AI: with and without a condom	2 encounters
Lyons, Smith, Grierson, & von Dousa, 2010	Melbourne, Australia	2007	Telephone interview	n=186 men reporting encounters at SOPV in last 48 hrs	Sexual behaviour with a partner (in multipartner encounters, each treated separately)	430 encounters for 186 MSM

Table 9.1 continued.

Author and year	Location	Years data collected	Collection method	Sample size	Encounter definition	Encounters per person
Mimichiello, Marino, Khan, & Browne, 2003	Melbourne, Sydney, Brisbane	1998	Encounter-level diary for 2 weeks	n=186 male sex workers	Sexual behaviour with a partner	2,087 encounters for 186 sex workers
Mustanski, 2007	US-based IBR	2003	Structured daily internet sex diary for 30 days	n=113 non-monogamous MSM	Sexual behaviour with a partner	4.69 encounters per person
Mustanski, 2008	US-based IBR	2003	Structured daily internet sex diary for 30 days	n=143 HIV- MSM; n=100 HIV- MSM reporting at least 1 sexual partner	Sexual behaviour with a partner	Up to 3 encounters a day; 2887 sex days for 143 MSM
Nagaraj et al., 2013	Lima, Iquitos, Pucallpa	2008-2009	CASI	n=735 sexually active, non-HIV+ MSM reporting high-risk behaviours	Last encounter with each of 3 partners in last 3 months	1,643 encounters for 735 MSM
Newcomb, 2013	US-based IBR	2011	Structured weekly internet sex diary for 12 weeks	n=143 non-monogamous, non-HIV+ MSM between 16-40; n=137 MSM reporting ≥ 1 sexual encounter	Sexual behaviour with a partner	0.94 encounters/week
Newcomb & Mustanski, 2013	US-based IBR	2011	Structured weekly internet sex diary for 12 weeks	n=143 non-monogamous, non-HIV+ MSM between 16-40; n=137 MSM reporting ≥ 1 sexual encounter	Sexual behaviour with a partner	0.94 encounters/week
Parsons, Lelutiu-Weinberger, Botisko, & Golub, 2012	New York City	2007-2010	ACASI, in-person interview; 30 day timeline follow-back	n=188 HIV- MSM between the ages of 18 and 29 without HIV+ partner	Day-level AI	Median of 5 anal intercourse days per person
Prestage et al., 2005	Sydney	2001-2003	In-person interview	n=207 HIV- MSM with regular partners, and n=264 HIV- with casual partners, reporting both PAI and UAI	Last 2 AI: with and without a condom	2 encounters per person for each comparison

Table 9.1 continued.

Author and year	Location	Years data collected	Collection method	Sample size	Encounter definition	Encounters per person
Reisen, Iracheta, Zea, Bianchi, & Poppen, 2010	New York City	2003-2008?	ACASI	n=315 Colombian, Dominican, or Brazilian MSM reporting at least one public and one private sex event	Sexual behaviour with a partner	2 encounters--last public and last private
A. M. A. Smith, Grierson, Pitts, & Pattison, 2006	Melbourne, Australia	2002	In-person interview	n=202 MSM	Most recent encounter with up to 5 different partners	733 encounters for 202 men
Van der Bij et al., 2007	Amsterdam	2004-2006	Self-administered or nurse-administered questionnaire	n=513 MSM with traceable partners, n=160 low-risk HIV- MSM with anonymous partners, n=235 MSM reporting UAI	Sexual behaviour with up to 4 traceable, anonymous partners in prior 6 months	Up to 4 encounters; 372 UAI episodes over 235 MSM
Wilson, 2004	New York City	2002-2003	In-person interview	n=116 Latino stimulant-using MSM	Last 2 AI with substance use: with and without a condom	2 encounters per person for each comparison
Wilson, Cook, McGaskey, Rowe, & Dennis, 2008	New York City	2004-2008?	Structured weekly internet sex diary for 6 weeks	n=100 HIV+ MSM	Last AI in the week	About 3 encounters per sexually active participant; 275 encounters for 100 MSM, of which 258 analysed
Wilson, Diaz, Yoshikawa, Shrout, & Diaz, 2009	New York City, Miami, Los Angeles	1998-1999	Survey and in-person structured interview	n=270 Latino MSM reporting inconsistent condom use	Last 2 AI: with and without a condom	2 encounters
Zablotska et al., 2009	New South Wales	1998-2006	In-person interview	n=627 MSM: n=407 HIV- MSM, n=220 HIV+ MSM	Last 2 AI with casual partner not known serodiscordant: with and without a condom	HIV- MSM: 797 encounters for 407 respondents HIV+ MSM: 437 encounters for 220 respondents
Zea, Reisen, Poppen, & Bianchi, 2009	New York City	2003-2008?	ACASI	n=413 MSM reporting at least 3 male encounters	Sexual behaviour with a partner across a range of settings and contexts	1777 encounters for 413 respondents

Table 9.2 continued.

Author and year	Analytic method	Outcome variables	Univariate model results	Event-level multivariate results	Person-level multivariate results
Coffax et al., 2004	CLR	Serotonconcordant UAI v. other AI or OI	Drinks: 1-2 1.2 ns, 3-5 1.7***, ≥ 6 3.3***; substance use 1.9***; partner alcohol: yes 1.8***, unknown 1.8***; partner substance use: yes 2.0***, unknown 1.8*** Partner age: 26-35 0.8 ns, 36-45 0.7***, >45 0.7*; partner type: steady non-primary 1.2 ns, nonsteady 1.5***; partner attractiveness: very 0.9 ns, extremely 1.0 ns; location: sex club or bath 1.5**, other 0.9 ns; encounters with partner in last six months: 2-5 1.0 ns, ≥ 6 0.8**	Drinks: 1-2 1.0 ns, 3-5 1.2 ns, ≥ 6 2.4***; substance use 1.5*; partner alcohol: yes 1.3*, unknown 1.2 ns; partner substance use: yes 1.5**, unknown 1.6** Partner age: 26-35 0.8*, 36-45 0.7*, >45 0.7 ns; partner type: steady non-primary 1.2 ns, nonsteady 1.3 ns; location: sex club or bath 1.1 ns, other 0.8*; encounters with partner in last six months: 2-5 1.2 ns, ≥ 6 1.2 ns	None
Hensel, Rosenberger, Novak, & Reece, 2012	GEE	Condom use with RAI v. other sex	None reported	Affective: negative mood 0.94 ns, non-AI sexual contact 0.82 ns Partner: casual 6.59*; older 0.42 ns, younger 0.61 ns Situational: lubricant use 0.68 ns, enema use 0.88 ns, event at residence 0.66 ns, ejaculation 0.71 ns, partner ejaculated 0.34 ns, duration of penetration 1.04 ns Subjective: erection difficulty 0.61 ns, pleasure 0.26*, arousal 2.01 ns, satisfaction with partner 1.90 ns	Condom nonuse in last 7 days: 0.04*
	GEE	Condom use with IAI v. other sex	None reported	Affective: negative mood 0.98 ns, non-AI sexual contact 0.82 ns Partner: casual 4.24*; older 1.87 ns, younger 2.06 ns Situational: lubricant use 0.57 ns, partner enema use 0.98*, event at residence 0.91 ns, ejaculation 0.81 ns, partner ejaculated 1.42 ns, duration of penetration 0.99 ns Subjective: erection difficulty 1.02 ns, pleasure 1.84*, arousal 0.59*, satisfaction with partner 1.12 ns	Condom nonuse in last 7 days: 0.57 ns
Horvath, 2005	Paired t-tests	AI v. other sex	Internet: 58% v. non: 48%, ns	None	None
	Paired t-tests	RAI v. other sex	Internet: 23% v. non: 24%, ns		
	Paired t-tests	IAI v. other sex	Internet: 41% v. non: 31%, ns		
	Paired t-tests	URAI v. other sex	Internet: 10% v. non: 12%, ns		
	Paired t-tests	UIAI v. other sex	Internet: 21% v. non: 14%, ns		

Table 9.2 continued.

Author and year	Analytic method	Outcome variables	Univariate model results	Event-level multivariate results	Person-level multivariate results
Irwin, Morgenstern, Parsons, & Weinberg, & Labovvie, 2006	Paired one-tailed t-test	Proportion of AI UAI by alcohol consumption	47% of non-alcohol AI events were UAI, 60% of alcohol AI events were UAI; one-tailed test*	None	None
	Paired one-tailed t-test	Proportion of AI URAI by alcohol consumption	58% of non-alcohol RAI events were UAI, 59% of alcohol IAI events were UAI; one-tailed test ns		
	Paired one-tailed t-test	Proportion of AI UIAI by alcohol consumption	45% of non-alcohol RAI events were URAI, 64% of alcohol RAI events were URAI; one-tailed test*		
Koblin et al., 2007	CLR	UAI v. PAI	Amphetamine 4.5*	Amphetamine 4.9* Event-level covariate results not reported	None
Lyons, Smith, Grierson, & von Doussa, 2010	Logistic regression with robust variance estimation	PAI v. other sex	None reported	Age: 18-24 26.9%, 25-34 39.3%, 35-44 78.5%, 45-54 23.2%, 55+ 71.0%, don't know 9.3%; Wald test ns HIV status: - 30.4%, + 20.0%, don't know 27.6%; Wald test ns Attractiveness: below average 32.3%, average 29.0%, above average 12.0%, unclear 8.1%; Wald test ns Partner affected by alcohol: yes 28.0%, no 34.1%, don't know 16.7%; Wald test ns Partner affected by drugs: yes 27.8%, no 28.3%, don't know 21.9%; Wald test ns	None
				Age: 18-24 3.9%, 25-34 6.0%, 35-44 4.2%, 45-54 2.9%, 55+ 3.2%, don't know 7.0%; ns HIV status: - 17.4%*, + 40.0%*, don't know 3.5% (ref) Attractiveness: below average 5.2%, average 4.5%, above average 4.0%, unclear 2.7%; ns Partner affected by alcohol: yes 3.7%*, no 15.9% (ref), don't know (0%) Partner affected by drugs: yes 11.1%, no 4.5%, don't know (0%); ns	
	Logistic regression with robust variance estimation	UAI v. other sex		Age: 18-24 23.1%, 25-34 23.1%, 35-44 13.9%, 45-54 7.3%, 55+ 9.7%, don't know 4.6%; ns HIV status: - 26.1%, + 60.0%*, don't know 13.4% (ref) Attractiveness: below average 16.1%, average 16.5%, above average 12.0%, unclear (0%); ns Partner affected by alcohol: yes 29.5%, no 13.7%, don't know 5.6%; ns Partner affected by drugs: yes 25.0%, no 15.0%, don't know 2.4%; ns	

Table 9.2 continued.

Author and year	Analytic method	Outcome variables	Univariate model results	Event-level multivariate results	Person-level multivariate results
	Logistic regression with robust variance estimation	RAI v. other sex		Age: 18-24 3.8%, 25-34 18.8%, 35-44 16.7%, 45-54 17.4%, 55+ 6.4%, don't know 9.3%, ns HIV status: - 13.0%, + (0%), don't know 15.4%, ns Attractiveness: below average 17.7%, average 14.8%, above average 4.0%, unclear 10.8%; ns Partner affected by alcohol: yes 15.9%, no 15.7%, don't know 8.3%; ns Partner affected by drugs: yes 11.1%, no 15.3%, don't know 17.1%; ns	
Minichiello, Marino, Khan, & Browne, 2003	GLMM	Unsafe sex	No substance use by MSW*, marijuana use by MSW*, polysubstance use: by MSW**, by client*	Baseline risk 11.1%, only marijuana use by MSW 3.8%*, no substance use by MSW 5.9%*	None
Mustanski, 2007	GLMM	UAI v. other sex	None reported	Meeting partner online 0.40*	Age 0.97 ns
	GLMM	UAI v. PAI		Meeting partner online 0.99 ns	Age 0.35 ns
	GLMM	Having a sex partner	None reported	Number of drinks 1.18***	Age 1.01 ns, moderating age effect 1.01 ns
Mustanski, 2008	GLMM	Day-level sexual risk index (0=handjob, protected fellatio; 1=PAI, unprotected fellatio; 2=unprotected fellatio; 4=UAI; 7=URAI)	Number of drinks 0.12 ns	Number of drinks 0.29*** New partner effect -0.01 ns	Age -0.02 ns, moderating age effect 0.04***
	GLMM	Encounter-level UAI v. other sex	None reported	Number of drinks 1.01 ns	Age 0.99 ns, moderating age effect 1.01*
Nagaraj et al., 2013	Logistic regression with robust variance estimation	UAI v. other sex	Knowledge of: HIV+ 0.21 ns, HIV- 0.96 ns, don't know (ref)	None	None
Newcomb, 2013	GLMM	UAVI v. other sex	None reported	Number of drinks before sex 1.07 ns Number of drinks interaction with: age 0.99**, Black 1.07 ns, Hispanic 1.14 ns, other 1.09 ns; bisexual 0.99 ns; sensation seeking 1.15**; baseline alcohol use 0.99 ns Drug use before sex 1.81** Female partner 5.70***, number of previous encounters with partner 1.00 ns	Age 1.03 ns; Black 0.47 ns, Hispanic 1.03 ns, other 1.09 ns; bisexual 1.03 ns; sensation seeking 1.59 ns; baseline alcohol use 1.01 ns
Newcomb & Mustanski, 2013	GLMM	UAVI v. other sex	None reported	Partner: age 1.00 ns, number of previous encounters 1.00 ns, female 4.59***, HIV+ Likert 1.09 ns, black 1.06 ns	Age 1.00 ns, Black 0.32**, bisexual 1.29 ns

Table 9.2 continued.

Author and year	Analytic method	Outcome variables	Univariate model results	Event-level multivariate results	Person-level multivariate results
	GLMM	UAI v. other sex		Partner age and: participant age 0.99 ns, Black participant 1.34*, Black participant age 0.96* Previous encounters and: participant's age 1.00 ns, Black participant 1.04**, Black participant age 1.00 ns	None reported
Parsons, Lelutiu-Weinberger, Boisko, & Golub, 2012	GEE	Day-level UAI v. day-level PAI	Cocaine 2.22**, MDMA 1.43 ns, methamphetamine 2.40*, GHB 2.33*, ketamine 4.36 ns, any substance 2.15***; main partner 2.62 ns BSI: total 1.03 ns, depression 1.04 ns, anxiety 1.05 ns; DB: 1.08***	Model 1: any drug 2.17***, main partner 4.25* Model 2: any drug 2.24***, main partner 7.33* Final model: any drug 2.08***, main partner 5.36***	Model 1: BSI total 1.36*, BSI and main partner interaction 0.15*** Model 2: DB 1.93***, DB and main partner interaction 2.01 ns Final model: BSI 1.16, DB 1.92***, BSI and main partner interaction 0.15***
Prestage et al., 2005	McNemar's test for within-subject comparisons	Casual partners: UAI v. PAI	Meeting partner: SOPV 30.7% v. 33.7%, gay bar 24.3% v. 29.6%, internet 12.95 v. 13.3%, through friends 7.2% v. 8.0%; all ns Location: respondent home 32.6% v. 35.6%, partner home 26.1% v. 24.2%, SOPV 31.1% v. 34.8%; all ns Drug use: alcohol 39.8% v. 36.0%, poppers 29.5% v. 26.1%, other drugs 23.1% v. 21.2%, sildenafil 9.5% v. 7.2%; all ns Group sex 11.7% v. 6.8%*, HIV- partner 29.5% v. 21.6%**, knowledge of serostatus prior to sex 30.3% v. 22.0%** Type of AI: IAI with ejaculation 23.9% v. 34.2%***, IAI without ejaculation 51.9% v. 39.0%***, RAI with ejaculation 12.5% v. 24.7%***, RAI without ejaculation 34.5% v. 27.7% ns	None	None
	McNemar's test for within-subject comparisons	Regular partners: UAI v. PAI	Location: respondent home 64.7% v. 60.4%, partner home 29.0% v. 31.4%; all ns Drug use: alcohol 25.9% v. 28.0%, poppers 29.0% v. 30.0%, other drugs 19.1% v. 20.8%, sildenafil 3.1% v. 3.4%; all ns Type of AI: IAI with ejaculation 35.7% v. 39.1%, IAI without ejaculation 37.2% v. 33.8%, RAI with ejaculation 31.9% v. 30.0%, RAI without ejaculation 28.0% v. 32.4%; all ns		

Table 9.2 continued.

Author and year	Analytic method	Outcome variables	Univariate model results	Event-level multivariate results	Person-level multivariate results
Reisen, Iracheta, Zea, Bianchi, & Poppen, 2010	McNemar's test for within-subject comparisons	Fellatio, manual penile stimulation, anilingus, manual anal stimulation, AI, UAI, group sex, alcohol use, drug use, known seroconcordance	Fellatio 88.0 v. 92.0 ns, manual penile stimulation 54.0 v. 52.0 ns, anilingus 28.0 v. 60.0***, manual anal stimulation 45.0 v. 63.0***, AI 55.0 v. 80.0***, UAI 14.0 v. 23.0***, group sex 33.0 v. 9.0***, alcohol use 34.0 v. 39.0 ns, drug use 25.0 v. 25.0 ns, known seroconcordance 8.0 v. 31.0***	None	None
A. M. A. Smith, Grierson, Pitts, & Pattison, 2006	GLMM, backwards stepwise selection, social network analysis	PAI v. NAI	None reported	Partner: occasional 3.29** , casual 2.64** , HIV+ 0.47** , HIV? 1.75 ns Location: partner's home 1.55 ns, beat 0.06*** , sauna 2.14*** , SOPV 2.22 ns, other 0.47 ns Partner intoxicated 1.55*	Majority gay social network 2.48**
	GLMM, backwards stepwise selection, social network analysis	UAI v. NAI		Partner: occasional 0.41*** casual 0.11*** , HIV+ 0.18*** , HIV? 3.00*** Location: partner's home 1.99 ns, beat 0.85 ns, sauna 1.91 ns, SOPV 17.99*** , other 1.95 ns	IDU: not in last year 0.86 ns, in last year 9.97***
Van der Bij et al., 2007	GEE	Traceable partners: AI v. other sex	Lower-risk HIV- MSM** : unknown 69%, discordant 54%, concordant 80% Lower-risk HIV+ MSM (NA) : unknown 57%, discordant 89%, concordant 100% High-risk HIV- MSM** : unknown 74%, discordant 75%, concordant 88% High-risk HIV+ MSM* : unknown 76%, discordant 83%, concordant 95%	None	None
	GEE	Traceable partners: UAI v. other sex	Lower-risk HIV- MSM*** : unknown 17%, discordant 19%, concordant 50% Lower-risk HIV+ MSM ns: unknown 36%, discordant 22%, concordant 72% High-risk HIV- MSM*** : unknown 39%, discordant 38%, concordant 72% High-risk HIV+ MSM*** : unknown 40%, discordant 36%, concordant 82%		
	GEE	Anonymous partners: AI v. other sex	Lower-risk HIV- MSM ns: Unknown 70%, discordant 71%, concordant 79%		
	GEE	Anonymous partners: UAI v. other sex	Lower-risk HIV- MSM ns: Unknown 13%, discordant 21%, concordant 26%		
	GEE, forward stepwise selection on Wald test	Traceable partners: Concordant UAI v. other sex	>35 years 1.61 ns, high-risk 1.55 ns, HIV+*, main partner***, syphilis*	Main partner 3.6* , partner met on internet 1.6* , same age 1.5 ns	Age ns, high-risk ns, HIV+ 2.1* , interaction between lower risk and anonymous UAI 0.3*

Table 9.2 continued.

Author and year	Analytic method	Outcome variables	Univariate model results	Event-level multivariate results	Person-level multivariate results
Wilson, 2004	CLR	UAI v. PAI	Substance use by self: meth 1.75, cocaine/crack 1.30, non-stimulant 0.91; all ns Perception of being very high 1.35 ns Partner substance use 1.92* Heightened attraction: physical 1.24, emotional 1.63; all ns Partner type: regular 1.36, anonymous 0.96; known HIV status 1.85 ns Condom discussions 0.52* Setting: home 1.23, other's home 1.19, SOPV 0.64; all ns Time since episode <1 month 0.62 ns	Model 1--univariate combinations: Meth use and: partner drug use 2.00 ns, emotional attraction 1.89 ns, regular partner 1.09 ns, no condom discussion 4.00**, home 0.90 ns, other home 1.78 ns, SOPV 0.60 ns Model 2--multivariate: partner drug use 1.61 ns, emotional attraction 1.37 ns, known HIV status 1.76 ns, condom discussions 0.43**, time since episode <1 month 0.61 ns Model 3--multivariate: partner drug use 1.57 ns, emotional attraction 1.37 ns, known HIV status 1.67 ns, condom discussions 0.74 ns, time since episode <1 month 0.67 ns, meth use and: partner drug use 1.07 ns, no condom discussion 3.13 ns	None
Wilson, Cook, McGaskey, Rowe, & Dennis, 2008	GLMM	UAI v. PAI	Substance use: self 2.3*, partner 2.8**, self and partner 2.4* Partner: met online 4.3**, partner physically ideal 0.8 ns, strong emotional attraction 0.7 ns, strong sexual attraction 0.8 ns Discussions about HIV/condom use 0.4**: multiple partners 2.2 ns; sex party or bathhouse 1.6 ns Substance use: self 1.4 ns, partner 1.1 ns, self and partner 0.9 ns Partner: met online 2.9*, partner physically ideal 0.6 ns, strong emotional attraction 0.8 ns, strong sexual attraction 0.3* Discussions about HIV/condom use 0.5 ns; multiple partners 0.9 ns; sex party or bathhouse 6.3**	Substance use: self ns, partner ns, self and partner ns Met partner online* Discussions about HIV/condom use*	None reported
	GLMM	Serononconcordant UAI v. other AI	Substance use: self 1.4 ns, partner 1.1 ns, self and partner 0.9 ns Partner: met online 2.9*, partner physically ideal 0.6 ns, strong emotional attraction 0.8 ns, strong sexual attraction 0.3* Discussions about HIV/condom use 0.5 ns; multiple partners 0.9 ns; sex party or bathhouse 6.3** Substance use: self 1.25 ns, partner 1.69*, self and partner 1.31 ns Attraction: physical 1.56*, emotional 1.66* Partner: known HIV status 1.54 ns, regular 2.23**; condom discussion 0.32**	Partner: met partner online*, strong sexual attraction* Sex party or bathhouse*	None reported
Wilson, Diaz, Yoshikawa, Shrout, & Diaz, 2009	CLR	UAI v. PAI	Awareness of partner's status: did not know/assume (ref), knew/discussed PRR 5.12**, assumed PRR 3.55*** Age: <35 (ref), 35-49 PRR 0.87 ns, ≥50 PRR 0.71*, time since HIV diagnosis 0-1 (ref), 2-9 PRR 0.72 ns, ≥10 PRR 0.56* No use of: alcohol PRR 0.99 ns, poppers 1.09 ns,	Substance use by partner 1.82* Attraction: physical 1.49 ns, emotional 1.17 ns Partner: known HIV status 1.26 ns, regular partner 1.55 ns, condom discussion 0.32**	None
Zablotska et al., 2009	Log binomial regression with robust variance estimation	HIV+ MSM: UAI v. PAI	Awareness of partner's status: did not know/assume (ref), knew/discussed PRR 5.12**, assumed PRR 3.55*** Age: <35 (ref), 35-49 PRR 0.87 ns, ≥50 PRR 0.71*, time since HIV diagnosis 0-1 (ref), 2-9 PRR 0.72 ns, ≥10 PRR 0.56* No use of: alcohol PRR 0.99 ns, poppers 1.09 ns,	Awareness of partner's status: did not know/assume (ref), knew/discussed PRR 5.17***, assumed PRR 3.70*** No use of other drugs 1.05 ns	Age: <35 (ref), 35-49 PRR 0.75 ns, ≥50 PRR 0.71 ns; time since HIV diagnosis 0-1 (ref), 2-9 PRR 0.91 ns, ≥10 PRR 0.95*

Table 9.2 continued.

Author and year	Analytic method	Outcome variables	Univariate model results	Event-level multivariate results	Person-level multivariate results
Zea, Reisen, Poppen, & Bianchi, 2009			sildenafil 1.11 ns, other drugs 1.28*		
	Log binomial regression with robust variance estimation	HIV- MSM: UAI v. PAI	Awareness of partner's status: did not know/assume (ref), knew/discussed PRR 1.86**, assumed PRR 2.06** Age: <35 (ref), 35-49 PRR 0.93 ns, ≥50 PRR 1.04 ns No use of: alcohol PRR 1.35*, poppers 0.87 ns, sildenafil 1.07 ns, other drugs 1.11 ns	Awareness of partner's status: did not know/assume (ref), knew/discussed PRR 1.88**, assumed PRR 2.12** No use of alcohol 1.36*	Age: <35 (ref), 35-49 PRR 0.98 ns, ≥50 PRR 1.08 ns
	GLMM	UAI v. other sex	None reported	Desire for sex 4.00**	Self-efficacy 1.59*, self-efficacy and desire interaction 0.72**
	GLMM	UAI v. other sex		Substance use 1.39*	Self-efficacy 0.83*
	GLMM	UAI v. other sex		Seroconcordance 1.74*	Depression ns
	GLMM	UAI v. other sex		Partner closeness 1.57*	Depression ns
	GLMM	UAI v. other sex		STI concern 0.30*	Depression 1.24*
	GLMM	UAI v. other sex		Partner closeness 3.57**	Age 1.05**, age and closeness interaction 0.98**

Table 10.1. Key excluded studies and reasons for their exclusion.

Author and year	Reason for exclusion
Clerkin, Newcomb, & Mustanski, 2011	Frequency in partnership analysis
Dolezal, Carballo-Diequez, Nieves-Rosa, & Diaz, 2000	Data collected 1995-1996
Drumright et al., 2006	Partnership-level analysis
Drumright et al., 2007	Partnership-level analysis
Drumright, Gorbach, Little, & Strathdee, 2009	Partnership-level analysis
Gillmore et al., 2002	Data collected 1995-1999
Myers et al., 1999	Data collected 1995
Newcomb, Clerkin, & Mustanski, 2011	Frequency in partnership analysis

Table 12.1. Variables used in each set of analyses.

Gray boxes indicate that this variable was used for analysing some outcomes but not others.

Variable	Multipartner encounters	New partner encounters		Single-partner encounters		
		CLRs	GEEs	CLRs	MLMs	LCA
UAI	✓	✓	✓	✓	✓	✓
Quality of the sex	✓	✓	✓	✓	✓	
Control over what happened	✓	✓	✓	✓	✓	
Any substance use by respondent	✓	✓	✓	✓	✓	
Number of substances used	✓	✓	✓	✓	✓	✓
Substance use by respondent: specific						
Poppers	✓	✓	✓	✓	✓	
Alcohol	✓	✓	✓	✓	✓	
Erectile dysfunction medications	✓	✓	✓	✓	✓	
Cannabis	✓	✓	✓	✓	✓	
MDMA	✓		✓	✓	✓	
Amphetamine (speed)						
Crystal methamphetamine	✓		✓	✓	✓	
Heroin						
Mephedrone	✓					
GHB	✓		✓	✓	✓	
Ketamine	✓		✓	✓	✓	
LSD						
Cocaine	✓	✓	✓	✓	✓	
Crack						
Any other drug						
Any substance use by partner	✓			✓	✓	
Number of substances used by partner	✓			✓	✓	
Substance use by partner: specific						
Alcohol	✓			✓	✓	
Erectile dysfunction medications	✓			✓	✓	
Cannabis	✓			✓	✓	
MDMA	✓			✓	✓	
Amphetamine (speed)						
Crystal methamphetamine	✓			✓	✓	
Heroin						
Mephedrone	✓					
GHB	✓			✓	✓	
Ketamine	✓			✓	✓	
LSD						
Cocaine	✓			✓	✓	
Crack						
Any other drug						
Number of participants	✓					
Location of sex	✓	✓	✓	✓	✓	✓
Relationship status with partner				✓	✓	✓
Serodiscordance	✓			✓	✓	✓
Perceived HIV transmission risk		✓	✓			
Month of encounter	✓			✓	✓	✓

Table 13.1. Number of surveys submitted per month.

Month	Submitted	% of enrolment
Enrolment	3,390	100
1	1,823	53.8%
2	1,728	51.0%
3	1,729	51.0%
5	1,542	45.5%
7	1,466	43.2%
10	1,394	41.1%
13	1,463	43.2%

Table 13.2. Demographic characteristics of enrolment survey sample.

Variable	N	n (%) Mean (SD, range)
Gender	3,375	
Man		99.6% (3,362)
Transman		0.4% (13)
Age	3,375	41.0 (12.0, 16-83)
16-19		1.6% (54)
20-29		18.3% (618)
30-39		25.5% (860)
40-49		30.1% (1,015)
50-59		17.2% (582)
60-69		6.5% (220)
70+		0.8% (26)
Education	3,359	
Low (no secondary qual, CSE, O-level)		20.0% (670)
Medium (A-level, higher ed below degree)		34.3% (1,152)
High (university degree)		45.8% (1,537)
Gross income per annum	3,367	
<£5,000		5.9% (199)
£5,000-£9,999		8.4% (284)
£10,000-£14,999		9.2% (310)
£15,000-£19,999		11.3% (379)
£20,000-£24,999		12.1% (409)
£25,000-£29,999		10.1% (340)
£30,000-£34,999		8.7% (293)
£35,000-£39,999		6.0% (203)
≥£40,000		20.7% (698)
Do not wish to respond		7.5% (252)
Ethnic group	3,364	
White British		80.6% (2,712)
White other		12.8% (429)
Black		2.1% (70)
Asian		2.8% (95)
Other		1.7% (58)
Strategic Health Authority of residence	3,280	
London		33.1% (1,085)
South West		8.5% (278)
South Central		6.3% (206)
South East Coast		9.5% (310)
East of England		7.1% (233)
East Midlands		6.2% (204)
West Midlands		6.9% (227)
Yorkshire and the Humber		6.8% (224)
North West		12.1% (396)
North East		3.6% (117)

Table 13.3. Sexual health and history, relationships and gender orientation characteristics of enrolment survey sample.

Variable	N	n (%) Mean (SD, range)
SEXUAL HEALTH AND HISTORY		
Ever received an HIV test result in first report	2,555	
No, never received a result		15.9% (406)
Yes, tested positive		18.0% (461)
Yes, last test negative		66.1% (1,688)
Positive test for non-HIV STI in first report	2,419	
No		97.0% (2,347)
Yes		3.0% (72)
RELATIONSHIPS AND GENDER ORIENTATION		
Relationship status at enrolment	3,360	
Single		54.3% (1,824)
One man only		37.3% (1,252)
Two or more men, no women		2.9% (98)
One or more women		5.5% (186)
Gender of attraction	3,375	
Men only		80.3% (2,710)
Mostly to men		13.6% (458)
Both men and women		4.3% (145)
Mostly to women		1.8% (62)
Describe sexual orientation	3,355	
Gay or homosexual		84.3% (2,828)
Straight or other		15.7% (527)
Outness	3,362	
Some or all		84.4% (2,837)
Few or none		15.6% (525)

Table 14.1. Demographic characteristics of multipartner encounter sample respondents.

Variable	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value
Gender	320			p = 1.000
Man		99.7% (319)	99.6% (3,043)	
Transman		0.3% (1)	0.4% (12)	
Age	320	44.6 (10.5, 18-70)	40.6 (12.1, 16-83)	p < 0.0001
16-19		0.6% (2)	1.7% (52)	p < 0.001
20-29		7.5% (24)	19.4% (594)	
30-39		21.9% (70)	25.9% (790)	
40-49		37.8% (121)	29.3% (894)	
50-59		23.8% (76)	16.6% (506)	
60-69		7.8% (25)	6.4% (195)	
70+		0.6% (2)	0.8% (24)	
Education	319			p = 0.003
Low (no secondary qual, CSE, O-level)		13.5% (43)	20.6% (627)	
Medium (A-level, higher ed below degree)		33.5% (107)	34.4% (1,045)	
High (university degree)		53.0% (169)	45.0% (1,368)	
Gross income per annum	319			p = 0.10
<£5,000		2.8% (9)	6.2% (190)	
£5,000-£9,999		9.1% (29)	8.4% (255)	
£10,000-£14,999		6.0% (19)	9.6% (291)	
£15,000-£19,999		10.3% (33)	11.4% (346)	
£20,000-£24,999		12.5% (40)	12.1% (369)	
£25,000-£29,999		13.5% (43)	9.7% (297)	
£30,000-£34,999		7.5% (24)	8.8% (269)	
£35,000-£39,999		5.3% (17)	6.1% (186)	
≥£40,000		26.6% (85)	20.1% (613)	
Do not wish to respond		6.3% (20)	7.6% (232)	
Ethnic group	319			p = 0.90
White British		79.3% (253)	80.8% (2,459)	
White other		14.4% (46)	12.6% (383)	
Black		1.9% (6)	2.1% (64)	
Asian		2.5% (8)	2.9% (87)	
Other		1.9% (6)	1.7% (52)	
Strategic Health Authority of residence	310			p = 0.22
London		39.7% (123)	32.4% (962)	
South West		9.4% (29)	8.4% (249)	
South Central		6.1% (19)	6.3% (187)	
South East Coast		8.7% (27)	9.5% (283)	
East of England		6.1% (19)	7.2% (214)	
East Midlands		5.2% (16)	6.3% (188)	
West Midlands		5.2% (16)	7.1% (211)	
Yorkshire and the Humber		5.8% (18)	6.9% (206)	
North West		12.3% (38)	12.1% (358)	
North East		1.6% (5)	3.8% (112)	

Table 14.2. Sexual health and history, relationships and gender orientation characteristics of multipartner encounter sample respondents.

Variable	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value
SEXUAL HEALTH AND HISTORY				
Included encounters	321	1.36 (0.61, 1-3)		
Ever received an HIV test result in first report	321			p < 0.001
No, never received a result		8.7% (28)	16.9% (378)	
Yes, tested positive		26.8% (86)	16.8% (375)	
Yes, last test negative		64.5% (207)	66.3% (1,481)	
Positive test for non-HIV STI in first report	317			p = 0.11
No		95.6% (303)	97.2% (2,044)	
Yes		4.4% (14)	2.8% (58)	
RELATIONSHIPS AND GENDER ORIENTATION				
Relationship status at enrolment	319			p = 0.001
Single		44.8% (143)	55.3% (1,681)	
One man only		42.0% (134)	36.8% (1,118)	
Two or more men, no women		5.0% (16)	2.7% (82)	
One or more women		8.1% (26)	5.3% (160)	
Gender of attraction	320			p = 0.28
Men only		76.3% (244)	80.7% (2,466)	
Mostly to men		16.3% (52)	13.3% (406)	
Both men and women		5.0% (16)	4.2% (129)	
Mostly to women		2.5% (8)	1.8% (54)	
Describe sexual orientation	316			p = 0.95
Gay or homosexual		84.2% (266)	84.3% (2,562)	
Straight or other		15.8% (50)	15.7% (477)	
Outness	318			p = 0.79
Some or all		84.9% (270)	84.3% (2,567)	
Few or none		15.1% (48)	15.7% (477)	

Table 14.3. Encounter-level and individual-level characteristics for the sample of multipartner encounters

Variable	Encounter-level		Individual-level	
	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)
UAI	438	37.7% (165)	321	36.8%
Quality of the sex	435	6.8 (1.6, 1-10)	320	6.8 (1.6)
Control over what happened	436		321	
Totally/mostly in control		87.2% (380)		88.6%
Some/no control		12.8% (56)		11.4%
Any substance use by respondent	437	67.7% (296)	320	65.1%
Number of substances used	433	1.6 (1.8, 0-10)	319	1.5 (1.8)
Substance use by respondent: specific	437		320	
Poppers	434	45.4% (197)		44.2%
Alcohol		38.0% (166)		34.6%
Erectile dysfunction medications		26.3% (115)		24.1%
Cannabis		5.3% (23)		5.6%
MDMA		7.8% (34)		6.6%
Amphetamine (speed)		1.1% (5)		1.2%
Crystal methamphetamine		8.0% (35)		7.4%
Heroin		0.5% (2)		0.3%
Mephedrone		7.3% (32)		7.2%
GHB		9.2% (40)		9.2%
Ketamine		6.0% (26)		6.4%
LSD		0.7% (3)		0.6%
Cocaine		7.1% (31)		7.6%
Crack		0% (0)		0.0%
Any other drug		0.2% (1)		0.3%
Any substance use by partner	436		319	
No substance use by partner		30.7% (134)		32.2%
Don't know		25.9% (113)		26.9%
Yes, but unsure what		14.2% (62)		12.7%
Yes, specifically		29.1% (127)		28.2%
Number of substances used by partner	436	0.8 (1.6, 0-13)	319	0.8 (1.5)
Substance use by partner: specific	436		319	
Alcohol		21.8% (95)		20.3%
Erectile dysfunction medications		13.8% (60)		13.1%
Cannabis		3.9% (17)		4.1%
MDMA		5.1% (22)		5.0%
Amphetamine (speed)		0.7% (3)		0.6%
Crystal methamphetamine		6.4% (28)		6.5%
Heroin		0.2% (1)		0.2%
Mephedrone		6.4% (28)		6.7%
GHB		7.3% (32)		7.5%
Ketamine		5.7% (25)		6.3%
LSD		0.2% (1)		0.2%
Cocaine		5.5% (24)		6.2%
Crack		0% (0)		0%
Any other drug		0.7% (3)		0.8%

Table 14.3 continued.

Variable	Encounter-level		Individual-level	
	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)
Number of participants	437	3.7 (4.3, 1-50)	320	3.7 (4.6)
Serodiscordance	434		320	
All partners believed HIV+ or HIV-		21.7% (94)		22.0%
Didn't care, didn't notice, didn't remember		74.9% (325)		74.2%
At least one person of different serostatus		3.5% (15)		3.8%
Location of sex	434		319	
Private (residence, hotel)		51.6% (224)		51.6%
Sex-on-premises venue		37.6% (163)		36.3%
Cruising or outdoors location		10.8% (47)		12.1%
Month of reporting	438			
Month 7		35.6% (156)		
Month 10		30.4% (133)		
Month 13		34.0% (149)		

Table 14.4. Initial models testing associations with UAI in the sample of multipartner encounters.

Variable	n	Group n	OR (95% CI)	Intercept (95% CI)	Model fit
Any substance use by respondent	437	320	1.73* (1.12, 2.70)	0.41*** (0.28, 0.60)	576.14
Number of substances used	433	319	1.24*** (1.11, 1.40)	0.42*** (0.31, 0.56)	557.91
Substance use by respondent: specific	433	319		0.46*** (0.33, 0.64)	553.29
Poppers			1.06 (0.69, 1.65)		
Alcohol			0.82 (0.50, 1.34)		
Erectile dysfunction medications			2.23* (1.26, 3.96)		
Cannabis			0.58 (0.21, 1.57)		
MDMA			0.64 (0.25, 1.61)		
Crystal methamphetamine			3.18* (1.19, 8.48)		
Mephedrone			1.05 (0.42, 2.59)		
GHB			1.50 (0.54, 4.17)		
Ketamine			1.64 (0.63, 4.30)		
Cocaine			0.92 (0.39, 2.14)		
Any substance use by partner	436	319		0.45*** (0.31, 0.66)	584.36
No substance use			Reference		
Don't know			1.33 (0.80, 2.23)		
Yes, but unsure what			1.33 (0.72, 2.46)		
Yes, specifically			1.71* (1.03, 2.83)		
Number of substances used by partner	436	319	1.14* (1.02, 1.28)	0.53*** (0.42, 0.68)	575.52
Substance use by partner: specific	436	319		0.54*** (0.42, 0.69)	570.95
Alcohol			0.85 (0.49, 1.47)		
Erectile dysfunction medications			2.68* (1.20, 6.01)		
Cannabis			0.91 (0.34, 2.48)		
MDMA			0.70 (0.23, 2.10)		
Crystal methamphetamine			3.21* (1.05, 9.82)		
Mephedrone			1.66 (0.58, 4.74)		
GHB			0.42 (0.12, 1.51)		
Ketamine			0.91 (0.34, 2.43)		
Cocaine			0.64 (0.25, 1.63)		
Number of participants	437	320	1.04 (0.99, 1.08)	0.52*** (0.39, 0.69)	580.50

Table 14.4 continued.

Variable	n	Group n	OR (95% CI)	Intercept (95% CI)	Model fit
Serodiscordance	434	320		1.18 (0.78, 1.78)	559.96
All partners believed HIV+ or HIV-			Reference		
Didn't care, didn't notice, didn't remember			0.39*** (0.25, 0.63)		
At least one person of different serostatus			0.62 (0.21, 1.81)		
Location of sex	434	319		0.69** (0.52, 0.91)	578.76
Private (residence, hotel)			Reference		
Sex-on-premises venue			0.74 (0.49, 1.12)		
Cruising or outdoors location			0.71 (0.36, 1.40)		
Control over what happened	436	321		1.05 (0.59, 1.73)	569.87
Some/no control			Reference		
Totally/mostly in control			0.54* (0.31, 0.94)		
Quality of the sex	435	320	1.17** (1.04, 1.32)	0.20*** (0.09, 0.46)	571.80
Month of reporting	438	321		0.52*** (0.38, 0.70)	585.68
Month 7			Reference		
Month 10			1.03 (0.71, 1.49)		
Month 13			1.43* (1.01, 2.03)		

Table 14.5. Multivariate models with categorical measures of any substance use testing associations with UAI in the sample of multipartner encounters.

Variable	Main effects n=435 in 318 groups OR (95% CI)	Interaction n=435 in 318 groups OR (95% CI)	Model 1 n=431 in 317 groups OR (95% CI)	Model 2 n=433 in 319 groups OR (95% CI)
Intercept				
Any substance use by respondent	0.38*** (0.25, 0.59)	0.43** (0.26, 0.69)	0.70 (0.39, 1.24)	0.75 (0.43, 1.29)
Any substance use by partner	1.53 (0.94, 2.50)	1.23 (0.60, 2.53)	1.48 (0.90, 2.44)	1.67* (1.06, 2.62)
No substance use	Reference	Reference	Reference	
Don't know	1.20 (0.70, 2.04)	0.77 (0.33, 1.79)	1.50 (0.85, 2.66)	
Yes, but unsure what	1.15 (0.60, 2.19)	0.58 (0.11, 3.19)	1.31 (0.67, 2.56)	
Yes, specifically	1.37 (0.78, 2.39)	4.94 (0.88, 27.70)	1.39 (0.77, 2.49)	
Interaction				
Respondent use and partner don't know		2.06 (0.69, 6.14)		
Respondent use and partner yes, but unsure what		2.38 (0.36, 15.54)		
Respondent use and partner yes, specifically		0.29 (0.05, 1.86)		
Serodiscordance				
All partners believed HIV+ or HIV-			Reference	Reference
Didn't care, didn't notice, didn't remember			0.35*** (0.21, 0.57)	0.38*** (0.24, 0.62)
At least one person of different serostatus			0.55 (0.18, 1.65)	0.57 (0.19, 1.70)
Month of reporting				
Month 7			Reference	Reference
Month 10			1.04 (0.70, 1.57)	1.06 (0.71, 1.59)
Month 13			1.38 (0.39, 1.24)	1.41 (0.96, 2.08)
Wald test (χ^2, df, p-value)	6.86, 4, 0.14	11.54, 7, 0.12	25.84, 8, 0.001	24.17, 5, 0.0002
Model fit	581.56	584.80	557.41	556.26

Table 14.6. Multivariate models with continuous measures of substance use testing associations with UAI in the sample of multipartner encounters.

Variable	Main effects n=431 in 317 groups OR (95% CI)	Interaction n=431 in 317 groups OR (95% CI)	Model 1 n=427 in 316 groups OR (95% CI)
Intercept	0.42** (0.32, 0.57)	0.36** (0.26, 0.49)	0.65 (0.38, 1.13)
Number of substances used	1.24** (1.07, 1.44)	1.39*** (1.17, 1.65)	1.38*** (1.16, 1.65)
Number of substances used by partner	0.99 (0.84, 1.17)	1.31* (1.02, 1.68)	1.23 (0.95, 1.59)
Interaction		0.93** (0.88, 0.98)	0.94* (0.89, 0.99)
Serodiscordance			
All partners believed HIV+ or HIV-			Reference
Didn't care, didn't notice, didn't remember			0.39*** (0.24, 0.65)
At least one person of different serostatus			0.51 (0.16, 1.62)
Month of reporting			
Month 7			Reference
Month 10			1.04 (0.68, 1.61)
Month 13			1.37 (0.91, 2.08)
Wald test (χ^2, df, <i>p</i>-value)	13.26, 2, 0.001	20.97, 3, <0.0001	35.01, 7, <0.0001
Model fit	558.30	549.30	532.82

Table 14.7. Multivariate models with categorical measures of specific substances testing associations with UAI in the sample of multipartner encounters.

Variable	Model 1 n=435 in 318 groups	Model 2 n=431 in 317 groups
	OR (95% CI)	OR (95% CI)
Intercept	0.45*** (0.35, 0.58)	0.82 (0.50, 1.35)
EDM use by respondent	2.00* (1.18, 3.40)	2.00* (1.16, 3.47)
Crystal meth use by respondent	3.52* (1.10, 11.28)	3.60* (1.04, 12.49)
EDM use by partner	1.15 (0.58, 2.31)	0.98 (0.47, 2.04)
Crystal meth use by partner	0.96 (0.27, 3.34)	1.01 (0.27, 3.77)
Serodiscordance		
All partners believed HIV+ or HIV-		Reference
Didn't care, didn't notice, didn't remember		0.40*** (0.24, 0.66)
At least one person of different serostatus		0.49 (0.15, 1.64)
Month of reporting		
Month 7		Reference
Month 10		1.00 (0.64, 1.55)
Month 13		1.37 (0.90, 2.08)
Wald test (χ^2, df, <i>p</i>-value)	25.41, 4, <0.0001	36.89, 8, <0.0001
Model fit	549.98	532.37

Table 14.8. Initial models testing associations with pleasure in the sample of multipartner encounters.

Variable	n	Group n	Beta (95% CI)	Intercept (95% CI)	Model fit
Any substance use by respondent	434	319	0.25 (-0.09, 0.59)	6.61*** (6.33, 6.89)	1156.77
Number of substances used	430	318	0.14** (0.05, 0.23)	6.55*** (6.33, 6.76)	1130.86
Substance use by respondent: specific	430	318		6.50*** (6.26, 6.75)	1146.68
Poppers			0.31 (-0.02, 0.65)		
Alcohol			0.03 (-0.34, 0.39)		
Erectile dysfunction medications			0.26 (-0.19, 0.72)		
Cannabis			0.23 (-0.50, 0.95)		
MDMA			0.24 (-0.46, 0.94)		
Crystal methamphetamine			0.17 (-0.55, 0.89)		
Mephedrone			0.02 (-0.67, 0.72)		
GHB			-0.02 (-0.80, 0.72)		
Ketamine			0.002 (-0.61, 0.70)		
Cocaine			0.04 (-0.61, 0.70)		
Any substance use by partner	433	318		6.86*** (6.58, 7.15)	1124.79
No substance use			Reference		
Don't know			-0.50* (-0.91, -0.09)		
Yes, but unsure what			0.20 (-0.30, 0.69)		
Yes, specifically			0.08 (-0.32, 0.49)		
Number of substances used by partner	433	318	0.05 (-0.04, 0.14)	6.74*** (6.56, 6.92)	1155.64
Substance use by partner: specific	433	318		6.75*** (6.56, 6.94)	1167.10
Alcohol			-0.01 (-0.44, 0.43)		
Erectile dysfunction medications			-0.21 (-0.87, 0.45)		
Cannabis			0.12 (-0.71, 0.95)		
MDMA			0.40 (-0.46, 1.27)		
Crystal methamphetamine			0.27 (-0.62, 1.12)		
Mephedrone			0.58 (-0.28, 1.44)		
GHB			-0.56 (-1.56, 0.44)		
Ketamine			-0.08 (-0.89, 0.73)		
Cocaine			0.34 (-0.41, 1.08)		
Number of participants	434	319	0.05** (0.02, 0.09)	6.58*** (6.37, 6.79)	1140.03
Serodiscordance	431	319		7.04*** (6.70, 7.38)	1144.37
All partners believed HIV+ or HIV-			Reference		
Didn't care, didn't notice, didn't remember			-0.38* (-0.76, -0.001)		
At least one person of different serostatus			0.50 (-0.39, 1.39)		
Location of sex	431	318		6.94*** (6.72, 7.17)	1122.58
Private (residence, hotel)			Reference		
Sex-on-premises venue			-0.13 (-0.46, 0.21)		
Cruising or outdoors location			-1.02*** (-1.54, -0.50)		
Control over what happened	433	320		6.75*** (6.31, 7.20)	1160.00
Some/no control			Reference		
Totally/mostly in control			0.03 (-0.45, 0.50)		
Month of reporting	435	320		6.81*** (6.56, 7.06)	1163.83
Month 7			Reference		
Month 10			-0.10 (-0.44, 0.24)		

Table 14.9. Multivariate models with continuous measures of substance use testing associations with pleasure in the sample of multipartner encounters.

Variable	Main effects n=426 in 316 groups	Interaction n=426 in 316 groups	Model 1 n=421 in 314 groups
Intercept	Beta (95% CI)	Beta (95% CI)	Beta (95% CI)
Number of substances used	6.72*** (6.44, 7.00)	6.64*** (6.33, 6.95)	6.67*** (6.25, 7.08)
Location of sex	0.11* (0.02, 0.20)	0.15** (0.04, 0.26)	0.14* (0.02, 0.25)
Private (residence, hotel)	Reference	Reference	Reference
Sex-on-premises venue	-0.07 (-0.41, 0.27)	0.05 (-0.40, 0.50)	0.05 (-0.41, 0.52)
Cruising or outdoors location	-0.86** (-1.40, -0.32)	-0.49 (-1.11, 0.13)	-0.37 (-0.99, 0.26)
Interaction: substance use and place			
Number of substances and SOPV		-0.07 (-0.26, 0.11)	-0.10 (-0.28, 0.08)
Number of substances and cruising location		-0.53* (-0.97, -0.08)	-0.54* (-0.98, -0.10)
Number of participants			0.05** (0.01, 0.09)
Serodiscordance			
All partners believed HIV+ or HIV-			Reference
Didn't care, didn't notice, didn't remember			-0.29 (-0.69, 0.11)
At least one person of different serostatus			0.62 (-0.30, 1.52)
Wald test (χ^2, df, <i>p</i>-value)	20.02, 3, 0.0001	25.74, 5, 0.0001	38.58, 8, <0.0001
Model fit	1104.79	1095.05	1063.56

Table 14.10. Initial models testing associations with control in the sample of multipartner encounters.

Variable	n	Group n	OR (95% CI)	Intercept (95% CI)	Model fit
Any substance use by respondent	435	320	0.62 (0.31, 1.22)	10.46*** (5.71, 19.16)	336.13
Number of substances used	431	319	0.92 (0.79, 1.07)	8.66*** (5.63, 13.31)	332.08
Substance use by respondent: specific	431	319		8.82*** (5.35, 14.53)	332.03
Poppers			1.03 (0.55, 1.94)		
Alcohol			0.61 (0.32, 1.17)		
Erectile dysfunction medications			2.02 (0.83, 4.88)		
Cannabis			1.22 (0.32, 4.61)		
MDMA			1.33 (0.38, 4.64)		
Crystal methamphetamine			0.15*** (0.05, 0.53)		
Mephedrone			1.39 (0.35, 5.53)		
GHB			3.93 (0.70, 22.04)		
Ketamine			1.15 (0.31, 4.27)		
Cocaine			0.37 (0.13, 1.03)		
Any substance use by partner	434	319		10.37*** (5.54, 19.41)	336.71
No substance use			Reference		
Don't know			0.78 (0.34, 1.77)		
Yes, but unsure what			0.47 (0.19, 1.13)		
Yes, specifically			0.63 (0.28, 1.39)		
Number of substances used by partner	434	319	1.13 (0.93, 1.38)	6.89*** (4.87, 9.74)	337.86
Substance use by partner: specific*	434	319			
Alcohol			0.88 (0.49, 1.56)	7.73*** (5.40, 11.05)	339.26
Erectile dysfunction medications			1.78 (0.74, 4.24)	7.13*** (5.07, 10.01)	336.31
Cannabis			1.88 (0.42, 8.29)	7.35*** (5.26, 10.27)	341.75
MDMA			All encounters with MDMA reported most control		
Crystal methamphetamine			1.36 (0.42, 4.37)	7.39*** (5.28, 10.36)	339.84
Mephedrone			4.37 (0.66, 28.96)	7.02*** (5.04, 9.77)	336.43
GHB			5.38 (0.64, 44.99)	6.91*** (4.97, 9.61)	336.64
Ketamine			3.22 (0.63, 16.54)	7.29*** (5.20, 10.20)	336.41
Cocaine			1.24 (0.37, 4.12)	7.41*** (5.28, 10.39)	341.91
Number of participants	435	320	1.11 (0.97, 1.27)	5.25*** (3.18, 8.68)	352.79
Serodiscordance	432	320		7.45*** (4.07, 13.66)	339.17
All partners believed HIV+ or HIV-			Reference		
Didn't care, didn't notice, didn't remember			1.00 (0.52, 1.92)		
At least one person of different serostatus			1.02 (0.22, 4.84)		
Location of sex	432	319		6.00*** (4.04, 8.93)	336.39
Private (residence, hotel)			Reference		
Sex-on-premises venue			1.54 (0.84, 2.82)		
Cruising or outdoors location			2.43 (0.72, 8.18)		
Quality of the sex	433	320	0.95 (0.81, 1.12)	10.57*** (3.26, 34.25)	339.86
Month of reporting	436	321		7.48*** (4.91, 11.38)	341.23
Month 7			Reference		
Month 10			1.17 (0.71, 1.91)		
Month 13			0.93 (0.59, 1.47)		

*Each substance was tested separately due to model convergence issues with block entry.

Table 15.1. Demographic characteristics of new partner encounter sample respondents.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				Generalised estimating equations			
	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value
Gender	181			p = 0.51	113			p = 0.36	1,872			p = 0.78
Man		99.4% (180)										
Transman		0.6% (1)										
Age	181	42.4 (11.5, 18-70)	40.9 (12.0, 16-83)	p = 0.09	113	39.5 (11.7, 19-70)	41.0 (12.0, 16-83)	p = 0.17	1,872	42.2 (11.9, 17-78)	39.5 (12.0, 16-83)	p < 0.0001
16-19		3.3% (6)	1.5% (48)	p = 0.04		2.7% (3)	1.6% (51)	p = 0.21		1.1% (21)	2.2% (33)	p = 0.0001
20-29		10.5% (19)	18.8% (599)			19.5% (22)	18.3% (596)			15.8% (296)	21.4% (322)	
30-39		23.8% (43)	25.6% (817)			31.9% (36)	25.3% (824)			24.7% (463)	26.4% (297)	
40-49		35.4% (64)	29.8% (951)			12.0% (26)	30.3% (989)			30.5% (571)	29.5% (444)	
50-59		19.9% (36)	17.1% (546)			17.7% (20)	17.2% (562)			19.3% (361)	14.7% (221)	
60-69		6.6% (12)	6.5% (208)			4.4% (5)	6.6% (215)			7.8% (146)	4.9% (74)	
70+		0.6% (1)	0.8% (25)			0.9% (1)	0.8% (25)			0.8% (14)	0.8% (12)	
Education	180			p = 0.84	112			p = 0.08	1,868			p < 0.001
Low (no secondary qual, CSE, O-level)		18.3% (33)	20.0% (637)			13.4% (15)	20.2% (655)			17.9% (334)	22.5% (336)	
Medium (A-level, higher ed below degree)		34.4% (62)	34.3% (1,090)			31.3% (35)	34.4% (1,117)			32.1% (600)	37.0% (552)	
High (university degree)		47.2% (85)	45.7% (1,452)			55.4% (62)	45.4% (1,475)			50.0% (934)	40.4% (603)	
Gross income per annum	181			p = 0.90	113			p = 0.11	1,871			p < 0.001
<£5,000		4.4% (8)	6.0% (191)			6.2% (7)	5.9% (192)			4.9% (91)	7.2% (108)	
£5,000-£9,999		10.5% (19)	8.3% (265)			14.2% (16)	8.2% (268)			8.6% (161)	8.2% (123)	
£10,000-£14,999		7.2% (13)	9.3% (297)			6.2% (7)	9.3% (303)			8.6% (161)	10.0% (149)	
£15,000-£19,999		12.2% (22)	11.2% (357)			11.5% (13)	11.2% (366)			10.6% (198)	12.1% (181)	
£20,000-£24,999		11.6% (21)	12.2% (388)			14.2% (16)	12.1% (393)			12.0% (224)	12.4% (185)	
£25,000-£29,999		11.6% (21)	10.0% (319)			14.2% (16)	10.0% (324)			9.8% (184)	10.4% (156)	
£30,000-£34,999		10.5% (19)	8.6% (274)			8.0% (9)	8.7% (294)			9.9% (185)	7.2% (108)	
£35,000-£39,999		6.1% (11)	6.0% (192)			3.5% (4)	6.1% (199)			6.8% (128)	5.0% (75)	
≥£40,000		19.3% (35)	20.8% (663)			20.4% (23)	20.7% (675)			22.1% (413)	19.1% (285)	
Do not wish to respond		6.6% (12)	7.5% (240)			1.8% (2)	7.7% (250)			6.7% (126)	8.4% (126)	
Ethnic group	180			p = 0.43	113			p = 0.49	1,866			p = 0.03
White British		83.3% (150)	80.5% (2,562)			75.2% (85)	80.8% (2,627)			81.7% (1,525)	79.2% (1,187)	
White other		12.2% (22)	12.8% (407)			17.7% (20)	12.6% (409)			12.9% (240)	12.6% (189)	
Black		2.8% (5)	2.0% (65)			1.8% (2)	2.1% (68)			1.6% (30)	2.7% (40)	
Asian		1.1% (2)	2.9% (93)			3.5% (4)	1.8% (91)			2.5% (46)	3.3% (49)	
Other		0.6% (1)	1.8% (57)			1.8% (2)	1.7% (56)			1.3% (25)	2.2% (33)	

Table 15.1 continued.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				Generalised estimating equations			
	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value
Strategic Health Authority of residence	177			p = 0.005	106			p = 0.96	1,829			p = 0.008
London		33.9% (60)	33.0% (1,025)			33.0% (35)	33.1% (1,050)			35.1% (642)	30.5% (443)	
South West		14.7% (26)	8.1% (252)			8.5% (9)	8.5% (269)			8.7% (160)	8.1% (118)	
South Central		9.6% (17)	6.1% (189)			6.6% (7)	6.3% (199)			6.7% (122)	5.8% (84)	
South East Coast		5.1% (9)	9.7% (301)			13.2% (14)	9.3% (296)			9.7% (178)	9.1% (132)	
East of England		8.5% (15)	7.0% (218)			6.6% (7)	7.1% (226)			7.4% (135)	6.8% (98)	
East Midlands		5.6% (10)	6.3% (194)			5.7% (6)	6.2% (198)			5.5% (101)	7.1% (103)	
West Midlands		5.1% (9)	7.0% (218)			6.6% (7)	6.9% (220)			6.6% (121)	7.3% (106)	
Yorkshire and the Humber		6.2% (11)	6.9% (213)			5.7% (6)	6.9% (218)			6.3% (116)	7.4% (108)	
North West		6.2% (11)	12.4% (385)			9.4% (10)	12.2% (386)			10.4% (190)	14.2% (206)	
North East		5.1% (9)	3.5% (108)			4.7% (5)	3.5% (112)			3.5% (64)	3.7% (53)	

Table 15.2. Sexual health and history, relationships and gender orientation characteristics of new partner encounter sample respondents.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				Generalised estimating equations			
	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value
SEXUAL HEALTH AND HISTORY												
Included encounters		2,00 (0.00, 2)				2,00 (0.00, 2)			1,881	1,55 (0.50, 1-2)		
Ever received an HIV test result in first report	182			p = 0.07	113			p = 0.04	1,878			p = 0.30
No, never received a result		15.9% (29)	15.9% (377)			23.9% (27)	15.5% (379)			15.7% (295)	16.4% (111)	
Yes, tested positive		24.2% (44)	17.8% (417)			19.5% (22)	17.8% (439)			17.4% (327)	19.8% (134)	
Yes, last test negative		59.9% (109)	66.5% (1,579)			56.6% (64)	66.5% (1,624)			66.9% (1,256)	63.8% (432)	
Positive test for non-HIV STI in first report	182			p = 0.79	113			p = 1.00	1,783			p = 0.06
No		96.7% (176)	97.0% (2,171)			97.4% (110)	97.0% (2,237)			97.4% (1,737)	95.9% (610)	
Yes		3.3% (6)	3.0% (66)			2.7% (3)	3.0% (69)			2.6% (46)	4.1% (26)	
RELATIONSHIPS AND GENDER ORIENTATION												
Relationship status at enrolment	179			p = 0.78	113			p = 0.96	1,866			p = 0.02
Single		58.1% (104)	54.1% (1,720)			54.0% (61)	54.3% (1,763)			54.1% (1,009)	54.6% (815)	
One man only		35.2% (63)	37.4% (1,189)			38.9% (44)	37.2% (1,208)			38.5% (719)	35.7% (533)	
Two or more men, no women		2.2% (4)	3.0% (94)			1.8% (2)	3.0% (96)			2.9% (54)	3.0% (44)	
One or more women		4.5% (8)	5.6% (178)			5.3% (6)	5.5% (180)			4.5% (84)	6.8% (102)	
Gender of attraction	181			p = 0.11	113			p = 0.01	1,872			p < 0.001
Men only		82.9% (150)	80.2% (2,560)			76.1% (86)	80.4% (2,624)			82.5% (1,545)	77.5% (1,165)	
Mostly to men		14.9% (27)	13.5% (431)			13.3% (15)	13.6% (443)			12.9% (242)	14.4% (216)	
Both men and women		1.1% (2)	4.5% (143)			10.6% (12)	4.1% (133)			3.7% (69)	5.1% (76)	
Mostly to women		1.1% (2)	1.9% (60)			0.0% (0)	1.9% (62)			0.9% (16)	3.1% (46)	
Describe sexual orientation	180			p = 0.13	111			p = 0.50	1,863			p = 0.003
Gay or homosexual		88.3% (159)	84.1% (2,669)			82.0% (91)	84.4% (2,737)			85.9% (1,601)	82.2% (1,227)	
Straight or other		11.7% (21)	15.9% (506)			18.0% (20)	15.6% (507)			14.1% (262)	17.8% (265)	
Outness	180			p = 0.20	112			p = 0.69	1,865			p = 0.003
Some or all		87.8% (158)	84.2% (2,679)			83.0% (93)	84.4% (2,744)			86.1% (1,605)	82.3% (1,232)	
Few or none		12.2% (22)	15.8% (503)			17.0% (19)	15.6% (506)			13.9% (260)	17.7% (265)	

Table 15.3. Encounter-level and individual-level characteristics for the sample of new partner encounters.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				Generalised estimating equations			
	Encounter-level		Individual	Mean (SD)	Encounter-level		Individual	N	Encounter-level		N	Mean % Mean (SD)
	N	% (n) Mean (SD, range)	N		% (n) Mean (SD, range)	% (n) Mean (SD, range)	Mean (SD)					
UAI	364	50.0% (182)			226	23.9% (54)			2,913	21.2% (618)	1,879	22.0%
Quality of the sex	358	6.4 (2.0, 1-10)		6.4 (1.6)	224	6.1 (2.1, 1-10)		6.1 (1.6)	2,892	6.3 (1.9, 1-10)	1,873	6.3 (1.8)
Control over what happened	360				226				2,896		1,873	
Totally/mostly in control		87.2% (314)				50.0% (113)				90.3% (2,615)		90.0%
Some/no control		12.8% (46)				50.0% (113)				9.7% (281)		10.0%
Any substance use by respondent	364	53.0% (193)			226	50.9% (115)			2,908	51.5% (1,498)	1,880	52.2%
Number of substances used	350	0.8 (1.1, 0-8)		0.8 (0.9)	226	0.7 (1.0, 0-8)		0.7 (0.8)	2,868	0.8 (1.0, 0-8)	1,867	0.8 (1.0)
Substance use by respondent: specific	350				226				2,908		1,880	
Poppers	350	23.7% (83)			226	17.7% (40)			2,876	22.1% (635)	1,868	23.2%
Alcohol		32.6% (114)				33.6% (76)				30.1% (874)		29.9%
Erectile dysfunction medications		10.3% (36)				11.1% (25)				10.7% (310)		11.1%
Cannabis		3.7% (13)				2.2% (5)				3.8% (111)		4.0%
MDMA		0.9% (3)				1.3% (3)				1.8% (53)		1.9%
Amphetamine (speed)		0.9% (3)				0.4% (1)				0.5% (13)		0.5%
Crystal methamphetamine		0.6% (2)				0.0% (0)				1.2% (35)		1.3%
Heroin		0.0% (0)				0.0% (0)				0.0% (0)		0.0%
Mephedrone		0.6% (2)				0.0% (0)				0.9% (27)		1.1%
GHB		1.7% (6)				1.3% (3)				1.8% (52)		2.0%
Ketamine		1.4% (5)				1.3% (3)				2.0% (59)		2.3%
LSD		0.0% (0)				0.0% (0)				0.0% (0)		0.0%
Cocaine		3.4% (12)				2.7% (6)				2.6% (76)		2.9%
Crack		0.0% (0)				0.0% (0)				0.1% (2)		0.1%
Any other drug		0.6% (2)				0.4% (1)				0.6% (18)		0.7%

Table 15.3 continued.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				Generalised estimating equations			
	Encounter-level		Individual		Encounter-level		Individual		Encounter-level		Individual-level	
	N	% (n) Mean (SD, range)	Mean (SD)	N	% (n) Mean (SD, range)	Mean (SD)	N	% (n) Mean (SD, range)	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)
Location of sex	364			226					2,909		1,876	
Private (residence, hotel)		85.7% (312)			85.8% (194)					82.3% (2,395)		81.7%
Sex-on-premises venue		11.0% (40)			8.4% (19)					12.9% (375)		13.4%
Cruising or outdoors location		3.3% (12)			5.8% (13)					4.8% (139)		5.0%
Perceived HIV transmission risk	362			226					2,898		1,876	
No risk		25.4% (92)			24.8% (56)					31.3% (907)		31.4%
Low risk		48.3% (175)			55.3% (125)					54.6% (1,583)		54.4%
Some risk		20.7% (75)			15.0% (34)					11.5% (332)		11.5%
High risk		5.5% (20)			4.9% (11)					2.6% (76)		2.7%
Month of reporting	364			226					2,917			
Month 1		50.0% (182)			50.0% (113)					51.5% (1,502)		
Month 3		50.0% (182)			50.0% (113)					48.5% (1,415)		

Table 15.4. Initial generalised estimating equation models testing associations with UAI in the sample of new partner encounters.

Variable	n	Group n	OR (95% CI)	Intercept (95% CI)	Model fit
Any substance use by respondent	2,904	1,878	1.57*** (1.31, 1.88)	0.21*** (0.18, 0.25)	2971.25
Number of substances used	2,865	1,865	1.32*** (1.22, 1.43)	0.21*** (0.19, 0.24)	2898.40
Substance use by respondent: specific	2,865	1,865		0.22*** (0.19, 0.25)	2892.98
Poppers			1.79*** (1.45, 2.21)		
Alcohol			1.04 (0.85, 1.27)		
Erectile dysfunction medications			1.10 (0.83, 1.47)		
Cannabis			1.26 (0.80, 1.99)		
MDMA			1.08 (0.54, 2.17)		
Crystal methamphetamine			2.15 (0.99, 4.65)		
GHB			1.43 (0.75, 2.73)		
Ketamine			1.73 (0.94, 3.18)		
Cocaine			1.60 (0.92, 2.76)		
Location of sex	2,906	1,875		0.29*** (0.26, 0.32)	2998.06
Private (residence, hotel)			Reference		
Sex-on-premises venue			0.69** (0.52, 0.91)		
Cruising or outdoors location			0.99 (0.66, 1.47)		
Control over what happened	2,892	1,871		0.50*** (0.39, 0.64)	2968.50
Some/no control			Reference		
Totally/mostly in control			0.51*** (0.39, 0.66)		
Quality of the sex	2,889	1,872	1.25*** (1.19, 1.31)	0.06*** (0.05, 0.09)	2910.67
Perceived HIV transmission risk	2,894	1,874		0.15*** (0.12, 0.18)	2419.08
No risk			Reference		
Low risk			1.09 (0.86, 1.39)		
Some risk			11.18*** (8.29, 15.09)		
High risk			78.95*** (33.69, 185.00)		
Month of reporting	2,913	1,879		0.26*** (0.23, 0.30)	3014.37
Month 1			Reference		
Month 3			1.10 (0.95, 1.27)		

Table 15.5. Models testing an interaction between a binary respondent substance use measure and location of sex and associations with UAI in the sample of new partner encounters.

Variable	Main effects n=2,897 in 1,874 groups	Interaction n=2,897 in 1,874 groups
	OR (95% CI)	OR (95% CI)
Intercept	0.14*** (0.10, 0.19)	0.23*** (0.20, 0.27)
Any substance use by respondent	1.57*** (1.31, 1.88)	1.47*** (1.21, 1.79)
Location of sex		
Private (residence, hotel)	Reference	Reference
Sex-on-premises venue	0.71* (0.53, 0.95)	0.43** (0.26, 0.72)
Cruising or outdoors location	1.11 (0.74, 1.66)	1.21 (0.74, 2.00)
Interaction: substance use and place		
Any substance use and SOPV		2.23* (1.21, 4.09)
Any substance use and cruising location		0.73 (0.30, 1.75)
Wald test (χ^2, df, <i>p</i>-value)	29.96, 3, <0.0001	33.52, 5, <0.0001
Model fit	2957.00	2954.28

Table 15.6. Models testing an interaction between number of substances used and location of sex and associations with UAI in the sample of new partner encounters.

Variable	Main effects n=2,858 in 1,861 groups	Interaction n=2,858 in 1,861 groups
	OR (95% CI)	OR (95% CI)
Intercept	0.22*** (0.19, 0.25)	0.22*** (0.19, 0.25)
Number of substances used	1.33*** (1.22, 1.44)	1.32*** (1.21, 1.44)
Location of sex		
Private (residence, hotel)	Reference	Reference
Sex-on-premises venue	0.72* (0.54, 0.96)	0.68 (0.47, 0.98)
Cruising or outdoors location	1.18 (0.78, 1.77)	1.36 (0.85, 2.15)
Interaction: substance use and place		
Number of substances and SOPV		1.06 (0.82, 1.35)
Number of substances and cruising location		0.72 (0.39, 1.35)
Wald test (χ^2, df, <i>p</i>-value)	52.29, 3, <0.0001	53.25, 5, <0.0001
Model fit	2884.28	2889.26

Table 15.7. Multivariate models testing an exploratory interaction between poppers use and location of sex and associations with UAI in the sample of new partner encounters.

Variable	Main effect n=2,873 in 1,866 groups OR (95% CI)	Main effects n=2,866 in 1,862 groups OR (95% CI)	Interaction n=2,866 in 1,862 groups OR (95% CI)
Intercept	0.23*** (0.21, 0.26)	0.24*** (0.21, 0.27)	0.25*** (0.22, 0.28)
Poppers use	1.93*** (1.57, 2.37)	1.94*** (1.58, 2.38)	1.78*** (1.42, 2.22)
Location of sex			
Private (residence, hotel)		Reference	Reference
Sex-on-premises venue		0.69* (0.52, 0.92)	0.54** (0.38, 0.79)
Cruising or outdoors location		1.06 (0.71, 1.59)	1.00 (0.63, 1.59)
Interaction: poppers use and place			
Poppers and SOPV			1.98* (1.08, 3.62)
Poppers and cruising location			1.24 (0.47, 3.22)
Wald test (χ^2, df, p-value)	39.53, 1, <0.0001	46.18, 3, <0.0001	49.09, 5, <0.0001
Model fit	2919.34	2904.01	2898.90

Table 15.8. Initial models testing associations with pleasure in the sample of new partner encounters.

Variable	n	Group n	Beta (95% CI)	Intercept (95% CI)	Model fit
Any substance use by respondent	2,883	1,872	0.18* (0.04, 0.32)	6.18*** (6.07, 6.28)	10897.76
Number of substances used	2,843	1,858	0.17*** (0.10, 0.24)	6.13*** (6.03, 6.22)	10714.09
Substance use by respondent: specific	2,843	1,858		6.13*** (6.03, 6.23)	10672.78
Poppers			0.27** (0.09, 0.45)		
Alcohol			0.17* (0.01, 0.33)		
Erectile dysfunction medications			0.02 (-0.21, 0.26)		
Cannabis			-0.17 (-0.57, 0.23)		
MDMA			0.21 (-0.21, 0.84)		
Crystal methamphetamine			0.83* (0.10, 1.55)		
GHB			0.19 (-0.40, 0.77)		
Ketamine			0.82** (0.26, 1.39)		
Cocaine			-0.23 (-0.73, 0.27)		
Location of sex	2,886	1,869		6.37*** (6.28, 6.45)	10813.07
Private (residence, hotel)			Reference		
Sex-on-premises venue			-0.61*** (-0.82, -0.40)		
Cruising or outdoors location			-0.42* (-0.74, -0.09)		
Control over what happened	2,871	1,865		6.18*** (5.95, 6.41)	10915.62
Some/no control			Reference		
Totally/mostly in control			0.10 (-0.15, 0.34)		
Perceived HIV transmission risk	2,876	1,869		6.28*** (6.15, 6.42)	10874.20
No risk			Reference		
Low risk			-0.08 (-0.24, 0.08)		
Some risk			0.09 (-0.16, 0.33)		
High risk			0.72** (0.27, 1.17)		
Month of reporting	2,892	1,873		6.14*** (6.05, 6.24)	10911.49
Month 1			Reference		
Month 3			0.26*** (0.14, 0.38)		

Table 15.9. Models testing an interaction between a binary respondent substance use measure and location of sex and associations with pleasure in the sample of new partner encounters.

Variable	Main effects n=2,877 in 1,868 groups	Interaction n=2,877 in 1,868 groups
	Beta (95% CI)	Beta (95% CI)
Intercept	6.28*** (6.17, 6.40)	6.27*** (6.15, 6.39)
Any substance use by respondent	0.15* (0.01, 0.29)	0.17* (0.02, 0.33)
Location of sex		
Private (residence, hotel)	Reference	Reference
Sex-on-premises venue	-0.59*** (-0.80, -0.39)	-0.61*** (-0.90, -0.32)
Cruising or outdoors location	-0.37* (-0.70, -0.04)	-0.18 (-0.57, 0.21)
Interaction: substance use and place		
Any substance use and SOPV		0.03 (-0.39, 0.44)
Any substance use and cruising location		-0.64 (-1.36, 0.08)
Wald test (χ^2, df, <i>p</i>-value)	39.33, 3, <0.0001	42.45, 5, <0.0001
Model fit	10759.004	10754.86

Table 15.10. Models testing an interaction between number of substances used and location of sex and associations with pleasure in the sample of new partner encounters.

Variable	Main effects n=2,837 in 1,854 groups	Interaction n=2,837 in 1,854 groups
	Beta (95% CI)	Beta (95% CI)
Intercept	6.23*** (6.13, 6.33)	6.24*** (6.14, 6.34)
Number of substances used	0.16*** (0.09, 0.23)	0.15*** (0.07, 0.22)
Location of sex		
Private (residence, hotel)	Reference	Reference
Sex-on-premises venue	-0.60*** (-0.81, -0.39)	-0.70*** (-0.96, -0.44)
Cruising or outdoors location	-0.34* (-0.68, -0.01)	-0.22 (-0.60, 0.16)
Interaction: substance use and place		
Number of substances and SOPV		0.14 (-0.07, 0.34)
Number of substances and cruising location		-0.34 (-0.85, 0.16)
Wald test (χ^2, df, <i>p</i>-value)	55.76, 3, <0.0001	59.45, 5, <0.0001
Model fit	10573.61	10564.52

Table 15.11. Multivariate models testing associations between specific substance use and pleasure in the sample of new partner encounters.

Variable	Model 1 n=2,843 in 1,858 groups	Model 2 n=2,837 in 1,854 groups
	Beta (95% CI)	Beta (95% CI)
Intercept	6.13*** (6.03, 6.23)	6.23*** (6.13, 6.34)
Poppers use	0.27*** (0.09, 0.45)	0.26** (0.08, 0.44)
Alcohol use	0.16 (-0.001, 0.32)	0.12 (-0.04, 0.28)
Crystal meth use	0.89* (0.19, 1.60)	0.84* (0.14, 1.54)
Ketamine use	0.83** (0.30, 1.37)	0.82** (0.29, 1.35)
Location of sex		
Private (residence, hotel)		Reference
Sex-on-premises venue		-0.59*** (-0.80, -0.38)
Cruising or outdoors location		-0.36* (-0.69, -0.03)
Wald test (χ^2, df, <i>p</i>-value)	37.42, 4, <0.0001	69.94, 6, <0.0001
Model fit	10670.81	10534.42

Table 15.12. Initial generalised estimating equation models testing associations with control in the sample of new partner encounters

Variable	n	Group n	OR (95% CI)	Intercept (95% CI)	Model fit
Any substance use by respondent	2,888	1,872	0.86 (0.67, 1.11)	9.95*** (8.21, 12.05)	1842.23
Number of substances used	2,849	1,859	0.94 (0.84, 1.06)	9.66*** (8.17, 11.42)	1821.05
Substance use by respondent: specific	2,849	1,859		10.05*** (8.40, 12.04)	1833.84
Poppers			0.93 (0.68, 1.26)		
Alcohol			<i>0.77 (0.59, 1.01)</i>		
Erectile dysfunction medications			1.10 (0.72, 1.69)		
Cannabis			1.02 (0.51, 2.01)		
MDMA			1.04 (0.34, 3.15)		
Crystal methamphetamine			1.50 (0.36, 6.33)		
GHB			0.73 (0.28, 1.93)		
Ketamine			1.06 (0.39, 2.89)		
Cocaine			1.10 (0.40, 12.04)		
Location of sex	2,888	1,868		8.94*** (7.74, 10.34)	1841.22
Private (residence, hotel)			Reference		
Sex-on-premises venue			<i>1.49 (0.98, 2.27)</i>		
Cruising or outdoors location			0.74 (0.45, 1.23)		
Quality of the sex	2,871	1,865	1.03 (0.96, 1.09)	7.89*** (5.22, 11.92)	1830.09
Perceived HIV transmission risk	2,878	1,868		13.06*** (10.03, 17.01)	1786.89
No risk			Reference		
Low risk			0.80 (0.59, 1.10)		
Some risk			0.33*** (0.22, 0.48)		
High risk			0.27*** (0.15, 0.49)		
Month of reporting	2,896	1,873		9.44*** (7.95, 11.20)	1848.42
Month 1			Reference		
Month 3			0.95 (0.77, 1.17)		

Table 16.1. Demographic characteristics of single-partner encounter sample respondents.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				All encounters (multilevel models)			
	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value
Gender	639			p = 0.29	306			p = 0.62	2,134			p = 0.78
Man		99.4% (635)	99.7% (2,727)			100.0% (306)	99.6% (3,056)			99.6% (2,125)	99.7% (1,237)	
Transman		0.6% (4)	0.3% (9)			0.0% (0)	0.4% (13)			0.4% (9)	0.3% (4)	
Age	639	41.9 (11.7, 17-77)	40.8 (12.1, 16-83)	p = 0.03	306	41.2 (12.1, 18-70)	40.9 (12.0, 16-83)	p = 0.70	2,134	42.5 (11.9, 17-78)	38.3 (11.7, 16-83)	p < 0.0001
16-19		1.6% (10)	1.6% (44)	p = 0.03		1.6% (5)	1.6% (49)	p = 0.55		1.3% (28)	2.1% (26)	p = 0.0001
20-29		15.3% (98)	19.0% (520)			19.3% (59)	18.2% (559)			14.7% (313)	24.6% (305)	
30-39		26.4% (169)	25.6% (691)			25.2% (77)	25.5% (783)			24.2% (517)	27.6% (343)	
40-49		29.3% (187)	30.3% (828)			25.5% (78)	30.5% (937)			31.3% (668)	28.0% (347)	
50-59		19.1% (122)	16.8% (460)			21.2% (65)	16.8% (517)			19.5% (416)	13.4% (166)	
60-69		7.8% (50)	6.2% (170)			6.5% (20)	6.5% (200)			8.2% (174)	3.7% (46)	
70+		0.5% (3)	0.8% (23)			0.7% (2)	0.8% (24)			0.8% (18)	0.6% (8)	
Education	637			p < 0.001	305			p = 0.48	2,129			p < 0.001
Low (no secondary qual, CSE, O-level)		14.6% (93)	21.2% (577)			21.0% (64)	19.8% (606)			17.8% (379)	23.7% (291)	
Medium (A-level, higher ed below degree)		32.2% (25)	34.8% (947)			31.1% (95)	34.6% (1,057)			32.6% (694)	37.2% (458)	
High (university degree)		53.2% (339)	44.0% (1,198)			47.9% (146)	45.5% (1,391)			49.6% (1,056)	39.1% (481)	
Gross income per annum	639			p = 0.19	305			p = 0.09	2,132			p < 0.001
<£5,000		6.0% (38)	5.9% (161)			8.9% (27)	5.6% (172)			5.2% (111)	7.1% (88)	
£5,000-£9,999		8.0% (51)	8.5% (233)			11.2% (34)	8.2% (250)			8.1% (173)	9.0% (111)	
£10,000-£14,999		8.3% (53)	9.4% (257)			11.8% (36)	9.0% (274)			8.7% (185)	10.1% (125)	
£15,000-£19,999		11.3% (72)	11.3% (307)			10.2% (31)	11.4% (348)			11.5% (245)	10.9% (134)	
£20,000-£24,999		12.8% (82)	12.0% (327)			12.1% (37)	12.1% (372)			11.5% (246)	13.2% (163)	
£25,000-£29,999		8.9% (57)	10.4% (283)			7.2% (22)	10.4% (318)			9.9% (211)	10.4% (129)	
£30,000-£34,999		9.4% (60)	8.5% (233)			7.5% (23)	8.8% (270)			9.9% (211)	6.6% (82)	
£35,000-£39,999		6.3% (40)	6.0% (163)			5.9% (18)	6.0% (185)			6.1% (129)	6.0% (74)	
≥£40,000		23.9% (153)	20.0% (545)			18.4% (56)	21.0% (642)			22.6% (481)	17.6% (217)	
Do not wish to respond		5.2% (33)	8.0% (219)			6.9% (21)	7.5% (231)			6.6% (140)	9.1% (112)	
Ethnic group	637			p = 0.57	306			p = 0.82	2,126			p = 0.007
White British		81.5% (519)	80.4% (2,193)			82.0% (251)	80.5% (2,461)			81.5% (1,732)	79.2% (980)	
White other		12.1% (77)	12.9% (352)			12.1% (37)	12.8% (392)			13.0% (277)	12.3% (152)	
Black		2.7% (17)	1.9% (53)			1.6% (5)	2.1% (65)			1.7% (37)	2.7% (33)	
Asian		2.5% (16)	2.9% (79)			3.3% (10)	2.8% (85)			2.5% (54)	3.3% (41)	
Other		1.3% (8)	1.8% (50)			1.0% (3)	1.8% (55)			1.2% (26)	2.6% (32)	

Table 16.1 continued.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				All encounters (multilevel models)			
	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value
Strategic Health Authority of residence	626			p=0.83	295			p=0.43	2,084			p=0.07
London		35.1% (220)	32.6% (865)			32.9% (97)	33.1% (988)			34.8% (726)	30.0% (359)	
South West		8.6% (54)	8.4% (224)			7.1% (21)	8.6% (257)			8.7% (181)	8.1% (97)	
South Central		6.5% (41)	6.2% (165)			9.2% (27)	6.0% (179)			6.6% (138)	5.7% (68)	
South East Coast		10.5% (66)	9.2% (244)			8.1% (24)	9.6% (286)			9.3% (193)	9.8% (117)	
East of England		6.7% (42)	7.2% (191)			7.1% (21)	7.1% (212)			6.9% (144)	7.4% (89)	
East Midlands		5.9% (37)	6.3% (167)			7.1% (21)	6.1% (183)			5.8% (120)	7.0% (84)	
West Midlands		6.4% (40)	7.0% (187)			7.5% (23)	6.9% (205)			6.9% (144)	6.9% (83)	
Yorkshire and the Humber		6.5% (41)	6.9% (183)			4.4% (13)	7.1% (211)			6.7% (140)	7.0% (84)	
North West		10.2% (64)	12.5% (332)			12.9% (38)	12.0% (358)			10.9% (228)	14.0% (168)	
North East		3.4% (21)	3.6% (96)			3.7% (11)	3.6% (106)			3.4% (70)	3.9% (47)	

Table 16.2. Sexual health and history, relationships and gender orientation characteristics of single-partner encounter sample respondents.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				All encounters (multilevel models)			
	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value	N	Included n (%) Mean (SD, range)	Excluded n (%) Mean (SD, range)	p-value
SEXUAL HEALTH AND HISTORY												
Included encounters	639	400 (104, 2-5)			308	404 (105, 2-5)			2,142	3,14 (1.54, 1-5)		
Ever received an HIV test result in first report	639			p < 0.001	308			p = 0.34	2,139			p = 0.24
No, never received a result		10.3% (66)	17.7% (340)			17.5% (54)	15.7% (352)			15.8% (337)	16.6% (69)	
Yes, tested positive		19.2% (123)	17.6% (338)			20.1% (62)	17.8% (399)			17.5% (375)	20.7% (86)	
Yes, last test negative		70.4% (639)	64.6% (1,238)			62.3% (192)	66.6% (1,496)			66.7% (1,427)	62.7% (261)	
Positive test for non-HIV STI in first report	639			p = 0.79	308			p = 0.77	2,118			p = 0.01
No		96.9% (619)	97.1% (1,728)			96.8% (298)	97.1% (2,049)			97.4% (2,062)	94.7% (285)	
Yes		3.1% (20)	2.9% (52)			3.2% (10)	2.9% (62)			2.6% (56)	5.3% (16)	
RELATIONSHIPS AND GENDER ORIENTATION												
Relationship status at enrolment	638			p < 0.001	305			p = 0.56	2,127			p < 0.001
Single		47.2% (301)	56.0% (1,523)			57.4% (175)	54.0% (1,649)			52.0% (1,105)	58.3% (719)	
One man only		45.8% (292)	35.3% (960)			33.8% (103)	37.6% (1,149)			40.0% (851)	32.5% (401)	
Two or more men, no women		3.6% (23)	2.8% (75)			2.6% (8)	2.9% (90)			3.2% (68)	2.4% (30)	
One or more women		3.4% (22)	6.0% (164)			6.2% (19)	5.5% (167)			4.8% (103)	6.7% (83)	
Gender of attraction	639			p < 0.001	306			p = 0.78	2,134			p < 0.001
Men only		81.7% (522)	80.0% (2,188)			78.1% (239)	80.5% (2,471)			81.4% (1,736)	78.5% (974)	
Mostly to men		16.0% (102)	13.0% (356)			15.4% (47)	13.4% (411)			13.8% (294)	13.2% (164)	
Both men and women		1.6% (10)	4.9% (135)			4.6% (14)	4.3% (131)			3.7% (79)	5.3% (66)	
Mostly to women		0.8% (5)	2.1% (57)			2.0% (6)	1.8% (56)			1.2% (25)	3.0% (37)	
Describe sexual orientation	635			p < 0.001	303			p = 0.47	2,123			p = 0.01
Gay or homosexual		88.5% (562)	83.3% (2,266)			82.8% (251)	84.4% (2,577)			85.5% (1,815)	82.2% (1,013)	
Straight or other		11.5% (73)	16.7% (454)			17.2% (52)	15.6% (475)			14.5% (308)	17.8% (219)	
Outness	635			p = 0.001	303			p = 0.053	2,125			p < 0.001
Some or all		88.8% (564)	83.4% (2,273)			80.5% (244)	84.8% (2,593)			86.0% (1,827)	81.6% (1,010)	
Few or none		11.2% (71)	16.6% (454)			19.5% (59)	15.2% (466)			14.0% (298)	18.4% (227)	

Table 16.3. Encounter-level and individual-level characteristics for the sample of single-partner encounters.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				All encounters (multilevel models)			
	Encounter-level		Individual-level		Encounter-level		Individual-level		Encounter-level		Individual-level	
	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)
UAI												
Quality of the sex	2,546	46.1% (1,178)	639	46.5%	1,238	36.4% (451)	306	37.2%	6,731	30.9%	2,141	32.2%
Control over what happened	2,508	6.5 (1.9, 1-10)	628	6.5 (1.36)	1,228	6.3 (1.9, 1-10)	304	6.4 (1.4)	6,687	6.5 (1.9, 1-10)	2,139	6.5 (1.6)
Totally/mostly in control	2,524		634		1,246		308		6,688		2,139	
Some/no control		90.1% (2,273)		89.8%		64.5% (804)		62.9%		91.4% (6,111)		90.9%
		9.9% (251)		10.2%		35.5% (442)		37.1%		8.6% (577)		9.1%
Any substance use by respondent	2,546	43.1% (1,097)	637	43.7%	1,239	41.9% (519)	307	42.6%	6,714	42.9% (2,881)	2,140	45.0%
Number of substances used	2,517	0.7 (1.1, 0-9)	631	0.7 (0.9)	1,228	0.7 (1.0, 0-8)	307	0.7 (0.9)	6,663	0.7 (1.0, 0-9)	2,132	0.7 (1.0)
Substance use by respondent: specific	2,517		631		1,228		307		6,714		2,140	
Poppers		22.3% (561)		22.8%		21.2% (260)		22.0%	6,687	20.5% (1,370)	2,134	22.3%
Alcohol		24.5% (617)		25.1%		26.6% (327)		27.1%		26.5% (1,776)		27.7%
Erectile dysfunction medications		7.9% (198)		8.0%		6.5% (80)		6.6%		7.2% (485)		7.4%
Cannabis		4.0% (101)		4.1%		3.3% (40)		3.2%		3.9% (262)		4.3%
MDMA		2.1% (53)		2.3%		1.4% (17)		1.4%		1.7% (113)		1.8%
Amphetamine (speed)		0.2% (6)		0.2%		0.7% (9)		0.8%		0.3% (22)		0.4%
Crystal methamphetamine		1.7% (42)		1.8%		0.6% (7)		0.7%		1.1% (72)		1.2%
Heroin		0.0% (0)		0.0%		0.0% (0)		0.0%		0.04% (3)		0.05%
Mephedrone		0.8% (21)		0.8%		0.7% (9)		0.9%		0.7% (46)		0.8%
GHB		1.6% (41)		1.8%		0.4% (5)		0.4%		1.4% (94)		1.7%
Ketamine		2.2% (55)		2.4%		1.4% (17)		1.6%		1.8% (119)		1.9%
LSD		0.1% (3)		0.1%		0.08% (1)		0.2%		0.1% (4)		0.1%
Cocaine		2.1% (52)		2.2%		1.9% (23)		2.1%		2.1% (141)		2.4%
Crack		0.04% (1)		0.03%		0.2% (3)		0.2%		0.04% (3)		0.03%
Any other drug		0.3% (7)		0.2%		1.1% (13)		1.0%		0.6% (37)		0.6%

Table 16.3 continued.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				All encounters (multilevel models)			
	Encounter-level		Individual-level		Encounter-level		Individual-level		Encounter-level		Individual-level	
	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)
Any substance use by partner	2,533		636		1,233		306		6,690		2,137	
No substance use by partner		65.1% (1,648)		64.2%		61.2% (757)		60.8%		64.0% (4,279)		61.8%
Don't know		6.8% (172)		7.1%		9.4% (116)		10.0%		7.9% (526)		8.7%
Yes, but unsure what		3.7% (94)		4.1%		3.6% (44)		3.8%		3.8% (253)		4.6%
Yes, specifically		24.4% (619)		24.6%		25.6% (316)		25.4%		24.4% (1,632)		24.9%
Number of substances used by partner	2,533		636		1,233		306		6,690		2,137	
Substance use by partner: specific	2,533		636		1,233		306		6,690		2,137	
Alcohol		20.5% (519)		20.5%		22.7% (280)		22.6%		20.9% (1,400)		21.2%
Erectile dysfunction medications		3.0% (76)		3.1%		2.8% (34)		3.0%		2.5% (165)		2.6%
Cannabis		3.2% (81)		3.1%		3.2% (40)		3.3%		3.1% (205)		3.3%
MDMA		1.7% (43)		1.8%		1.3% (16)		1.3%		1.2% (83)		1.2%
Amphetamine (speed)		0.1% (3)		0.1%		0.5% (6)		0.6%		0.2% (13)		0.2%
Crystal methamphetamine		1.5% (37)		1.6%		0.4% (5)		0.4%		0.9% (62)		0.9%
Heroin		0.0% (0)		0.0%		0.0% (0)		0.0%		0.01% (1)		0.02%
Mephedrone		0.8% (19)		0.7%		0.5% (6)		0.6%		0.6% (39)		0.7%
GHB		1.5% (37)		1.6%		0.7% (8)		0.7%		1.2% (79)		1.3%
Ketamine		1.7% (43)		1.9%		0.8% (10)		1.0%		1.4% (92)		1.4%
LSD		0.1% (2)		0.1%		0.0% (0)		0.0%		0.04% (3)		0.04%
Cocaine		2.0% (50)		2.2%		2.0% (25)		2.3%		1.8% (118)		2.0%
Crack		0.04% (1)		0.03%		0.2% (2)		0.1%		0.03% (2)		0.02%
Any other drug		0.6% (15)		0.6%		1.0% (12)		0.8%		0.8% (51)		0.8%
Location of sex	2,546		637		1,234		305		6,723		2,141	
Private (residence, hotel)		87.6% (2,230)		87.6%		86.1% (1,062)		86.3%		87.2% (5,862)		86.7%
Sex-on-premises venue		7.0% (179)		7.2%		7.0% (86)		6.8%		7.3% (490)		7.8%
Cruising or outdoors location		5.4% (137)		5.2%		7.0% (86)		6.9%		5.5% (371)		5.6%
Relationship status with partner	2,549		638		1,238		306		6,724		2,141	
Regular and steady		36.0% (917)		35.2%		30.5% (378)		29.6%		32.3% (2,174)		31.1%
Regular, non-steady		25.7% (656)		26.0%		24.9% (308)		25.0%		26.3% (1,766)		26.1%
Opportunity/anonymous		38.3% (976)		38.8%		44.6% (552)		45.4%		41.4% (2,784)		42.8%

Table 16.3 continued.

Variable	Conditional logistic regressions: UAI				Conditional logistic regressions: control				All encounters (multilevel models)			
	Encounter-level		Individual-level		Encounter-level		Individual-level		Encounter-level		Individual-level	
	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)	N	% (n) Mean (SD, range)	N	Mean % Mean (SD)
Serodiscordance	2,524		635		1,231		305		6,701		2,139	
Both partners believed HIV+ or HIV-		49.0% (1,236)		48.3%		39.1% (481)		38.2%		43.0% (2,882)		42.0%
Didn't care, didn't notice, didn't remember		43.8% (1,106)		44.4%		52.6% (648)		53.9%		50.0% (3,352)		51.1%
One partner HIV+ and one HIV-		7.2% (182)		7.3%		8.3% (102)		8.0%		7.0% (467)		6.9%
Month of encounter	2,556		639		1,246				6,742			
Month 2		19.9% (508)				19.7% (245)				22.7% (1,528)		
Month 5		20.6% (527)				21.2% (264)				20.3% (1,369)		
Month 7		20.4% (521)				20.7% (258)				19.2% (1,293)		
Month 10		19.6% (502)				19.4% (242)				18.6% (1,253)		
Month 13		19.5% (498)				19.0% (237)				19.3% (1,299)		

Table 16.4. Initial conditional logistic regression models testing associations with UAI in the sample of single-partner encounters.

Variable	OR (95% CI)	Model fit
Any substance use by respondent	1.79*** (1.42, 2.26)	1897.88
Number of substances used	1.46*** (1.30, 1.65)	1858.59
Substance use by respondent: specific		1859.91
Poppers	1.79*** (1.32, 2.41)	
Alcohol	0.97 (0.74, 1.26)	
Erectile dysfunction medications	2.51*** (1.55, 4.08)	
Cannabis	1.33 (0.70, 2.52)	
MDMA	1.54 (0.59, 4.04)	
Crystal methamphetamine	2.21 (0.67, 7.26)	
GHB	1.80 (0.70, 4.64)	
Ketamine	1.00 (0.41, 2.47)	
Cocaine	2.19 (0.91, 5.24)	
Any substance use by partner		1897.20
No substance use	Reference	
Don't know	0.81 (0.55, 1.20)	
Yes, but unsure what	1.21 (0.75, 1.96)	
Yes, specifically	1.60*** (1.24, 2.05)	
Number of substances used by partner	1.44*** (1.25, 1.66)	1882.58
Substance use by partner: specific		1888.60
Alcohol	1.30 (0.99, 1.70)	
Erectile dysfunction medications	2.84* (1.29, 6.24)	
Cannabis	1.56 (0.83, 2.93)	
MDMA	1.72 (0.67, 4.47)	
Crystal methamphetamine	1.73 (0.55, 5.44)	
GHB	1.59 (0.61, 4.16)	
Ketamine	0.56 (0.23, 1.35)	
Cocaine	1.65 (0.73, 3.73)	
Location of sex		1896.35
Private (residence, hotel)	Reference	
Sex-on-premises venue	0.59* (0.38, 0.91)	
Cruising or outdoors location	0.28*** (0.16, 0.47)	
Relationship status with partner		
Regular and steady	Reference	1828.08
Regular, non-steady	0.50*** (0.36, 0.70)	
Opportunity/anonymous	0.23*** (0.17, 0.31)	
Serodiscordance		
Both partners believed HIV+ or HIV-	Reference	1792.06
Didn't care, didn't notice, didn't remember	0.24*** (0.18, 0.31)	
One partner HIV+ and one HIV-	0.32*** (0.20, 0.51)	
Control over what happened		
Some/no control	Reference	1887.84
Totally/mostly in control	0.50*** (0.35, 0.70)	
Quality of the sex	1.38*** (1.30, 1.47)	1774.51
Month of encounter		1929.98
Month 2	Reference	
Month 5	0.87 (0.69, 1.10)	
Month 7	1.08 (0.85, 1.37)	
Month 10	0.85 (0.67, 1.09)	
Month 13	0.82 (0.64, 1.05)	

Table 16.5. Conditional logistic regression models with categorical measures of any substance use testing interactions in associations with UAI in the sample of single-partner encounters.

Variable	Main effects n=2,524 in 634 groups OR (95% CI)	Interaction n=2,524 in 634 groups OR (95% CI)	Main effects n=2,536 in 635 groups OR (95% CI)	Interaction n=2,536 in 635 groups OR (95% CI)
Any substance use by respondent	1.70*** (1.30, 2.23)	1.68** (1.23, 2.29)	1.79*** (1.41, 2.26)	1.78*** (1.39, 2.28)
Any substance use by partner				
No substance use	Reference	Reference		
Don't know	0.77 (0.52, 1.15)	1.07 (0.40, 2.86)		
Yes, but unsure what	0.97 (0.59, 1.59)	0.89 (0.48, 1.65)		
Yes, specifically	1.19 (0.89, 1.60)	0.92 (0.54, 1.57)		
Interaction				
Respondent use and partner don't know		0.70 (0.32, 1.49)		
Respondent use and partner yes, but unsure what		0.90 (0.29, 2.81)		
Respondent use and partner yes, specifically		1.42 (0.70, 2.86)		
Location of sex				
Private (residence, hotel)			Reference	Reference
Sex-on-premises venue			0.55** (0.36, 0.85)	0.58 (0.31, 1.07)
Cruising or outdoors location			0.28*** (0.16, 0.48)	0.25*** (0.13, 0.50)
Interaction: substance use and place				
Substance use and SOPV				0.94 (0.44, 2.03)
Substance use and cruising location				1.31 (0.46, 3.76)
-2LL	1869.90	1867.76	1858.92	1858.62
Model test (χ^2, df, p-value)	30.36, 4, <0.0001	32.50, 7, <0.0001	54.47, 3, <0.0001	54.77, 5, <0.0001
Model fit	1877.90	1881.76	1864.92	1868.62
Deviance test (χ^2, df, p-value)		2.14, 3, 0.54		0.30, 2, 0.86

Table 16.6. Multivariate conditional logistic regression models with categorical measures of any substance use testing associations with UAI in the sample of single-partner encounters.

Variable	Model 1 n=2,477 in 627 groups	Model 2 n=2,498 in 630 groups
	OR (95% CI)	OR (95% CI)
Any substance use by respondent	1.57** (1.17, 2.09)	1.66*** (1.30, 2.13)
Any substance use by partner		
No substance use	Reference	
Don't know	1.21 (0.76, 1.93)	
Yes, but unsure what	1.38 (0.80, 2.36)	
Yes, specifically	1.16 (0.85, 1.58)	
Location of sex		
Private (residence, hotel)	Reference	Reference
Sex-on-premises venue	0.96 (0.58, 1.59)	1.04 (0.65, 1.67)
Cruising or outdoors location	0.39** (0.21, 0.71)	0.44** (0.24, 0.78)
Relationship status with partner		
Regular and steady	Reference	Reference
Regular, non-steady	0.63* (0.44, 0.90)	0.63* (0.44, 0.90)
Opportunity/anonymous	0.33*** (0.23, 0.48)	0.34*** (0.24, 0.49)
Serodiscordance		
Both partners believed HIV+ or HIV-	Reference	Reference
Didn't care, didn't notice, didn't remember	0.37*** (0.27, 0.51)	0.36*** (0.26, 0.48)
One partner HIV+ and one HIV-	0.31*** (0.19, 0.51)	0.31*** (0.19, 0.50)
-2LL	1674.66	1696.37
Model test (χ^2, df, <i>p</i>-value)	190.39, 10, <0.0001	188.57, 7, <0.0001
Model fit	1694.66	1710.37
Deviance test (χ^2, df, <i>p</i>-value)		2.01, 3, 0.57

Table 16.7. Conditional logistic regression models with continuous measures of substance use testing interactions in associations with UAI in the sample of single-partner encounters.

Variable	Main effects n=2,496 in 628 groups OR (95% CI)	Interaction n=2,496 in 628 groups OR (95% CI)	Main effects n=2,507 in 629 groups OR (95% CI)	Interaction n=2,507 in 629 groups OR (95% CI)
Number of substances used by respondent	1.39*** (1.20, 1.62)	1.38*** (1.18, 1.61)	1.45*** (1.28, 1.64)	1.43*** (1.26, 1.63)
Number of substances used by partner	1.13 (0.94, 1.34)	1.07 (0.84, 1.38)		
Interaction: number of substances used		1.02 (0.95, 1.09)		
Location of sex				
Private (residence, hotel)			Reference	Reference
Sex-on-premises venue			0.56** (0.36, 0.86)	0.57* (0.33, 0.98)
Cruising or outdoors location			0.29*** (0.17, 0.50)	0.23*** (0.12, 0.45)
Interaction: substance use and place				
Number of substances and SOPV				0.98 (0.70, 1.36)
Number of substances and cruising location				1.64 (0.80, 3.36)
-2LL	1834.20	1833.94	1822.66	1820.70
Model test (χ^2, df, <i>p</i>-value)	44.46, 2, <0.0001	44.73, 3, <0.0001	68.33, 3, <0.0001	70.29, 5, <0.0001
Model fit	1838.21	1839.94	1828.66	1830.70
Deviance test (χ^2, df, <i>p</i>-value)		0.27, 1, 0.60		2.51, 2, 0.28

Table 16.8. Multivariate conditional logistic regression models with continuous measures of substance use testing associations with UAI in the sample of single-partner encounters.

Variable	Model 1 n=2,449 in 621 groups	Model 2 n=2,469 in 624 groups
	OR (95% CI)	OR (95% CI)
Number of substances used by respondent	1.34*** (1.14, 1.57)	1.39*** (1.22, 1.58)
Number of substances used by partner	1.09 (0.90, 1.32)	
Location of sex		
Private (residence, hotel)	Reference	Reference
Sex-on-premises venue	1.08 (0.67, 1.75)	1.06 (0.66, 1.70)
Cruising or outdoors location	0.43** (0.24, 0.78)	0.45** (0.25, 0.81)
Relationship status with partner		
Regular and steady	Reference	Reference
Regular, non-steady	0.65* (0.45, 0.93)	0.65* (0.45, 0.93)
Opportunity/anonymous	0.33*** (0.23, 0.48)	0.34*** (0.24, 0.49)
Serodiscordance		
Both partners believed HIV+ or HIV-	Reference	Reference
Didn't care, didn't notice, didn't remember	0.38*** (0.28, 0.52)	0.37*** (0.27, 0.50)
One partner HIV+ and one HIV-	0.31*** (0.19, 0.52)	0.31*** (0.19, 0.52)
-2LL	1645.61	1665.34
Model test (χ^2, df, p-value)	197.85, 8, <0.0001	197.2, 7, <0.0001
Model fit	1661.61	1679.34
Deviance test (χ^2, df, p-value)		0.82, 1, 0.37

Table 16.9. Multivariate conditional logistic regression models with categorical measures of specific substances testing associations with UAI in the sample of single-partner encounters.

Variable	Model 1 n=2,496 in 628 groups	Model 2 n=2,449 in 621 groups
	OR (95% CI)	OR (95% CI)
Poppers use by respondent	1.87*** (1.38, 2.53)	1.77*** (1.29, 2.45)
EDM use by respondent	2.52*** (1.58, 4.01)	2.22** (1.36, 3.63)
EDM use by partner	2.77** (1.35, 5.70)	3.06** (1.37, 6.83)
Location of sex		
Private (residence, hotel)		Reference
Sex-on-premises venue		1.06 (0.66, 1.72)
Cruising or outdoors location		0.42** (0.23, 0.76)
Relationship status with partner(s)		
Regular and steady		Reference
Regular, non-steady		0.65* (0.45, 0.93)
Opportunity/anonymous		0.33* (0.23, 0.48)
Serodiscordance		
Both partners believed HIV+ or HIV-		Reference
Didn't care, didn't notice, didn't remember		0.37*** (0.27, 0.51)
One partner HIV+ and one HIV-		0.31*** (0.19, 0.51)
-2LL	1825.34	1633.61
Model test (χ^2, df, <i>p</i>-value)	53.33, 3, <0.0001	209.85, 9, <0.0001
Model fit	1831.34	1651.61
Deviance test (χ^2, df, <i>p</i>-value)		159.76, 6, <0.0001

Table 16.10. Initial random intercept models testing associations with UAI in the sample of single-partner encounters.

Variable	Group n	n	OR (95% CI) ICC (95% CI)	Intercept (95% CI)	Between-level variance (95% CI)	Model fit
Null model	2,141	6,731	66.8% (63.0-70.5)	0.22*** (0.19, 0.26)	6.63 (5.59, 7.87)	7046.80
Any substance use by respondent	2,139	6,704	2.02*** (1.67, 2.45)	0.16*** (0.14, 0.20)	6.59 (5.55, 7.82)	6980.57
Number of substances used	2,131	6,654	1.64*** (1.49, 1.80)	0.16*** (0.13, 0.19)	6.53 (5.49, 7.75)	6869.53
Substance use by respondent: specific	2,131	6,654		0.17*** (0.15, 0.20)	6.38 (5.37, 7.59)	6836.01
Poppers			2.35*** (1.84, 3.00)			
Alcohol			0.84 (0.67, 1.05)			
Erectile dysfunction medications			3.14*** (2.12, 4.67)			
Cannabis			1.59 (0.95, 2.65)			
MDMA			1.48 (0.67, 3.26)			
Crystal methamphetamine			3.14* (1.18, 8.36)			
GHB			2.32* (1.02, 5.29)			
Ketamine			1.72 (0.80, 3.06)			
Cocaine			1.56 (0.80, 3.06)			
Any substance use by partner	2,136	6,680		0.20*** (0.17, 0.24)	6.60 (5.55, 7.84)	6978.35
No substance use			Reference			
Don't know			0.68* (0.48, 0.97)			
Yes, but unsure what			1.53 (0.99, 2.36)			
Yes, specifically			1.61*** (1.29, 1.99)			
Number of substances used by partner	2,136	6,680	1.64*** (1.44, 1.85)	0.19*** (0.16, 0.22)	6.52 (5.49, 7.74)	6941.13
Substance use by partner: specific	2,136	6,680		0.20*** (0.17, 0.24)	6.38 (5.37, 7.58)	6928.84
Alcohol			1.09 (0.87, 1.38)			
Erectile dysfunction medications			4.27*** (2.19, 8.34)			
Cannabis			1.87* (1.10, 3.18)			
MDMA			2.09 (0.88, 4.95)			
Crystal methamphetamine			2.92* (1.00, 8.46)			
GHB			3.07* (1.24, 7.64)			
Ketamine			0.98 (0.43, 2.22)			
Cocaine			1.84 (0.91, 3.70)			

Table 16.10 continued.

Variable	Group n	n	OR (95% CI) ICC (95% CI)	Intercept (95% CI)	Between-level variance (95% CI)	Model fit
Location of sex	2,140	6,712		0.25*** (0.21, 0.29)	6.68 (5.63, 7.94)	6991.75
Private (residence, hotel)			Reference			
Sex-on-premises venue			0.48*** (0.33, 0.70)			
Cruising or outdoors location			0.29*** (0.19, 0.46)			
Relationship status with partner(s)	2,140	6,713		0.59*** (0.48, 0.73)	6.46 (5.44, 7.68)	6816.52
Regular and steady			Reference			
Regular, non-steady			0.41*** (0.32, 0.53)			
Opportunity/anonymous			0.16*** (0.12, 0.21)			
Serodiscordance	2,138	6,691		0.57*** (0.47, 0.68)	6.36 (5.34, 7.57)	6739.60
Both partners believed HIV+ or HIV-			Reference			
Didn't care, didn't notice, didn't remember			0.17*** (0.14, 0.22)			
One partner HIV+ and one HIV-			0.31*** (0.21, 0.46)			
Control over what happened	2,138	6,678		0.53*** (0.38, 0.72)	6.63 (5.58, 7.87)	6957.90
Some/no control			Reference			
Totally/mostly in control			0.39*** (0.29, 0.53)			
Quality of the sex	2,138	6,677	1.47*** (1.40, 1.56)	0.02*** (0.01, 0.03)	6.96 (5.85, 8.28)	6765.12
Month of encounter	2,141	6,731		0.25*** (0.20, 0.31)	6.66 (5.61, 7.90)	7046.85
Month 2			Reference			
Month 5			0.82 (0.66, 1.03)			
Month 7			1.02 (0.81, 1.28)			
Month 10			0.84 (0.67, 1.06)			
Month 13			0.79* (0.63, 1.00)			

Table 16.11. Random intercept models with categorical measures of any substance use testing interactions in associations with UAI in the sample of single-partner encounters.

Variable	Main effects n=6,655 in 2,134 groups OR (95% CI)	Interaction n=6,655 in 2,134 groups OR (95% CI)	Main effects n=6,685 in 2,138 groups OR (95% CI)	Interaction n=6,685 in 2,138 groups OR (95% CI)
Intercept				
Any substance use by respondent	0.08*** (0.06, 0.12)	0.17*** (0.14, 0.20)	0.09*** (0.07, 0.13)	0.18*** (0.15, 0.22)
Any substance use by partner	2.00*** (1.59, 2.53)	2.10*** (1.60, 2.75)	2.01*** (1.65, 2.45)	2.00*** (1.63, 2.46)
No substance use	Reference	Reference		
Don't know	0.60** (0.42, 0.86)	0.77 (0.48, 1.22)		
Yes, but unsure what	1.09 (0.70, 1.71)	1.28 (0.51, 3.19)		
Yes, specifically	1.05 (0.81, 1.36)	0.91 (0.51, 1.61)		
Interaction				
Respondent use and partner don't know		0.61 (0.31, 1.21)		
Respondent use and partner yes, but unsure what		0.80 (0.28, 2.26)		
Respondent use and partner yes, specifically		1.14 (0.60, 2.17)		
Location of sex				
Private (residence, hotel)			Reference	Reference
Sex-on-premises venue			0.45*** (0.31, 0.65)	0.48** (0.28, 0.82)
Cruising or outdoors location			0.30*** (0.19, 0.48)	0.27*** (0.16, 0.48)
Interaction: substance use and place				
Substance use and SOPV				0.91 (0.47, 1.85)
Substance use and cruising location				1.36 (0.55, 3.35)
Between-level variance (95% CI)	6.53 (5.50, 7.76)	6.54 (5.50, 7.77)	6.65 (5.60, 7.91)	6.65 (5.60, 7.90)
-2LL	6920.00	6917.52	6915.89	6915.36
Model test (χ^2, df, p-value)	61.54, 4, <0.0001	64.17, 7, <0.0001	88.87, 3, <0.0001	88.86, 5, <0.0001
Model fit	6932.00	6932.52	6925.89	6929.36
Deviance test (χ^2, df, p-value)		2.48, 3, 0.48		0.54, 2, 0.77

Table 16.12. Multivariate random intercept model with categorical measures of any substance use testing associations with UAI in the sample of single-partner encounters.

Variable	Model 1 n=6,582 in 2,129 groups
	OR (95% CI)
Intercept	0.34*** (0.23, 0.51)
Any substance use by respondent	2.15*** (1.69, 2.74)
Any substance use by partner	
No substance use	Reference
Don't know	1.35 (0.91, 2.01)
Yes, but unsure what	1.63* (1.01, 2.61)
Yes, specifically	0.99 (0.76, 1.30)
Location of sex	
Private (residence, hotel)	Reference
Sex-on-premises venue	1.00 (0.66, 1.52)
Cruising or outdoors location	0.55* (0.34, 0.90)
Relationship status with partner(s)	
Regular and steady	Reference
Regular, non-steady	0.54*** (0.41, 0.71)
Opportunity/anonymous	0.25*** (0.19, 0.34)
Serodiscordance	
Both partners believed HIV+ or HIV-	Reference
Didn't care, didn't notice, didn't remember	0.27*** (0.21, 0.35)
One partner HIV+ and one HIV-	0.30*** (0.20, 0.45)
Month of encounter	
Month 2	Reference
Month 5	0.81 (0.64, 1.03)
Month 7	1.09 (0.86, 1.39)
Month 10	0.85 (0.66, 1.08)
Month 13	0.77* (0.60, 0.98)
Between-level variance (95% CI)	6.36 (5.33, 7.59)
-2LL	6481.26
Model test (χ^2, df, p-value)	348.14, 14, <0.0001
Model fit	6513.26
Deviance test (χ^2, df, p-value)	

Table 16.13. Random intercept models with continuous measures of substance use testing interactions in associations with UAI in the sample of single-partner encounters.

Variable	Main effects n=6,606 in 2,126 groups OR (95% CI)	Interaction n=6,606 in 2,126 groups OR (95% CI)	Main effects n=6,635 in 2,130 groups OR (95% CI)	Interaction n=6,635 in 2,130 groups OR (95% CI)
Intercept	0.16*** (0.13, 0.19)	0.16*** (0.13, 0.19)	0.18*** (0.15, 0.22)	0.18*** (0.15, 0.21)
Number of substances used by respondent	1.54*** (1.36, 1.74)	1.48*** (1.30, 1.69)	1.62*** (1.47, 1.79)	1.62*** (1.46, 1.79)
Number of substances used by partner	1.14 (0.97, 1.34)	0.98 (0.78, 1.24)		
Interaction: number of substances used		1.06 (0.99, 1.14)		
Location of sex				
Private (residence, hotel)			Reference	Reference
Sex-on-premises venue			0.45*** (0.31, 0.66)	0.50** (0.31, 0.79)
Cruising or outdoors location			0.31*** (0.20, 0.49)	0.25*** (0.15, 0.43)
Interaction: substance use and place				
Number of substances and SOPV				0.91 (0.66, 1.24)
Number of substances and cruising location				1.60 (0.89, 2.87)
Between-level variance (95% CI)	6.51 (5.48, 7.74)	6.50 (5.46, 7.72)	6.57 (5.53, 7.82)	6.57 (5.53, 7.82)
-2LL	6817.73	6814.55	6807.59	6804.55
Model test (χ^2, df, p-value)	101.94, 2, <0.0001	99.98, 3, <0.0001	133.23, 3, <0.0001	134.69, 5, <0.0001
Model fit	6825.73	6824.55	6817.59	6818.55
Deviance test (χ^2, df, p-value)		3.18, 1, 0.07		3.04, 2, 0.22

Table 16.14. Multivariate random intercept models with continuous measures of substance use testing associations with UAI in the sample of single-partner encounters.

Variable	Model 1 n=6,534 in 2,121 groups	Model 2 n=6,580 in 2,126 groups
	OR (95% CI)	OR (95% CI)
Intercept	0.70** (0.53, 0.91)	0.70** (0.54, 0.92)
Number of substances used by respondent	1.65*** (1.45, 1.87)	1.65*** (1.50, 1.83)
Number of substances used by partner	1.02 (0.86, 1.20)	
Location of sex		
Private (residence, hotel)	Reference	Reference
Sex-on-premises venue	1.03 (0.71, 1.50)	1.14 (0.76, 1.71)
Cruising or outdoors location	0.60* (0.38, 0.97)	0.63 (0.39, 1.01)
Relationship status with partner(s)		
Regular and steady	Reference	Reference
Regular, non-steady	0.53*** (0.40, 0.70)	0.52*** (0.40, 0.69)
Opportunity/anonymous	0.25*** (0.19, 0.34)	0.25*** (0.19, 0.34)
Serodiscordance		
Both partners believed HIV+ or HIV-	Reference	Reference
Didn't care, didn't notice, didn't remember	0.29*** (0.23, 0.37)	0.28*** (0.22, 0.36)
One partner HIV+ and one HIV-	0.28*** (0.19, 0.43)	0.28*** (0.18, 0.42)
Month of encounter		
Month 2	Reference	Reference
Month 5	0.84 (0.66, 1.07)	0.84 (0.66, 1.07)
Month 7	1.11 (0.87, 1.42)	1.12 (0.88, 1.43)
Month 10	0.88 (0.68, 1.13)	0.89 (0.69, 1.14)
Month 13	0.79 (0.62, 1.01)	0.80 (0.63, 1.03)
Between-level variance (95% CI)	6.28 (5.25, 7.50)	6.26 (5.24, 7.47)
-2LL	6389.49	6426.63
Model test (χ^2, df, <i>p</i>-value)	369.01, 12, <0.0001	373.11, 11, <0.0001
Model fit	6417.49	6452.64
Deviance test (χ^2, df, <i>p</i>-value)		0.03, 1, 0.86

Table 16.15. Multivariate random intercept models with categorical measures of specific substances testing associations with UAI in the sample of single-partner encounters.

Variable	Model 1 n=6,606 in 2,126 groups	Model 2 n=6,534 in 2,121 groups
	OR (95% CI)	OR (95% CI)
Intercept	0.16*** (0.13, 0.19)	0.72* (0.55, 0.94)
Poppers use by respondent	2.38*** (1.87, 3.04)	2.59*** (2.01, 3.34)
EDM use by respondent	2.70*** (1.82, 4.00)	2.78*** (1.85, 4.19)
Crystal meth use by respondent	3.33 (0.96, 11.52)	3.34 (0.94, 11.88)
GHB use by respondent	1.32 (0.44, 3.94)	1.39 (0.45, 4.27)
EDM use by partner	2.87** (1.48, 5.58)	2.74** (1.37, 5.47)
Cannabis use by partner	1.73* (1.01, 2.94)	1.57 (0.90, 2.73)
Crystal meth use by partner	1.06 (0.28, 4.06)	0.83 (0.21, 3.28)
GHB use by partner	2.36 (0.73, 7.61)	2.37 (0.72, 7.86)
Location of sex		
Private (residence, hotel)		Reference
Sex-on-premises venue		1.12 (0.75, 1.68)
Cruising or outdoors location		0.61* (0.38, 0.97)
Relationship status with partner(s)		
Regular and steady		Reference
Regular, non-steady		0.50*** (0.38, 0.66)
Opportunity/anonymous		0.28*** (0.18, 0.33)
Serodiscordance		
Both partners believed HIV+ or HIV-		Reference
Didn't care, didn't notice, didn't remember		0.30*** (0.23, 0.38)
One partner HIV+ and one HIV-		0.28*** (0.18, 0.42)
Month of encounter		
Month 2		Reference
Month 5		0.84 (0.66, 1.07)
Month 7		1.11 (0.87, 1.42)
Month 10		0.88 (0.69, 1.13)
Month 13		0.77* (0.60, 0.99)
Between-level variance (95% CI)	6.36 (5.35, 7.56)	6.15 (5.15, 7.35)
-2LL	6761.79	6333.5494
Model test (χ^2, df, <i>p</i>-value)	144.98, 8, <0.0001	397.50, 18, <0.0001
Model fit	6781.79	6373.55
Deviance test (χ^2, df, <i>p</i>-value)		362.95, 10, <0.0001

Table 16.16. Initial random intercept models testing associations with pleasure in the sample of single-partner encounters.

Variable	Group n	n	Beta (95% CI) ICC (95% CI)	Intercept (95% CI)	Between-level variance (95% CI)	Model fit
Null model	2,139	6,687	38.3% (35.6-41.0)	6.48*** (6.41, 6.54)	1.40 (1.27, 1.54)	26591.10
Any substance use by respondent	2,137	6,661	0.24*** (0.15, 0.34)	6.37*** (6.30, 6.44)	1.41 (1.28, 1.55)	26463.38
Number of substances used	2,129	6,611	0.19*** (0.14, 0.24)	6.34*** (6.27, 6.42)	1.41 (1.28, 1.56)	26246.48
Substance use by respondent: specific	2,129	6,611		6.36*** (6.28, 6.43)	1.41 (1.28, 1.56)	26232.26
Poppers			0.31*** (0.19, 0.43)			
Alcohol			-0.01 (-0.12, 0.10)			
Erectile dysfunction medications			0.33** (0.14, 0.53)			
Cannabis			0.42** (0.16, 0.68)			
MDMA			0.09 (-0.31, 0.48)			
Crystal methamphetamine			0.76** (0.29, 1.23)			
GHB			0.37 (-0.05, 0.78)			
Ketamine			0.04 (-0.35, 0.43)			
Cocaine			-0.05 (-0.38, 0.29)			
Any substance use by partner	2,134	6,638		6.49*** (6.42, 6.57)	1.36 (1.23, 1.50)	26303.46
No substance use			Reference			
Don't know			-0.62*** (-0.79, -0.46)			
Yes, but unsure what			-0.21 (-0.44, 0.01)			
Yes, specifically			0.19** (0.08, 0.29)			
Number of substances used by partner	2,134	6,638	0.22*** (0.15, 0.28)	6.40*** (6.33, 6.47)	1.39 (1.26, 1.53)	26334.98
Substance use by partner: specific	2,134	6,638		6.41*** (6.35, 6.48)	1.38 (1.26, 1.53)	26337.68
Alcohol			0.13* (0.02, 0.25)			
Erectile dysfunction medications			0.73*** (0.41, 1.05)			
Cannabis			0.28* (0.003, 0.55)			
MDMA			0.39 (-0.05, 0.82)			
Crystal methamphetamine			0.05 (-0.46, 0.57)			
GHB			0.10 (-0.35, 0.54)			
Ketamine			0.09 (-0.33, 0.50)			
Cocaine			-0.02 (-0.37, 0.33)			

Table 16.16 continued.

Variable	Group n	n	Beta (95% CI) ICC (95% CI)	Intercept (95% CI)	Between-level variance (95% CI)	Model fit
Location of sex	2,138	6,668		6.57*** (6.50, 6.64)	1.36 (1.23, 1.50)	26410.52
Private (residence, hotel)			Reference			
Sex-on-premises venue			-0.64*** (-0.81, -0.46)			
Cruising or outdoors location			-0.74*** (-0.94, -0.54)			
Relationship status with partner(s)	2,138	6,669		6.83*** (6.73, 6.93)	1.27 (1.15, 1.40)	26346.16
Regular and steady			Reference			
Regular, non-steady			-0.11 (-0.24, 0.01)			
Opportunity/anonymous			-0.76*** (-0.88, -0.64)			
Serodiscordance	2,136	6,646		6.78*** (6.70, 6.87)	1.30 (1.18, 1.43)	26274.73
Both partners believed HIV+ or HIV-			Reference			
Didn't care, didn't notice, didn't remember			-0.61*** (-0.71, -0.51)			
One partner HIV+ and one HIV-			0.01 (-0.18, 0.21)			
Control over what happened	2,136	6,636		6.33*** (6.17, 6.49)	1.39 (1.27, 1.54)	26382.95
Some/no control			Reference			
Totally/mostly in control			0.16* (0.004, 0.32)			
Month of encounter	2,139	6,687		6.46*** (6.37, 6.56)	1.40 (1.27, 1.54)	26590.55
Month 2			Reference			
Month 5			-0.02 (-0.13, 0.10)			
Month 7			-0.02 (-0.13, 0.10)			
Month 10			0.13* (0.01, 0.25)			
Month 13			-0.001 (-0.12, 0.12)			

Table 16.17. Random intercept models with categorical measures of any substance use testing interactions in associations with pleasure in the sample of single-partner encounters.

Variable	Main effects n=6,614 in 2,132 groups	Interaction n=6,614 in 2,132 groups	Main effects n=6,642 in 2,136 groups	Interaction n=6,642 in 2,136 groups
Intercept	Beta (95% CI)	Beta (95% CI)	Beta (95% CI)	Beta (95% CI)
Any substance use by respondent	6.17*** (6.01, 6.33)	6.44*** (6.36, 6.52)	6.24*** (6.09, 6.39)	6.47*** (6.39, 6.55)
Any substance use by partner	0.26*** (0.15, 0.38)	0.21** (0.07, 0.34)	0.23*** (0.14, 0.33)	0.24*** (0.14, 0.34)
No substance use	Reference	Reference		
Don't know	-0.69*** (-0.85, -0.52)	-0.78*** (-1.00, -0.56)		
Yes, but unsure what	-0.35*** (-0.58, -0.12)	-0.38 (-0.83, 0.08)		
Yes, specifically	0.02 (-0.11, 0.15)	-0.09 (-0.37, 0.19)		
Interaction				
Respondent use and partner don't know		0.23 (-0.10, 0.56)		
Respondent use and partner yes, but unsure what		0.08 (-0.45, 0.61)		
Respondent use and partner yes, specifically		0.17 (-0.15, 0.48)		
Location of sex				
Private (residence, hotel)			Reference	Reference
Sex-on-premises venue			-0.67*** (-0.84, -0.49)	-0.74*** (-0.99, -0.50)
Cruising or outdoors location			-0.72*** (-0.92, -0.53)	-0.62*** (-0.86, -0.39)
Interaction: substance use and place				
Substance use and SOPV				0.14 (-0.19, 0.47)
Substance use and cruising location				-0.35 (-0.78, 0.07)
Between-level variance (95% CI)	1.36 (1.24, 1.50)	1.37 (1.24, 1.51)	1.37 (1.25, 1.51)	1.38 (1.25, 1.52)
-2LL	26174.75	26172.17	26269.79	26266.19
Model test (χ^2, df, p-value)	102.29, 4, <0.0001	104.90, 7, <0.0001	122.32, 3, <0.0001	125.99, 5, <0.0001
Model fit	26188.75	26192.17	26281.79	26282.19
Deviance test (χ^2, df, p-value)		2.57, 3, 0.46		3.60, 2, 0.17

Table 16.18. Multivariate random intercept model with categorical measures of any substance use testing associations with pleasure in the sample of single-partner encounters.

Variable	Model 1
	n=6,540 in 2,127 groups Beta (95% CI)
Intercept	6.54*** (6.35, 6.73)
Any substance use by respondent	0.26*** (0.15, 0.37)
Any substance use by partner	
No substance use	Reference
Don't know	-0.29** (-0.46, -0.12)
Yes, but unsure what	-0.17 (-0.40, 0.06)
Yes, specifically	-0.004 (-0.13, 0.12)
Location of sex	
Private (residence, hotel)	Reference
Sex-on-premises venue	-0.20* (-0.39, -0.02)
Cruising or outdoors location	-0.37*** (-0.58, -0.17)
Relationship status with partner(s)	
Regular and steady	Reference
Regular, non-steady	-0.02 (-0.15, 0.12)
Opportunity/anonymous	-0.51*** (-0.64, -0.38)
Serodiscordance	
Both partners believed HIV+ or HIV-	Reference
Didn't care, didn't notice, didn't remember	-0.34*** (-0.45, -0.23)
One partner HIV+ and one HIV-	-0.04 (-0.24, 0.15)
Month of encounter	
Month 2	Reference
Month 5	-0.01 (-0.12, 0.11)
Month 7	0.02 (-0.09, 0.14)
Month 10	0.14* (0.03, 0.26)
Month 13	0.003 (-0.11, 0.12)
Between-level variance (95% CI)	1.24 (1.12, 1.38)
-2LL	25617.24
Model test (χ^2, df, <i>p</i>-value)	354.45, 14, <0.0001
Model fit	25651.24
Deviance test (χ^2, df, <i>p</i>-value)	

Table 16.19. Random intercept models with continuous measures of substance use testing interactions in associations with pleasure in the sample of single-partner encounters.

Variable	Main effects n=6,564 in 2,124 groups	Interaction n=6,564 in 2,124 groups	Main effects n=6,592 in 2,128 groups	Interaction n=6,592 in 2,128 groups
Intercept	Beta (95% CI)	Beta (95% CI)	Beta (95% CI)	Beta (95% CI)
Number of substances used by respondent	6.34*** (6.27, 6.42)	6.37*** (6.29, 6.44)	6.44*** (6.37, 6.52)	6.44*** (6.36, 6.51)
Number of substances used by partner	0.15*** (0.09, 0.21)	0.12*** (0.06, 0.19)	0.18*** (0.14, 0.23)	0.19*** (0.14, 0.24)
Interaction: number of substances used	0.09* (0.004, 0.17)	-0.004 (-0.11, 0.11)		
Location of sex		0.03* (0.01, 0.06)		
Private (residence, hotel)				
Sex-on-premises venue			Reference	Reference
Cruising or outdoors location			-0.67*** (-0.84, -0.49)	-0.66*** (-0.88, -0.45)
Interaction: substance use and place			-0.71*** (-0.91, -0.51)	-0.65*** (-0.87, -0.43)
Number of substances and SOPV				
Number of substances and cruising location				-0.002 (-0.16, 0.15)
Between-level variance (95% CI)	1.40 (1.27, 1.55)	1.40 (1.27, 1.54)	1.38 (1.25, 1.52)	1.38 (1.25, 1.52)
-2LL	26030.27	26024.65	26054.67	26053.27
Model test (χ^2, df, p-value)	66.87, 2, <0.0001	72.55, 3, <0.0001	158.65, 3, <0.0001	160.08, 5, <0.0001
Model fit	26040.27	26036.65	26066.67	26069.27
Deviance test (χ^2, df, p-value)		5.63, 1, 0.02		1.40, 2, 0.50

Table 16.20. Multivariate random intercept models with continuous measures of substance use testing associations with pleasure in the sample of single-partner encounters.

Variable	Model 1
	n=6,491 in 2,119 groups Beta (95% CI)
Intercept	6.80*** (6.67, 6.93)
Number of substances used by respondent	0.15*** (0.09, 0.22)
Number of substances used by partner	-0.08 (-0.18, 0.03)
Interaction: number of substances used	0.03* (0.003, 0.06)
Location of sex	
Private (residence, hotel)	Reference
Sex-on-premises venue	-0.30** (-0.48, -0.12)
Cruising or outdoors location	-0.43*** (-0.63, -0.23)
Interaction: substance use and place	
Number of substances and SOPV	
Number of substances and cruising location	
Relationship status with partner(s)	
Regular and steady	Reference
Regular, non-steady	-0.03 (-0.16, 0.10)
Opportunity/anonymous	-0.52*** (-0.66, -0.39)
Serodiscordance	
Both partners believed HIV+ or HIV-	Reference
Didn't care, didn't notice, didn't remember	-0.34*** (-0.46, -0.24)
One partner HIV+ and one HIV-	-0.05 (-0.24, 0.14)
Month of encounter	
Month 2	Reference
Month 5	-0.01 (-0.13, 0.11)
Month 7	0.03 (-0.09, 0.14)
Month 10	0.15* (0.03, 0.27)
Month 13	0.02 (-0.10, 0.13)
Between-level variance (95% CI)	1.25 (1.13, 1.38)
-2LL	25422.69
Model test (χ^2, df, <i>p</i>-value)	374.31, 13, <0.0001
Model fit	25454.69
Deviance test (χ^2, df, <i>p</i>-value)	

Table 16.21. Multivariate random intercept models with categorical measures of specific substances testing associations with pleasure in the sample of single-partner encounters.

Variable	Model 1 n=6,564 in 2,124 groups	Model 2 n=6,491 in 2,119 groups
	Beta (95% CI)	Beta (95% CI)
Intercept	6.33*** (6.26, 6.41)	6.78*** (6.65, 6.91)
Poppers use by respondent	0.31*** (0.18, 0.43)	0.32*** (0.20, 0.44)
EDM use by respondent	0.21* (0.01, 0.41)	0.23* (0.03, 0.42)
Cannabis use by respondent	0.41* (0.08, 0.74)	0.37* (0.04, 0.69)
Crystal meth use by respondent	0.78** (0.33, 1.24)	0.67** (0.22, 1.12)
Alcohol use by partner	0.12* (0.01, 0.24)	0.06 (-0.05, 0.18)
EDM use by partner	0.55* (0.23, 0.86)	0.45** (0.14, 0.76)
Cannabis use by partner	-0.05 (-0.40, 0.30)	-0.14 (-0.48, 0.20)
Location of sex		
Private (residence, hotel)		Reference
Sex-on-premises venue		-0.28** (-0.45, -0.12)
Cruising or outdoors location		-0.50*** (-0.72, -0.27)
Relationship status with partner(s)		
Regular and steady		Reference
Regular, non-steady		-0.05 (-0.19, 0.08)
Opportunity/anonymous		-0.53*** (-0.66, -0.40)
Serodiscordance		
Both partners believed HIV+ or HIV-		Reference
Didn't care, didn't notice, didn't remember		-0.34*** (-0.45, -0.23)
One partner HIV+ and one HIV-		-0.06 (-0.25, 0.14)
Month of encounter		
Month 2		Reference
Month 5		-0.004 (-0.12, 0.11)
Month 7		0.03 (-0.08, 0.15)
Month 10		0.15* (0.03, 0.27)
Month 13		0.01 (-0.10, 0.13)
Between-level variance (95% CI)	1.40 (1.27, 1.54)	1.24 (1.12, 1.37)
-2LL	25991.91	25397.43
Model test (χ^2, df, <i>p</i>-value)	105.80, 7, <0.0001	401.10, 17, <0.0001
Model fit	26011.91	25437.43
Deviance test (χ^2, df, <i>p</i>-value)		285.94, 10, <0.0001

Table 16.22. Initial conditional logistic regression models testing associations with control in the sample of single-partner encounters.

Variable	OR (95% CI)	Model fit
Any substance use by respondent	0.84 (0.60, 1.17)	894.08
Number of substances used	0.81* (0.67, 0.96)	897.25
Substance use by respondent: specific		914.18
Poppers	0.81 (0.53, 1.24)	
Alcohol	1.22 (0.82, 1.80)	
Erectile dysfunction medications	0.70 (0.33, 1.49)	
Cannabis	0.62 (0.24, 1.63)	
MDMA	0.49 (0.10, 2.41)	
Ketamine	0.38	
Cocaine	0.61 (0.20, 1.91)	
Any substance use by partner		906.37
No substance use	Reference	
Don't know	0.67 (0.40, 1.11)	
Yes, but unsure what	0.62 (0.30, 1.27)	
Yes, specifically	0.92 (0.63, 1.35)	
Number of substances used by partner	0.91 (0.72, 1.15)	905.36
Substance use by partner: specific		906.22
Alcohol	1.38 (0.92, 2.06)	
Erectile dysfunction medications	1.07 (0.37, 3.11)	
Cannabis	0.85 (0.31, 2.30)	
MDMA	0.24 (0.04, 1.40)	
Ketamine	0.67 (0.14, 3.17)	
Cocaine	0.37 (0.11, 1.19)	
Location of sex		907.21
Private (residence, hotel)	Reference	
Sex-on-premises venue	1.11 (0.58, 2.11)	
Cruising or outdoors location	0.73 (0.39, 1.35)	
Relationship status with partner		909.80
Regular and steady	Reference	
Regular, non-steady	0.63 (0.38, 1.05)	
Opportunity/anonymous	0.75 (0.46, 1.21)	
Serodiscordance		905.24
Both partners believed HIV+ or HIV-	Reference	
Didn't care, didn't notice, didn't remember	1.05 (0.71, 1.57)	
One partner HIV+ and one HIV-	1.68 (0.83, 3.39)	
Quality of the sex	1.05 (0.97, 1.14)	902.35
Month of encounter		898.04
Month 2	Reference	
Month 5	1.04 (0.75, 1.44)	
Month 7	1.47* (1.04, 2.09)	
Month 10	1.47* (1.03, 2.10)	
Month 13	2.27*** (1.55, 3.34)	

Table 16.23. Multivariate conditional logistic regression models testing associations between number of substances used by respondent and control in the single-partner encounter sample.

Variable	Model 1 n=1,228 in 307 groups
	OR (95% CI)
Number of substances used	0.81* (0.67, 0.97)
Month of encounter	
Month 2	Reference
Month 5	1.04 (0.75, 1.45)
Month 7	1.44* (1.01, 2.05)
Month 10	1.49* (1.04, 2.14)
Month 13	2.29*** (1.55, 3.37)
-2LL	871.76
Model test (χ^2, df, <i>p</i>-value)	29.21, 5, <0.0001
Model fit	881.76

Table 16.24. Initial random intercept models testing associations with control in the sample of single-partner encounters.

Variable	n	Group n	OR (95% CI) ICC (95% CI)	Intercept (95% CI)	Between-level variance (95% CI)	Model fit
Null model	6,688	2,139	60.7% (54.0-67.0)	45.75*** (33.45, 62.57)	5.07 (3.86, 6.68)	3561.91
Any substance use by respondent	6,663	2,137	0.89 (0.68, 1.15)	48.32*** (34.48, 67.71)	5.06 (3.84, 6.66)	3547.13
Number of substances used	6,615	2,129	0.89 (0.79, 1.01)	49.97*** (35.69, 69.95)	5.11 (3.88, 6.74)	3527.52
Substance use by respondent: specific	6,615	2,129		48.84*** (34.85, 68.45)	5.14 (3.89, 6.79)	3540.46
Poppers			0.82 (0.60, 1.14)			
Alcohol			0.99 (0.73, 1.34)			
Erectile dysfunction medications			1.15 (0.65, 2.03)			
Cannabis			1.11 (0.54, 2.27)			
MDMA			1.02 (0.34, 3.09)			
Crystal methamphetamine			2.05 (0.44, 9.50)			
GHB			0.96 (0.28, 3.25)			
Ketamine			0.41 (0.15, 1.14)			
Cocaine			0.68 (0.28, 1.61)			
Any substance use by partner	6,643	2,134		50.92*** (36.53, 70.99)	5.05 (3.83, 6.65)	3539.73
No substance use			Reference			
Don't know			0.55** (0.36, 0.84)			
Yes, but unsure what			0.52* (0.30, 0.92)			
Yes, specifically			0.89 (0.66, 1.20)			
Number of substances used by partner	6,643	2,134	0.97 (0.81, 1.15)	46.55*** (33.69, 64.34)	5.14 (3.90, 6.77)	3546.71
Substance use by partner: specific	6,643	2,134		46.19*** (33.34, 63.99)	5.20 (3.94, 6.88)	3552.67
Alcohol			1.15 (0.83, 1.59)			
Erectile dysfunction medications			1.00 (0.41, 2.46)			
Cannabis			1.02 (0.47, 2.22)			
MDMA			0.50 (0.16, 1.58)			
Crystal methamphetamine			2.64 (0.41, 17.07)			
GHB			0.61 (0.18, 2.06)			
Ketamine			1.90 (0.49, 7.39)			
Cocaine			0.43 (0.18, 1.05)			

Table 16.24 continued.

Variable	n	Group n	OR (95% CI) ICC (95% CI)	Intercept (95% CI)	Between-level variance (95% CI)	Model fit
Location of sex	6,669	2,138		46.36*** (33.69, 63.80)	5.07 (3.85, 6.68)	3538.86
Private (residence, hotel)			Reference			
Sex-on-premises venue			1.35 (0.80, 2.27)			
Cruising or outdoors location			0.66 (0.40, 1.08)			
Relationship status with partner(s)	6,670	2,138		54.52*** (36.88, 80.59)	5.10 (3.87, 6.73)	3552.09
Regular and steady			Reference			
Regular, non-steady			0.76 (0.53, 1.09)			
Opportunity/anonymous			0.80 (0.58, 1.11)			
Serodiscordance	6,648	2,136		48.93*** (34.45, 69.50)	5.13 (3.89, 6.76)	3532.55
Both partners believed HIV+ or HIV-			Reference			
Didn't care, didn't notice, didn't remember			0.87 (0.65, 1.15)			
One partner HIV+ and one HIV-			1.52 (0.85, 2.72)			
Quality of the sex	6,636	2,136	1.07* (1.00, 1.14)	29.82*** (17.81, 49.91)	5.12 (3.88, 6.76)	3532.27
Month of encounter	6,688	2,139		36.75*** (25.72, 52.51)	5.21 (3.96, 6.87)	3541.45
Month 2			Reference			
Month 5			0.96 (0.70, 1.30)			
Month 7			1.40* (1.01, 1.95)			
Month 10			1.48* (1.06, 2.07)			
Month 13			2.21*** (1.55, 3.17)			

Table 16.25. Diagnostic statistics for latent class models tested.

Latent class model	-2LL	Free parameters	Scaled relative entropy	AIC	BIC	BIC, sample size adjusted	VLMR-LRT
2 classes, factor on means	47712.40	21	90.2%	47754.40	47897.54	47830.80	p = 0.0004
3 classes, factor on means	44886.08	34	92.1%	44954.08	45185.83	45077.79	p < 0.0001
3 classes, no factor on means	44662.05	35	92.4%	44732.05	44970.61	44859.39	p < 0.0001
4 classes, factor on means	43709.278	47	86.7%	43803.28	44123.64	43974.28	p = 0.25

Table 16.26. Model specifications and conditional probabilities.

Manifest indicators n=6,742 in 2,142 groups	Class 1		Class 2		Class 3	
	Probability Mean (SE)	p-value	Probability Mean (SE)	p-value	Probability Mean (SE)	p-value
Class properties						
Random intercept probability	5.35%		94.20%		0.45%	
Posterior probability	31.94%		61.22%		6.85%	
Most likely class probability (count)	31.50% (2,124)		61.81% (4,167)		6.69% (451)	
Manifest indicators						
Number of substances used	0.41 (0.02)		0.50 (0.02)		3.52 (0.13)	
Variance of number of substances used	0.48 (0.02)		0.48 (0.02)		0.48 (0.02)	
Relationship status with partner(s)						
Regular and steady	94.07%	0.001	1.23%	<0.001	22.26%	0.002
Regular, non-steady	5.33%	0.097	35.93%	<0.001	37.67%	0.663
Opportunity/anonymous	0.61%		62.84%		40.08%	
Seroconcordance						
Both partners believed HIV+ or HIV -	27.86%	<0.001	73.06%	<0.001	45.31%	<0.001
Didn't care, didn't notice, didn't remember	68.31%	<0.001	15.63%	0.06	39.83%	<0.001
One partner HIV+ and one HIV -	3.83%		11.31%		14.86%	
Location of sex						
Private (residence, hotel)	99.12%	<0.001	80.67%	<0.001	89.85%	<0.001
Sex-on-premises venue	0.00%	<0.001	10.95%	0.007	8.57%	<0.001
Cruising or outdoors location	0.88%		8.38%		1.58%	
Mean level of UAI	41.5% (1.1)		23.0% (0.7)		52.9% (2.4)	
Mean level of pleasure	6.86 (0.04)		6.22 (0.03)		6.79 (0.09)	
Mean level of most control	92.1% (0.6)		91.1% (0.5)		90.8% (1.4)	

Table 16.27. Mean probabilities for most likely class membership by latent class.

Most likely class	Class 1	Class 2	Class 3
Class 1	97.1%	2.6%	0.3%
Class 2	2.0%	97.3%	0.6%
Class 3	1.1%	4.0%	94.9%

Table 16.28. Classification probabilities for most likely class membership.

Most likely class	Class 1	Class 2	Class 3
Class 1	95.8%	4.0%	0.2%
Class 2	1.3%	98.2%	0.4%
Class 3	1.5%	5.8%	92.7%

Table 16.29. Chi-square tests for equality of means on distal outcomes between classes.

Comparison	Chi-square	p-value
UAI		
Class 1 v. Class 2	202.26	p < 0.001
Class 1 v. Class 3	18.21	p < 0.001
Class 2 v. Class 3	138.49	p < 0.001
Overall test	312.58	p < 0.001
Pleasure		
Class 1 v. Class 2	157.11	p < 0.001
Class 1 v. Class 3	0.50	0.48
Class 2 v. Class 3	32.73	p < 0.001
Overall test	159.11	p < 0.001
Control		
Class 1 v. Class 2	1.79	0.18
Class 1 v. Class 3	0.74	0.39
Class 2 v. Class 3	0.04	0.85
Overall test	1.49	0.47

Table 16.30. Tests of associations between month of reporting and encounter class.

Month	Class 1 v. Class 3		Class 2 v. Class 3	
	OR	p-value	OR	p-value
Month 2	Reference		Reference	
Month 5	1.47	0.20	1.64	0.06
Month 7	1.29	0.41	1.63	0.06
Month 10	1.88	0.05	1.43	0.21
Month 13	2.46	0.01	1.51	0.14

Works cited

- Aghaizu, A., Brown, A. E., Nardone, A., Gill, O. N., & Delpech, V. C. (2013). *HIV in the United Kingdom: 2013 Report*. London: Health Protection Agency.
- Agresti, A. T. (2007). *An Introduction to Categorical Data Analysis* (2nd ed.). New York: John Wiley & Sons.
- Agudelo-Suarez, A. A., Gil-Gonzalez, D., Vives-Cases, C., Love, J. G., Wimpenny, P., & Ronda-Perez, E. (2012). A metasynthesis of qualitative studies regarding opinions and perceptions about barriers and determinants of health services' accessibility in economic migrants. *BMC Health Services Research*, 12(461).
- Alasuutari, P. (1996). Theorizing in qualitative research: A cultural studies perspective. *Qualitative Inquiry*, 2(4), 371–384.
- Allison, P. D. (2002). *Missing Data*. Thousand Oaks, CA: Sage Publications.
- Altice, F. L., Kamarulzaman, A., Soriano, V. V., Schechter, M., & Friedland, G. H. (2010). Treatment of medical, psychiatric, and substance-use comorbidities in people infected with HIV who use drugs. *The Lancet*, 376, 367–387.
- Alvy, L. M., McKirnan, D. J., Mansergh, G., Koblin, B., Colfax, G. N., Flores, S. A., ... Project M I X Study Group. (2011). Depression is associated with sexual risk among men who have sex with men, but is mediated by cognitive escape and self-efficacy. *AIDS and Behavior*, 15(6), 1171–1179.
- Andersen, M. F., Nielsen, K. M., & Brinkmann, S. (2012). Meta-synthesis of qualitative research on return to work among employees with common mental disorders. *Scandinavian Journal of Work, Environment & Health*, 38(2), 93–104.
- Anderson, V. R., Jason, L. A., Hlavaty, L. E., Porter, N., & Cudia, J. (2012). A review and meta-synthesis of qualitative studies on myalgic encephalomyelitis/chronic fatigue syndrome. *Patient Education and Counseling*, 86(2), 147–155.
- Annells, M. (1997a). Grounded theory method, part I: within the five moments of qualitative research. *Nursing Inquiry*, 4(2), 120–129.
- Annells, M. (1997b). Grounded theory method, part II: options for users of the method. *Nursing Inquiry*, 4(3), 176–180.
- Artinian, B., Giske, T., & Cone, P. (2009). *Glaserian Grounded Theory in Nursing Research: Trusting Emergence*. New York: Springer Publishing Co.
- Asparouhov, T., & Muthén, B. O. (2010). *Wald Test of Mean Equality for Potential Latent Class Predictors in Mixture Modeling*. Los Angeles: Muthén & Muthén.
- Asparouhov, T., & Muthén, B. O. (2013). *Auxiliary Variables in Mixture Modeling : 3-Step Approaches Using Mplus* (No. 15). Los Angeles: Muthén & Muthén.

- Atkins, S., Lewin, S., Smith, H., Engel, M., Fretheim, A., & Volmink, J. (2008). Conducting a meta-ethnography of qualitative literature: lessons learnt. *BMC Medical Research Methodology*, 8(21).
- Bakk, Z., Tekle, F. B., & Vermunt, J. K. (2013). Estimating the association between latent class membership and external variables using bias adjusted three-step approaches. *Sociological Methodology*, 43(1): 272-311.
- Balan, I. C., Carballo-Díéguez, A., Ventuneac, A., Remien, R. H., Dolezal, C., Ford, J., ... Carballo-Díéguez, A. (2013). Are HIV-negative men who have sex with men and who bareback concerned about HIV infection? Implications for HIV risk reduction interventions. *Archives of Sexual Behavior*, 42(2), 279–289.
- Baral, S., Logie, C. H., Grosso, A., Wirtz, A. L., & Beyrer, C. (2013). Modified social ecological model: a tool to guide the assessment of the risks and risk contexts of HIV epidemics. *BMC Public Health*, 13(482).
- Barnett-Page, E., & Thomas, J. (2009). Methods for the synthesis of qualitative research: a critical review. *BMC Medical Research Methodology*, 9(59).
- Bauermeister, J. A. (2007). It's all about "connecting": Reasons for drug use among Latino gay men living in the San Francisco Bay area. *Journal of Ethnicity in Substance Abuse*, 6(1), 109–129.
- Bauermeister, J. A. (2008). Latino gay men's drug functionality: The role of social networks and social support. *Journal of Ethnicity in Substance Abuse*, 7(1), 41–65.
- Bauermeister, J. A., Carballo-Díéguez, A., Ventuneac, A., & Dolezal, C. (2009). Assessing motivations to engage in intentional condomless anal intercourse in HIV-risk contexts ("bareback sex") among men who have sex with men. *AIDS Education and Prevention*, 21(2), 156–168.
- Bayhakki, & Hatthakit, U. (2012). Lived experiences of patients on hemodialysis: a meta-synthesis. *Nephrology Nursing Journal*, 39(4), 295–305.
- Bennion, A. E., Shaw, R. L., & Gibson, J. M. (2012). What do we know about the experience of age related macular degeneration? A systematic review and meta-synthesis of qualitative research. *Social Science and Medicine*, 75(6), 976–985.
- Benotsch, E. G., Martin, A. M., Koester, S., Cejka, A., & Luckman, D. (2011). Nonmedical use of prescription drugs and HIV risk behavior in gay and bisexual men. *Sexually Transmitted Diseases*, 38(2), 105–110.
- Benotsch, E. G., Mikytuck, J. J., Ragsdale, K., & Pinkerton, S. D. (2006). Sexual risk and HIV acquisition among men who have sex with men travelers to Key West, Florida: a mathematical modeling analysis. *AIDS Patient Care and STDs*, 20(8), 549–556.

- Beyrer, C., Baral, S. D., Walker, D., Wirtz, A. L., Johns, B., & Sifakis, F. (2010). The expanding epidemics of HIV type 1 among men who have sex with men in low- and middle-income countries: diversity and consistency. *Epidemiologic Reviews*, 32(1), 137–151.
- Beyrer, C., Sullivan, P. S., Sanchez, J., Dowdy, D., Altman, D., Trapence, G., ... Mayer, K. H. (2012). A call to action for comprehensive HIV services for men who have sex with men. *The Lancet*, 380, 424–438.
- Birnbaum, R., & Saini, M. (2012). A qualitative synthesis of children's participation in custody disputes. *Research on Social Work Practice*, 22(4), 400–409.
- Blacksher, E., & Lovasi, G. S. (2012). Place-focused physical activity research, human agency, and social justice in public health: taking agency seriously in studies of the built environment. *Health & Place*, 18(2), 172–9.
- Blakely, T. A., & Woodward, A. J. (2000). Ecological effects in multi-level studies. *Journal of Epidemiology and Community Health*, 54(5), 367–374.
- Blankenship, K. M., Bray, S. J., & Merson, M. H. (2000). Structural interventions in public health. *AIDS*, 14(Suppl 1), S11–S21.
- Blumer, H. (1992). *Symbolic Interactionism: Perspective and Method*. Berkeley, CA: University of California Press.
- Bonell, C. P., Hickson, F. C. I., Weatherburn, P., & Reid, D. S. (2010). Methamphetamine use among gay men across the UK. *International Journal of Drug Policy*, 21(3), 244–246.
- Bonell, C. P., Strange, V., Allen, E., & Barnett-Page, E. (2006). HIV prevention outreach in commercial gay venues in large cities: evaluation findings from London. *Health Education Research*, 21(4), 452–464.
- Bonell, C. P., Weatherburn, P., Rhodes, T., Hickson, F., Keogh, P., & Elford, J. (2008). Addressing gay men's use of methamphetamine and other substances. *Addiction Research & Theory*, 16(5), 417–420.
- Boone, M. R., Cook, S. H., & Wilson, P. (2013). Substance use and sexual risk behavior in HIV-positive men who have sex with men: an episode-level analysis. *AIDS and Behavior*, 17(5), 1883–1887.
- Borg Xuereb, C., Shaw, R. L., & Lane, D. A. (2012). Patients' and health professionals' views and experiences of atrial fibrillation and oral-anticoagulant therapy: a qualitative meta-synthesis. *Patient Education and Counseling*, 88(2), 330–337.
- Bourne, A. (2012). Drug use among men: Implications for harm reduction. In C. Stoicescu (Ed.), *The Global State of Harm Reduction 2012* (pp. 147–155). London: Harm Reduction International.

- Bourne, A., Hickson, F., Keogh, P., Reid, D., & Weatherburn, P. (2012). Problems with sex among gay and bisexual men with diagnosed HIV in the United Kingdom. *BMC Public Health*, 12(916).
- Bourne, A., Reid, D., Hickson, F., Torres Rueda, S., & Weatherburn, P. (2014). *The Chemsex Study: drug use in sexual settubgs among gay & bisexual men in Lambeth, Southwark, & Lewisham*. London: Sigma Research, London School of Hygiene and Tropical Medicine.
- Bowling, A. (2009). *Research Methods in Health: Investigating Health and Health Services* (3rd ed.). London: Open University Press.
- Bradshaw, S. A., Playford, E. D., & Riazi, A. (2012). Living well in care homes: a systematic review of qualitative studies. *Age and Ageing*, 41(4), 429–440.
- Brohan, E., Henderson, C., Wheat, K., Malcolm, E., Clement, S., Barley, E. A., ... Thornicroft, G. (2012). Systematic review of beliefs, behaviours and influencing factors associated with disclosure of a mental health problem in the workplace. *BMC Psychiatry*, 12(11).
- Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In W. Damon and R. M Lerner (Eds.), *Handbook of Child Psychology Volume 1, Theoretical Models of Human Development* (pp. 793–828). New York: Wiley Online Library.
- Brooks-Gunn, J., Duncan, G., & Klebanov, P. (1993). Do neighborhoods influence child and adolescent development? *American Journal of Sociology*, 99(2), 353–395.
- Brown III, A. D. (2003). Sex and Sensibility: Toward a Sociology of HIV Risk. *Dissertation Abstracts International: Section A. The Humanities and Social Sciences*, 64(10), 3864.
- Brown, G., Lau, C., Murray, J., & Lyons, L. (2000). *Drug Use & HIV Risk Among Gay Men in the Dance/Club Scene in Toronto: How Should AIDS Prevention Programmes Respond?* Toronto: AIDS Committee of Toronto.
- Brown, K., Worrall, L. E., Davidson, B., & Howe, T. (2012). Living successfully with aphasia: a qualitative meta-analysis of the perspectives of individuals with aphasia, family members, and speech-language pathologists. *International Journal of Speech-Language Pathology*, 14(2), 141–155.
- Buckley, E. J., White, D. G., Morris, C., Elsmore, M., Morrall, I. A., & Pugh, R. N. (2010). The effects of community-based sexual health testing and health promotion on gay men's sexual risk-taking behaviour. *International Journal of Health Promotion and Education*, 48(4), 123–128.
- Burls, A. (2010). *10 questions to help you make sense of qualitative research*. Retrieved from www.casp-uk.net.

- Butler, J. (1999). *Gender Trouble* (2nd ed.). New York: Routledge.
- Butler, J. (2009). Performativity, precarity and sexual politics. *Revista de Antropologia Iberoamericana*, 4(3), i–xiii.
- Caceres, C. F., & Cortinas, J. I. (1996). Fantasy island: an ethnography of alcohol and gender roles in a Latino gay bar. *Journal of Drug Issues*, 26(1), 245–260.
- Calabrese, S. K., Rosenberger, J. G., Schick, V. R., Novak, D. S., & Reece, M. (2013). An event-level comparison of risk-related sexual practices between black and other-race men who have sex with men: condoms, semen, lubricant, and rectal douching. *AIDS Patient Care and STDs*, 27(2), 77–84.
- Campsmith, M. L., Nakashima, A. K., & Davidson, A. J. (2003). Self-reported health-related quality of life in persons with HIV infection: results from a multi-site interview project. *Health and Quality of Life Outcomes*, 1(12).
- Carey, J. W., Mejia, R., Bingham, T., Ciesielski, C., Gelaude, D., Herbst, J. H., ... Stall, R. (2009). Drug use, high-risk sex behaviors, and increased risk for recent HIV infection among men who have sex with men in Chicago and Los Angeles. *AIDS and Behavior*, 13(6), 1084–1096.
- Cassels, S., Menza, T. W., Goodreau, S. M., & Golden, M. R. (2009). HIV serosorting as a harm reduction strategy: evidence from Seattle, Washington. *AIDS*, 23(18), 2497–2506.
- Centers for Disease Control and Prevention. (2011). *CDC Fact Sheet: HIV and AIDS among Gay and Bisexual Men*. Atlanta, GA: Centers for Disease Control and Prevention.
- Charmaz, K. (2006). *Constructing Grounded Theory*. Thousand Oaks, CA: Sage Publications.
- Chartier, M., Araneta, A., Duca, L., McGlynn, L. M., Gore-Felton, C., Goldblum, P., & Koopman, C. (2009). Personal values and meaning in the use of methamphetamine among HIV-positive men who have sex with men. *Qualitative Health Research*, 19(4), 504–518.
- Chartier, M., Vinatieri, T., Delonga, K., McGlynn, L. M., Gore-Felton, C., & Koopman, C. (2010). A pilot study investigating the effects of trauma, experiential avoidance, and disease management in HIV-positive MSM using methamphetamine. *Journal of the International Association of Physicians in AIDS Care*, 9(2), 78–81.
- Chenail, R. J., George, S. S., Wulff, D., Duffy, M., Scott, K. W., & Tomm, K. (2012). Clients' relational conceptions of conjoint couple and family therapy quality: A grounded formal theory. *Journal of Marital and Family Therapy*, 38(1), 241–264.

- Child, S., Goodwin, V., Garside, R., Jones-Hughes, T., Boddy, K., & Stein, K. (2012). Factors influencing the implementation of fall-prevention programmes: a systematic review and synthesis of qualitative studies. *Implementation Science*, 7(91).
- Clark, A. M., King-Shier, K. M., Thompson, D. R., Spaling, M. A., Duncan, A. S., Stone, J. A., ... Angus, J. E. (2012). A qualitative systematic review of influences on attendance at cardiac rehabilitation programs after referral. *American Heart Journal*, 164(6), 835-845.
- Clark, A. M., Savard, L. A., Spaling, M. A., Heath, S., Duncan, A. S., & Spiers, J. A. (2012). Understanding help-seeking decisions in people with heart failure: a qualitative systematic review. *International Journal of Nursing Studies*, 49(12), 1582–1597.
- Clark, S. L., & Muthén, B. (2009). *Relating latent class analysis results to variables not included in the analysis*. Los Angeles: Muthén & Muthén.
- Clerkin, E. M., Newcomb, M. E., & Mustanski, B. S. (2011). Unpacking the racial disparity in HIV rates: the effect of race on risky sexual behavior among Black young men who have sex with men (YMSM). *Journal of Behavioral Medicine*, 34(4), 237–243.
- Cochran, S. D., Ackerman, D., Mays, V. M., & Ross, M. W. (2004). Prevalence of non-medical drug use and dependence among homosexually active men and women in the US population. *Addiction*, 99(8), 989–998.
- Cohen, D., Farley, T. A., & Mason, K. (2003). Why is poverty unhealthy? Social and physical mediators. *Social Science & Medicine*, 57(9), 1631–1641.
- Cohen, K., & Collens, P. (2012). The impact of trauma work on trauma workers: a metasynthesis on vicarious trauma and vicarious posttraumatic growth. *Psychological Trauma: Theory, Research, Practice, and Policy*. Advance online publication.
- Colfax, G. N., & Guzman, R. (2006). Club drugs and HIV infection: a review. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, 42(10), 1463–1469.
- Colfax, G. N., Mansergh, G., Guzman, R., Vittinghoff, E., Marks, G., Rader, M., & Buchbinder, S. (2001). Drug use and sexual risk behavior among gay and bisexual men who attend circuit parties: a venue-based comparison. *Journal of Acquired Immune Deficiency Syndromes*, 28(4), 373–379.
- Colfax, G. N., Vittinghoff, E., Husnik, M. J., McKirnan, D., Buchbinder, S., Koblin, B., ... Coates, T. J. (2004). Substance use and sexual risk: a participant- and episode-level analysis among a cohort of men who have sex with men. *American Journal of Epidemiology*, 159(10), 1002–1012.

- Collins, L. M., & Lanza, S. T. (2010). *Latent Class and Latent Transition Analysis: with Applications in the Social, Behavioral, and Health Sciences*. New York: Wiley-Blackwell.
- Collins, R. (1981). On the microfoundations of macrosociology. *American Journal of Sociology*, 86(5), 984–1014.
- Connolly, J. A., & Joly, L. E. (2012). Outreach with street-involved youth: a quantitative and qualitative review of the literature. *Clinical Psychology Review*, 32(6), 524–534.
- Connolly, M., & Liang, K. (1988). Conditional logistic regression models for correlated binary data. *Biometrika*, 75(3), 501–506.
- Cook, C., Fay, S., & Rockwood, K. (2012). A meta-ethnography of paid dementia care workers' perspectives on their jobs. *Canadian Geriatrics Journal*, 15(4), 127–136.
- Cook, K. (2012). Neoliberalism, welfare policy and health: a qualitative meta-synthesis of single parents' experience of the transition from welfare to work. *Health*, 16(5), 507–530.
- Corbin, J. C., & Strauss, A. L. (2008). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Corcoran, J., Crowley, M., Bell, H., Murray, A., & Grindle, L. (2012). U.S. Latinas' knowledge and attitudes toward mammography: meta-synthesis. *Journal of Human Behavior in the Social Environment*, 22(6), 671–689.
- Croff, J. M. K., Clapp, J. D., Chambers, C., Woodruff, S. I., & Strathdee, S. A. (2012). Brief field-based intervention to reduce alcohol-related problems among men who have sex with men. *Journal of Studies on Alcohol and Drugs*, 73(2), 285–289.
- Crosby, R., & Diclemente, R. J. (2004). Use of recreational Viagra among men having sex with men. *Sexually Transmitted Infections*, 80(6), 466–468.
- Daly, M. (2013, June). The meth-fuelled, week-long orgies ravaging London's gay sex party scene. *Vice*. Retrieved from www.vice.com/en_uk/read/the-week-long-meth-fuelled-sex-parties-taking-over-londons-gay-scene
- De Certeau, M. (2011). *The Practice of Everyday Life* (3rd ed.). Berkeley, CA: University of California Press.
- Deiss, R. G., Clark, J. L., Konda, K. a, Leon, S. R., Klausner, J. D., Caceres, C. F., & Coates, T. J. (2013). Problem drinking is associated with increased prevalence of sexual risk behaviors among men who have sex with men (MSM) in Lima, Peru. *Drug and Alcohol Dependence*, 132(1-2), 1–6.

- DeLorenze, G. N., Weisner, C., Tsai, A.-L., Satre, D. D., & Quesenberry, C. P. (2011). Excess mortality among HIV-infected patients diagnosed with substance use dependence or abuse receiving care in a fully integrated medical care program. *Alcoholism, Clinical and Experimental Research*, 35(2), 203–210.
- Denzin, N. K. (2002). Much ado about Goffman. *The American Sociologist*, (Summer 2002), 105–117.
- Denzin, N. K., & Lincoln, Y. S. (2011). *The SAGE Handbook of Qualitative Research* (4th ed.). Thousand Oaks, CA: Sage Publications.
- Desai, M., Desai, S., Sullivan, A. K., Mohabeer, M., Mercey, D., Kingston, M. A., ... GUMNET. (2013). Audit of HIV testing frequency and behavioural interventions for men who have sex with men: policy and practice in sexual health clinics in England. *Sexually Transmitted Infections*, 89(5), 404–408.
- Digiusto, E., & Rawstorne, P. (2013). Is it really crystal clear that using methamphetamine (or other recreational drugs) causes people to engage in unsafe sex? *Sexual Health*, 10(2), 133–137.
- Dillon, P. J., Roscoe, L. A., & Jenkins, J. J. (2012). African Americans and decisions about hospice care: Implications for health message design. *Howard Journal of Communications*, 23(2), 175–193.
- Dixon-Woods, M., Agarwal, S., Young, B., Jones, D., & Sutton, A. J. (2004). *Integrative approaches to qualitative and quantitative evidence*. London: NHS Health Development Agency.
- Dixon-Woods, M., Booth, A., & Sutton, A. J. (2007). Synthesizing qualitative research: a review of published reports. *Qualitative Research*, 7(3), 375–422.
- Dixon-Woods, M., Cavers, D., Agarwal, S., Annandale, E., Arthur, A., Harvey, J., ... Sutton, A. J. (2006). Conducting a critical interpretive synthesis of the literature on access to healthcare by vulnerable groups. *BMC Medical Research Methodology*, 6(35).
- Dixon-Woods, M., Shaw, R. L., Agarwal, S., & Smith, J. A. (2004). The problem of appraising qualitative research. *Quality and Safety in Health Care*, 13(3), 223–225.
- Dodds, J. P., Mercer, C. H., Mercey, D. E., Copas, A. J., & Johnson, A. M. (2006). Men who have sex with men: a comparison of a probability sample survey and a community based study. *Sexually Transmitted Infections*, 82(1), 86–87.
- Dolezal, C., Carballo-Dieglez, A., Nieves-Rosa, L., & Diaz, F. (2000). Substance use and sexual risk behavior: understanding their association among four ethnic groups of Latino men who have sex with men. *Journal of Substance Abuse*, 11(4), 323–336.

- Dong, Y., & Peng, C.-Y. J. (2013). Principled missing data methods for researchers. *SpringerPlus*, 2(1), 222.
- Dowling, M. (2006). Approaches to reflexivity in qualitative research. *Nurse Researcher*, 13(3), 7–21.
- Dowsett, G. W. (1993). Sustaining safe sex: sexual practices, HIV and social context. *AIDS*, 7(Suppl 1), S257–S262.
- Dowsett, G. W. (1996). *Practicing Desire: Homosexual Sex in the Era of AIDS*. Stanford, CA: Stanford University Press.
- Dowsett, G. W. (2003). Some considerations on sexuality and gender in the context of AIDS. *Reproductive Health Matters*, 11(22), 21–29.
- Dowsett, G. W. (2009). Dangerous desires and post-queer HIV prevention: Rethinking community, incitement and intervention. *Social Theory & Health*, 7(3), 218–240.
- Dowsett, G. W., Wain, D., & Keys, D. (2005). Good Gay Men Don't Get "Messy": Injecting Drug Use and Gay Community. *Sexuality Research and Social Policy*, 2(1), 22–36.
- Drumright, L. N. (2006). Illicit substance use and risk of HIV transmission among men who have sex with men. *Dissertation Abstracts International: Section B. Sciences and Engineering*, 67(01), 330.
- Drumright, L. N., Gorbach, P. M., Little, S. J., & Strathdee, S. A. (2009). Associations between substance use, erectile dysfunction medication and recent HIV infection among men who have sex with men. *AIDS and Behavior*, 13(2), 328–336.
- Drumright, L. N., Little, S. J., Strathdee, S. A., Slymen, D. J., Araneta, M. R. G., Malcarne, V. L., ... Gorbach, P. M. (2006). Unprotected anal intercourse and substance use among men who have sex with men with recent HIV infection. *Journal of Acquired Immune Deficiency Syndromes*, 43(3), 344–350.
- Drumright, L. N., Patterson, T. L., & Strathdee, S. A. (2006). Club drugs as causal risk factors for HIV acquisition among men who have sex with men: a review. *Substance Use & Misuse*, 41(10-12), 1551–1601.
- Drumright, L. N., Strathdee, S. A., Little, S. J., Araneta, M. R. G., Slymen, D. J., Malcarne, V. L., ... Gorbach, P. M. (2007). Unprotected anal intercourse and substance use before and after HIV diagnosis among recently HIV-infected men who have sex with men. *Sexually Transmitted Diseases*, 34(6), 401–407.
- Duggleby, W., Hicks, D., Nekolaichuk, C., Holtslander, L., Williams, A., Chambers, T., & Eby, J. (2012). Hope, older adults, and chronic illness: a metasynthesis of qualitative research. *Journal of Advanced Nursing*, 68(6), 1211–1223.

- Dunbar, D. (2011). People with AIDS (PWA) since highly active antiretroviral therapy, 1996. *The Journal of Medical Humanities*, 32(2), 115–125.
- Eaton, L. A., Kalichman, S. C., O’Connell, D. A., & Karchner, W. D. (2009). A strategy for selecting sexual partners believed to pose little/no risks for HIV: serosorting and its implications for HIV transmission. *AIDS Care*, 21(10), 1279–1288.
- Eaves, Y. (2001). A synthesis technique for grounded theory data analysis. *Journal of Advanced Nursing*, 35(5), 654–663.
- Elford, J., Bolding, G., & Sherr, L. (2002). High-risk sexual behaviour increases among London gay men between 1998 and 2001: what is the role of HIV optimism? *AIDS*, 16(11), 1537–1544.
- Elford, J., Hart, G. J., & Sherr, L. (2002). Peer led HIV prevention among homosexual men in Britain. *Sexually Transmitted Infections*, 78, 158–159.
- Elwood, W. N., Greene, K., & Carter, K. K. (2003). Gentlemen don’t speak: communication norms and condom use in bathhouses. *Journal of Applied Communication Research*, 31(4), 277–297.
- Elwood, W. N., & Williams, M. L. (1998). Sex, drugs, and situation: attitudes, drug use, and sexual risk behaviors among men who frequent bathhouses. *Journal of Psychology & Human Sexuality*, 10(2), 23–44.
- Feinberg, M. (1996). Changing the natural history of HIV disease. *The Lancet*, 348, 239–246.
- Fine, G. (1993). The sad demise, mysterious disappearance, and glorious triumph of symbolic interactionism. *Annual Review of Sociology*, 19, 61–87.
- Finfgeld, D. L. (1999). Courage as a process of pushing beyond the struggle. *Qualitative Health Research*, 9(6), 803–814.
- Finfgeld, D. L. (2003). Metasynthesis: the state of the art—so far. *Qualitative Health Research*, 13(7), 893–904.
- Finfgeld-Connett, D. L. (2010). Generalizability and transferability of meta-synthesis research findings. *Journal of Advanced Nursing*, 66(2), 246–254.
- Finfgeld-Connett, D. L., Bloom, T. L., & Johnson, E. D. (2012). Perceived competency and resolution of homelessness among women with substance abuse problems. *Qualitative Health Research*, 22(3), 416–427.
- Flemming, K., Closs, S. J., Foy, R., & Bennett, M. I. (2012). Education in advanced disease. *Journal of Pain and Symptom Management*, 43(5), 885–901.

- Fletcher, B., Gheorghe, A., Moore, D., Wilson, S., & Damery, S. (2012). Improving the recruitment activity of clinicians in randomised controlled trials: a systematic review. *BMJ Open*, 2(1), e000496.
- Flores, D., Blake, B., & Sowell, R. (2011). "Get them while they're young": reflections of young gay men newly diagnosed with HIV infection. *Journal of the Association of Nurses in AIDS Care*, 22(5), 376–387.
- Folch, C., Esteve, A., Zaragoza, K., Muñoz, R., & Casabona, J. (2010). Correlates of intensive alcohol and drug use in men who have sex with men in Catalonia, Spain. *European Journal of Public Health*, 20(2), 139–145.
- Frankel, R. M., & Devers, K. J. (2000). Study design in qualitative research--1: developing questions and assessing resource needs. *Education for Health*, 13(2), 251–261.
- French, R., & Power, R. (1998). A qualitative study of the social contextual use of alkyl nitrites (poppers) among targeted groups. *Journal of Drug Issues*, 28(1), 57–76.
- Galárraga, O., Colchero, M. A., Wamai, R. G., & Bertozzi, S. M. (2009). HIV prevention cost-effectiveness: a systematic review. *BMC Public Health*, 9(Suppl 1).
- Gallo, R. (2002). The early years of HIV/AIDS. *Science*, 298(November), 1728–1730.
- Galuska, L. A. (2012). Cultivating nursing leadership for our envisioned future. *Advances in Nursing Science*, 35(4), 333–345.
- Garrett, C. R., Gask, L. L., Hays, R., Cherrington, A., Bundy, C., Dickens, C., ... Coventry, P. A. (2012). Accessing primary health care: a meta-ethnography of the experiences of British South Asian patients with diabetes, coronary heart disease or a mental health problem. *Chronic Illness*, 8(2), 135–155.
- Gatter, P. N. (1995). Anthropology, HIV and contingent identities. *Social Science & Medicine*, 41(11), 1523–1533.
- Gebo, K. A., Fleishman, J. A., Conviser, R., Hellinger, J., Hellinger, F. J., Josephs, J. S., ... Moore, R. D. (2010). Contemporary costs of HIV healthcare in the HAART era. *AIDS*, 24(17), 2705–2715.
- Geertz, C. (1973). *The Interpretation of Cultures*. New York: Basic Books.
- Gelman, A., Carlin, J. B., Stern, H. S., & Rubin, D. B. (2003). *Bayesian Data Analysis* (2nd ed.). Boca Raton, FL: Chapman & Hall/CRC.
- German, D., Sifakis, F., Maulsby, C., Towe, V. L., Flynn, C. P., Latkin, C. A., ... Holtgrave, D. R. (2011). Persistently high prevalence and unrecognized HIV

- infection among men who have sex with men in Baltimore: the BESURE study. *Journal of Acquired Immune Deficiency Syndromes*, 57(1), 77–87.
- Giancola, P. R., Josephs, R. A., Parrott, D. J., & Duke, A. A. (2010). Alcohol myopia revisited: clarifying aggression and other acts of disinhibition through a distorted lens. *Perspectives on Psychological Science*, 5(3), 265–278.
- Gibbons, L. E., & Hosmer, D. W. (1991). Conditional logistic regression with missing data. *Communications in Statistics - Simulation and Computation*, 20(1), 109–120.
- Giddens, A. (1984). *The Constitution of Society*. Cambridge, UK: Polity.
- Gill, I. J., & Fox, J. R. E. (2012). A qualitative meta-synthesis on the experience of psychotherapy for deaf and hard-of-hearing people. *Mental Health, Religion & Culture*, 15(6), 637–651.
- Gillmore, M. R., Morrison, D. M., Leigh, B. C., Hoppe, M. J., Gaylord, J., & Rainey, D. T. (2002). Does “high=high risk”? An event-based analysis of the relationship between substance use and unprotected anal sex among gay and bisexual men. *AIDS and Behavior*, 6(4), 361–370.
- Glaser, B. G. (2002). Constructivist grounded theory? *Forum Qualitative Sozialforschung / Forum: Qualitative Research*, 3(3), 1–10.
- Glaser, B. G., & Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago, IL, US: Aldine.
- Goethals, S., Dierckx de Casterle, B., & Gastmans, C. (2012). Nurses’ decision-making in cases of physical restraint: a synthesis of qualitative evidence. *Journal of Advanced Nursing*, 68(6), 1198–1210.
- Goffman, E. (1959). *The Presentation of the Self in Everyday Life*. New York: Penguin Books.
- Golden, M. R., Dombrowski, J. C., Kerani, R. P., & Stekler, J. D. (2012). Failure of serosorting to protect African American men who have sex with men from HIV infection. *Sexually Transmitted Diseases*, 39(9), 659–664.
- Golden, M. R., Stekler, J., Hughes, J. P., & Wood, R. W. (2008). HIV serosorting in men who have sex with men: is it safe?. *Journal of Acquired Immune Deficiency Syndromes (1999)*, 49(2), 212–218.
- Gonzalez, A., Barinas, J., & O’Cleirigh, C. (2011). Substance use: impact on adherence and HIV medical treatment. *Current HIV/AIDS Reports*, 8(4), 223–234.
- Green, A. I. (2003). “Chem friendly”: The institutional basis of “club-drug” use in a sample of urban gay men. *Deviant Behavior*, 24, 427–447.

- Green, A. I., & Halkitis, P. N. (2006). Crystal methamphetamine and sexual sociality in an urban gay subculture: an elective affinity. *Culture, Health & Sexuality*, 8(4), 317–333.
- Green, J., & Thorogood, N. (2009). *Qualitative Methods for Health Research* (2nd ed.). London: Sage Publications.
- Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., Kyriakidou, O., & Peacock, R. (2005). Storylines of research in diffusion of innovation: a meta-narrative approach to systematic review. *Social Science & Medicine*, 61(2), 417–430.
- Greenland, S., Schwartzbaum, J. A., & Finkle, W. D. (2000). Problems due to small samples and sparse data in conditional logistic regression analysis. *American Journal of Epidemiology*, 151(5), 531–539.
- Greenspan, N. R., Aguinaldo, J. P., Husbands, W., Murray, J., Ho, P., Sutdhibhasilp, N., ... Maharaj, R. (2011). “It’s not rocket science, what I do”: self-directed harm reduction strategies among drug using ethno-racially diverse gay and bisexual men. *International Journal of Drug Policy*, 22(1), 56–62.
- Gregson, N., & Rose, G. (2000). Taking Butler elsewhere: performativities, spatialities and subjectivities. *Environment and Planning D: Society and Space*, 18(4), 433–452.
- Grov, C., Bux, D., Parsons, J. T., & Morgenstern, J. (2009). Recruiting hard-to-reach drug-using men who have sex with men into an intervention study: lessons learned and implications for applied research. *Substance Use & Misuse*, 44(13), 1855–1871.
- Grov, C., & Crow, T. (2012). Attitudes about and HIV risks related to the “most common place” MSM meet their sex partners: comparing men from bathhouse, bars/clubs, and craigslist.org. *AIDS Education and Prevention*, 24(2), 102–116.
- Grov, C., Hirshfield, S., Remien, R. H., Humberstone, M., & Chiasson, M. A. (2013). Exploring the venue’s role in risky sexual behavior among gay and bisexual men: an event-level analysis from a national online survey in the U.S. *Archives of Sexual Behavior*, 42(2), 291–302.
- Halkitis, P. N., Fischgrund, B. N., & Parsons, J. T. (2005). Explanations for methamphetamine use among gay and bisexual men in New York City. *Substance Use & Misuse*, 40(9-10), 1331–1345.
- Halkitis, P. N., Moeller, R. W., & DeRaleau, L. B. (2008). Steroid use in gay, bisexual, and nonidentified men-who-have-sex-with-men: relations to masculinity, physical, and mental health. *Psychology of Men & Masculinity*, 9(2), 106–115.
- Halkitis, P. N., Mukherjee, P. P., & Palamar, J. J. (2009). Longitudinal modeling of methamphetamine use and sexual risk behaviors in gay and bisexual men. *AIDS and Behavior*, 13(4), 783–791.

- Halkitis, P. N., Parsons, J. T., & Wilton, L. (2003). An exploratory study of contextual and situational factors related to methamphetamine use among gay and bisexual men in New York City. *The Journal of Drug Issues*, (Spring 2003), 413–432.
- Halkitis, P. N., Pollock, J. a, Pappas, M. K., Dayton, A., Moeller, R. W., Siconolfi, D., & Solomon, T. (2011). Substance use in the MSM population of New York City during the era of HIV/AIDS. *Substance Use & Misuse*, 46(2-3), 264–273.
- Hancock, B. H., & Garner, R. (2011). Towards a Philosophy of Containment: Reading Goffman in the 21st Century. *The American Sociologist*, 42(4), 316–340.
- Hanley, J. A., Negassa, A., Edwardes, M. D. d., & Forrester, J. E. (2003). Statistical analysis of correlated data using generalized estimating equations: an orientation. *American Journal of Epidemiology*, 157(4), 364–375.
- Hannes, K., & Macaitis, K. (2012). A move to more systematic and transparent approaches in qualitative evidence synthesis: update on a review of published papers. *Qualitative Research*, 12(4), 402–442.
- Hart, G. J., & Elford, J. (2010). Sexual risk behaviour of men who have sex with men: emerging patterns and new challenges. *Current Opinion in Infectious Diseases*, 23(1), 39–44.
- Haubrich, D. J., Myers, T., Calzavara, L., Ryder, K., & Medved, W. (2004). Gay and bisexual men's experiences of bathhouse culture and sex: "looking for love in all the wrong places". *Culture, Health & Sexuality*, 6(1), 19–29.
- Hawker, S., Payne, S., Kerr, C., Hardey, M., & Powell, J. (2002). Appraising the evidence: reviewing disparate data systematically. *Qualitative Health Research*, 12(9), 1284–1299.
- Health Protection Agency. (2011). *HIV in the United Kingdom: 2011 Report*. London: Health Protection Agency.
- Heath, H., & Cowley, S. (2004). Developing a grounded theory approach: a comparison of Glaser and Strauss. *International Journal of Nursing Studies*, 41(2), 141–150.
- Heaton, J., Corden, A., & Parker, G. (2012). "Continuity of care": a critical interpretive synthesis of how the concept was elaborated by a national research programme. *International Journal of Integrated Care*, 12, e12.
- Heijman, T., Geskus, R. B., Davidovich, U., Coutinho, R. A., Prins, M., & Stolte, I. G. (2012). Less decrease in risk behaviour from pre-HIV to post-HIV seroconversion among MSM in the combination antiretroviral therapy era compared with the pre-combination antiretroviral therapy era. *AIDS*, 26(4), 489–495.

- Heinze, K. E., & Nolan, M. T. (2012). Parental decision making for children with cancer at the end of life: a meta-ethnography. *Journal of Pediatric Oncology Nursing*, 29(6), 337–345.
- Henry, K., & Muthén, B. (2010). Multilevel latent class analysis: an application of adolescent smoking typologies with individual and contextual predictors. *Structural Equation Modeling*, 17(2), 193–215.
- Hensel, D. J., Rosenberger, J. G., Novak, D. S., & Reece, M. (2012). Sexual event-level characteristics of condom use during anal intercourse among HIV-negative men who have sex with men. *Sexually Transmitted Diseases*, 39(7), 550–555.
- Herbst, J. H., Beeker, C., Mathew, A., McNally, T., Passin, W. F., Kay, L. S., ... Johnson, R. L. (2007). The effectiveness of individual-, group-, and community-level HIV behavioral risk-reduction interventions for adult men who have sex with men: a systematic review. *American Journal of Preventive Medicine*, 32(Suppl 4), S38–S67.
- Hickson, F., Bonell, C. P., Weatherburn, P., & Reid, D. (2010). Illicit drug use among men who have sex with men in England and Wales. *Addiction Research & Theory*, 18(1), 14–22.
- Hickson, F., Bourne, A., Weatherburn, P., Reid, D., Jessup, K., & Hammond, G. (2010). *Tactical dangers: findings from the United Kingdom Gay Men's Sex Survey 2008*. London: Sigma Research, London School of Hygiene and Tropical Medicine.
- Hickson, F., Weatherburn, P., Reid, D., & Stephens, M. (2003). *Out and about: findings from the United Kingdom Gay Men's Sex Survey 2002*. London: Sigma Research, London School of Hygiene and Tropical Medicine.
- Hilber, A. M., Kenter, E., Redmond, S., Merten, S., Bagnol, B., Low, N., ... R., G. (2012). Vaginal practices as women's agency in Sub-Saharan Africa: a synthesis of meaning and motivation through meta-ethnography. *Social Science and Medicine*, 74(9), 1311–1323.
- Hodge, D. R., Horvath, V. E., Larkin, H., & Curl, A. L. (2012). Older adults' spiritual needs in health care settings: a qualitative meta-synthesis. *Research on Aging*, 34(2), 131–155.
- Horvath, K. J. (2005). The use of a daily web diary to examine the relation between online sex seeking and HIV risk among internet-using men who have sex with men. *Dissertation Abstracts International: Section B. Sciences and Engineering*, 67(01), 546.
- Hosmer Jr., D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied Logistic Regression* (3rd ed.). New York: Wiley-Blackwell.

- Houston, S. (2001). Beyond Social Constructionism: Critical realism and social work. *British Journal of Social Work*, 31(6), 845–861.
- Hoy, S. (2012). Beyond men behaving badly: a meta-ethnography of men's perspectives on psychological distress and help seeking. *International Journal of Men's Health*, 11(3), 202–226.
- Hu, F. B., Goldberg, J., Hedeker, D., Flay, B. R., & Pentz, M. A. (1998). Comparison of population-averaged and subject-specific approaches for analyzing repeated binary outcomes. *American Journal of Epidemiology*, 147(7), 694–703.
- Hubbard, A. E., Ahern, J., Fleischer, N. L., Van der Laan, M., Lippman, S. a, Jewell, N., ... Satariano, W. A. (2010). To GEE or not to GEE: comparing population average and mixed models for estimating the associations between neighborhood risk factors and health. *Epidemiology*, 21(4), 467–474.
- Hubbard, G., McLachlan, K., Forbat, L., & Munday, D. (2012). Recognition by family members that relatives with neurodegenerative disease are likely to die within a year: a meta-ethnography. *Palliative Medicine*, 26(2), 108–122.
- Husbands, W., Lau, C., Murray, J., Care, L. T., Sutdhibhasilp, N., Maharaj, R., ... Gray, T. (2004). *Party Drugs in Toronto's Gay Dance Club Scene*. Toronto: AIDS Committee of Toronto.
- Ireland, K., Southgate, E., Knox, S., Van de Ven, P., Howard, J., & Kippax, S. (1999). *Using & "the scene": patterns and contexts of drug use among Sydney gay men*. Sydney: National Centre in HIV Social Research.
- Irwin, T. W., Morgenstern, J., Parsons, J. T., Wainberg, M., & Labouvie, E. (2006). Alcohol and sexual HIV risk behavior among problem drinking men who have sex with men: an event level analysis of timeline followback data. *AIDS and Behavior*, 10(3), 299–307.
- Jaccard, J. (2001). *Interaction Effects in Logistic Regression*. Thousand Oaks, CA: Sage Publications.
- Jack, B. A., Thomas, J., & Jinks, A. M. (2012). Resilience to care: a systematic review and meta-synthesis of the qualitative literature concerning the experiences of student nurses in adult hospital settings in the UK. *Nurse Education Today*, 32(6), 657–664.
- Jensen, L. A., & Allen, M. N. (1996). Meta-synthesis of qualitative findings. *Qualitative Health Research*, 6(4), 553–560.
- Jerome, R. C., Halkitis, P. N., & Siconolfi, D. E. (2009). Club drug use, sexual behavior, and HIV seroconversion: a qualitative study of motivations. *Substance Use & Misuse*, 44(3), 431–447.

- Johnson, W. D., Diaz, R. M., Flanders, W. D., Goodman, M., Hill, A. N., Holtgrave, D., ... McClellan, W. M. (2008). Behavioral interventions to reduce risk for sexual transmission of HIV among men who have sex with men. *The Cochrane Database of Systematic Reviews*, (3), CD001230.
- Kalichman, S. C. (2010). Social and structural HIV prevention in alcohol-serving establishments. *Alcohol Research & Health*, 33(3), 184–194.
- Kalichman, S. C., Cain, D., Carey, K., Carey, M., & Simbayi, L. (2013). Social and structural HIV prevention in South African informal alcohol serving establishments. *Alcoholism: Clinical and Experimental Research*, 37, 285A.
- Kalichman, S. C., Heckman, T., & Kelly, J. A. (1996). Sensation seeking as an explanation for the association between substance use and HIV-related risky sexual behavior. *Archives Of Sexual Behavior*, 25(2), 141–154.
- Kalichman, S. C., & Rompa, D. (1995). Sexual sensation seeking and sexual compulsivity scales: validity, and predicting HIV risk behavior. *Journal of Personality Assessment*, 65(3), 586–601.
- Kangasniemi, M., Halkoaho, A., Lansimies-Antikainen, H., & Pietila, A.-M. (2012). Duties of the patient: a tentative model based on metasynthesis. *Nursing Ethics*, 19(1), 58–67.
- Kearney, M. H. (1998). Ready to wear: discovering grounded formal theory. *Research in Nursing & Health*, 21(2), 179–186.
- Kearney, M. H. (2001). New directions in formal grounded theory. In R. S. Schreiber & P. N. Stern (Eds.), *Using Grounded Theory in Nursing* (pp. 227–246). New York: Springer Publishing Co.
- Kelly, J. A. (2004). Popular opinion leaders and HIV prevention peer education: resolving discrepant findings, and implications for the development of effective community programmes. *AIDS Care*, 16(2), 139–150.
- Kelly, J. A., Morin, S. F., Remien, R. H., Steward, W. T., Higgins, J. a, Seal, D. W., ... Sikkema, K. J. (2009). Lessons learned about behavioral science and acute/early HIV infection. The NIMH Multisite Acute HIV Infection Study: V. *AIDS and Behavior*, 13(6), 1068–1074.
- Kelly, J. A., Murphy, D. A., Sikkema, K. J., McAuliffe, T. L., Roffman, R. A., Solomon, L. J., ... Kalichman, S. C. (1997). Randomised, controlled, community-level HIV-prevention intervention for sexual-risk behaviour among homosexual men in US cities. *The Lancet*, 350, 1500–1505.
- Kelly, J. A., St. Lawrence, J. S., Stevenson, L. Y., Hauth, A. C., Kalichman, S. C., Diaz, Y. E., ... Morgan, M. G. (1992). Community AIDS/HIV risk reduction: the effects of endorsements by popular people in three cities. *American Journal of Public Health*, 82(11), 1483–1489.

- Kemp, K., Griffiths, J., & Lovell, K. (2012). Understanding the health and social care needs of people living with IBD: a meta-synthesis of the evidence. *World Journal of Gastroenterology*, 18(43), 6240–6249.
- Kirby, T., & Thornber-Dunwell, M. (2013a). High-risk drug practices tighten grip on London gay scene. *The Lancet*, 381, 101–102.
- Kirby, T., & Thornber-Dunwell, M. (2013b). New HIV diagnoses in London's gay men continue to soar. *The Lancet*, 382, 295.
- Klitzman, R. (2006). From “male bonding rituals” to “suicide Tuesday”: a qualitative study of issues faced by gay ecstasy (MDMA) users. *Journal of Homosexuality*, 51(3), 7–32.
- Koblin, B. A., Chesney, M., & Coates, T. (2004). Effects of a behavioural intervention to reduce acquisition of HIV infection among men who have sex with men: the EXPLORE randomised controlled study. *The Lancet*, 364: 41-50.
- Koblin, B. A., Murrill, C., Camacho, M., Xu, G., Liu, K.-L., Raj-Singh, S., & Torian, L. (2007). Amphetamine use and sexual risk among men who have sex with men: results from the National HIV Behavioral Surveillance study - New York City. *Substance Use & Misuse*, 42(10), 1613–1628.
- Kools, S., McCarthy, M., Durham, R., & Robrecht, L. (1996). Dimensional analysis: broadening the conception of grounded theory. *Qualitative Health Research*, 6(3), 312–330.
- Korthuis, P. T., Zephyrin, L. C., Fleishman, J. a, Saha, S., Josephs, J. S., McGrath, M. M., ... Gebo, K. A. (2008). Health-related quality of life in HIV-infected patients: the role of substance use. *AIDS Patient Care and STDs*, 22(11), 859–867.
- Kott, A. (2012). Condom use among men with male partners varies according to situation. *Perspectives on Sexual and Reproductive Health*, 44(4), 274.
- Kramer, J. M., Olsen, S., Mermelstein, M., Balcells, A., & Liljenquist, K. (2012). Youth with disabilities' perspectives of the environment and participation: a qualitative meta-synthesis. *Child: Care, Health and Development*, 38(6), 763–777.
- Kurtz, S. P. (2005). Post-circuit blues: motivations and consequences of crystal meth use among gay men in Miami. *AIDS and Behavior*, 9(1), 63–72.
- Lamb, J., Bower, P., Rogers, A., Dowrick, C., & Gask, L. (2012). Access to mental health in primary care: a qualitative meta-synthesis of evidence from the experience of people from “hard to reach” groups. *Health*, 16(1), 76–104.
- Lanza, S. T., Tan, X., & Bray, B. C. (2013). Latent class analysis with distal outcomes: a flexible model-based approach. *Structural Equation Modeling: A Multidisciplinary Journal*, 20(1), 1–26.

- Lawrence, V., Fossey, J., Ballard, C., Moniz-Cook, E., & Murray, J. (2012). Improving quality of life for people with dementia in care homes: making psychosocial interventions work. *British Journal of Psychiatry*, 201(5), 344–351.
- Lea, T., Mao, L., Bath, N., Prestage, G., Zablotska, I., de Wit, J., & Holt, M. (2013). Injecting drug use among gay and bisexual men in Sydney: prevalence and associations with sexual risk practices and HIV and hepatitis C infection. *AIDS and Behavior*, 17(4), 1344–1351.
- Lee, M.-Y., Mu, P.-F., Tsay, S.-F., Chou, S.-S., Chen, Y.-C., & Wong, T.-T. (2012). Body image of children and adolescents with cancer: a metasynthesis on qualitative research findings. *Nursing & Health Sciences*, 14(3), 381–390.
- Leichliter, J. S., Haderxhanaj, L. T., Chesson, H. W., & Aral, S. O. (2013). Temporal trends in sexual behavior among men who have sex with men in the United States, 2002 to 2006-10. *Journal of Acquired Immune Deficiency Syndromes*. Advance online publication.
- Leigh, B. C., & Stall, R. (1993). Substance use and risky sexual behavior for exposure to HIV: issues in methodology, interpretation, and prevention. *American Psychologist*, 48(10), 1035–1045.
- Levy, A., Johnston, K., Annemans, L., Tramarin, A., & Montaner, J. (2010). The impact of disease stage on direct medical costs of HIV management: a review of the international literature. *Pharmacoeconomics*, 28(Suppl 1), 35–47.
- Lewis, L. A. (1994). The inner Sydney gay dance party culture in the context of the HIV/AIDS pandemic: a qualitative analysis. *Dissertation Abstracts International: Section B. Sciences and Engineering*, 55(04), 1396.
- Lewis, L. A., & Ross, M. W. (1995). The gay dance party culture in Sydney: a qualitative analysis. *Journal of Homosexuality*, 29(1), 41–70.
- Lewis, L. A., & Ross, M. W. (1996). *A Select Body: The Gay Dance Party Subculture and the HIV-AIDS Pandemic*. Sydney: Cassell.
- Liang, K., & Zeger, S. (1986). Longitudinal data analysis using generalized linear models. *Biometrika*, 73(1), 13–22.
- Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. a, ... Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLOS Medicine*, 6(7), e1000100.
- Lim, S. H., Ostrow, D., Stall, R., Chmiel, J., Herrick, A., Shoptaw, S., ... Plankey, M. (2012). Changes in stimulant drug use over time in the MACS: evidence for resilience against stimulant drug use among men who have sex with men. *AIDS and Behavior*, 16(1), 151–158.

- Lipsitz, S., Parzen, M., & Ewell, M. (1998). Inference using conditional logistic regression with missing covariates. *Biometrics*, 54(1), 295–303.
- Lofland, J. (1970). Interactionist imagery and analytic interruptus. In T. Shibutani (Ed.), *Human Nature and Collective Behavior: Papers in Honor of Herbert Blumer* (pp. 35–45). New Brunswick, NJ: Transaction Books.
- Lundgren, I., Begley, C., Gross, M. M., & Bondas, T. (2012). “Groping through the fog”: a metasynthesis of women’s experiences on VBAC (vaginal birth after Caesarean section). *BMC Pregnancy and Childbirth*, 12(85).
- Lyles, R., Muñoz, A., Yamashita, T. E., Bazmi, H., Detels, R., Rinaldo, C. R., ... Mellors, J. W. (2000). Natural history of human immunodeficiency virus type 1 viremia after seroconversion and proximal to AIDS in a large cohort of homosexual men. *Journal of Infectious Diseases*, 181(3), 872–880.
- Lyons, A., Smith, A. M. A., Grierson, J. W., & von Doussa, H. (2010). Australian men’s sexual practices in saunas, sex clubs and other male sex on premises venues. *Sexual Health*, 7(2), 186–192.
- MacKellar, D. A., Hou, S.-I., Whalen, C. C., Samuelsen, K., Valleroy, L. A., Secura, G. M., ... Torian, L. V. (2011a). A plausible causal model of HAART-efficacy beliefs, HIV/AIDS complacency, and HIV-acquisition risk behavior among young men who have sex with men. *AIDS and Behavior*, 15(4), 788–804.
- MacKellar, D. A., Hou, S.-I., Whalen, C. C., Samuelsen, K., Valleroy, L. A., Secura, G. M., ... Torian, L. V. (2011b). HIV/AIDS complacency and HIV infection among young men who have sex with men, and the race-specific influence of underlying HAART beliefs. *Sexually Transmitted Diseases*, 38(8), 755–763.
- Maclure, M. (1991). The case-crossover design: a method for studying transient effects on the risk of acute events. *American Journal of Epidemiology*, 133(2), 144–153.
- Maclure, M., & Mittleman, M. A. (2000). Should we use a case-crossover design? *Annual Review of Public Health*, 21, 193–221.
- Makaroff, K. L. S. (2012). Experiences of kidney failure: a qualitative meta-synthesis. *Nephrology Nursing Journal*, 39(1), 21–30.
- Malpass, A., Carel, H., Ridd, M., Shaw, A., Kessler, D., Sharp, D., ... Wallond, J. (2012). Transforming the perceptual situation: a meta-ethnography of qualitative work reporting patients’ experiences of mindfulness-based approaches. *Mindfulness*, 3(1), 60–75.
- Malpass, A., Shaw, A., Sharp, D., Walter, F., Feder, G., Ridd, M., & Kessler, D. (2009). “Medication career” or “moral career”? The two sides of managing antidepressants: a meta-ethnography of patients’ experience of antidepressants. *Social Science & Medicine*, 68(1), 154–168.

- Mansergh, G., Koblin, B. A., McKirnan, D. J., Hudson, S. M., Flores, S. A., Wiegand, R. E., ... Project MIX Study Team. (2010). An intervention to reduce HIV risk behavior of substance-using men who have sex with men: A two-group randomized trial with a nonrandomized third group. *PLOS Medicine*, 7(8), e1000329.
- Mansergh, G., Shouse, R. L., Marks, G., Guzman, R., Rader, M., Buchbinder, S., & Colfax, G. N. (2006). Methamphetamine and sildenafil (Viagra) use are linked to unprotected receptive and insertive anal sex, respectively, in a sample of men who have sex with men. *Sexually Transmitted Infections*, 82(2), 131-134.
- Mattison, A. M., Ross, M. W., Wolfson, T., & Franklin, D. (2001). Circuit party attendance, club drug use, and unsafe sex in gay men. *Journal of Substance Abuse*, 13(1-2), 119-126.
- McDaid, L. M., & Hart, G. J. (2010a). Contact with HIV prevention services highest in gay and bisexual men at greatest risk: cross-sectional survey in Scotland. *BMC Public Health*, 10(798).
- McDaid, L. M., & Hart, G. J. (2010b). Sexual risk behaviour for transmission of HIV in men who have sex with men: recent findings and potential interventions. *Current Opinion in HIV and AIDS*, 5(4), 311-315.
- McFarland, W., Chen, Y.-H., Raymond, H. F., Nguyen, B., Colfax, G., Mehrtens, J., ... Truong, H.-H. M. (2011). HIV seroadaptation among individuals, within sexual dyads, and by sexual episodes, men who have sex with men, San Francisco, 2008. *AIDS Care*, 23(3), 261-268.
- McKirnan, D. J., Houston, E., & Tolou-Shams, M. (2007). Is the web the culprit? Cognitive escape and Internet sexual risk among gay and bisexual men. *AIDS and Behavior*, 11(1), 151-160.
- McKirnan, D. J., Ostrow, D. G., & Hope, B. Y. (1996). Sex, drugs and escape: a psychological model of HIV-risk sexual behaviours. *AIDS Care*, 8(6), 655-670.
- McKirnan, D. J., Venable, P. A., Ostrow, D. G., & Hope, B. (2001). Expectancies of sexual "escape" and sexual risk among drug and alcohol-involved gay and bisexual men. *Journal of Substance Abuse*, 13(1-2), 137-154.
- Melendez-Torres, G. J., & Bonell, C. (2013). Systematic review of cognitive behavioural interventions for HIV risk reduction in substance-using men who have sex with men. *International Journal of STD & AIDS*. Advance online publication.
- Mendeley Ltd, & Glyph & Cog LLC. (2014). Mendeley Desktop.
- Menza, T. W., Kerani, R. P., Handsfield, H. H., & Golden, M. R. (2011). Stable sexual risk behavior in a rapidly changing risk environment: findings from population-based surveys of men who have sex with men in Seattle, Washington, 2003-2006. *AIDS and Behavior*, 15(2), 319-329.

- Metzger, D., Woody, G., & O'Brien, C. P. (2010). Drug treatment as HIV prevention: a research update. *Journal of Acquired Immune Deficiency Syndromes*, 55(Suppl 1), S32–S36.
- Miles, M. B., & Huberman, A. M. (1984). *Qualitative Data Analysis*. Thousand Oaks, CA: Sage Publications.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Miller, W. C., Rosenberg, N. E., Rutstein, S. E., & Powers, K. a. (2010). Role of acute and early HIV infection in the sexual transmission of HIV. *Current Opinion in HIV and AIDS*, 5(4), 277–82.
- Mills, A. J., Durepos, G., & Wiebe, E. (2010). Analytic generalization. In *Encyclopedia of Case Study Research* (pp. 21–23). Thousand Oaks, CA: Sage Publications.
- Minichiello, V., Marino, R., Khan, M. A., & Browne, J. (2003). Alcohol and drug use in Australian male sex workers: its relationship to the safety outcome of the sex encounter. *AIDS Care*, 15(4), 549–561.
- Monforte-Royo, C., Villavicencio-Chavez, C., Tomas-Sabado, J., Mahtani-Chugani, V., & Balaguer, A. (2012). What lies behind the wish to hasten death? A systematic review and meta-ethnography from the perspective of patients. *PLOS ONE*, 7(5), e37117.
- Montagnier, L. (2002). A History of HIV Discovery. *Science*, 298(November), 1727–1728.
- Mor, Z., & Dan, M. (2012). The HIV epidemic among men who have sex with men — behaviour beats science. *EMBO Reports*, 13(11), 948–953.
- Morris, S. R., & Little, S. J. (2011). MSM: resurgent epidemics. *Current Opinion in HIV and AIDS*, 6(4), 326–332.
- Mullens, A. B., Young, R. M., Hamernik, E., & Dunne, M. (2009). The consequences of substance use among gay and bisexual men: a consensual qualitative research analysis. *Sexual Health*, 6(2), 139–152.
- Mustanski, B. S. (2007a). Are sexual partners met online associated with HIV/STI risk behaviours? Retrospective and daily diary data in conflict. *AIDS Care*, 19(6), 822–827.
- Mustanski, B. S. (2007b). The influence of state and trait affect on HIV risk behaviors: A daily diary study of MSM. *Health Psychology*, 26(5), 618–626.
- Mustanski, B. S. (2008). Moderating effects of age on the alcohol and sexual risk taking association: An online daily diary study of men who have sex with men. *AIDS and Behavior*, 12(1), 118–126.

- Mustanski, B. S., Garofalo, R., Herrick, A., & Donenberg, G. (2007). Psychosocial health problems increase risk for HIV among urban young men who have sex with men: preliminary evidence of a syndemic in need of attention. *Annals of Behavioral Medicine*, 34(1), 37–45.
- Mustanski, B. S., Newcomb, M. E., & Clerkin, E. (2011). Relationship characteristics and sexual risk-taking in young men who have sex with men. *Health Psychology*, 30(5), 597–605.
- Mustanski, B. S., Newcomb, M. E., Du Bois, S. N., Garcia, S. C., & Grov, C. (2011). HIV in young men who have sex with men: a review of epidemiology, risk and protective factors, and interventions. *Journal of Sex Research*, 48(2-3), 218–253.
- Muthén, B. O., & Muthén, L. K. (2012). Mplus. Muthén & Muthén.
- Muthén, L. K., & Muthén, B. O. (2012). *Mplus: Statistical Analysis with Latent Variables User's Guide* (7th ed.). Los Angeles: Muthén & Muthén.
- Myers, T., Allman, D., Calzavara, L., Morrison, K., Marchand, R., & Major, C. (1999). Gay and bisexual men's sexual partnerships and variations in risk behaviour. *Canadian Journal of Human Sexuality*, 8(2), 115–126.
- Nagaraj, S., Segura, E. R., Peinado, J., Konda, K. A., Segura, P., Casapia, M., ... Lama, J. R. (2013). A cross-sectional study of knowledge of sex partner serostatus among high-risk Peruvian men who have sex with men and transgender women: implications for HIV prevention. *BMC Public Health*, 13(181).
- Nagata, J. M., Gatti, L. R., & Barg, F. K. (2012). Social determinants of iron supplementation among women of reproductive age: a systematic review of qualitative data. *Maternal and Child Nutrition*, 8(1), 1–18.
- Natale, A. P. (2008). HIV transmission factors: Denver MSM culture and contexts. *Journal of HIV/AIDS & Social Services*, 7(3), 241–264.
- Nelson, A. M. (2012). A meta-synthesis related to infant feeding decision making. *MCN. The American Journal of Maternal Child Nursing*, 37(4), 247–252.
- Neubeck, L., Freedman, S. Ben, Clark, A. M., Briffa, T., Bauman, A., & Redfern, J. (2012). Participating in cardiac rehabilitation: a systematic review and meta-synthesis of qualitative data. *European Journal of Preventive Cardiology*, 19(3), 494–503.
- Newcomb, M. E. (2012). Developmental and racial differences in a situational model of sexual risk in men who have sex with men. *Dissertation Abstracts International: Section B. Sciences and Engineering*, 74(06), 148.

- Newcomb, M. E. (2013). Moderating Effect of Age on the Association Between Alcohol Use and Sexual Risk in MSM: Evidence for Elevated Risk Among Younger MSM. *AIDS and Behavior*, 17(5), 1746–1754.
- Newcomb, M. E., Clerkin, E. M., & Mustanski, B. S. (2011). Sensation seeking moderates the effects of alcohol and drug use prior to sex on sexual risk in young men who have sex with men. *AIDS and Behavior*, 15(3), 565–575.
- Newcomb, M. E., & Mustanski, B. S. (2013). Racial differences in same-race partnering and the effects of sexual partnership characteristics on HIV risk in MSM: a prospective sexual diary study. *Journal of Acquired Immune Deficiency Syndromes*, 62(3), 329–333.
- Noblit, G., & Hare, W. D. (1988). *Meta-Ethnography: Synthesizing Qualitative Studies*. Newbury Park, California: Sage Publications.
- Nyman, S. R., Dibb, B., Victor, C. R., & Gosney, M. A. (2012). Emotional well-being and adjustment to vision loss in later life: a meta-synthesis of qualitative studies. *Disability and Rehabilitation*, 34(12), 971–981.
- O’Byrne, P. (2009). The intersection of desire, drugs, and unsafe sexual practices: An ethnographic study of the gay circuit party subculture. *Dissertation Abstracts International: Section A. The Humanities and Social Sciences*, 70(10), 339.
- O’Byrne, P. (2011). Examining the intersection of desire, drugs and place among gay men. *Journal of Research in Nursing*, (September 2011), 1–12.
- O’Byrne, P., & Holmes, D. (2011a). Desire, drug use and unsafe sex: a qualitative examination of gay men who attend gay circuit parties. *Culture, Health & Sexuality*, 13(1), 1–13.
- O’Byrne, P., & Holmes, D. (2011b). Drug use as boundary play: a qualitative exploration of gay circuit parties. *Substance Use & Misuse*, 46(12), 1510–1522.
- O’Halloran, R., Grohn, B., & Worrall, L. (2012). Environmental factors that influence communication for patients with a communication disability in acute hospital stroke units: a qualitative metasynthesis. *Archives of Physical Medicine and Rehabilitation*, 93(Suppl 1), S77–S85.
- O’Leary, A., & Wolitski, R. J. (2009). Moral agency and the sexual transmission of HIV. *Psychological Bulletin*, 135(3), 478–494.
- Ostrow, D. G. (2000). The role of drugs in the sexual lives of men who have sex with men: continuing barriers to researching this question. *AIDS and Behavior*, 4(2), 205–219.
- Pan, W. (2001). Akaike’s information criterion in generalized estimating equations. *Biometrics*, 57(1), 120–125.

- Parsons, J. T., Grov, C., & Golub, S. A. (2012). Sexual compulsivity, co-occurring psychosocial health problems, and HIV risk among gay and bisexual men: further evidence of a syndemic. *American Journal of Public Health, 102*(1), 156–162.
- Parsons, J. T., Lelutiu-Weinberger, C., Botsko, M., & Golub, S. A. (2012). Predictors of day-level sexual risk for young gay and bisexual men. *AIDS and Behavior, 17*(4), 1465–1477.
- Parsons, J. T., Severino, J., Nanin, J., Punzalan, J. C., von Sternberg, K., Missildine, W., & Frost, D. (2006). Positive, negative, unknown: assumptions of HIV status among HIV-positive men who have sex with men. *AIDS Education and Prevention, 18*(2), 139–149.
- Patel, P., Taylor, M. M., Montoya, J. A., Hamburger, M. E., Kerndt, P. R., & Holmberg, S. D. (2006). Circuit parties: sexual behaviors and HIV disclosure practices among men who have sex with men at the White Party, Palm Springs, California, 2003. *AIDS Care, 18*(8), 1046–1049.
- Paterson, B. L., Thorne, S. E., Canam, C., & Jillings, C. (2001). *Meta-Study of Qualitative Health Research: A Practical Guide to Meta-Analysis and Meta-Synthesis*. Thousand Oaks, CA: Sage Publications.
- Penedo, F., Antoni, M., Schneiderman, N., Ironson, G. H., Malow, R. M., Cruess, S., ... LaPerriere, A. (2001). Dysfunctional attitudes, coping, and depression among HIV-seropositive men who have sex with men. *Cognitive Therapy and Research, 25*(5), 591–606.
- Perry, M. A., Hudson, H. S., Meys, S., Norrie, O., Ralph, T., & Warner, S. (2012). Older adults' experiences regarding discharge from hospital following orthopaedic intervention: a metasynthesis. *Disability and Rehabilitation, 34*(4), 267–278.
- Phillips, A. N., Cambiano, V., Nakagawa, F., Brown, A. E., Lampe, F., Rodger, A., ... Delpech, V. C. (2013). Increased HIV incidence in men who have sex with men despite high levels of ART-induced viral suppression: analysis of an extensively documented epidemic. *PLOS ONE, 8*(2), e55312.
- Pisani, E., Purnomo, H., Sutrisna, A., Asy, A., Zaw, M., Tilman, C., ... Neilsen, G. (2006). Basing policy on evidence: low HIV, STIs, and risk behaviour in Dili, East Timor argue for more focused interventions. *Sexually Transmitted Infections, 82*(1), 88–93.
- Popay, J., Rogers, a., & Williams, G. (1998). Rationale and standards for the systematic review of qualitative literature in health services research. *Qualitative Health Research, 8*(3), 341–351.
- Pope, C., Ziebland, S., & Mays, N. (2000). Analysing qualitative data. *BMJ, 320*, 5–7.

- Prestage, G., Van de Ven, P., Grulich, A., Kaldor, J., Kippax, S., & Mao, L. (2005). Contexts for last occasions of unprotected anal intercourse among HIV-negative gay men in Sydney: the health in men cohort. *AIDS Care*, 17(1), 23–32.
- Qin, J., & Zhang, B. (2005). Marginal likelihood, conditional likelihood and empirical likelihood: connections and applications. *Biometrika*, 92(2), 251–270.
- Rabe-Hesketh, S., Skrondal, A., & Pickles, A. (2002). Reliable estimation of generalized linear mixed models using adaptive quadrature. *The Stata Journal*, 2(1), 1–21.
- Rabe-Hesketh, S., Skrondal, A., & Pickles, A. (2005). Maximum likelihood estimation of limited and discrete dependent variable models with nested random effects. *Journal of Econometrics*, 128(2), 301–323.
- Rajasingham, R., Mimiaga, M. J., White, J. M., Pinkston, M. M., Baden, R. P., & Mitty, J. A. (2012). A systematic review of behavioral and treatment outcome studies among HIV-infected men who have sex with men who abuse crystal methamphetamine. *AIDS Patient Care and STDs*, 26(1), 36–52.
- Ram, N., & Grimm, K. (2009). Growth Mixture Modeling: A Method for Identifying Differences in Longitudinal Change Among Unobserved Groups. *International Journal of Behavioral Development*, 33(6), 565–576.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical Linear Models* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Reback, C. J. (1997). *The Social Construction of a Gay Drug: Methamphetamine Use Among Gay And Bisexual Males in Los Angeles*. Los Angeles: City of Los Angeles AIDS Coordinator.
- Reed, M. C., Wood, V., Harrington, R., & Paterson, J. (2012). Developing stroke rehabilitation and community services: a meta-synthesis of qualitative literature. *Disability and Rehabilitation*, 34(7), 553–563.
- Reisen, C. A., Iracheta, M. A., Zea, M. C., Bianchi, F. T., & Poppen, P. J. (2010). Sex in public and private settings among Latino MSM. *AIDS Care*, 22(6), 697–704.
- Riegler, A. (2005). Editorial. the constructivist challenge. *Constructivist Foundations*, 1(1), 1–8.
- Robrecht, L. C. (1995). Grounded theory: evolving methods. *Qualitative Health Research*, 5(2), 169–177.
- Rolfe, G. (2006). Validity, trustworthiness and rigour: quality and the idea of qualitative research. *Journal of Advanced Nursing*, 53(3), 304–310.
- Rose, G. (1992). *The Strategy of Preventive Medicine*. Oxford, UK: Oxford University Press.

- Rosenberger, J. G., Reece, M., Schick, V., Herbenick, D., Novak, D. S., Van Der Pol, B., & Fortenberry, J. D. (2011). Sexual behaviors and situational characteristics of most recent male-partnered sexual event among gay and bisexually identified men in the United States. *Journal of Sexual Medicine*, 8(11), 3040–3050.
- Rothenberg, R. (2009). HIV transmission networks. *Current Opinion in HIV and AIDS*, 4(4), 260–265.
- Rowe, M. S., & Dowsett, G. W. (2008). Sex, love, friendship, belonging and place: is there a role for “gay community” in HIV prevention today? *Culture, Health and Sexuality*, 10(4), 329–344.
- Rudolfsson, G., & Berggren, I. (2012). Nursing students’ perspectives on the patient and the impact of the nursing culture: a meta-synthesis. *Journal of Nursing Management*, 20(6), 771–781.
- Ryan, M., Merry, C., Ryan, C., Bennett, K., Heerey, A., McGowan, B., ... Barry, M. (2004). Population based study of the cost of inpatient care for HIV-infected individuals in an Irish teaching hospital. *The Irish Medical Journal*, 97(4), 200–202.
- Saldana, J. (2009). *The Coding Manual for Qualitative Researchers*. Thousand Oaks, CA: Sage Publications.
- Sandelowski, M. (2008). Reading, writing and systematic review. *Journal of Advanced Nursing*, 64(1), 104–110.
- Sandelowski, M. (2012). Metasynthesis of qualitative research. In H. Cooper (Ed.), *APA handbook of research methods in psychology, Vol 2: Research designs: Quantitative, qualitative, neuropsychological, and biological* (pp. 19–36). Washington, DC: American Psychological Association.
- Sandelowski, M., & Barroso, J. (2007). *Handbook for Synthesizing Qualitative Research*. New York: Springer.
- Sandelowski, M., Docherty, S., & Emden, C. (1997). Focus on qualitative methods. Qualitative metasynthesis: issues and techniques. *Research in Nursing & Health*, 20(4), 365–371.
- Sandelowski, M., Voils, C. I., Chang, Y., & Lee, E.-J. (2009). A systematic review comparing antiretroviral adherence descriptive and intervention studies conducted in the USA. *AIDS Care*, 21(8), 953–966.
- Santos, G.-M., Das, M., & Colfax, G. N. (2011). Interventions for non-injection substance use among US men who have sex with men: what is needed. *AIDS and Behavior*, 15(Suppl 1), S51–S56.
- Santos, G.-M., Do, T., Beck, J., Makofane, K., Arreola, S., Pyun, T., ... Ayala, G. (2014). Syndemic conditions associated with increased HIV risk in a global

- sample of men who have sex with men. *Sexually Transmitted Infections*, 90(3), 250–253.
- Schafer, J. L., & Graham, J. W. (2002). Missing data: our view of the state of the art. *Psychological Methods*, 7(2), 147–177.
- Schatzman, L. (1991). Dimensional analysis: notes on an alternative approach to the grounding of theory in qualitative research. In D. R. Maines (Ed.), *Social Organization and Social Process: Essays in Honor of Anselm Strauss* (pp. 303–314). New York: Aldine de Gruyter.
- Schatzman, L., & Strauss, A. (1973). *Field Research: Strategies for a Natural Sociology*. Englewood Cliffs, NJ: Prentice-Hall.
- Scheer, S., Kellogg, T., Klausner, J. D., Schwarcz, S., Colfax, G., Bernstein, K., ... McFarland, W. (2008). HIV is hyperendemic among men who have sex with men in San Francisco: 10-year trends in HIV incidence, HIV prevalence, sexually transmitted infections and sexual risk behaviour. *Sexually Transmitted Infections*, 84(6), 493–498.
- Schmied, V., Olley, H., Burns, E., Duff, M., Dennis, C.-L., & Dahlen, H. G. (2012). Contradictions and conflict: a meta-ethnographic study of migrant women's experiences of breastfeeding in a new country. *BMC Pregnancy and Childbirth*, 12(163).
- Schulman-Green, D., Jaser, S., Martin, F., Alonzo, A., Grey, M., McCorkle, R., ... Whittemore, R. (2012). Processes of self-management in chronic illness. *Journal of Nursing Scholarship*, 44(2), 136–144.
- Schutz, A. (1962). *Collected papers, volume 1*. The Hague: Martinus Nijhoff.
- Scott-Sheldon, L. A. J., Fielder, R. L., & Carey, M. P. (2010). Sexual risk reduction interventions for patients attending sexually transmitted disease clinics in the United States: a meta-analytic review, 1986 to early 2009. *Annals of Behavioral Medicine*, 40(2), 191–204.
- Semple, S. J., Strathdee, S. A., Zians, J., McQuaid, J. R., & Patterson, T. L. (2011). Drug assertiveness and sexual risk-taking behavior in a sample of HIV-positive, methamphetamine-using men who have sex with men. *Journal of Substance Abuse Treatment*, 41(3), 265–272.
- Semple, S. J., Strathdee, S. A., Zians, J., & Patterson, T. L. (2010). Factors associated with sex in the context of methamphetamine use in different sexual venues among HIV-positive men who have sex with men. *BMC Public Health*, 10(178).
- Semple, S. J., Zians, J., Strathdee, S. a, & Patterson, T. L. (2009). Sexual marathons and methamphetamine use among HIV-positive men who have sex with men. *Archives of Sexual Behavior*, 38(4), 583–590.

- Shoptaw, S., & Frosch, D. (2000). Substance abuse treatment as HIV prevention for men who have sex with men. *AIDS and Behavior*, 4(2), 193–203.
- Shoptaw, S., & Reback, C. J. (2007). Methamphetamine use and infectious disease-related behaviors in men who have sex with men: implications for interventions. *Addiction*, 102(Suppl 1), 130–135.
- Sigma Research Group. (2011). *Making it count: a collaborative planning framework to minimise the incidence of HIV infection during sex between men*. London: Sigma Research, London School of Hygiene and Tropical Medicine.
- Sikkema, K. J. (2005). HIV prevention among women in low-income housing developments: issues and intervention outcomes in a place-based randomized controlled trial. *The ANNALS of the American Academy of Political and Social Science*, 599(1), 52–70.
- Singer, M., & Clair, S. (2003). Syndemics and public health: reconceptualizing disease in bio-social context. *Medical Anthropology Quarterly*, 17(4), 423–441.
- Skrondal, A., & Rabe-Hesketh, S. (2004). *Generalized Latent Variable Modeling: Multilevel, Longitudinal, and Structural Equation Models*. Boca Raton, FL: Chapman & Hall/CRC.
- Slavin, S. (2004). Drugs, space, and sociality in a gay nightclub in Sydney. *Journal of Contemporary Ethnography*, 33(3), 265–295.
- Sloan, C. E., Champenois, K., Choisy, P., Losina, E., Walensky, R. P., Schackman, B. R., ... Yazdanpanah, Y. (2012). Newer drugs and earlier treatment: impact on lifetime cost of care for HIV-infected adults. *AIDS*, 26(1), 45–56.
- Small, M. L. (2009). “How many cases do I need?": On science and the logic of case selection in field-based research. *Ethnography*, 10(1), 5–38.
- Smit, C., Lindenburg, K., Geskus, R. B., Brinkman, K., Coutinho, R. A., & Prins, M. (2006). Highly active antiretroviral therapy (HAART) among HIV-infected drug users: a prospective cohort study of sexual risk and injecting behaviour. *Addiction*, 101(3), 433–440.
- Smith, A. M. A., Grierson, J., Pitts, M., & Pattison, P. (2006). Individual characteristics are less important than event characteristics in predicting protected and unprotected anal intercourse among homosexual and bisexual men in Melbourne, Australia. *Sexually Transmitted Infections*, 82(6), 474–477.
- Smith, A., Miles, I., Le, B., Finlayson, T., & Oster, A. (2010). Prevalence and awareness of HIV infection among men who have sex with men—21 cities, United States, 2008. *MMWR*, 59(37).
- Smith, L. K., Pope, C., & Botha, J. L. (2005). Patients’ help-seeking experiences and delay in cancer presentation: a qualitative synthesis. *The Lancet*, 366, 825–831

- Smith, M., & Aguirre, R. T. P. (2012). Reproductive attitudes and behaviors in people with sickle cell disease or sickle cell trait: a qualitative interpretive meta-synthesis. *Social Work in Health Care*, 51(9), 757–779.
- Snijders, T. A. B., & Bosker, R. J. (2011). *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Southgate, E., & Hopwood, M. (1999a). Mardi gras says “be drug free”: accounting for resistance, pleasure and the demand for illicit drugs. *Health*, 3(3), 303–316.
- Southgate, E., & Hopwood, M. (1999b). *The Drug Use and Gay Men Project Issue Papers*. Sydney: National Centre in HIV Social Research.
- Southgate, E., & Hopwood, M. (2001). The role of folk pharmacology and lay experts in harm reduction: Sydney gay drug using networks. *International Journal of Drug Policy*, 12(4), 321–335.
- Stall, R., Mills, T. C., Williamson, J., Hart, T., Greenwood, G., Paul, J., ... Catania, J. A. (2003). Association of co-occurring psychosocial health problems and increased vulnerability to HIV/AIDS among urban men who have sex with men. *American Journal of Public Health*, 93(6), 939–942.
- Stankov, I., Olds, T., & Cargo, M. (2012). Overweight and obese adolescents: what turns them off physical activity? *International Journal of Behavioral Nutrition and Physical Activity*, 9(53).
- Stark, M. M., & Norfolk, G. A. (2011). *Clinical Forensic Medicine*. (M. M. Stark, Ed.). Totowa, NJ: Humana Press.
- StataCorp. (2013). StataMP. College Station, TX: StataCorp.
- Steele, C. M., & Josephs, R. A. (1990). Alcohol myopia: Its prized and dangerous effects. *The American Psychologist*, 45(8), 921–933.
- Steen, M., Downe, S., Bamford, N., & Edozien, L. (2012). Not-patient and not-visitor: a metasynthesis fathers’ encounters with pregnancy, birth and maternity care. *Midwifery*, 28(4), 362–371.
- Stolte, I., Van den Boom, W., Sandfort, T., & Davidovich, U. (2011). Serosorting and sexual risk behaviour during casual sex among MSM - from one-night stands to sex buddies. *Sexually Transmitted Infections*, 87, A142–A143.
- Strauss, A. L. (1970). Discovering new theory from previous theory. In T. Shibutani (Ed.), *Human Nature and Collective Behavior: Papers in Honor of Herbert Blumer* (pp. 46–53). New Brunswick, NJ: Transaction Books.
- Strauss, A. L., & Corbin, J. C. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Thousand Oaks, CA: Sage Publications.

- Strauss, A. L., & Corbin, J. C. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Stuart, D. (2013). Sexualised drug use by MSM: background, current status and response. *HIV Nursing*, (Spring 2013), 6–10.
- Suddaby, R. (2006). From the editors: what grounded theory is not. *Academy of Management Journal*, 49(4), 633–642.
- Sullivan, P. S., Hamouda, O., Delpech, V., Geduld, J. E., Prejean, J., Semaille, C., ... Fenton, K. A. (2009). Reemergence of the HIV epidemic among men who have sex with men in North America, Western Europe, and Australia, 1996-2005. *Annals of Epidemiology*, 19(6), 423–431.
- Tabachnick, B. G., & Fidell, L. S. (2012). *Using Multivariate Statistics*. (6th, Ed.). New York: Pearson.
- Tashkin, D. P. (2001). Airway effects of marijuana, cocaine, and other inhaled illicit agents. *Current Opinion in Pulmonary Medicine*, 7(2), 43–61.
- Thiede, H., Jenkins, R. A., Carey, J. W., Hutcheson, R., Thomas, K. K., Stall, R. D., ... M.R., G. (2009). Determinants of recent HIV infection among Seattle-area men who have sex with men. *American Journal of Public Health*, 99(Suppl 1), S157–S164.
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8(45).
- Thomas, J., Harden, A., Oakley, A., Oliver, S., & Sutcliffe, K. (2004). Integrating qualitative research with trials in systematic reviews. *BMJ*, 328, 1010–1012.
- Thorne, S., Jensen, L., Kearney, M. H., Noblit, G., & Sandelowski, M. (2004). Qualitative metasynthesis: reflections on methodological orientation and ideological agenda. *Qualitative Health Research*, 14(10), 1342–1365.
- Turner, V. W. (1957). *Schism and continuity in an African society: A study of Ndembu village life*. Manchester, UK: Manchester University Press.
- Turner, V. W. (1969). *The Rites of Passage: Structure and Anti-Structure*. Piscataway, NJ: Transaction Books.
- Turner, V. W. (1982). *From ritual to theater: The human seriousness of play*. New York: PAJ Publications.
- Usndek, D. (2004). Gay crystal methamphetamine abusers: A grounded theory approach to a multifaceted issue. *Dissertation Abstracts International: Section B. Sciences and Engineering*, 65(10), 5426.

- Van Beneden, C. A., O'Brien, K., Modesitt, S., Yusem, S., Rose, A., & Fleming, D. (2002). Sexual behaviors in an urban bathhouse 15 years into the HIV epidemic. *Journal of Acquired Immune Deficiency Syndromes*, 30(5), 522–526.
- Van der Bij, A. K., Kolader, M. E., de Vries, H. J. C., Prins, M., Coutinho, R. A., & Dukers, N. H. T. M. (2007). Condom use rather than serosorting explains differences in HIV incidence among men who have sex with men. *Journal of Acquired Immune Deficiency Syndromes*, 45(5), 574–580.
- Van der Graaf, M., & Diepersloot, R. J. A. (1986). Transmission of human immunodeficiency virus (HIV/HTLV-III/LAV): a review. *Infection*, 14(5), 203–211.
- Van Gennep, A. (1909). *The Rites of Passage*. New York City: Routledge.
- Vanable, P. a, Carey, M. P., Blair, D. C., & Littlewood, R. a. (2006). Impact of HIV-related stigma on health behaviors and psychological adjustment among HIV-positive men and women. *AIDS and Behavior*, 10(5), 473–482.
- Vanley, G., Huberman, R., & Lufkin, R. B. (1982). Atypical Pneumocystis carinii pneumonia in homosexual men with unusual immunodeficiency. *American Journal of Radiology*, 138(6), 1037–1041.
- Velasquez, M. M., von Sternberg, K., Johnson, D. H., Green, C., Carbonari, J. P., & Parsons, J. T. (2009). Reducing sexual risk behaviors and alcohol use among HIV-positive men who have sex with men: a randomized clinical trial. *Journal of Consulting and Clinical Psychology*, 77(4), 657–667.
- Velter, A., Barin, F., Bouyssou, A., Guinard, J., Léon, L., Le Vu, S., ... Semaille, C. (2013). HIV prevalence and sexual risk behaviors associated with awareness of HIV status among men who have sex with men in Paris, France. *AIDS and Behavior*, 17(4), 1266–1278.
- Vermunt, J. K. (2003). Multilevel latent class models. *Sociological Methodology*, 33, 213–239.
- Vermunt, J. K. (2010). Latent class modeling with covariates: two improved three-step approaches. *Political Analysis*, 18(4), 450–469.
- Vittinghoff, E., Douglas, J., Judson, F., McKirnan, D., MacQueen, K., & Buchbinder, S. P. (1999). Per-contact risk of human immunodeficiency virus transmission between male sexual partners. *American Journal of Epidemiology*, 150(3), 306–311.
- Volberding, P. A., & Deeks, S. G. (2010). Antiretroviral therapy and management of HIV infection. *The Lancet*, 376, 49–62.
- Vosburgh, H. W., Mansergh, G., Sullivan, P. S., & Purcell, D. W. (2012). A review of the literature on event-level substance use and sexual risk behavior among men who have sex with men. *AIDS and Behavior*, 16(6), 1394–1410.

- Waibel, S., Henao, D., Aller, M.-B., Vargas, I., & Vazquez, M.-L. (2012). What do we know about patients' perceptions of continuity of care? A meta-synthesis of qualitative studies. *International Journal for Quality in Health Care*, 24(1), 39–48.
- Walsh, D., & Devane, D. (2012). A metasynthesis of midwife-led care. *Qualitative Health Research*, 22(7), 897–910.
- Walsh, D., & Downe, S. (2005). Meta-synthesis method for qualitative research: a literature review. *Journal of Advanced Nursing*, 50(2), 204–211.
- Wang, C.-P., Brown, C. H., & Bandeen-Roche, K. (2005). Residual diagnostics for growth mixture models. *Journal of the American Statistical Association*, 100(471), 1054–1076.
- Weems, M. R. (2007). The fierce tribe: Body fascists, crack whores, and circuit queens in the spiritual performance of masculine nonviolence. *Dissertation Abstracts International: Section A. The Humanities and Social Sciences*, 68(04), 476.
- Weems, M. R. (2008). *The Fierce Tribe: Masculine Identity and Performance in the Circuit*. Salt Lake City, Utah: Utah State University Press.
- Weinstein, M. (2012). Text Analysis Markup System Analyzer.
- Wells, B., Starks, T. J., Parsons, J. T., & Golub, S. A. (2013). Conflict and expectancies interact to predict sexual behavior under the influence among gay and bisexual men. *Journal of Health Psychology*. Advance online publication.
- Westhaver, R. (2003). Party Boys: Identity, Community, and the Circuit. *Dissertation Abstracts International: Section A. The Humanities and Social Sciences*, 66(06), 2409.
- Westhaver, R. (2005). “Coming out of your skin”: circuit parties, pleasure and the subject. *Sexualities*, 8(3), 347–374.
- Westhaver, R. (2006). Flaunting and empowerment: thinking about circuit parties, the body, and power. *Journal of Contemporary Ethnography*, 35(6), 611–644.
- Williams, D. L. H. (2003). A chemist's view of the nitric oxide story. *Organic & Biomolecular Chemistry*, 1(3), 441–449.
- Williamson, L. M., Dodds, J. P., Mercey, D. E., Hart, G. J., & Johnson, A. M. (2008). Sexual risk behaviour and knowledge of HIV status among community samples of gay men in the UK. *AIDS*, 22(9), 1063–1070.
- Wilson, D. P., Regan, D. G., Heymer, K.-J., Jin, F., Prestage, G. P., & Grulich, A. E. (2010). Serosorting may increase the risk of HIV acquisition among men who have sex with men. *Sexually Transmitted Diseases*, 37(1), 13–17.

- Wilson, H., & Hutchinson, S. (1996). Methodologic mistakes in grounded theory. *Nursing Research*, 45(2), 122–124.
- Wilson, P. A. (2004). Sexual risk-taking and drug use among Latino men: Examining episodes of high-risk and low-risk sexual behavior. *Dissertation Abstracts International: Section B. Sciences and Engineering*, 65(09), 4902.
- Wilson, P. A., Cook, S., McGaskey, J., Rowe, M., & Dennis, N. (2008). Situational predictors of sexual risk episodes among men with HIV who have sex with men. *Sexually Transmitted Infections*, 84(6), 506–508.
- Wilson, P. A., Díaz, R. M., Yoshikawa, H., Shrout, P. E. Y., & Diaz, R. M. (2009). Drug use, interpersonal attraction, and communication: situational factors as predictors of episodes of unprotected anal intercourse among Latino gay men. *AIDS and Behavior*, 13(4), 691–699.
- Wilton, L., Halkitis, P. N., English, G., & Roberson, M. (2005). An exploratory study of barebacking, club drug use, and meanings of sex in Black and Latino gay and bisexual men in the age of AIDS. *Journal of Gay & Lesbian Psychotherapy*, 9(3-4), 49–72.
- Wohlfeiler, D., & Potterat, J. J. (2005). Using gay men's sexual networks to reduce sexually transmitted disease (STD)/human immunodeficiency virus (HIV) transmission. *Sexually Transmitted Diseases*, 32(10 Suppl), S48–S52.
- Wolitski, R. J. (2005). The emergence of barebacking among gay and bisexual men in the United States: a public health perspective. *Journal of Gay & Lesbian Psychotherapy*, 9(3-4), 9–34.
- Wolitski, R. J., & Fenton, K. A. (2011). Sexual health, HIV, and sexually transmitted infections among gay, bisexual, and other men who have sex with men in the United States. *AIDS and Behavior*, 15(Suppl 1), S9–S17.
- Wood, D. M., Hunter, L., Measham, F., & Dargan, P. I. (2012). Limited use of novel psychoactive substances in South London nightclubs. *QJM*, 105(10), 959–964.
- World Health Organization. (2007). *WHO Case Definitions Of HIV For Surveillance And Revised Clinical Staging And Immunological Classification Of HIV-Related Disease In Adults And Children*. Geneva: World Health Organization.
- Xu, F., Sternberg, M. R., & Markowitz, L. E. (2010). Men who have sex with men in the United States: demographic and behavioral characteristics and prevalence of HIV and HSV-2 infection: results from National Health and Nutrition Examination Survey 2001-2006. *Sexually Transmitted Diseases*, 37(6), 399–405.
- York, M., & Wiseman, T. (2012). Gardening as an occupation: a critical review. *British Journal of Occupational Therapy*, 75(2), 76–84.

- Zablotska, I. B., Imrie, J., Prestage, G., Crawford, J., Rawstorne, P., Grulich, A., ... Kippax, S. (2009). Gay men's current practice of HIV seroconcordant unprotected anal intercourse: serosorting or seroguessing? *AIDS Care*, 21(4), 501–510.
- Zea, M. C., Reisen, C. A., Poppen, P. J., & Bianchi, F. T. (2009). Unprotected anal intercourse among immigrant Latino MSM: the role of characteristics of the person and the sexual encounter. *AIDS and Behavior*, 13(4), 700–715.
- Zeger, S. L., & Liang, K. Y. (1986). Longitudinal data analysis for discrete and continuous outcomes. *Biometrics*, 42(1), 121–130.
- Zeger, S. L., Liang, K. Y., & Albert, P. S. (1988). Models for longitudinal data: a generalized estimating equation approach. *Biometrics*, 44(4), 1049–1060.
- Zimmer, L. (2006). Qualitative meta-synthesis: a question of dialoguing with texts. *Journal of Advanced Nursing*, 53(3), 311–318.

Appendices

Appendix 1. Search strings and hits for the qualitative metasynthesis

MEDLINE and MEDLINE In-Process & Non-Indexed Citations (1,353 hits)

Embase (1,291 hits)

PsycINFO (766 hits)

1. gay OR bisexual OR homosexual OR queer OR LGBT* OR men who have sex with men OR MSM OR exp homosexuality/ OR exp homosexuality, male/ OR exp bisexuality/ OR exp transsexualism/ OR exp transvestism/
2. drug* OR substance* OR alcohol* OR marijuan* OR cannab* OR marihuan* OR hashish* OR cocaine* OR crack* OR GHB OR *hydroxybutyric OR crystal* OR n-methyl-3-4-methylenedioxyamphetamine OR ketamine OR MDMA* OR meth* OR alkyl nitrites OR poppers OR ecstasy OR heroin* OR lsd* OR lysergic acid diethylamide* OR opiat* OR opioid* OR narcot* OR illicit drug* OR recreational drug* OR club drug* OR party drug* OR sniff* OR exp substance-related disorders/ OR exp alcohol-related disorders/ OR exp street drugs/ OR exp prescription drugs/ OR exp designer drugs/ OR exp marijuana smoking/
3. public* OR social* OR circuit part* OR White Party OR Black Blue Party OR Winter Party OR dance club* OR rave* OR cruis* lounge* OR gay bar* OR sauna* OR bath house* OR bathhouse* OR tea room* OR tea part* OR tea dance* OR cruis* OR cottag* OR sex club* OR glory hole* OR glory-hole* OR backroom* OR back room* OR sex on premises* OR sex-on-premises* OR commercial sex venue* OR marathon OR (group adj2 sex)
4. qualitative* OR focus group* OR focus-group* OR interview* OR grounded theor* OR thematic analys* OR framework analys* OR hermeneutic* OR grounded-theor* OR phenomeno* OR ethnograph* OR interpretiv* OR interpretativ* OR realis* OR (theoretical* adj sampl*) OR constructiv* OR field research OR field-research OR exp qualitative research/ OR exp ethnography/OR exp ethnopsychology/ OR exp anthropology, cultural/ OR exp sociology/ OR exp sociology, medical/
5. 1 AND 2 AND 3 AND 4

CINAHL (305 hits)

(gay OR bisexual OR homosexual OR queer OR LGBT* OR men who have sex with men OR MSM) AND (drug* OR substance* OR alcohol* OR marijuan* OR cannab* OR marihuan* OR hashish* OR cocaine* OR crack* OR GHB OR *hydroxybutyric OR crystal* OR n-methyl-3-4-methylenedioxyamphetamine OR ketamine OR MDMA* OR meth* OR alkyl nitrites OR poppers OR ecstasy OR heroin* OR lsd* OR lysergic acid diethylamide* OR opiat* OR opioid* OR narcot* OR illicit drug* OR recreational drug* OR club drug* OR party drug* OR sniff*) AND (public* OR social* OR circuit part* OR White Party OR Black Blue Party OR Winter Party OR dance club* OR rave* OR cruis* lounge* OR gay bar* OR sauna* OR bath house* OR bathhouse* OR tea room* OR tea part* OR tea dance* OR cruis* OR cottag* OR sex club* OR glory hole* OR glory-hole* OR backroom* OR back room* OR sex on premises* OR sex-on-premises* OR commercial sex

venue* OR marathon OR (group N2 sex)) AND (qualitative* OR focus group* OR focus-group* OR interview* OR grounded theor* OR thematic analys* OR framework analys* OR hermeneutic* OR grounded-theor* OR phenomeno* OR ethnograph* OR interpretiv* OR interpretativ* OR realis* OR (theoretical* N2 sampl*) OR constructiv* OR field research OR field-research)

ERIC (189 hits), **Sociological Abstracts** (739 hits), **ASSIA** (345 hits)

(gay OR bisexual OR homosexual OR queer OR LGBT* OR men who have sex with men OR MSM) AND (drug* OR substance* OR alcohol* OR marijuan* OR cannab* OR marihuan* OR hashish* OR cocaine* OR crack* OR GHB OR *hydroxybutyric OR crystal* OR n-methyl-3-4-methylenedioxyamphetamine OR ketamine OR MDMA* OR meth* OR alkyl nitrites OR poppers OR ecstasy OR heroin* OR lsd* OR lysergic acid diethylamide* OR opiat* OR opioid* OR narcot* OR illicit drug* OR recreational drug* OR club drug* OR party drug* OR sniff*) AND (public* OR social* OR circuit part* OR White Party OR Black Blue Party OR Winter Party OR dance club* OR rave* OR cruis* lounge* OR gay bar* OR sauna* OR bath house* OR bathhouse* OR tea room* OR tea part* OR tea dance* OR cruis* OR cottag* OR sex club* OR glory hole* OR glory-hole* OR backroom* OR back room* OR sex on premises* OR sex-on-premises* OR commercial sex venue* OR marathon OR (group NEAR/2 sex)) AND (qualitative* OR focus group* OR focus-group* OR interview* OR grounded theor* OR thematic analys* OR framework analys* OR hermeneutic* OR grounded-theor* OR phenomeno* OR ethnograph* OR interpretiv* OR interpretativ* OR realis* OR (theoretical* NEAR/2 sampl*) OR constructiv* OR field research OR field-research)

ISI Web of Science (832 hits), including Science Citation Index, Social Sciences Citation Index, Arts & Humanities Citation Index, Conference Proceedings Citation Index—Science, Conference Proceedings Citation Index—Social Science & Humanities

TS=((gay OR bisexual OR homosexual OR queer OR LGBT* OR men who have sex with men OR MSM) AND (drug* OR substance* OR alcohol* OR marijuan* OR cannab* OR marihuan* OR hashish* OR cocaine* OR crack* OR GHB OR *hydroxybutyric OR crystal* OR n-methyl-3-4-methylenedioxyamphetamine OR ketamine OR MDMA* OR meth* OR alkyl nitrites OR poppers OR ecstasy OR heroin* OR lsd* OR lysergic acid diethylamide* OR opiat* OR opioid* OR narcot* OR illicit drug* OR recreational drug* OR club drug* OR party drug* OR sniff*) AND (public* OR social* OR circuit part* OR White Party OR Black Blue Party OR Winter Party OR dance club* OR rave* OR cruis* lounge* OR gay bar* OR sauna* OR bath house* OR bathhouse* OR tea room* OR tea part* OR tea dance* OR cruis* OR cottag* OR sex club* OR glory hole* OR glory-hole* OR backroom* OR back room* OR sex on premises* OR sex-on-premises* OR commercial sex venue* OR marathon OR (group NEAR/2 sex)) AND (qualitative* OR focus group* OR focus-group* OR interview* OR grounded theor* OR thematic analys* OR framework analys* OR hermeneutic* OR grounded-theor* OR phenomeno* OR ethnograph* OR interpretiv* OR interpretativ* OR realis* OR (theoretical* NEAR/2 sampl*) OR constructiv* OR field research OR field-research))

ProQuest Dissertations and Theses A&I (618 hits)

ab((gay OR bisexual OR homosexual OR queer OR LGBT* OR men who have sex with men OR MSM) AND (drug* OR substance* OR alcohol* OR marijuan* OR cannab* OR marihuan* OR hashish* OR cocaine* OR crack* OR GHB OR *hydroxybutyric OR crystal* OR n-methyl-3-4-methylenedioxyamphetamine OR ketamine OR MDMA* OR meth* OR alkyl nitrites OR poppers OR ecstasy OR heroin* OR lsd* OR lysergic acid diethylamide* OR opiat* OR opioid* OR narcot* OR illicit drug* OR recreational drug* OR club drug* OR party drug* OR sniff*) AND (public* OR social* OR circuit part* OR White Party OR Black Blue Party OR Winter Party OR dance club* OR rave* OR cruises* lounge* OR gay bar* OR sauna* OR bath house* OR bathhouse* OR tea room* OR tea part* OR tea dance* OR cruises* OR cottages* OR sex club* OR glory hole* OR glory-hole* OR backroom* OR back room* OR sex on premises* OR sex-on-premises* OR commercial sex venue* OR marathon OR (group NEAR/2 sex)) AND (qualitative* OR focus group* OR focus-group* OR interview* OR grounded theor* OR thematic analys* OR framework analys* OR hermeneutic* OR grounded-theor* OR phenomeno* OR ethnograph* OR interpretiv* OR interpretativ* OR realis* OR (theoretical* NEAR/2 sampl*) OR constructiv* OR field research OR field-research))

JSTOR (401 hits)

((((ti:(gay OR bisexual OR homosexual OR queer OR LGBT OR men who have sex with men OR MSM) AND (qualitative OR "focus group" OR "focus-group" OR interview OR "grounded theory" OR thematic analysis OR framework analysis OR hermeneutic OR phenomeno* OR ethnograph* OR interpretiv*)) AND (drug OR substance OR alcohol OR "illicit drug" OR "recreational drug" OR "club drug" OR "party drug" OR sniff)) AND (public OR social OR "circuit party" OR "dance club" OR rave OR "gay bar" OR sauna OR "bath house" OR bathhouse OR "tea room" OR "tea party" OR "tea dance" OR cruising OR cottaging OR "group sex"~2))

Appendix 2. Authors contacted for the qualitative metasynthesis

On 8 November 2012, these authors were contacted:

- Carlos Caceres, Universidad Peruana Cayetano Heredia, Peru
- Adam Isaiah Green, University of Toronto, Canada
- David Holmes, University of Ottawa, Canada
- Patrick O’Byrne, University of Ottawa, Canada
- Sean Slavin, National Association of People With HIV, Australia

Appendix 3. Data extraction and adapted critical appraisal guidance for qualitative metasynthesis

Critical appraisal guidance is originally from the EPPI-Centre—see Thomas & Harden (2008).

DATA EXTRACTION FORM	AUTHOR AND YEAR: Screening questions	
Does this study focus on MSM?	YES	NO
Does this study discuss a specific, culturally bounded place?	YES	NO
Does this study relate drug use by MSM to that place?	YES	NO
Does this study present qualitative data?	YES	NO
Study design and execution		
What were the aims, research questions, or hypotheses of this study?	_____	

Is this part of a larger project, or linked to other studies? To which 'master publication' is this report linked?	_____	
How do the authors describe the methods used to collect and analyse data--e.g. grounded theory, thematic analysis?	_____	
How was data collected?	_____	

Do the authors report being guided by a specific theoretical or philosophical framework? If so, whose ideas?	_____	

What kinds of data were used in this study? If people were interviewed, how many accounts were taken?	_____	

How were the people interviewed, or the locales observed, chosen or sampled for this study?	_____	

In which form is this article--is it a monograph? A journal article? A thesis or dissertation?	_____	

Study contexts		
Where, geographically, was this study done?	_____	

When was this study done?	_____	

Which culturally bounded places do the authors discuss in this study?	_____	

Which types of drugs do the authors discuss in this study?	_____	

Do the authors report targeting a specific sample of MSM? Why?	_____	

DATA EXTRACTION FORM

AUTHOR AND YEAR:

Critical appraisal (Bonell et al. 2012; CASP 2010)--see attached form

Were steps taken to increase rigour in the sampling? _____

Rationale for judgment _____

Were steps taken to increase rigour in the data collected? _____

Rationale for judgment _____

Were steps taken to increase rigour in data analysis? _____

Rationale for judgment _____

Were study findings grounded in/supported by the data? _____

Rationale for judgment _____

Please rate study findings in terms of breadth and depth. _____

Rationale for judgment _____

To what extent are the perspectives/experiences of men who have sex with men privileged in this study? _____

Rationale for judgment _____

How might the researcher's perspective have shaped data collection and analysis? _____

Rationale for judgment _____

Have ethical issues been taken into consideration? _____

Rationale for judgment _____

Overall, what weight would you assign to this study in terms of the reliability/trustworthiness of its findings? _____

Rationale for judgment _____

What weight would you assign to this study in terms of its findings' usefulness for this review? _____

Rationale for judgment _____**Data extraction**

Which page numbers and titled sections of the study are to be imported for coding? _____

Is this paper an appropriate choice for an index paper for open coding? Why? _____

If imported data stretches beyond the section labelled 'findings' or 'results', please justify. _____

Were steps taken to increase rigour in the sampling?

Consider whether: a) the sampling strategy was appropriate to the questions posed in the study (e.g. was the strategy well reasoned and justified?); b) attempts were made to obtain a diverse sample of the population in question (think about who might have been excluded who may have had a different perspective to offer); c) characteristics of the sample critical to the understanding of the study context and findings were presented (i.e. do we know who the participants were in terms of for example, basic socio-demographics, characteristics relevant to the context of the study etc.)

Yes, a thorough attempt was made (please specify) +++

Yes, several steps were taken (please specify) ++

Yes, a few steps were taken (please specify) +

No, not at all/Not stated/Can't tell (please specify) –

Unclear (please specify) 0

Were steps taken to increase rigour in the data collected?

Consider whether: a) data collection tools were piloted; b) data collection was comprehensive, flexible and/or sensitive enough to provide a complete and/or vivid and rich description of people's perspectives and experiences (e.g. did the researchers spend sufficient time at the site/with participants? Did they keep 'following up'? Was more than one method of data collection used?); c) steps were taken to ensure that all participants were able and willing to contribute (e.g., processes for consent, language barriers, power relations between adults and children/young people).

Yes, a thorough attempt was made (please specify) +++

Yes, several steps were taken (please specify) ++

Yes, a few steps were taken (please specify) +

No, not at all/Not stated/Can't tell (please specify) -

Unclear (please specify) 0

Were steps taken to increase rigour in data analysis?

Consider whether: a) data analysis methods were systematic (e.g. was a method described/ can a method be discerned?); b) diversity in perspective was explored; c) the analysis was balanced in the extent to which it was guided by preconceptions or by the data; d) the analysis sought to rule out alternative explanations for findings (in qualitative research this could be done by, for example, searching for negative cases/exceptions, feeding back preliminary results to participants, asking a colleague to review the data, or reflexivity).

Yes, a thorough attempt was made (please specify) +++

Yes, several steps were taken (please specify) ++

Yes, a few steps were taken (please specify) +

No, not at all/Not stated/Can't tell (please specify) -

Unclear (please specify) 0

Were study findings grounded in/supported by the data?

Consider whether: a) enough data are presented to show how the author's arrived at their findings; b) the data presented fit the interpretation/support claims about patterns in data; c) the data presented illuminate/illustrate the findings; d) quotes are numbered or otherwise identified and the reader can see that they don't just come from one or two people.

Findings are well grounded/supported ++

Findings are fairly well grounded/supported +

Limited grounding/support of findings -

Please rate study findings in terms of breadth and depth.

Consider whether: a) a range of issues are covered; b) the perspectives of participants are fully explored in terms of breadth (contrast of two or more perspectives) and depth (insight into a single perspective); c) richness and complexity has been portrayed (e.g. variation explained, meanings illuminated); d) there has been theoretical/conceptual development. (NB: It may be helpful to consider 'breadth' as the extent of description and 'depth' as the extent to which data has been transformed/analysed.)

Limited breadth or depth -

Good/fair breadth but very little depth +/-

Good/fair depth but very little breadth -/+

Good/fair breadth AND depth ++

To what extent are the perspectives/experiences of MSM privileged in this study?

Consider all of the below questions and make an overall judgment: a) there was a balance between open-ended and fixed response options; b) whether MSM were involved in designing the research; c) there was a balance between the use of an *a priori* coding framework and induction in the analysis; d) the position of the researchers (did they consider it important to listen to MSM?); e) steps were taken to assure confidentiality and put MSM at their ease.

Not at all (0), A little (+), Somewhat (++), A lot (+++)

How might the researcher's perspective have shaped data collection and analysis?

Is it clear: a) if the researcher critically examined their own role, potential bias and influence during formulation of research questions and data collection including: sample recruitment, choice of location; b) how the researcher responded to events during the study and whether they considered the implications of any changes in the research design?

Not at all (0), A little (+), Somewhat (++), A lot (+++)

Have ethical issues been taken into consideration?

a) Are there sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained? b) Has the researcher discussed issues raised by the study (e.g. issues around informed consent or confidentiality)? c) Has approval been sought from the ethics committee?

Not at all (0), A little (+), Somewhat (++), A lot (+++)

Overall, what weight would you assign to this study in terms of the reliability/trustworthiness of its findings?

Guidance: Think (mainly) about the answers you have given to the first four questions above.

Low (-), Medium (+), High (++)

What weight would you assign to this study in terms of its findings' usefulness for this review?

Guidance: Think (mainly) about the answers you have given above and consider: a) the match between the study aims and findings and the aims and purpose of the synthesis; b) its conceptual depth/explanatory power.

Low (-), Medium (+), High (++)

Appendix 4. Search strings and hits for the systematic review of multiple-event analyses

MEDLINE and MEDLINE In-Process & Non-Indexed Citations (2,610 hits)

Embase (3,066 hits)

PsycINFO (2,616 hits)

1. (gay or bisexual or homosexual or queer or LGBT* or men who have sex with men or MSM).mp. or exp homosexuality/ or exp homosexuality, male/ or exp bisexuality/ or exp transsexualism/ or exp transvestism/
2. (event\$ or encounter\$ or episode\$ or (critical adj2 incident) or conditional logistic regression or multi-day or multiday or diary or association\$).mp.
3. (HIV or condom or (safe* adj2 sex*) or (unsafe* adj2 sex*) or (unprotected adj3 intercourse*) or (protected adj3 intercourse*) or risky sex*).mp. or exp sexually transmitted diseases/ or exp safe sex/ or exp sexual behavior/ or exp HIV infections/ or exp Acquired Immunodeficiency Syndrome/
4. 1 AND 2 AND 3
5. limit 4 to yr="1996–Current"

CINAHL (433 hits)

1. gay or bisexual or homosexual or queer or LGBT* or men who have sex with men or MSM or MH("Homosexuality+") or MH("Homosexuality, Male+") or MH("Bisexuality+") or MH("Transsexualism+") or MH("Transvestism+")
2. (event* or encounter* or episode* or (critical N2 incident) or (conditional AND logistic AND regression) or multi-day or multiday or diary or association*)
3. (HIV or condom or (safe* N2 sex*) or (unsafe* N2 sex*) or (unprotected N3 intercourse*) or (protected N3 intercourse*) or risky sex*) or MH("Sexually Transmitted Diseases+") or MH("Safe Sex+") or MH("Sexual Behaviour+") or MH("HIV Infections+") or MH("Acquired Immunodeficiency Syndrome+")
4. S1 AND S2 AND S3, Limiters - Published Date from: 19960101-

ISI Web of Science (2,208 hits)

1. TS=(gay or bisexual or homosexual or queer or LGBT* or men who have sex with men or MSM)
2. TS=(event* or encounter* or episode* or (critical NEAR/2 incident) or (conditional AND logistic AND regression) or multi-day or multiday or diary or association*)

3. TS=(HIV or condom or (safe* NEAR/2 sex*) or (unsafe* NEAR/2 sex*) or (unprotected NEAR/3 intercourse*) or (protected NEAR/3 intercourse*) or (risky AND sex*))
4. #1 AND #2 AND #3, Timespan=1996-Current

Sociological Abstracts (122 hits)

ASSIA (240 hits)

ProQuest Dissertations and Theses (215 hits)

1. AB((gay or bisexual or homosexual or queer or LGBT* or men who have sex with men or MSM) AND (event* or encounter* or episode* or (critical NEAR/2 incident) or (conditional AND logistic AND regression) or multi-day or multiday or diary or association*) AND (HIV or condom or (safe* NEAR/2 sex*) or (unsafe* NEAR/2 sex*) or (unprotected NEAR/3 intercourse*) or (protected NEAR/3 intercourse*) or (risky AND sex*)))
2. (limit 1 to) 1996-2013

Appendix 5. Text of The Sigma Panel 2011

This appendix has been removed as copyright does not rest with the author of the thesis. Please contact the author for more information.

Appendix 6. Naïve univariate correlation matrices

Table A6.1. Naïve univariate correlation matrix for the sample of multipartner encounters.

	UAI	Quality of sex	Control	Respondent substance use	Number of substances used	Poppers	Alcohol	EDM	THC	MDMA	Crystal meth	Mephedrone	GHB	Ketamine	Cocaine
UAI	1.00														
Quality of sex	0.16	1.00													
Control	-0.18	0.01	1.00												
Respondent substance use	0.13	0.08	-0.09	1.00											
Number of substances used	0.22	0.15	-0.09	0.60	1.00										
Poppers	0.09	0.11	-0.04	0.63	0.47	1.00									
Alcohol	0.01	0.07	-0.11	0.54	0.52	0.12	1.00								
Erectile dysfunction medications	0.22	0.12	-0.01	0.41	0.74	0.17	0.39	1.00							
Cannabis	-0.01	0.08	-0.03	0.16	0.31	0.13	0.13	0.14	1.00						
MDMA	0.11	0.10	0.01	0.20	0.58	0.14	0.23	0.37	0.16	1.00					
Crystal methamphetamine	0.27	0.08	-0.12	0.20	0.55	0.10	0.05	0.40	0.12	0.23	1.00				
Mephedrone	0.16	0.06	0.06	0.19	0.57	0.12	0.11	0.39	0.05	0.34	0.37	1.00			
GHB	0.23	0.10	0.02	0.22	0.65	0.18	0.05	0.42	0.14	0.35	0.58	0.52	1.00		
Ketamine	0.16	0.09	-0.06	0.17	0.55	0.15	0.16	0.29	0.07	0.32	0.32	0.37	0.46	1.00	
Cocaine	0.08	0.06	-0.11	0.19	0.56	0.09	0.22	0.34	0.17	0.39	0.25	0.26	0.25	0.31	1.00
Partner use: Yes, but unsure what	0.09	0.08	-0.16	0.17	0.21	0.12	0.26	0.17	0.02	0.10	0.05	0.01	0.05	0.12	0.04
Partner use: Yes, specifically	0.04	0.07	0.03	0.39	0.46	0.08	0.45	0.36	0.14	0.23	0.26	0.32	0.29	0.20	0.23
Partner use: Don't know	-0.01	-0.18	-0.01	-0.11	-0.22	-0.02	-0.14	-0.18	-0.09	-0.13	-0.16	-0.17	-0.15	-0.15	-0.10
Number of substances used by partner	0.13	0.06	0.06	0.29	0.63	0.14	0.28	0.43	0.25	0.46	0.45	0.54	0.49	0.43	0.35
Alcohol	-0.03	0.04	0.02	0.31	0.28	0.03	0.54	0.25	0.10	0.18	-0.05	0.13	-0.01	0.12	0.16
Erectile dysfunction medications	0.17	0.03	0.07	0.26	0.58	0.18	0.22	0.52	0.17	0.41	0.45	0.47	0.45	0.32	0.28
Cannabis	0.04	0.03	0.01	0.11	0.20	0.04	0.11	0.09	0.43	0.21	0.16	0.08	0.10	0.10	0.17
MDMA	0.06	0.05	0.09	0.14	0.42	0.09	0.21	0.29	0.13	0.60	0.16	0.34	0.22	0.30	0.26
Crystal methamphetamine	0.20	0.02	0.04	0.14	0.40	0.05	-0.01	0.31	0.15	0.20	0.71	0.36	0.50	0.21	0.18
Mephedrone	0.12	0.03	0.07	0.14	0.40	0.07	0.03	0.27	0.06	0.24	0.34	0.72	0.47	0.29	0.11
GHB	0.12	-0.01	0.08	0.17	0.49	0.09	0.03	0.37	0.13	0.28	0.56	0.49	0.70	0.23	0.20
Ketamine	0.09	0.05	0.06	0.13	0.40	0.08	0.09	0.23	0.03	0.30	0.29	0.38	0.33	0.65	0.20
Cocaine	0.00	0.05	-0.03	0.14	0.35	0.11	0.18	0.15	0.21	0.27	0.15	0.16	0.17	0.28	0.56
Number of partners	0.08	0.14	0.02	0.03	0.12	0.04	0.12	0.07	-0.01	0.02	0.09	0.02	0.10	0.14	0.07
Serostatus match: unsure	-0.23	-0.12	-0.05	-0.06	-0.10	-0.01	0.09	-0.11	-0.03	-0.13	-0.16	-0.07	-0.17	-0.11	-0.02
Serostatus match: serodiscordant	0.03	0.07	0.00	0.02	0.09	0.06	-0.07	0.06	0.01	0.04	0.13	0.05	0.21	0.06	0.05
Location: SOPV	-0.09	0.00	0.03	-0.07	-0.10	-0.04	0.08	-0.04	-0.10	-0.10	-0.13	-0.15	-0.12	-0.06	-0.09
Location: Cruising or outdoors	-0.01	-0.18	0.07	-0.18	-0.20	-0.08	-0.20	-0.17	-0.05	-0.10	-0.08	-0.10	-0.11	-0.06	-0.07

Table A6.1 continued.

	Partner use: Yes, but unsure what	Partner use: Yes, specifically	Partner use: Yes, Don't know	Partner number of substances	Alcohol	EDM	Cannabis	MDMA	Crystal meth	Mephedrone	GHB	Ketamine	Cocaine	Number of partners	Serostatus match: unsure	Serostatus match: serodiscordant	Location: SOPV	Location: Cruising or outdoors
Partner use: Yes, but unsure what	1.00																	
Partner use: Yes, specifically	-0.26	1.00																
Partner use: Don't know	-0.24	-0.38	1.00															
Number of substances used by partner	-0.20	0.75	-0.29	1.00														
Alcohol	-0.21	0.82	-0.31	0.57	1.00													
Erectile dysfunction medications	-0.16	0.62	-0.24	0.81	0.42	1.00												
Cannabis	-0.08	0.31	-0.12	0.49	0.27	0.33	1.00											
MDMA	-0.09	0.36	-0.14	0.62	0.34	0.46	0.28	1.00										
Crystal methamphetamine	-0.11	0.41	-0.15	0.62	0.04	0.55	0.19	0.20	1.00									
Mephedrone	-0.11	0.41	-0.15	0.66	0.18	0.49	0.14	0.32	0.43	1.00								
GHB	-0.11	0.44	-0.17	0.69	0.09	0.60	0.22	0.34	0.68	0.64	1.00							
Ketamine	-0.10	0.38	-0.15	0.68	0.28	0.45	0.26	0.44	0.38	0.54	0.38	1.00						
Cocaine	-0.10	0.38	-0.14	0.56	0.29	0.34	0.32	0.31	0.27	0.18	0.20	0.33	1.00					
Number of partners	0.07	-0.03	0.07	0.07	-0.05	0.04	0.03	0.02	0.07	0.03	0.10	0.11	0.06	1.00				
Serostatus match: unsure	0.02	-0.15	0.28	-0.12	-0.06	-0.18	-0.02	-0.14	-0.13	-0.03	-0.11	-0.05	-0.02	0.10	1.00			
Serostatus match: serodiscordant	0.03	0.05	-0.08	0.07	-0.07	0.07	0.03	0.02	0.10	0.11	0.14	-0.05	0.12	-0.07	-0.33	1.00		
Location: SOPV	0.20	-0.25	0.31	-0.22	-0.18	-0.20	-0.06	-0.12	-0.15	-0.17	-0.13	-0.11	-0.15	0.31	0.30	-0.11	1.00	
Location: Cruising or outdoors	-0.08	-0.19	0.12	-0.16	-0.15	-0.14	-0.07	-0.08	-0.09	-0.09	-0.10	-0.09	-0.08	-0.06	0.17	-0.06	-0.27	1.00

Table A6.2. Naïve univariate correlation matrix for the sample of new partner encounters.

	UAI	Quality of sex	Control	Respondent substance use	Number of substances used	Poppers	Alcohol	EDM	THC	MDMA	Crystal meth	GHB	Ketamine	Cocaine	Location: SOPV	Location: Cruising or outdoors	HIV risk: Low	HIV risk: Some	HIV risk: High
UAI	1.00																		
Quality of sex	0.16	1.00																	
Control	-0.10	0.02	1.00																
Respondent substance use	0.11	0.05	-0.02	1.00															
Number of substances used	0.16	0.09	-0.01	0.73	1.00														
Poppers	0.14	0.06	-0.01	0.52	0.53	1.00													
Alcohol	0.03	0.05	-0.03	0.64	0.55	0.01	1.00												
Erectile dysfunction medications	0.06	0.03	0.01	0.34	0.51	0.11	0.09	1.00											
Cannabis	0.06	0.01	0.01	0.19	0.37	0.08	0.10	0.06	1.00										
MDMA	0.07	0.05	0.01	0.13	0.43	0.09	0.08	0.14	0.13	1.00									
Crystal methamphetamine	0.09	0.07	0.01	0.11	0.31	0.10	0.00	0.10	0.03	0.20	1.00								
GHB	0.08	0.04	-0.01	0.13	0.41	0.10	0.01	0.22	0.05	0.20	0.29	1.00							
Ketamine	0.10	0.07	0.01	0.14	0.45	0.13	0.08	0.16	0.09	0.36	0.21	0.18	1.00						
Cocaine	0.07	0.01	0.01	0.16	0.46	0.06	0.13	0.15	0.17	0.36	0.14	0.22	0.30	1.00					
Location: SOPV	-0.05	-0.10	0.05	-0.04	-0.03	0.00	-0.07	0.04	-0.01	-0.02	-0.03	-0.04	-0.03	0.00	1.00				
Location: Cruising or outdoors	0.00	-0.04	-0.03	-0.11	-0.09	-0.03	-0.09	-0.06	-0.03	-0.03	-0.02	-0.02	-0.02	-0.04	-0.09	1.00			
HIV risk: Low	-0.20	-0.05	0.04	-0.02	-0.03	-0.02	-0.01	-0.01	0.00	0.01	-0.01	-0.02	-0.01	-0.02	0.03	-0.02	1.00		
HIV risk: Some	0.38	0.02	-0.13	0.07	0.10	0.10	0.02	0.04	0.01	0.06	0.03	0.03	0.09	0.08	-0.01	0.03	-0.39	1.00	
HIV risk: High	0.29	0.05	-0.07	0.04	0.06	0.08	0.00	-0.01	0.02	0.04	0.04	0.04	0.01	-0.01	0.01	0.02	-0.18	-0.06	1.00

Table A6.3. Naïve univariate correlation matrix for the sample of single-partner encounters.

	UAI	Quality of sex	Control	Respondent substance use	Number of substances used	Poppers	Alcohol	EDM	THC	MDMA	Crystal meth	GHB	Ketamine	Cocaine
UAI	1.00													
Quality of sex	0.19	1.00												
Control	-0.08	0.03	1.00											
Respondent substance use	0.10	0.04	-0.01	1.00										
Number of substances used	0.15	0.08	-0.01	0.75	1.00									
Poppers	0.13	0.07	-0.01	0.59	0.54	1.00								
Alcohol	0.01	0.00	-0.01	0.69	0.61	0.07	1.00							
Erectile dysfunction medications	0.13	0.05	0.01	0.32	0.60	0.13	0.25	1.00						
Cannabis	0.06	0.05	0.01	0.23	0.43	0.11	0.17	0.18	1.00					
MDMA	0.07	0.03	0.00	0.15	0.48	0.11	0.13	0.24	0.22	1.00				
Crystal methamphetamine	0.09	0.05	0.02	0.12	0.31	0.09	-0.01	0.19	0.02	0.21	1.00			
GHB	0.09	0.04	0.01	0.14	0.38	0.11	0.02	0.21	0.07	0.22	0.33	1.00		
Ketamine	0.10	0.04	0.00	0.15	0.45	0.11	0.08	0.28	0.12	0.40	0.23	0.22	1.00	
Cocaine	0.05	0.01	0.00	0.17	0.42	0.08	0.16	0.21	0.11	0.31	0.16	0.13	0.22	1.00
Partner use: Yes, but unsure what	0.02	-0.03	-0.03	0.14	0.14	0.06	0.15	0.06	0.03	0.07	0.00	0.06	0.02	0.04
Partner use: Yes, specifically	0.05	0.05	0.00	0.54	0.52	0.07	0.64	0.28	0.22	0.15	0.13	0.14	0.17	0.18
Partner use: Don't know	-0.05	-0.11	-0.04	0.03	0.01	0.04	0.00	0.01	0.00	-0.01	-0.02	-0.03	-0.01	-0.01
Number of substances used by partner	0.12	0.07	0.00	0.45	0.68	0.14	0.49	0.41	0.33	0.39	0.29	0.33	0.40	0.38
Alcohol	0.02	0.03	-0.01	0.51	0.44	0.03	0.71	0.19	0.14	0.09	-0.01	0.01	0.07	0.14
Erectile dysfunction medications	0.13	0.08	0.00	0.16	0.42	0.13	0.12	0.44	0.12	0.29	0.22	0.25	0.29	0.26
Cannabis	0.06	0.04	0.00	0.17	0.31	0.08	0.14	0.17	0.67	0.13	0.02	0.06	0.12	0.08
MDMA	0.07	0.03	0.00	0.12	0.39	0.10	0.09	0.23	0.17	0.71	0.19	0.17	0.33	0.23
Crystal methamphetamine	0.08	0.02	0.02	0.09	0.25	0.07	-0.01	0.17	0.02	0.19	0.74	0.29	0.20	0.13
GHB	0.10	0.03	0.00	0.11	0.30	0.10	0.00	0.20	0.06	0.13	0.33	0.75	0.22	0.12
Ketamine	0.07	0.05	0.02	0.12	0.33	0.09	0.04	0.21	0.09	0.29	0.20	0.16	0.72	0.17
Cocaine	0.06	0.02	-0.02	0.13	0.33	0.09	0.12	0.18	0.07	0.22	0.13	0.12	0.19	0.73
Relationship: regular, non-steady	0.02	0.08	0.00	0.04	0.06	0.07	-0.01	0.05	0.05	0.01	0.04	0.00	0.01	0.02
Relationship: opportunity/anonymous	-0.19	-0.21	-0.02	0.05	0.01	0.01	0.04	0.01	-0.03	0.00	0.00	0.01	-0.01	-0.01
Serostatus match: unsure	-0.23	-0.18	-0.03	0.01	-0.03	0.00	0.02	-0.02	-0.05	-0.04	-0.05	-0.06	-0.06	-0.02
Serostatus match: serodiscordant	-0.02	0.04	0.02	0.05	0.08	0.03	0.02	0.03	0.08	0.05	0.04	0.05	0.07	0.04
Location: SOPV	-0.05	-0.10	0.02	0.05	0.04	0.06	0.02	0.04	0.00	0.00	-0.01	-0.01	0.00	-0.01
Location: Cruising or outdoors	-0.06	-0.07	-0.02	-0.08	-0.08	-0.04	-0.07	-0.04	-0.03	-0.03	-0.02	-0.03	-0.02	-0.02

Table A6.3 continued.

	Partner use: Yes, but unsure what	Partner use: Yes, specifically	Partner use: Don't know	Partner use: Don't know	Partner number of substances	Alcohol	EDM	Cannabis	MDMA	Crystal meth	GHB	Ketamine	Cocaine	Relationship: regular, non-steady	Relationship: opportunity/anonymous	Serostatus match: unsure	Serostatus match: serodiscordant	Location: SOPV	Location: Cruising or outdoors
Partner use: Yes, but unsure what	1.00																		
Partner use: Yes, specifically	-0.11	1.00																	
Partner use: Don't know	-0.06	-0.17	1.00																
Number of substances used by partner	-0.09	0.82	-0.14	1.00															
Alcohol	-0.10	0.91	-0.15	0.70	1.00														
Erectile dysfunction medications	-0.03	0.28	-0.05	0.59	0.15	1.00													
Cannabis	-0.04	0.31	-0.05	0.45	0.20	0.17	1.00												
MDMA	-0.02	0.20	-0.03	0.49	0.12	0.33	0.15	1.00											
Crystal methamphetamine	-0.02	0.17	-0.03	0.34	-0.01	0.26	0.02	0.21	1.00										
GHB	-0.02	0.19	-0.03	0.40	0.02	0.30	0.06	0.18	0.38	1.00									
Ketamine	-0.02	0.21	-0.03	0.47	0.08	0.31	0.12	0.35	0.23	0.19	1.00								
Cocaine	-0.03	0.24	-0.04	0.47	0.17	0.29	0.09	0.07	0.23	0.13	0.15	0.21	1.00						
Relationship: regular, non-steady	-0.02	0.04	-0.09	0.06	0.02	0.06	0.07	0.02	0.02	0.04	0.00	0.04	0.03	1.00					
Relationship: opportunity/anonymous	0.09	-0.05	0.26	-0.06	-0.04	-0.05	-0.07	-0.07	-0.02	-0.01	0.00	-0.04	-0.03	-0.50	1.00				
Serostatus match: unsure	0.06	-0.06	0.23	-0.09	-0.03	-0.07	-0.06	-0.06	-0.05	-0.05	-0.06	-0.06	-0.05	0.00	0.42	1.00			
Serostatus match: serodiscordant	0.00	0.07	-0.06	0.10	0.04	0.07	0.08	0.03	0.03	0.04	0.05	0.06	0.05	0.00	-0.12	-0.27	1.00		
Location: SOPV	0.10	-0.10	0.32	-0.09	-0.09	-0.03	-0.04	-0.04	-0.03	-0.03	-0.03	-0.02	-0.02	-0.10	0.27	0.22	-0.06	1.00	
Location: Cruising or outdoors	0.01	-0.09	0.15	-0.08	-0.08	-0.09	-0.03	-0.02	-0.03	-0.02	-0.03	-0.03	-0.02	-0.06	0.18	0.16	-0.06	-0.07	1.00

Appendix 7. Conditional logistic regression analyses testing associations with UAI and control in the sample of new partner encounters

Models testing associations with UAI

CLRs testing associations with UAI found no significant effects for either overall measure of substance use, for specific substances when entered as a block or for location of sex (all $ps > 0.10$) (see table A5.1). Compared within respondents to encounters where the respondent reported not being in control of outcomes, encounters where the respondent reported being mostly or totally in control of sexual outcomes were associated with lower odds of UAI (OR=0.30, 95% CI [0.12, 0.75]). Encounters with greater quality of sex were associated with higher odds of UAI (1.49, [1.27, 1.75]).

Initial CLR models testing the association between perceived HIV transmission risk and UAI did not converge because all 20 encounters in the analysis sample in which respondents reported high risk of HIV transmission included UAI. The two categories for ‘some risk’ and ‘high risk’ were collapsed and the model re-estimated. Compared to perceptions of no HIV transmission risk, encounters with low risk were not associated with increased odds of UAI ($p > 0.10$), but encounters with some or high risk were so associated (OR=12.55, 95% CI [4.67, 33.73]).

Month of reporting was not significantly associated with differential odds of UAI ($p > 0.10$).

Models testing associations with control

CLRs testing associations with control found no significant associations for either overall measure of substance use, for specific substances when entered as a block, for location of sex or for month of reporting (all $ps > 0.10$) (see table A5.2). Perceived HIV transmission risk was also not associated with perceived control (all $ps > 0.10$).

Table A7.1. Initial conditional logistic regression models testing associations with UAI in the sample of new partner encounters.

Variable	OR (95% CI)	Model fit
Any substance use by respondent	0.85 (0.51, 1.40)	253.90
Number of substances used	0.98 (0.76, 1.25)	244.57
Substance use by respondent: specific		248.34
Poppers	1.17 (0.56, 2.45)	
Alcohol	0.80 (0.44, 1.46)	
Erectile dysfunction medications	0.68 (0.30, 1.53)	
Cannabis	0.52 (0.11, 2.52)	
Cocaine	3.38 (0.67, 17.00)	
Location of sex		253.91
Private (residence, hotel)	Reference	
Sex-on-premises venue	0.73 (0.36, 1.49)	
Cruising or outdoors location	2.13 (0.54, 8.38)	
Control over what happened		243.58
Some/no control	Reference	
Totally/mostly in control	0.30* (0.12, 0.75)	
Quality of the sex	1.49*** (1.27, 1.75)	218.17
Perceived HIV transmission risk		195.00
No risk	Reference	
Low risk	1.16 (0.60, 2.24)	
Some or high risk*	12.55*** (4.67, 33.73)	
Month of reporting		251.13
Month 1	Reference	
Month 3	1.30 (0.97, 1.75)	

*Categories were collapsed because the four-category model did not converge.

*p<0.05 **p<0.01 ***p<0.001; italicised text indicates marginal significance (p<0.10)

Table A7.2. Initial conditional logistic regression models testing associations with control in the sample of new partner encounters.

Variable	OR (95% CI)	Model fit
Any substance use by respondent	0.74 (0.37, 1.47)	157.89
Number of substances used	0.88 (0.63, 1.23)	158.10
Substance use by respondent: specific		158.57
Poppers	1.90 (0.62, 5.86)	
Alcohol	0.50 (0.22, 1.15)	
Erectile dysfunction medications	1.33 (0.52, 3.40)	
Location of sex		160.33
Private (residence, hotel)	Reference	
Sex-on-premises venue	0.77 (0.26, 2.31)	
Cruising or outdoors location	0.67 (0.15, 3.05)	
Quality of the sex	1.03 (0.89, 1.19)	157.10
Perceived HIV transmission risk		158.50
No risk	Reference	
Low risk	0.90 (0.38, 2.09)	
Some risk	0.38 (0.11, 1.35)	
High risk	0.30 (0.05, 1.64)	
Month of reporting		158.64
Month 1	Reference	
Month 3	0.98 (0.68, 1.42)	

Appendix 8. Ethics approval for projects included in this thesis

DEPARTMENT OF SOCIAL POLICY AND INTERVENTION

Barnett House, 32 Wellington Square,
Oxford, OX1 2ER, United Kingdom
www.spi.ox.ac.uk



9th November 2012

G.J. Melendez-Torres
St. Hilda's College
Oxford

Dear G.J.,

Ref: 2012-13_04

Meta-ethnography of the experiences of men who have sex with men of substance use in public spaces

Your application for research ethics approval in connection with your thesis has been considered by the Departmental Research Ethics Committee (DREC) in accordance with the procedures laid down by the University for ethical approval.

I am pleased to inform you that, on the basis of the information provided, the proposed research has been judged as meeting appropriate ethical standards and DREC approval has been granted.

If any revisions to your research methodology are made subsequent to this approval, these must be detailed in writing and submitted to DREC immediately.

Please can you ensure that you submit a copy of this letter with your thesis in August.

Yours sincerely

A handwritten signature in black ink that reads 'Lucie Cluver'.

Dr Lucie Cluver
Chair of DREC

Direct line: Tel: +44 (0)1865 280734 Email: gemma.roche@spi.ox.ac.uk
General enquiries: Tel. +44(0)1865 270325 Fax: +44(0)1865 270324

DEPARTMENT OF SOCIAL POLICY AND INTERVENTION

Barnett House, 32 Wellington Square,
Oxford, OX1 2ER, United Kingdom
www.spi.ox.ac.uk



21st March 2013

G.J. Melendez-Torres
St. Hilda's College
Oxford

Dear G.J.,

Ref: 2012-13_25

Re: Event-level crossover analysis of substance use and sexual risk in men who have sex with men

Your application for research ethics approval in connection with your thesis has been considered by the Departmental Research Ethics Committee (DREC) in accordance with the procedures laid down by the University for Ethical Approval.

I am pleased to inform you that, on the basis of the information provided, the proposed research has been judged as meeting appropriate ethical standards and DREC approval has been granted.

Yours sincerely

A handwritten signature in black ink that reads 'Lucie Cluver'.

Dr Lucie Cluver
Chair of DREC

CC Chris Bonell

Direct line: Tel: +44 (0)1865 280734 Email: gemma.roche@spi.ox.ac.uk
General enquiries: Tel. +44(0)1865 270325 Fax: +44(0)1865 270324