Men who have sex with men and HIV transmission risks in sub-Saharan Africa

A Kenyan case Study

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MEN WHO HAVE SEX WITH MEN AND HIV TRANSMISSION RISKS IN SUB-SAHARAN AFRICA: A KENYAN CASE STUDY

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ABSTRACT

Introduction Men who have sex with men have been largely unrecognised within African HIV epidemics until recently. This thesis reports on three projects in Mombasa, Kenya and in Oxford that aimed to describe the burden and risk factors for HIV among MSM across sub-Saharan Africa and in Kenya specifically, and to describe patterns of sexual behaviour and partnerships relevant to individual and population HIV risk.

Methods 1 -cross-sectional study of HIV prevalence and risk factors among 285 MSM at enrolment to a vaccine feasibility cohort in Mtwapa, Kenya; **2** -review and meta-analysis of behavioural and HIV studies in sub-Saharan African MSM until 2010; **3** -prospective, self-administered daily diary study of sexual behaviour among a sample of 83 IAVI vaccine feasibility cohort participants

Main results HIV prevalence was 24.6% among MSM, who frequently reported transactional sex. Receptive anal sex practice, injecting drug use, concomitant STIs, homosexual exclusivity and age were independent risk factors for HIV prevalence. Prevalence studies identified high HIV burden among MSM across Africa, not associated with prevalence amongst the general adult population despite commonplace heterosexual behaviours. HIV prevalence associations with homosexual exclusivity, unprotected anal sex and transactional sex were largely consistent across different contexts. In Mombasa, prospective behaviour studies described a transactional sexual network serving both male and female clients, transaction dictating both relationship patterns and age-differences between partners and condom use. Young age, homosexual exclusivity, alcohol use, religious affiliation and low earnings were associated with high risk homosexual behaviours. Heterosexual sex was commonplace, yet heterosexually active MSM had a significantly lower profile of homosexual behavioural HIV risk.

Conclusions: There is an urgent need for African countries to identify MSM populations and deliver appropriate and relevant HIV prevention, treatment and care. Effective and accessible responses will benefit African MSM, and likely also enhance wider HIV control efforts.

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CONTENTS

LIST OF ABBREVIATIONS

ABC strategy	Abstain, Be Faithful, Use a Condom
AIDS	Acquired immunodeficiency syndrome
AI	Anal Intercourse
AIS	AIDS Indicator Survey
ANC	Antenatal Clinic
ART	Antiretroviral therapy
ARV	Antiretroviral
CDC	Centers for Disease Control and Prevention
CD4	CD4 T-lymphocyte
CAPI	Computer assisted personal interview
CI	Confidence interval
CROI	Conference on Retroviruses and Opportunistic Infections
GOK	Government of Kenya
HAART	Highly-active antiretroviral therapy
HIV	Human immunodeficiency virus
HSV-2	Herpes simplex virus-2
IAI	Insertive Anal Sex (between men)
IAS	International AIDS Society
IAVI	International AIDS Vaccine Initiative
IRB	Institutional Review Board
IRR	Incidence Rate Ratio
KAIS	Kenya AIDS Indicator Survey
KDHS	Kenya Demographic and Health Survey
KEMRI	Kenya Medical Research Institute
KNASP	Kenya National HIV/AIDS Strategic Plan
KNBS	Kenya National Bureau of Statistics
KSh	Kenya Shilling
FSW	Female sex work / worker
MARP	Most at Risk Population
MOMS	Ministry of Medical Services
MOPHS	Ministry of Public Health and Sanitation
MSM	Men who have sex with men
MSME	Men who have sex with men exclusively
MSMW	Men who have sex with men and women
MTCT	Mother-to-child transmission
NACC	National AIDS Control Council
NASCOP	National AIDS and STI Control Programme
OR	Odds Ratio
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PLWHA	People living with HIV/AIDS
PMTCT	Prevention of mother to child transmission
RAI	Receptive Anal Intercourse
RDS	Respondent Driven Sampling
STI	Sexually transmitted infection
uAI	Unprotected anal intercourse
uHET	Unprotected Heterosexual Intercourse
uIAI	Unprotected Insertive Anal Intercourse
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
UNGASS	United Nations General Assembly Special Session on HIV/AIDS
uRAI	Unprotected Receptive Anal Intercourse

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Chapter 1

BACKGROUND: THE NEGLECT OF MSM IN SUB-SAHARAN AFRICA'S EPIDEMIC RESPONSES

The emergence of AIDS

AIDS in the West

On June 5, 1981, *MMWR* published a report on a new clinical syndrome in California, USA. Between October 1980 and May 1981 five young men were treated for *Pneumocystis carinii* pneumonia at three different hospitals in Los Angeles, two of whom died[3]. At the time, *Pneumocystis carinii* pneumonia was recognised as a rare cause of pneumonia, typically only seen amongst patients with a known reason for profound immunosuppression. The following month, the *MMWR* reported an increase in notification of Kaposi's sarcoma, an extremely rare malignancy, which had recently been diagnosed in 26 male patients in New York and California in the past 30 months[4]. Most had an aggressive clinical presentation (disseminated malignancy), uncharacteristic symptoms (pyrexia of unknown origin, lymphadenopathy) or concomitant diseases (*Pneumocystis carinii* pneumonia), and eight of these men died. In the same issue, the *MMWR* also reported on five men in New York who had developed severe, progressive, perianal herpes simplex infections[4]. Three men had died. The uniting features of these case series of rare opportunistic infections were that all cases were young homosexual men and all had unexplained cellular immune deficiencies.

These case reports were later recognized as the first reported cases of acquired immunodeficiency syndrome (AIDS) caused by a blood-borne and sexually transmissible virus identified in 1983 (LAV/HTLV-III/HIV)[5]. In the USA, Western Europe and Australia, AIDS was mostly seen among individuals in 'high risk groups' – men who have sex with men, injecting drug users, haemophiliacs and certain immigrant groups (Haitians). Initial prevention measures differed somewhat between countries, but all involved a combination of 1) dissemination of basic knowledge about HIV/AIDS transmission and prevention[6], 2) strategies to reduce negative attitudes towards people living with HIV/AIDS and those most at high risk of infection, and 3) risk behaviour reduction programs aimed at populations at high risk for infection[7].

Globally, in most high-income and industrialised settings, MSM have since accounted for a higher proportion of AIDS cases than any other population [8], and whilst overall HIV epidemic trends are in decline, MSM are the exception[9]. In the USA, since 2001, sex between men remained the largest HIV transmission category, and the group in which numbers of new HIV/AIDS diagnoses are increasing fastest (8% per year since 2001)[10]. Similarly half of new HIV diagnoses in Western Europe in 2008 were among MSM, for whom annual increases of 8% per year were reported between 2003-2007[11]. Stable or increasing HIV incidence among MSM is also reported in studies from Asia, Latin America and Australia[9].

HIV/AIDS in Africa

The first reports of more significant epidemics in sub-Saharan Africa started to emerge in 1983-84 from Zaire, Rwanda and Uganda. The epidemics encountered by visiting Western researchers differed in a number of important clinical and epidemiological respects from their experience of AIDS in their home countries.

Firstly, Central African HIV/AIDS epidemics were considerably more severe than those documented in the West. Piot et al identified 38 hospitalised adults from four hospitals in Kinshasa, Zaire who satisfied the clinical case definition for AIDS during a 3 week period in October 1983[12]. Comparing only those cases identified to the denominator of the population of Kinshasa, Piot estimated the adult AIDS incidence rate to be 55-100 per 100,000 person-years. Even this considerable underestimate of the true incidence in Kinshasa represented a higher incidence rate than being observed in San Francisco and New York amongst homosexual men at the same time. In Kigali, Rwanda, Van de Perre and colleagues identified 26 patients satisfying the same case definition from one urban hospital over a four week period[13]. The authors estimated the annual incidence of AIDS to be 80 per 100,000 person-years. The disease was next recognised in epidemic proportions in Zambia, with the recognition of an aggressive form of Kaposi's sarcoma with a 61% 6-month case fatality resembling the natural history of the cancer amongst homosexual men with AIDS in the West[14]. With the availability of the first field test for HIV (then called human T-cell lymphotrophic virus III (HTLV-III/LAV)), Serwadda reported an HTLV-III seroprevalence of 10% amongst symptomless adults in Uganda[15].

Secondly, whilst the age distribution of AIDS cases in Central Africa was comparable to experiences in the West - almost all cases identified in early case series were from the sexually active age-range - the gender distribution was different. The male to female ratio among AIDS cases in Africa was nearly equal compared with the 19:1 male to female ratio observed in the USA and Europe[16 17].

The final difference between Western and Central African epidemics, and adding further evidence to the existence of widespread heterosexual HIV transmission, were the lack of alternative explanations for epidemic transmission. In particular, early case series failed to identify any of the 'expected' risk behaviours seen amongst AIDS cases in the West in sufficient frequency amongst African AIDS cases to account for the rapid spread, and broad distribution of the epidemic. Among the small initial case series in Kinshasa [12] and Kigale[13], none of the male AIDS cases admitted to either homosexuality or injecting drug use. Instead, African men with AIDS reported a higher number of *female* sexual partners [18] and were more likely to report sex with *female sex workers* [19 20]. Further, 40% of female AIDS cases in Rwanda reported sex work, and female sex workers repeatedly had the highest HIV seroprevalence of all populations studied in Africa[20 21].

The heterosexual paradigm of African HIV epidemics

These findings from Africa sent alarm throughout the global public health community, presented now with evidence that HIV epidemics, which in most parts of the world had hitherto remained epidemiologically segregated within certain minority populations, also had the potential for widespread, self-sustained transmission amongst the majority heterosexual population. In 1986, a seminal review in Science co-authored by the leading Western researchers declared that AIDS in Africa was an 'epidemiologic paradigm'[22]. The authors stated that 'heterosexual activity, blood transfusions, vertical transmission from mother to infant, and probably frequent exposure to unsterilized needles account for the spread of HIV infection and AIDS in Africa'. With respect to 'homosexual activity and injecting drug abuse', still synonymous with HIV risk elsewhere, the authors concluded that 'it is evident from the multiple studies performed in Africa by both national and international experts in sexually transmitted diseases that these two risk factors do not play a major role in HIV transmission in Africa'. The paper does not cite any African studies in support of this assertion, beyond the small case series from Zaire and Rwanda discussed above[12 13]. Yet the same review [22] cited data from the WHO Collaborating Centre on AIDS on risk behaviour and geographic origin of AIDS cases diagnosed in Europe through March 1986 [23]. This stated that of 177 AIDS cases of African residence, 6% of all adults, and10% of male African residents, *did* report homosexual activity.

These epidemiological conclusions were explained in contemporary assertions of researchers that homosexuality either did not exist in Africa, or was so rare as to be irrelevant to HIV transmission. Robert Biggar declared that 'most Africans both male and female, adamantly deny homosexual activity' [24]. Hrdy concluded that 'Homosexuality is not part of traditional societies in sub-Saharan Africa' and that 'the apparent lack of AIDS among homosexuals in Africa also supports the absence of significant homosexual activity'[25]. A few commentators advised caution in conflating the observation that homosexual men did not constitute the majority of AIDS cases with conclusions that such men did not exist and were not significant to HIV transmission, given the lack of population-based sexuality data and the particular difficulties external researchers faced in obtaining accurate information on minority behaviours in contexts antipathetic to sexual minorities. For example, Imperato et al conclude, based on personal observations, that whilst homosexuality and drug use were 'vehemently denied by Africans', both 'are more common than African health officials are willing to admit'[26].

Anthropology and social science literatures, by contrast, had documented sex between men across sub-Saharan Africa, both before and after the recognition of HIV/AIDS[27-29]. Historic and contemporary studies document patterns of MSM partnership (status-differentiated on the basis of differences in age or gender identity)[30], and egalitarian partnerships [29], as well as MSM experimentation before marriage, in adolescence or institutional settings[31] and describe same sex practices as a necessary component of certain traditional practices[29 32].

In 1989 Caldwell et al assessed the available empirical evidence of the social context of sexual behaviours relevant to the transmission of HIV in sub-Saharan epidemics. This significant and widely cited review of the nuanced influence of sexuality upon HIV risk in African societies focussed exhaustively on evidence of promiscuity, adultery, polygamy and transactional heterosexual sex as cultural determinants of HIV risk, making no reference at all to literatures on homosexuality in Africa [33]. In later attempting to unify an epidemiological model of AIDS in sub-Saharan Africa in 1996, the same authors declared this to be 'the world's only purely heterosexual AIDS epidemic' [34].

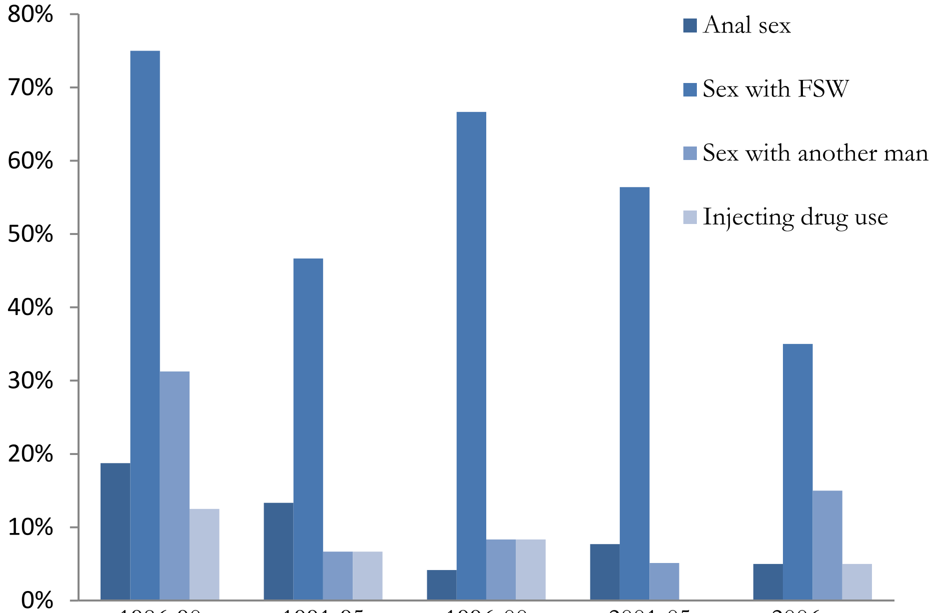
African risk factor studies 1986-2007

The notion that sub-Saharan Africa's HIV epidemics could reasonably be simplified to this heterosexual paradigm seems to have passed largely unchallenged in subsequent research, despite a lack of explanation for the considerable variability in severity of HIV epidemics across Africa. A literature search of the PubMED database for full-text studies (detailed in Appendix 1) yielded 114 studies of risk factors for HIV among adult African men until 2007. Figure 1 charts the proportion of studies that documented any ascertainment of high risk behaviours (AI, injecting drug use) and sexual contact with two categories of sexual partner (same sex partners, female sex workers) in either methods or results.

Only fourteen papers over 21 years of HIV/AIDS research reported one or more measure of male same sex practices as potential HIV risk factors. The proportion of papers that measured MSM behaviours or injecting drug use behaviours among men was highest in the earliest literature (1986-1990), declining thereafter. 100 of the 114 (88%) papers reviewed make no acknowledgement, in either manuscript text or tabled data, of any measurement of MSM practices in the assessment of HIV risk amongst male participants. Assessment of anal intercourse (AI) and injecting drug use behaviours (IDU) are similarly rare, based on the reported content of these studies. By contrast, the overwhelming majority of risk factor papers over the period assessed female sex work contact as a potential risk factor for HIV among men.

Among the fourteen papers assessing MSM behaviour in African men over 21 years of research into HIV risk in sub-Saharan Africa, 10 identified men who reported homosexual behaviours at low frequency (0.06-3.6% of all men), whilst four studies identified none (Table 1). Only five of 10 studies presented measures of association between reported homosexual behaviour and HIV prevalence, one of which demonstrated a statistically significant association[35].

Figure 1: Proportion of peer reviewed epidemiological studies reporting specific behavioural risk assessment, by period of publication



	1986-90 (16)	1991-95 (15)	1996-00 (24)	2001-05 (39)	2006 on (20)
Anal sex	19%	13%	4%	8%	5%
Sex with FSW	75%	47%	67%	56%	35%
Sex with another man	31%	7%	8%	5%	15%
Injecting drug use	13%	7%	8%	0%	5%

Table 1: Observational risk factor studies of adult men in sub-Saharan Africa to 2007: reporting of homosexual behaviours

Cross sectional studies

Country	Sample size	Year of study	Population	MSM Behaviours All men % (CI)	HIV + men n (%)	HIV – Men n (%)	HIV+ vs. HIV – OR (*p* value)
Cote D'Ivoire[36]	1,169	1992	STD Clinic Attenders	0.4 (0.1-0.10)	not reported		not reported
Kenya[37]	115	1988	GUD Patients	0.0 (0.0-3.2)	-	-	-
Kenya[38]	283	1995	Truck Drivers	0.4 (0.0-2.0)	not reported		not reported
Kenya[39]	1,337	2007	MC RCT enrolees	0.3 (0.1-0.7)	not reported		not reported
South Africa[35]	1,277	2006	MC RCT enrolees	3.6 (2.6 – 4.8)	3/26 (11.5%)	43/1251 (3.4%)	3.61 (*p*=0.05)
South Africa[40]	11,904†	2006	15-24 year old Household survey	0.06 (0.02- 0.12)	not reported		not reported
Tanzania[41]	213	2001	<25 years	2.3 (0.8-5.3)	not reported		not reported
Uganda[42]	607	1989	General Hospital Admissions and OPD	6/594 1.0 (0.4-2.2)	3/252 (1.2%)	3/342 (0.8%)	1.36 (*p*>0.05)
Uganda[43]	175	1990	STD Clinic Attenders	0.0 (0.0-0.2)	-	-	-
Zaire[44]	7,068	1990	Company employees	0.0 (0.00-0.05)	-	-	-
Zimbabwe[45]	87	1996	Psychiatric admissions	0.0 (0.0 – 4.2)	-	-	-

Case control studies

Country	Sample size	Year of study	Population	MSM Behaviours HIV+ men (cases) (n, %)	HIV- men (controls) (n, %)	OR (p value)
Cote D'Ivoire[46]	729	1996	TB patients	1/490 (0.2%)	1/ 239 (0.4%)	0.5 (*p*>0.05)
Cote D'Ivoire[47]	171	2002	Blood Donors	2/104 (1.9%)	0/67 (0%)	∞ (*p*>0.05)
Kenya[48]	340	1988	STD Clinic Attenders, with STD and reported FSW contact	1/38 (2.6%)	1/302 (0.3%)	9 (*p*>0.05)

†: men and women (results not disaggregated by gender)

HIV/AIDS policy in sub-Saharan Africa

Initial prevention efforts in sub-Saharan Africa countries, most of which satisfied the UNAIDS/WHO criteria for having 'generalised' HIV epidemics, focussed upon population-level interventions aiming to limit heterosexual transmission though a change in community norms, values and sexual behaviour. The hallmark regional policy marking this initial era in prevention was the 'ABC' strategy: abstain, be faithful and use condoms[49], however the scope of national population-based strategies have diversified to include promotion of social change to reduce concurrency, increase availability of male circumcision and to improve access and uptake of HIV testing and anti-retroviral therapy[50 51].

The UNAIDS initiative 'Know your epidemic, know your response' represented an effort to reinvigorate HIV prevention and drive improvements in national HIV/AIDS surveillance and responsiveness [52]. This approach explicitly recognised the potential diversity of epidemiological drivers within countries whatever the classification of their epidemic (Box 2), and in doing so drew specific focus onto the need to understand and address prevention needs among vulnerable and marginal groups within an effective national response. Under commitments made in the Declaration of Commitment of HIV/AIDS agreement[53], from 2006 all member states were required to initiate, collate and report a range of new indices reflecting the epidemiological profile, program scope and financial resourcing of their HIV/AIDS response. Thus, for the first time, UN member states were required to report surveillance data on 'most at risk populations', including MSM, in a standardised format.

Strategic information on MSM populations relevant to HIV/AIDS policy (2006-2008)

The 2008 UNGASS reporting round is notable more for the dearth in strategic information concerning MSM in sub-Saharan Africa than for the value of returned information itself. 35 (67.3%) of 52 African countries were unable to report *any one* of the core indicators referent to MSM (Figure 2) compared to 27.6% among the rest of reporting UN members. 80.7% were unable to provide an estimate of HIV prevalence among MSM (Indicator 22). Responses to the other core indicators were similarly sparse (Figure 2).

Box 2: UNAIDS/WHO classification of HIV/AIDS epidemics

Low-level

- Principle: although HIV infection may have existed for many years, it has never spread to significant levels in any sub-population.
- Infection is largely confined to individuals with higher risk behaviour: e.g. sex workers, drug injectors, homosexual men. This suggests that networks of risk are rather diffuse (low levels of partner exchange or sharing of drug injecting equipment), or a very recent introduction of the virus.
- **UNAIDS/WHO Numerical proxy: HIV prevalence has not consistently exceeded 5% in any defined sub-population**

Concentrated

- Principle: HIV has spread rapidly in a defined sub-population, but is not well-established in the general population.
- This suggests active networks of risk within the sub-population. The future course of the epidemic is determined by the frequency and nature of links between highly infected sub-populations and the general population.
- **UNAIDS/WHO Numerical proxy: HIV prevalence consistently >5% in at least one defined sub-population <u>but</u> <1% in pregnant women in urban areas**

Generalised†

- Principle: in generalised epidemics, HIV is firmly established in the general population.
- Although sub-populations at high risk may continue to contribute disproportionately to the spread of HIV, sexual networking in the general population is sufficient to sustain an epidemic independent of sub-populations at higher risk of infection.
- **UNAIDS/WHO Numerical proxy: HIV prevalence consistently >1% in pregnant women**

†Areas where HIV prevalence exceeds 15% in the adult population subsequently reclassified as 'hyperendemic'

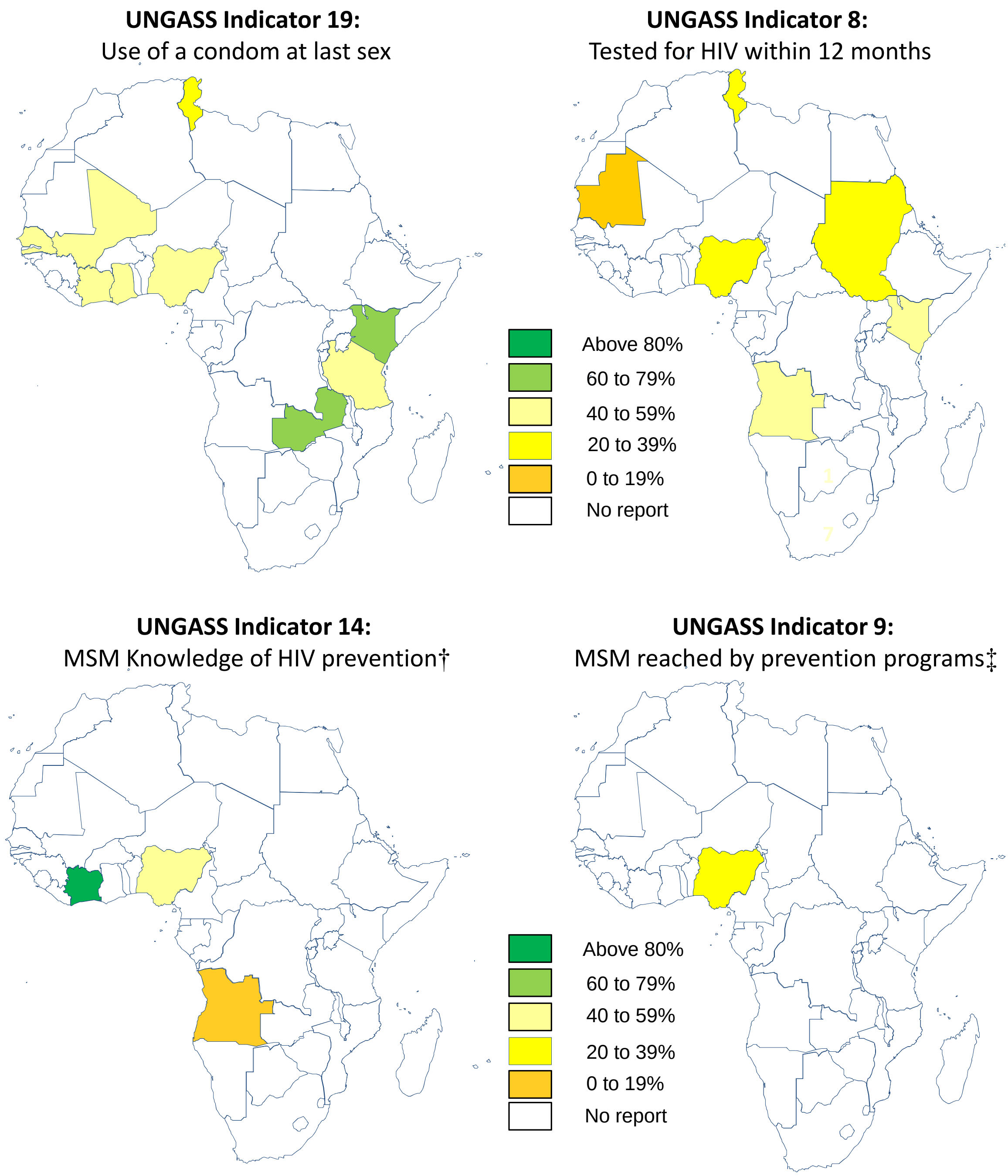
Box 1: UNGASS 2008 core indicators relevant to MSM populations[2]

National Programmes
8. Percentage of MSM that have received an HIV test in the last 12 months and who know their results (every 2 years)
9. Percentage of MSM reached with HIV prevention programmes (every 2 years)

Knowledge and behaviour
14. Percentage of MSM who both correctly identify ways of preventing the sexual transmission of HIV and who reject major misconceptions about HIV transmission (every 2 years)
19. Percentage of men reporting the use of a condom the last time they had AI with a male partner (every 2 years)

Impact
22. Percentage of MSM who are HIV infected (annual)

Figure 2: UNGASS 2008 MSM Indicators: Africa



† Correct response: all of the following

1. Can having sex with only one faithful, uninfected partner reduce the risk of HIV transmission?
2. Can using condoms reduce the risk of HIV transmission?
3. Can a healthy-looking person have HIV?
4. Can a person get HIV from mosquito bites?
5. Can a person get HIV by sharing a meal with someone who is infected?

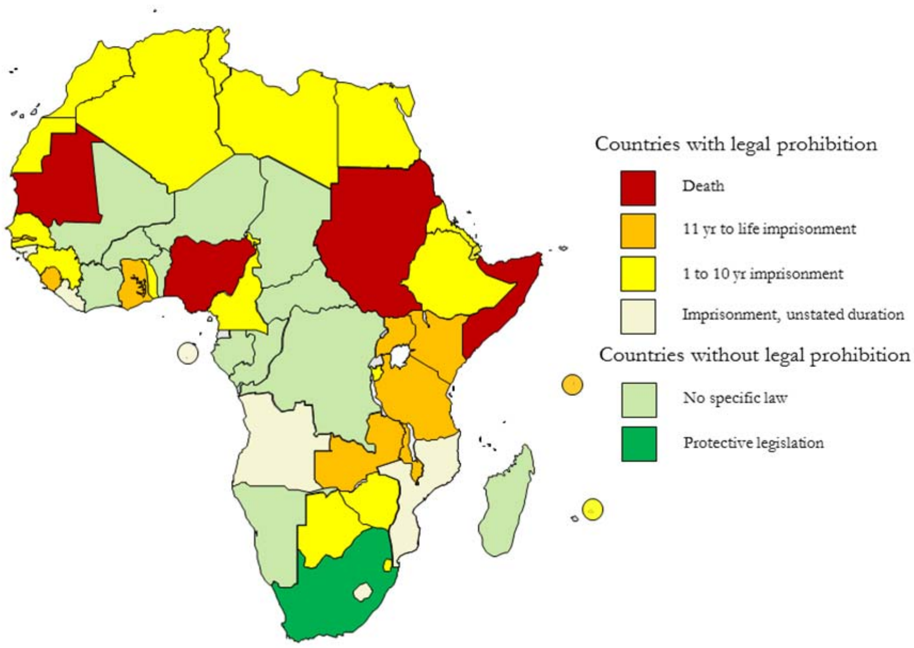
‡ Both of the following:

1. Do you know where you can go if you wish to receive an HIV test?
2. In the last twelve months, have you been given condoms? (e.g. through an outreach service, drop-in centre or sexual health clinic)

Origins of neglect

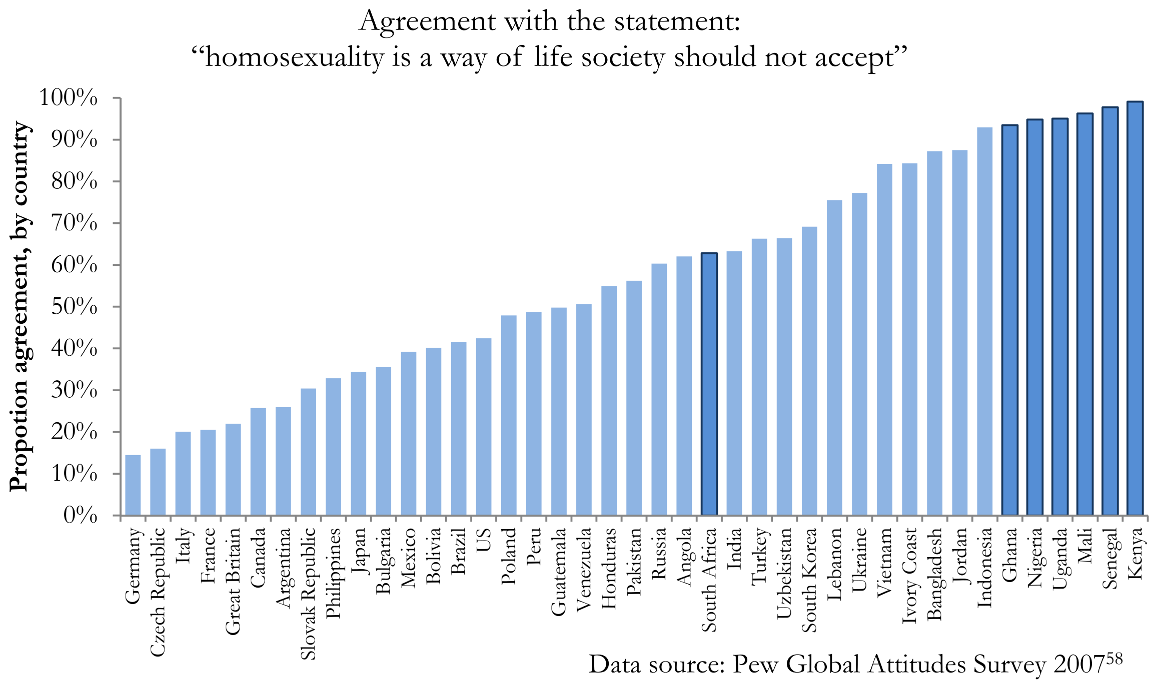
These straightforward reviews of strategic information on MSM populations within sub Saharan African epidemics through 2007 indicated that the notion that MSM groups do not exist in sub Saharan Africa or are irrelevant to HIV epidemics is not based on sound research or surveillance, since neither exists. It is unlikely to be possible, or productive, to identify why, through uncovering the new epidemiological reality of population-wide epidemics in sub-Saharan Africa, that HIV researchers and policy makers so comprehensively disregarded the very population from which the original insights into AIDS and HIV science came. Contemporary commentators attribute the oversight to intimidation of researchers[54], resistance of research review panels to approve MSM research[55], compromise of scientific rigor to account for cultural mores[55 56] and pervasive colonial preconceptions among visitors[28 56]. Whichever, if any, are true is of little relevance as the global HIV community now faces up to the challenge of belatedly describing HIV risk and burden among MSM populations, and developing appropriate HIV/AIDS prevention, treatment and care for these groups.

Figure 3: Criminalization of male homosexual behaviours in African penal codes (2007, source Ottosson[57])



Yet there remain today, as throughout this historic take on the HIV/AIDS epidemic, an array of extreme political, social and other structural conditions antipathetic to homosexual citizens of African countries that both may in part explain the neglect of MSM in the HIV response to date, but which also threaten future prospects for research and delivery of effective interventions. Male homosexual behaviours are illegal in 37 of 52 countries and punishable by death in four, whilst MSM enjoy legal protections in only one country (Figure 3). In successive Pew Global Surveys, African societies head the worldwide league table of populations that believe 'homosexuality should not be accepted by society' (Figure 4[58]), Populist anti-gay rhetoric from political and religious figures is widespread, intolerant and derogatory[59], and both organised and opportunistic physical, sexual and verbal abuse against MSM are commonly reported[54 60 61]. With these obstacles to coherent HIV/AIDS research and response comes the recognition that the targets of any such intervention are hesitant to disclose to identify themselves for fear of reprisal[55], and where MSM have fashioned supportive social networks these are in spite of prevailing society and distant from its reach[55].

Figure 4: Public opinion regarding societal acceptance of homosexuality



Data source: Pew Global Attitudes Survey 2007[58]
Dark blue indicates sub-Saharan African state

Scope of the thesis

In 2006, I visited an International AIDS Vaccine Initiative (IAVI) study clinic in a suburb of Mombasa, Kenya, where for the previous eighteen months an HIV vaccine-feasibility had been initiated. This study was one among an international effort to establish operationally robust cohorts of HIV negative adults perceived to be at high risk of infection to permit timely evaluation of candidate HIV vaccines should they emerge. These aims necessitated the recruitment of adults believed to be at the highest HIV risk – in Mombasa, these groups were believed to be female sex workers, HIV negative adults in HIV discordant partnerships, and men with other sexually transmitted infections. However once mobilisation had begun female sex workers started to bring men to the clinic. Surprisingly, these men also reported selling sex to men.

My first visit involved participation in a self-help group for these men, then being actively recruited into cohort follow up. Based upon my own experience of working as a clinician and epidemiologist on HIV/AIDS in both Africa and the UK, the impact was immediate and startling – this was a group of gay men, openly discussing same sex practices and sharing personal experiences of HIV/AIDS. Not in any way a surprising gathering in Soho or the waiting rooms of London sexual health clinics, but certainly so in a deprived, peri-urban neighbourhood in an African country with a generalised HIV epidemic.

This thesis details three complementary projects conducted in Kenya and Oxford that evolved from this initial contact, and which cover a period of rapid change in national and international attention toward men who have sex with men (MSM) within African HIV epidemics. The following chapter describes the Kenyan context in more detail, in terms of its national HIV epidemic and what was known of MSM populations prior to 2007. Chapter 3 then reports a cross-sectional analysis of risk factors for HIV among MSM who had already enrolled with the IAVI study described above, also published in AIDS[62]. This represented the first published study of HIV risk factors in Eastern Africa, and the second on the continent [63].

The results described in Chapter 3 prompted two parallel projects: a systematic review of comparable studies across sub-Saharan Africa to 2010, and a diary study of sexual behaviour among a sample of the IAVI study population conducted in 2007-2008. The review set out to explore the emerging literature describing HIV burden and risk among MSM populations across the continent, and to place the findings from Chapter 3 in a broader context. In the thesis, the literature review is reported before the prospective study since the literature described is best compared to the cross-sectional study, rather than the prospective study.

The cross-sectional study highlighted the need to better understand the behavioural origins of HIV transmission risk and opportunities for prevention among MSM, a task for which that study had not been designed. Chapters 5 – 7 describe a prospective, diary-based approach to sexual behavioural measurement. Chapter 5 describes the design of the study, and assessment of the performance of study components. Chapter 6 reports the characteristics of sexual partners and sexual partnerships (dyads) measured in the prospective study, and explored the aspects of partner, dyad and situation that were predictive of unsafe sex within partnerships. Chapter 7 reports the cumulative behaviours reported by study participants over their entire period of follow up. The analysis describes the heterogeneity in participants' frequency of intercourse, frequency of unprotected intercourse and probability of condom-unprotected sex with male and female partners, and explored the characteristics of the participant that were predictive of risk behaviour.

The thesis concludes in Chapter 8 with a discussion that aims to summarise the specific insights from studies in Kenya and sub-Saharan Africa, and to consider the opportunities and challenges as African countries start to address the HIV prevention, treatment and care needs of MSM within complex epidemiological, social and cultural contexts.

Chapter 2

RESEARCH CONTEXT: MALE HOMOSEXUALITY AND THE KENYAN HIV EPIDEMIC

The introduction briefly reflected upon the neglect of homosexual behaviours and populations in HIV/AIDS epidemiological surveillance, research and policy making in sub-Saharan Africa until 2007, and outlined some of the enduring contextual obstacles to future research and program delivery across the continent.

This chapter focuses specifically on the Kenyan HIV epidemic and national response, which was the context of field research discussed in later chapters. The chapter details the direct and indirect evidence indicating the existence of homosexuality in Kenya historically, through to recent engagement of MSM populations in epidemiological research. The chapter concludes by describing preliminary results from IAVI studies based in coastal Kenya which marked the start of my collaboration with KEMRI-IAVI.

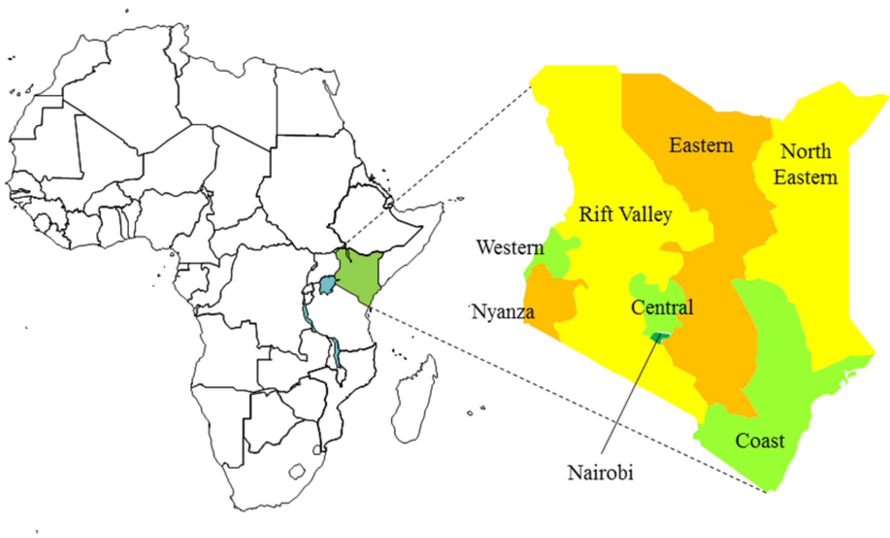
Kenya

Kenya is an equatorial country in East Africa, bordered by the Indian Ocean to the southeast, Somalia, Ethiopia and Sudan to the north, Uganda to the west and Tanzania to the south (Figure 5). It has a land area of 580,000 km^2 and a population of 40 million residents[64]. Most Kenyans are Christian (45% Protestant, 33% Catholic), however religious and tribal affiliation is highly region specific: sixty per cent of all Kenyan Muslims live in Coast Province, and 10% in border regions with Ethiopia and Somalia[64].

Kenya's current population is an amalgam of indigenous African settlement plus intercontinental immigration and colonisation. Arab and Persian colonization of coastal Kenya began in 800AD, and by 1000AD had established a maritime-based economy based around the port of Mombasa. The Swahili coast of Kenya was part of the east Africa region that traded with the Arab world and India, especially for ivory and slaves, and is culturally, ethnically and religiously distinct from inland Kenya to this day. British colonisation of Kenya from 1888 saw large transport developments linking the port of Mombasa to the fertile highlands around Nairobi (now capital of Kenya), and beyond to

Uganda. This prompted a further swell in economic migration: skilled manpower for railway construction was provided by a significant inflow of Indian workers, and British and other European farmers settled the interior central highlands to farm coffee and tea. Kenya achieved independence from Britain in 1963.

Figure 5: Kenya national boundaries and administrative provinces (2010)



Today Kenya has a population of 41.6 million and is classified as a low income country by the World Bank[65]. Kenya's economy is the largest in East and Central Africa (GDP $65.96 billion, 2010[64]).Tourism contributes about 62% GDP[64] and is concentrated in coastal regions and game reserves. Agriculture is the second largest contributor to GDP (22%)[64] The principal cash crops are tea, horticultural produce and coffee. Unemployment rates are high (ranked 187th globally, 40% in 2001 & 2008), and 50% of Kenyans live below the poverty line[64]. Life expectancy at birth was 57 in 2011, is increasing but has yet to return to that pre-dating the demographic impact of HIV/AIDS (peak life expectancy: 61.6 years in 1987).

The HIV epidemic in Kenya

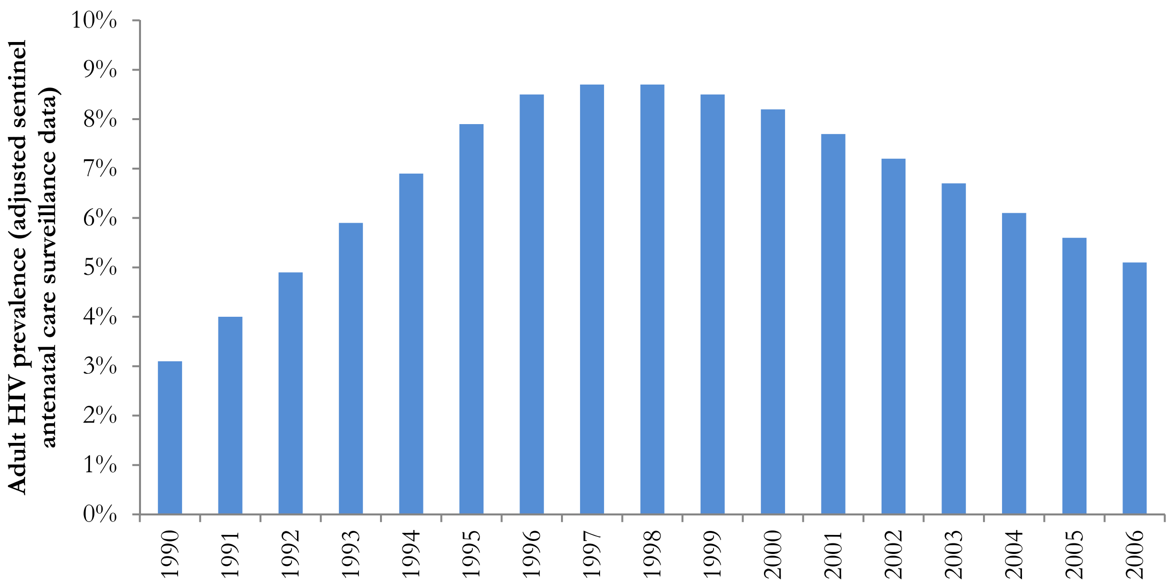
HIV surveillance and monitoring in Kenya

Standardised monitoring of HIV prevalence within Kenya has been based on a sentinel surveillance system first implemented by the National AIDS and STD Control Programme in 1990. Annual prevalence information is collected from two sources: pregnant women attending antenatal clinics, and clients of STI clinics, intended to represent the general population and 'high risk groups' respectively. From 1990 to the present day, the estimated HIV prevalence among the adult general population has remained consistently above 1%, meeting the numerical criteria of a 'generalised HIV epidemic', and the recognition that sexual networks in the general population can sustain HIV transmission, even in the absence of high risk populations.

The burden of HIV/AIDS in Kenya

In 2011, 1.6 million Kenyans were living with HIV, representing 6.2% of adults (15-49 years), and 62,000 Kenyans died due to AIDS[66]. Antenatal surveillance data collected between 1998 and 2004 suggest that HIV prevalence among the general population peaked in the late 1990's since when a sustained decline has been apparent (Figure 6). Applying Kenya prevalence data to incidence projection models (UNAIDS reference group on Estimates, Model and Projections), Cheluget et al suggested these declines in Kenyan HIV prevalence were consistent with a peak in HIV incidence occurring 1993-4, and a subsequent decline in HIV incidence through the period analysed [67]. The decline in prevalence is thought attributable to two factors.

Figure 6: Adult HIV prevalence estimates 1990-2006 (source: Kenya Mode of Transmission Study 2008[68])



Firstly, deaths from AIDS among individuals with HIV exceeded the estimated number of people newly infected with HIV from 1999-2004. However, deaths from AIDS peaked in 2003, following which they declined markedly further with the increasing availability of antiretroviral therapy (ART). Modelling studies suggest that AIDS mortality alone was insufficient explanation for the observed decline in HIV prevalence and estimated decline in incidence even before ART became widely available[69].

Secondly, measures of sexual behaviour and knowledge of HIV/AIDS suggest evidence of behaviour change among the general population, and of the impact of population-based HIV programs. Demographic and behavioural data are collected in a variety of periodic national population surveys, including Demographic and Health Surveys (KDHS) and AIDS Indicator Surveys (AIS) (Table 2). Declines were apparent in the proportion of adults reporting more than one partner in the last year, and adults sexually active in the previous four weeks. The same period also saw significant increases in women reporting the use of a condom at last higher risk sex, with a similar, but not statistically significant trend among male respondents.

Table 2: Indicators of sexual behaviour in routine surveys: Kenya 1993 – 2009

Indicator		KDHS 1993[70] % (sample size)	KDHS 1998[70] % (sample size)	KDHS 2003 [70] % (sample size)	KDHS 2008-9[71] % (sample size)
15-19 year olds who had sex by age 15 (%)					
	Women	15.8 (1754)	15.0 (1851)	14.5 (1856)	11.5 (1761)
	Men	-	31.7 (811)	30.9 (856)	22.3 (776)
Mean age at first sex (years)					
	Women	16.8 (5786)	16.7 (6030)	17.8 (4648)	18.2 (8444)
	Men	-	16.8 (2596)	17.1 (2041)	17.6 (4758)
Had more than one sex partner in the last 12 months (%)					
	Women	-	4.2 (7881)	1.8 (8027)	1.2 (8444)
	Men	-	24.1 (3407)	11.9 (3579)	9.4 (3465)
Sexually active in the last 4 weeks (%)					
	Women	53.8 (6402)	51.6 (7881)	47.6 (8195)	49.0 (8444)
	Men	-	55.5 (3407)	47.0 (3578)	48.7 (3465)
Use of a condom at last higher risk sex (%)†					
	Women	-	15.1 (308)	23.9 (1006)	35.3 (1079)
	Men	-	42.5 (520	46.5 (942)	61.5 (835)

†: 1998: condom use at last sex with non-spousal/non-regular partner
2003 & 2008-09: condom use at last sex with non-marital, non-cohabiting partner

The HIV/AIDS response in Kenya

The encouraging trends in population level sexual behaviour measures correlate with increased political and programmatic commitment to HIV/AIDS in Kenya. Despite establishing a National AIDS committee in 1985 and developing a national AIDS control program in 1987, Kenya attracted local and international criticism for its initial response to the epidemic through political denial of the evidence and weak implementation[72]. A policy process beset by corruption resulted in distancing of international donors and a rechanneling of disbursement of HIV/AIDS funding from Kenyan government to Kenyan NGOs (via the Kenya AIDS NGOs consortium KANCO). Yet the NGO response suffered for lack of central co-ordination and limited application of evidence, resulting in divergent policies on condom use and sex education[73].

In the mid-1990s, AIDS began to be taken seriously as a development issue in Kenya, and in 1997 Parliament passed Sessional Paper No.4 on AIDS which stressed the need for HIV/AIDS advocacy and policy development. In 1999 the Government of Kenya declared HIV a 'national disaster' and established the National AIDS Control Council (NACC)[74]. The Kenyan government began internal investment into prevention programs. In 2002, new president Mwai Kibaki declared 'total war on HIV/AIDS', and in 2003 Kenya conducted its first large-scale HIV testing survey (KDHS 2003). These new declarations of local political commitment to HIV control, and an on-going political anti-corruption program in Kenya, have enabled a renewed engagement between international donors and the government led response and access to recent international HIV/AIDS funding streams, such as the Global Fund & PEPFAR.

The initial Kenyan response promoted population-level behaviour change though AIDS awareness and the ABC approach. HIV/AIDS education is represented in primary and secondary school curricula, in recent surveys 75% women and 81% men knew that condoms reduce the risk of HIV infection[75]. The policy response has diversified with time to improve access to Voluntary Counselling and Testing (VCT), prevention of mother to child transmission and voluntary male circumcision and ART.

By 2007, the number of VCT sites had increased from three in 2000 to almost 960 countrywide in 2007[76] and provider initiated testing was available in 73% health facilities. Yet in 2008, still only 36% of Kenyan adults knew their HIV status and 80% of HIV infected people did not [77]. In 2008, an estimated 65% of pregnant women were tested for HIV, and in 2009 73% of pregnant women living with HIV received ART for preventing transmission to their babies. In 2009, Kenya introduced combination ART to replace single dose nevirapine. However PMTCT services, although free to the user, were still only available in 50% of facilities in 2009. Access to ART dramatically improved from 5% of eligible adults (CD4+<200/mm^3) in 2003 to 65% (or 48%)

against new WHO criteria for ART initiation (CD4+<350/mm^3)), provided free in public hospitals and health centres. Access to ART for children remains less developed (32% of eligible children).

The national response, projected to cost USD$671 million for 2009/10, remains largely dependent on donor funding[77]. 59.9% of funds are earmarked for treatment (38.3% ART) and 19.5% to prevention (3.8% VCT, 2.7% PMTCT, 1.9% Condom provision, 1.2% Male Circumcision) [77].

Heterogeneity and known risk groups in the Kenyan HIV epidemic

The first Kenya AIDS Indicator Survey (KAIS) in 2007 indicated the extent of diversity within the generalised Kenyan epidemic [75], particularly by provincial region of Kenya, age, gender and ethnicity. Nyanza province (see Figure 5) had an overall prevalence of 13.9%, significantly higher than any other province (Nairobi 7.0%, Western 6.6%). Coast region had a relatively low HIV prevalence (4.2%). Provincial differences were also reflected in considerable heterogeneity by ethnic origin: HIV prevalence was highest among the Luo, the tribe indigenous to Nyanza province (23% women and 17% men age 15-49). Ethnic differences in HIV prevalence were partly attributed to cultural differences in male circumcision practices by different ethnic groups: on average, uncircumcised men had five fold HIV prevalence compared to circumcised men [68]. Adults in urban settings had a slightly higher HIV prevalence (7%) than rural adults (6%), more marked amongst women (urban: 10% vs. rural: 7%) than men (urban: 5% vs. rural: 4%).

In keeping with epidemics in Southern and Eastern Africa, women in Kenya had a markedly higher HIV prevalence than Kenyan men in all population-based surveys to date[70 71 75]. The most recent KDHS reported a sex ratio of 1.9 women infected for every man [71]. The gender disparity was highest among the young: women aged 15-24 years were four times more likely to be HIV infected that men of the same age [71]. Successive surveys also documented an increase in the age-group with the highest HIV prevalence, from age 25-29 years (10.4 %) in 2003 [70], 30-34 in 2007 (11.6%)[75] to 40-44 in 2008-09 (10.3%)[71]. Surveys report inconsistent patterns of HIV prevalence by education level, but adults in employment consistently had higher HIV prevalence than unemployed adults, and both men and women in the highest quintiles of wealth indices have higher rates of HIV infection than poorer men and women.

Most at risk populations

With the publication of *Towards Universal Access* in 2007[52], UNAIDS signalled an intensification of national HIV/AIDS responses and more explicit monitoring of national HIV/AIDS control programs toward the principles within the UNGASS declaration. Prominent amongst these requirements was the need for member states to report epidemiological data relating to 'most-at-risk populations' (MARPS) which include sex workers, injecting drug users and MSM, and to diversify HIV/AIDS response appropriately. Kenya, as other sub-Saharan states with generalised HIV epidemics and population-based HIV/AIDS control programs, knew little of these groups as of the 2008 reporting round.

Female sex workers

HIV was first identified among female sex workers (FSW) in Nairobi in the mid-1980s and who are thought to have played a significant role in the rapid establishment of the generalised HIV epidemic through transactional interactions with men in migratory occupational groups, particularly long-distance truck drivers. Recent studies continue to document widespread female sex work in large cities, alongside major transport hubs & routes (trans-Africa highways [78], Mombasa port[79 80], and among lakeside fishing communities[81]. HIV prevalence among female sex workers in the 1980s was 65%, and remains high according to more recent surveys (35% - 50%)[78 82].The 2003 KDHS reported that 6% of all adult women reported receiving money, gifts or favours in exchange for sex in the previous 12 months (16% of women aged between 16-19)[70].

Clients of sex workers

Whilst not explicitly restrictive to FSW contact, questions regarding purchase of sex have only been asked of men and in conjunction with questions about recent female partners. In routine surveys, a minority of men aged 15-49 (3% in KDHS 2003:[70]; 2% in KDHS 2008-09[71]) admit to paying for sex in the previous 12 months. High frequency of contact with female sex workers is advanced as the explanation for high HIV prevalence among specific occupational groups working away from home for periods. Long-distance truck drivers in Kenya are at particularly high risk of HIV infection, when tested at truck stops on major road routes (Athi River 1994, 27%[83], Mariakani 1995, 26%[38]) or via transport companies (Mombasa 1997 18%[84], Mariakani 1999, 18%[79]). Similarly, recent surveys of fishermen living in occupational communities living away from their family home around Lake Victoria indicate a high HIV prevalence (25-40%) [81 85].

Other risk groups

At the time of the writing, IDU and MSM groups had not featured in the national dialogue on Kenyan risk groups, and had never been featured in resource allocation or service planning in national programs[86]. Yet, unlike most other sub-Saharan African countries, there was already evidence of research engagement with MSM[87]. The remainder of this chapter collates direct and contextual evidence for MSM behaviours and populations in Kenya prior to their recognition in the research context discussed in the following chapter.

Homosexuality in Kenya

Political and religious commentary on homosexuality

In Kenya, as in many other sub-Saharan African countries, the existence of homosexuality has historically been denied by political and religious leaders. In 1938 Jomo Kenyatta, later to become the first president of independent Kenya, stated in a monograph examining the society and institutions of the Gikuyu that "Homosexuality is unknown" in Kenya[88]

More recently, denial has turned to moral condemnation. In 1999, then President Daniel Arap Moi said "It is not right that a man should go with another man or a woman with another woman. It is against African tradition and Biblical teachings. I will not shy away from warning Kenyans against the dangers of the scourge"[89]. Religious leaders have similarly publicly condemned homosexual practices. At Mtwapa's Masjid Answar Sunna mosque, Sheikh Ali Hussein told around 300 worshippers that homosexuality is a sin which should be punishable by death[59].

Homosexuality in law

The current penal code of Kenya includes reference to the offence of having 'carnal knowledge of any person against the order of nature', legally interpreted as anal intercourse between men (Box 3). This offence carries a liability of fourteen years imprisonment. Although formal prosecution under this item of the penal code is thought to be unusual[90], harassment from authorities under threat of prosecution is anecdotally commonplace[91 92]

It is important to recognise that this aspect of the Kenya penal code remains intact from the original widespread importation of the colonial Indian Penal Code (written between 1897 and 1902) to British African colonies[93]. The same text features in most other former British colonies in Africa. Thus, although frequently cited as evidence that homosexuality is not acceptable to African cultures, the penal code probably bears very little relation to prevailing behaviours or indigenous cultural attitudes at the time of writing.

Box 3: Extract from Kenya Penal Code[1]

Kenya Penal Code Chapter 63: Code 162

Any person who:

(a) has carnal knowledge of any person against the order of nature; or

(b) has carnal knowledge of an animal; or

(c) permits a male person to have carnal knowledge of him or her against the order of nature,

is guilty of a felony and is liable to imprisonment for fourteen years.

Homosexuality in spoken language

Longer-term evidence of the existence of homosexuality is apparent from spoken language. The first Swahili-English dictionary, published in 1882, included local terminology for homosexuality[94] that remains in use today. This included the Arabic derived terms *mumemke (mume* = man, *mke* = woman), *hanithi* meaning 'catamite' (a boy who submits to a sexual relationship with a man) and *shoga* meaning 'homosexual' when referring to a man [30]. Onyanyo-Ouma described a wide range of local Swahili and English terms MSM commonly use to describe their own sexualities in Kenya. *Kuchu* or 'queens', as with the Senegalese *ibbi*[61], refers to MSM with feminine mannerisms who take a receptive role during sex [92]. 'Kings' *or basha* (the Persian-derived Swahili term for the king in a pack of cards) characterise the dominant, masculine partner, and is synonymous with taking the insertive role in AI. Porter also reported two terms derived from the Bantu language: *msagaliwa* referring literally to "men who grind *liwa,* which is an aromatic wood", and *rambuza,* a word describing effeminate males[95].

Kenyan LGBTI organisations

ISHTAR MSM, a locally run LGBTI NGOs, was formed in 1997 and has since advocated for the sexual health rights of MSM including access to STI/HIV and AIDS related care and treatment in Kenya. ISHTAR currently offer psychosocial support and services, referral to MSM-friendly VCT and other health services, free condoms and water-based lubricants, and workshops that include safer sex awareness and peer education. Galebitra (founded in 2002) and GAY Kenya (founded in 2004) advocate for human rights of LGBTI in Kenya through written and electronic publications, documentaries and distributed media[96]. Since 2006, these NGOs have since come together under an umbrella organisation, the Gay and Lesbian Coalition of Kenya (GALCK), funded by a Norwegian LGBT organisation. This group does not engage in programmatic activities, but provides community resources and safe social spaces to MSM in Nairobi. Non-governmental organisations are less prominent outside Nairobi.

Public opinion

In the 2007 Pew Global Attitudes Survey 96% of Kenyans said that homosexuality should be *rejected* by society, one of the highest rates of the 44 countries surveyed (Figure 4, page 12)[58]. Public demonstrations and rallies against homosexuality, and in particular 'gay marriage', have been an increasingly regular feature in urban settings, frequently orchestrated by religious leaders[59].

Homosexuality research in Kenya

Anthropological studies

Homosexuality has been studied in some detail by anthropologists working among Swahili-speakers on coastal Kenya from the 1970's through to 1995[30 95 97]**.** On the basis of field research conducted in Mombasa in the 1970s, Gill Shepperd estimated that around one in ten Swahili Muslim were homosexual, and found homosexual men to be open about their behaviour, and observed established social rules for 'fitting them into everyday life'[30]. She also noted the presence of both male and female prostitutes among the Swahili, who found customers among wealthy locals, tourists and sailors from ships berthed in the Mombasa docks[30].

Shepperd characterised homosexual partnerships within the Swahili community as almost exclusively between a younger, poorer man and a richer, older man, both in single encounters and within longer-term relationships[30]. Shepperd also states that 'financial considerations are always involved', whether by payment for single encounters, or through some means of on-going financial allowance, housing or offering of gifts[30]. In all cases, financial support was offered from the older to the younger partner. Further, the younger, paid partner tended to take the receptive role (*mashoga)*, whilst the older, paying partner tended to take the active role (*mabasha)*. Shepperd also noted that whilst same-sex attraction behaviours were institutionalised within Islamic social society in Mombasa, they were mediated by traditional mores expecting respectable men to marry and father children. According to Shepperd, older Swahili MSM were highly likely to be married but maintain an interest in homosexual behaviour, whilst young, single Swahili MSM were likely to be single and exclusively homosexual. Further, Shepperd asserts that these two caricatures are probably not different populations, but the same one in transition. In other words, younger, single Swahili MSM who sell sex aspire to become the older, married MSM in the future

Conducting work in Mombasa in the 1980's, Amory considered Shepperd's previous characterisation an overgeneralisation, noting that whilst some *mashoga* were indeed sex workers, and paid to provide RAI to older partners, many MSM did not fit this description. Instead, Amory asserts that "definitions of *mabasha* and *mashoga* identity rely on the 'active' vs. 'passive' roles in sex, roles that are specifically gendered in coastal society and that correlate with other gendered behaviours, such as dress and speech"[97], rather than age or financial exchange. Noting by this stage the impact of AIDS among these men, Amory refers to her interviewees showing and commenting on photo albums of other MSM: "If they survive to adulthood, they can assume the socially stigmatized but still recognised identity of *mashoga.* Indeed they may come to describe themselves as *magai* (gay)".

Amory, Shepperd and Porter bring different interpretations to their work. Shepperd conceptualised *mashoga* as rational economic men, in pursuit of higher socio-economic status through sex work, rather than acknowledging *mashoga* to be members of a third gender category. Porter instead argues that *mashoga* identity is highly stigmatized precisely because it represents violation against social status and gender norms[95]

Tourism studies

From a business discipline, Wanjohi Kibicho et al reported a description of sex tourism in Malindi in 2003, based on mixed methods including qualitative and quantitative surveys of male and female sex workers[98]. Kibicho conceptualised three types of sex trade in Malindi based upon the income generated and origin of clients: 'high-class' (escort service, stripteases and call-outs) targeting international tourists and local elite, 'tourism sex trade' targeting local and international tourists and 'poverty sex trade' (street-, private apartment- or brothel-based) targeting locals. He estimated that 67% of sex work in Malindi was 'poverty sex trade', motivated by economic hardship and/or isolation from family[98]. Sex workers in tourism and high class sex trades accounted for 25% and 8% of sex workers, and were typically motivated by prestige of international relationships, personal sexual pleasure or exceptional income[90].

Kibicho specifically noted that male sex workers reported both homosexual and heterosexual interactions with foreign tourists, although makes no comment on such interactions with local residents or domestic tourists. Yet in comparison to female sex workers, male sex workers were less likely to operate from fixed locations, more likely to migrate between towns, and that sex worker – client interactions tended to be more permanent arrangements[98].

In summary, whilst evidence of MSM or homosexual populations in Kenya is sparse, the long-standing existence of this group is directly suggested from a visible grass-roots activism, objective anthropological studies and linguistic tradition, and indirectly suggested by the specificity of social prohibitions and rhetoric concerning homosexuality.

HIV research among MSM in Kenya

Studies assessing MSM behaviours and HIV risk among general populations

Of sixteen Kenyan HIV risk factor studies identified by the literature review described in the previous chapter (Table 1), four reported ascertainment of MSM behaviours by a variety of means, of which three identified a small number of MSM. Among long-distance truck drivers, Mbugua et al report one man (0.4%) who 'stated himself to be a practicing homosexual', although it is not clear whether this information was obtained objectively among other participants[38]. In a sub-study within a randomised controlled trial of male circumcision in young men in Kisumu, Western Kenya[39], 4 men (0.3%) reported sex with another man. Simonsen et al reported a case-control study among men with sexually transmitted infection (STI) after female sex worker contact in Nairobi[48]. Two men (0.6%) reported homosexual contact in the past (in a standardised interview), representing 2.6% (1/38) of HIV positive cases and 0.3% (1/302) of HIV negative controls. In a separate study from the same clinic, Greenblatt at al found no men admitting to MSM behaviours in the previous six weeks in a study of genital ulcer disease and HIV-1 prevalence[37].

Further to the review in Chapter 1, one further abstract describing crude analysis of routine information collected on male VCT clients attending HIV testing at facilities provided by a centre in Nairobi, published as an abstract in 2006[99]. Angala et al reported that among more than 88,000 men testing in their facilities from 2002 to 2005, 780 (0.9%) men reported homosexual behaviour among whom HIV prevalence was 11.9%, compared to 7.3% among heterosexual men. This study noted that MSM were more likely to be HIV positive if they were older (unspecified age groups, crude OR 1.6 $p<0.01$) or were married (crude OR 4.3 $p<0.01$). This study was not published, and it remains unclear how systematically MSM behaviours were elicited in such a large population.

Studies assessing sexual behaviour among MSM populations

A behavioural study of MSM was conducted in 2004 by the International African Studies group at the University of Nairobi and the Horizons and Frontiers Programs of the Population Council. The study team conducted a quantitative survey of 500 MSM, in-depth interviews and ethnographic observations in Nairobi. The study did not assess HIV prevalence, but the study had important conclusions. Firstly, the rapidity of reaching a large sample size through snowball sampling led investigators to speculate that the population of Kenyan MSM living in Nairobi must be considerable. Respondents represented diverse socio-economic backgrounds, from those without employment to working professional. 69% MSM reported ever having sex with a woman, 14% were current or previously married, and 7% reported sex with a woman in the last month. HIV knowledge and prevention practices were more comprehensive that the investigators expected: 77% of MSM were aware of the benefits of consistent condom use, and 58% reported always using condoms for AI.

Studies assessing HIV prevalence among MSM populations

In 2006, Sanders at al reported initial 12 month estimates of HIV prevalence and incidence among risk groups in the newly established IAVI study[100]. HIV prevalence at enrolment was higher in the newly described MSM group than any other (48% (25/58), female sex workers 31% (45/143), heterosexual men with multiple partners 9% (6/67))[100]. Further, HIV negative MSM at enrolment had an exceedingly high incidence of HIV infection in follow up 21 per 100 person-years (CI 9.5 - 46.9), even when compared to other high risk groups in the same context (FSW in IAVI cohort follow up: 5 new HIV infections per 100 person-years (CI 1.6 – 15.5))[100].

Summary

As of 2007, Kenya had a mature, generalised HIV epidemic, with recent evidence for declining HIV prevalence and incidence among the general population. These declines in part reflect recent concerted national efforts to deliver effective population-based behaviour change and impressive scaling up of access to HIV diagnosis and treatment.

However, in common with most African countries that had long pursued HIV/AIDS control strategies focussed on the general population, little was known of the impact of the HIV epidemic upon Kenyan high risk groups, or the need among these groups for prevention, treatment and care. The clear, albeit anecdotal, evidence of the long-standing existence of homosexual men and early evidence of sexual health needs among fairly large groups of MSM identified in recent surveys Kenya had not been accompanied by diversification of the HIV/AIDS surveillance or response. Instead, the national political and religious narrative has evolved from denial of the existence of homosexuality to the language of stigma and moral exclusion.

The following chapter reports the first conclusive analysis of HIV and risk factors among MSM in Kenya, from which followed a number of studies from our research group and others (chapter 4). This evidence has since contributed to much needed progress in Kenyan HIV/AIDS policy toward MSM, discussed in Chapter 8. However, the highly stigmatising environment for MSM described herein was, and remains, the context of the work discussed throughout this thesis.

Chapter 3

RISK FACTORS FOR HIV PREVALENCE AMONG MSM IN COASTAL KENYA: CROSS-SECTIONAL ANALYSIS

This chapter reports the analysis of HIV prevalence and associated risk factors among MSM attending enrolment screening for entry into IAVI high risk cohorts in Mtwapa, Kenya. The project followed up on preliminary results indicating high HIV prevalence and incidence in this risk group compared to other high risk groups[100], by relating HIV prevalence at enrolment screening to individual socio-demographic, behavioural and clinical factors also collected at that time.

The author takes no credit for the study methods that generated this data, which are summarised since they are relevant as the specific context of prospective behavioural studies described in Chapters 5-7. However, it was the author's suggestion that data was used for risk factor analysis, which the author conducted and reported in full. The content of this chapter was published in AIDS[101].

Study site

Mombasa and the Kenya Coast

The field studies described in this chapter and chapters 5-7 took place in and around the coastal city of Mombasa, the second city of Kenya, East Africa. Mombasa's historic economic and cultural importance hinges upon its natural deep sea harbour, linking shipping routes in the Indian Ocean to overland routes across Eastern and Central Africa. The city is also the centre of coastal tourism in Kenya, owing to the presence of an international airport. The coastlines immediately north and south of Mombasa Island and game reserves inland are popular destinations for both internal and international tourists.

Mombasa has experienced occupation by Arab, Portuguese, Zanzibarian and British colonists, and over the centuries, many immigrants have settled in Mombasa, particularly from the Middle East, Iran, Somalia and India. The area has a reputation within Kenya for tolerance of ethnic, cultural and religious diversity.

The KEMRI-IAVI research station

After two years of preparatory investigations, the International AIDS Vaccine Initiative (IAVI) established a longitudinal study of individuals considered at high risk of HIV infection on the Kenya Coast in 2005. The study was one of a multi-centre, international initiative to prepare for HIV-1 efficacy trials in the African region by establishing clinical trials infrastructure to identify and follow up cohorts of individuals considered to be at high risk of HIV infection to support future Phase 2 field testing of candidate HIV vaccines. Subsequently, IAVI has also focussed upon immune and viral profiling of individuals with acute HIV-1 infections detected in these cohorts, to inform the design of HIV-1 vaccines.

The KEMRI-IAVI research station, the base for the field studies to be described later, is situated in Mtwapa, a peri-urban township 16 kilometres north of Mombasa Island. The research clinic is situated approximately 20 kilometres north of Mombasa in a busy suburb with regular transport connections to the north and south. The choice of the Mtwapa site reflected two practical priorities. Although close to Mombasa, Mtwapa falls within the administration of Kilifi District, a large administrative region stretching to Malindi in the north and consisting of predominantly sparse, rural populations throughout. Kilifi district has been the long-standing focus of intensive demographic surveillance through the KEMRI-Wellcome Trust program based in Kilifi town.

Further, Mtwapa has a particular reputation for a burgeoning and permissive night life, with rapid expansion of roadside drinking houses, nightclubs and hotels frequented by local clientele as well as domestic and international tourists. There had been a visible increase in the female sex trade in Mtwapa in previous years, and by 2006 lap-dancing and exotic dancers were already unavoidable features of night spots. A preliminary mapping study conducted by the IAVI study team identified 77 bars, clubs and brothels within the area at which transactional sex was available, in addition to sex work on the streets and beaches. This suited investigators' aspirations to recruit populations at high-risk of HIV infection, as well as being within a well-developed population research infrastructure.

Methods

Study population

Recruitment began in July 2005, originally of female sex workers, discordant couples and men with STIs, and latterly of men who have sex with men[100]. The unanticipated inclusion of MSM prompted amendment of study protocols to extend inclusion criteria to include 'men and women reporting AI within the previous three months', the limited revision of risk assessment questionnaires to record AI behaviours pertinent to HIV risk amongst MSM, and a broadening of mobilization efforts into surrounding districts.

In the absence of a clear understanding of the wider population of MSM, the identification of potential volunteers eligible for inclusion in the cohort was not based on a formal sampling frame, instead reliant on a combination of community mobilisation at identified social and health service venues, snowball referral methods and contacts established through a well-managed network of peer-educators in the local community. Identification and recruitment of potential MSM study participants was conducted by a team of 10-15 trained peer mobilisers, who approached individuals via personal networks and at venues at which MSM meet to establish contact with partners and clients.

Data collection

MSM identified in the community were invited to the study clinic to learn about research participation, view a consent video, and meet with a pre-enrolment counsellor. At enrolment, socio-demographic details and sexual behavioural history were elicited by face-to-face interview (FTFI) (Appendix 3.1). A standardized medical history and physical examination, including genital examination was conducted and recorded by study clinicians. Syndromic treatment was administered for symptomatic STIs in accordance with WHO treatment guidelines[102]. Participants were asked if they had previously tested for HIV, and if so the result and date. Blood was collected for HIV and syphilis screening following the risk assessment. HIV negative participants were recruited to the 'high-risk cohort', whilst HIV-1 positive at screening were offered enrolment into the 'positive cohort'. Both cohorts shared follow up schedules and assessments. Clinical care and/or referrals to government services were provided irrespective of study participation.

Laboratory procedures

Whole blood was tested for HIV on site using two rapid test kits (*Determine*, Abbot Laboratories, USA; *Unigold*, Trinity Biotech, PLC, Ireland) in parallel. Discrepant rapid HIV test results were resolved by a 4th-generation HIV-1 antigen/antibody assay performed at the Kenya AIDS Vaccine Initiative (KAVI) Laboratories in Nairobi[103]. Active syphilis was diagnosed by positive rapid plasma reagin (RPR) titre confirmed by the *Treponema pallidum* haemagglutination assay (TPHA), at KEMRI, Kilifi. Gram staining of urethral or rectal discharge was performed when symptoms or signs of an infection were present. Urethritis was confirmed by microscopic observation of ≥5 white blood cells (WBC) per oil emersion field and attributed to N. gonorrhoea where Gram-negative, intracellular diplococci were identified.

Data management and analysis

Questionnaire, clinical and laboratory data were entered into a secure database. Individual and aggregate data were subjected to routine accuracy checks by research staff and periodic review by study monitors. Data cleaning, recoding and analysis were conducted using Stata 9.2[104]. Socio-demographic and behavioural risk factors for prevalent HIV infection at initial screening were summarized. Categorical variables were tested using Chi-squared (χ^2) or Fisher's exact test. Non-normally distributed continuous and categorical data was compared using the Wilcoxon rank sum test and Spearman rank correlation[105]. Where reported, p values were two-tailed.

Logistic regression was performed to estimate adjusted odds ratios (aOR) of HIV-1 seropositivity. All variables associated with HIV status in univariate analysis at a p value <0.2 were entered into a multivariate model. Missing values for clinical variables were recoded and included in the analysis as discrete variables. Variables were evaluated using backward stepwise estimation, and retained in the final model where evidence an association with HIV status persisted (p value <0.2) or where effect sizes of other covariates differed by >10%. Bivariate and multivariate analyses of risk factors for HIV were restricted to men not known to have tested HIV positive prior to this study (n = 278).

Characteristics of participants were also compared to characteristics of the adult male population reported in KDHS 2008-09[71], from which the age-distribution of adult men was used as reference for age-standardised comparisons.

Results

Between August 2005 and April 2007, 285 men who reported sex with men were identified. MSM represented approximately one-third of all subjects screened for enrolment; others included 228 female sex workers and 146 men at high risk of heterosexually acquired HIV infection.

Sociodemographic characteristics

The sociodemographic characteristics of MSM screening for enrolment are shown in Table 3.

Age

The average age of study participants was 28.1 years (median 27 years (IQR 23-32)). In comparison to national estimates of population distribution of adult men (18 years +) in urban settings (source: KDHS 2008-09[71] Figure 7), the age distribution of study participants was younger, and comparatively few were over 45 years of age. This age-distribution is consistent with two other studies of MSM populations in Kenya. In a venue-based study of male sex workers operating in Mombasa, Geibel reported an average participant age of 26 years[106]. In Nairobi, MSM recruited to a behavioural study were within the age-range 18 – 55 years, with a median age of 26[92].

Figure 7: Age-distribution of study participants vs. Kenyan urban male population

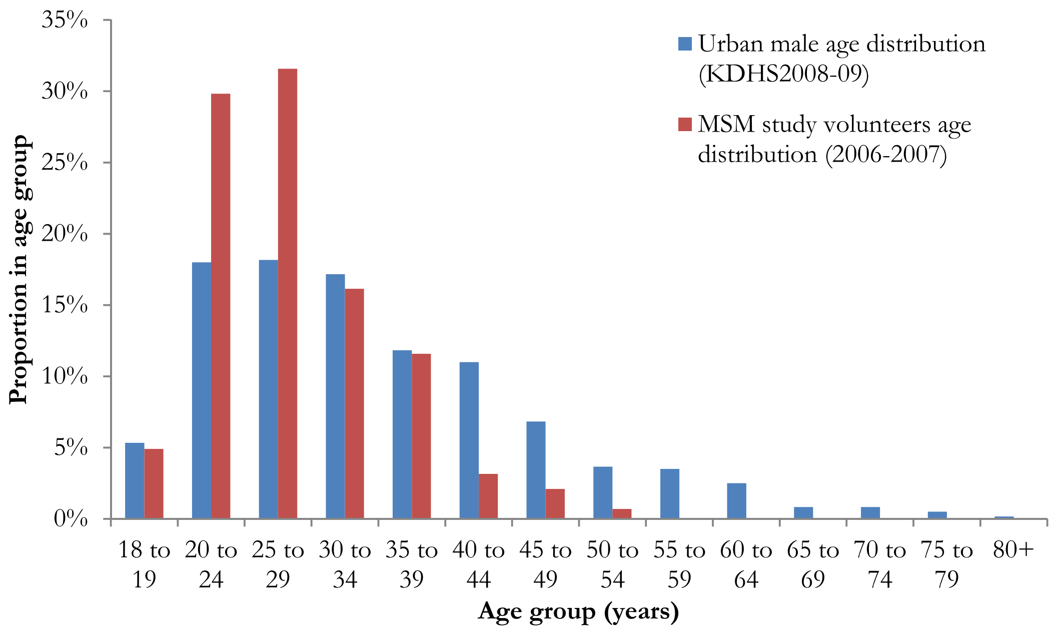


Table 3: Sociodemographic Characteristics

		N or median	% or IQR
Age	Median age in years	27	23-32†
Highest level of educational attendance	None	21	7.4
	Primary	151	53.0
	Secondary	89	31.2
	Tertiary	24	8.4
Level of education	Median years in education	8	7-11†
Employment	Unemployed	139	48.8
	Self-employed	95	33.3
	Formal employment	51	17.9
Monthly income	10,000 KSH +	31	10.9
	5,000-9,999 KSH	49	17.2
	2,000-4,999 KSH	72	25.3
	<2,000 KSH	133	46.7
Personal assets	Private toilet	78	27.4
	Tap water (private or shared)	169	59.3
	Electricity	131	46.0
	Television	74	26.0
	Mobile phone	66	23.2
	Median asset count	1	0 -2†
Marital status	Single	241	84.6
	Married	20	7.0
	Separated or widowed	24	8.4
Religion	Catholic	72	25.3
	Protestant	60	21.1
	Muslim	116	40.7
	Other	3	1.1
	None	34	11.9
Circumcision status‡	Yes	255	92.1
	No	22	7.9

†IQR (inter-quartile range) ‡ Circumcision status missing for 8 participants

Education

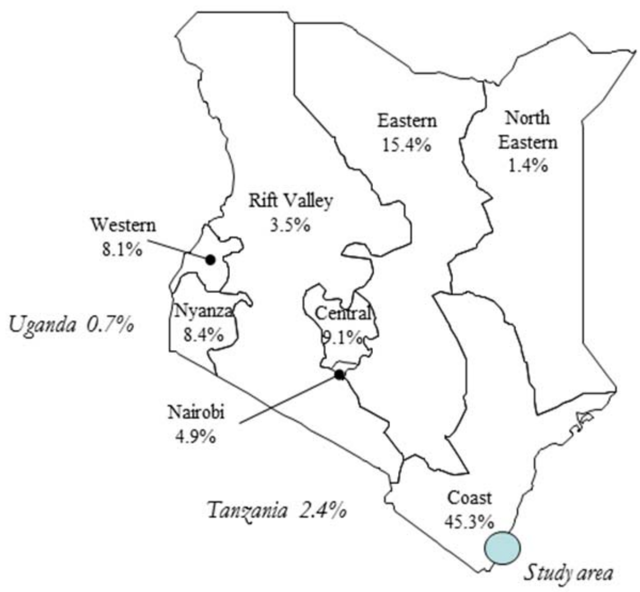
Twenty-one participants (7.4%) had received no schooling, somewhat more than adult men in Coastal province as a whole[71]. Overall MSM reported a slightly lower median number of years of education was 8.0 (IQR 5 – 10), compared to 8.3 among all adult males in Coast province. Even when accounting for the relatively young age of the population, MSM were twice as likely to have had no education (7.4% observed vs. 3.3% expected; age-standardised ratio 2.22), similarly likely to have attended primary education only (53.0% observed vs. 48.3% expected; age-standardised ratio

1.10), and less likely to have had secondary or higher education (39.6% observed vs. 47.7% expected; age-standardised ratio 0.83) than adult men in Kenya as a whole[71].

Birthplace, ethnicity and religion

Most study participants were native to Kenya: 274/285 (96.4%) were born in Kenya and 9 (3.2%) were born in Uganda or Tanzania. Of Kenyan born MSM, 54.7% (156/285) had been born outside Coastal province (Figure 8). Of participants reporting a birthplace outside of the Coast, most reported moving to the study area as an adult: 91.7% (143/156) were 18 years or older when first living in the study area (median age of arrival in study area: 24 years (IQR 21 - 28)). Participants reporting having been born of the Coast predominantly identified themselves with tribes native to the area (Digo (15.5%), Duruma (4.7%) Giryama (13.2%), Taita (14.0%), Bajun (5.4%)), whereas participants moving to the study area were more representative of larger tribes dominating Kenya's interior (Kikuyu (25.5%), Luhya (17.9%), Luo (13.1%), Meru (5.5%)) and the Kamba (21.4%), a tribe originating from the Tanzanian border.

Figure 8: Location of birth, study participants (n=285)



MSM less often reported following a formal religion (88.1%) than other Kenyan men (96.0%). However, participants in the survey were more likely to observe Muslim religion (40.7%) than

Kenyan men in general (13.1%). This likely reflected the location of the study within considerable regional heterogeneity in Kenyan religious affiliation. When stratified by province of birth: participants born on the Coast were significantly more likely to observe Muslim faith than participants native to other parts of Kenya (64.3% vs. 21.2%, χ^2 p<0.001), whilst participants born elsewhere were more likely to observe a Christian faiths (60.9% vs. 28.7%, χ^2 p<0.001) or no faith at all (17.8% vs. 7.0%, χ^2 p=0.006)

Marital status

A minority of participants reporting being in a current marital relationship with a female spouse (7.0%) or having previously been married (8.4%). This was markedly lower than men of similar age in Kenya: in age-standardised comparison to other Kenyan men, participants were more likely to never have married than would be expected among adult Kenyan men[71](observed 84.6% vs. expected 44.4%; age-standardised ratio 1.90), and much less likely to be in a current marital relationship (observed 7.0% % vs. 50.0% expected; age-standardised ratio 0.14).

Sexual partners and risk behaviour

Table 4 charts sexual risk behaviours and HIV testing. 97.8% reported anal intercourse (AI) in the prior three months, although questionnaire design did not distinguish between heterosexual and homosexual AI. 114 men (40%) reported only sex with men, whilst 171 (60%) men reported sex with both men and women, although period of reference was unspecified. Twelve (4%) MSM reported having been forced to have sex against their will in the last three months. Only 7.0% (20/229) claimed to know the HIV status of any of their partners, and 0.7% (2/229) knew their partner to be HIV positive.

Of MSM who reported AI in the last three months, 37.2% reported that all episodes had been unprotected by condoms, and over three-quarters of MSM (81.8%) reported at least one episode of unprotected AI with any partner (male or female) in the last 3 months. Questionnaire design did not differentiate condom use by AI role or gender of partners. Only 4 participants (1.4%) reported the use of injecting drug use in the last three months.

Table 4: Sexual risk behaviour among MSM

		N or median	% or IQR
Sexual partnerships			
Number of different sexual partners (last month)	Regular	1	0 – 1
	Casual	2	1 – 5
Partner gender (period not specified)	Only male partners	114	40.0
	Male and female partners	171	60.0
Commercial, group, and non-consensual sex (last 3 months)	Received money or goods for sex	211	74.0
	Paid another person for sex	109	38.2
	Participated in group sex	41	14.4
	Forced to have sex	12	4.2
Participation in AI (last 3 months)	Any IAI†	207	72.6
	Any RAI	155	54.4
	Both IAI and RAI†	83	29.1
Use of condoms and risk awareness			
Condom use with regular partners (last week)	Always	37/133	27.8
	Sometimes	14/133	10.5
	Never	82/133	61.7
Condom use with casual partners (last week)	Always	101/175	57.7
	Sometimes	24/175	13.7
	Never	50/175	28.6
Condom use for AI (last 3 months)	Always	51/279	18.3
	Sometimes	124/279	44.4
	Never	104/279	37.3
HIV testing			
Prior HIV testing	Never tested	212	74.4
	Tested	72	25.3
	Unknown	1	0.4
Prior HIV test result	Last result positive	7	9.7
	Last result negative	60	83.3
	Last result unknown	5	6.9

† Risk assessment did not distinguish between heterosexual and same sex AI

Transactional sex

Most MSM (74%) reported selling sex for money or goods in the prior three months. MSM who reported female partners during the previous three months were significantly more likely to have paid someone else for sex over the same period. MSM selling sex reported higher numbers of casual sexual partners in the last month than MSM not selling sex (median 3 casual partners vs. 0, $p<0.001$), and were more likely to report unprotected sex with casual partners (of either gender) in the last week (41.4% vs. 25.3%, $p=0.013$). By contrast, there was no difference in numbers of regular partners (median 1 vs. 1, $p=0.133$) or reported condom-unprotected AI in the past 3 months (79.5% of male sex workers vs. 80.0% of non-sex workers, χ^2 $p=0.831$).

Sexually transmitted infections

Prevalence of sexually transmitted infections (STIs) at enrolment screening are shown in Table 5. Of 277 participants undergoing genital examination (8 refused), 62 (22.4%) had urethral discharge, confirmed microscopically as gonococcal urethritis in 3.2% (n = 9) and non-specific urethritis in 12.6% (n = 35) of participants. Prevalence of perianal condylomata was higher in MSM reporting RAI than MSM who did not (6.3% vs. 0.9%, $p = 0.032$). The same trend was apparent for prevalent perianal ulceration, but differences were not significant (3.5% vs. 2.0%, $p=0.506$).

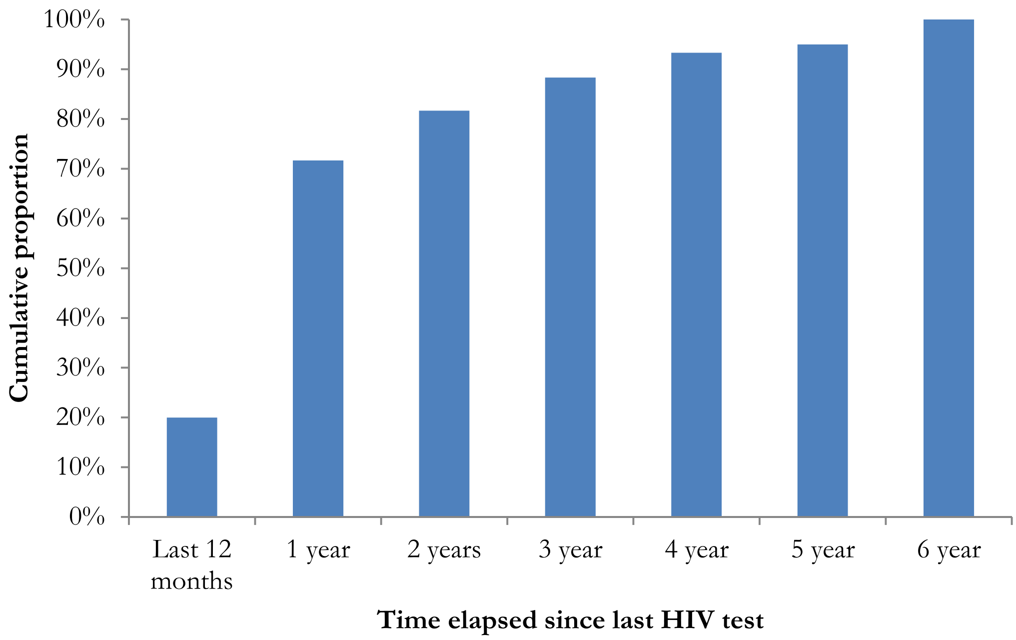
Table 5: Sexually transmitted infections among MSM

		N/total	%	HIV-1 prevalence % (95% CI) ‡
Clinically signs of STI (at enrolment) §	Urethral discharge	62 / 277	22.4	27.4 (17-40)
	Penile ulceration	11 / 277	4.0	36.3 (11-69)
	Perianal condylomata	10 / 254	4.0	70 (35-93)
	Perianal ulcer	10 / 243	4.1	71 (29-96)
Laboratory investigations	TPHA & RPR seropositive	10/285	3.5	50 (12-88)
	HIV-1 seropositive	70 / 285	24.6	-

§ Missing records for STI data: urethral discharge & penile ulceration (8 missing), perianal condylomata (33) & perianal ulcers (42), largely due to refusal of genital or anal examination.
‡ Exact binomial confidence interval

MSM HIV prevalence at enrolment was 24.6% (CI 19.5 -29.6), compared to 12.3% (n=146: CI 6.9 – 17.7) in 'high risk' heterosexual men (multiple partners or STI diagnosis in the past month) and 32.9% (n=228: CI 26.8 – 39.0) in female sex workers. Overall, 25.3% MSM reported prior HIV testing. 77.1% of MSM HIV-positive at screening claimed never to have previously HIV tested, and only 10% (7/70) correctly self-reported their status. 14.3% (10/70) had CD4 counts <350/mm^3 and 13/53 (23.5%: 17 missing clinical assessments) had WHO stage 3-4 HIV disease[107]. Similarly, 73.5% of MSM HIV-negative at screening had never previously tested. Among the 60 MSM reporting previous negative HIV testing, the median period elapsed since the last negative test was 1 year (IQR 1 – 2 years, Figure 9).

Figure 9: Period since last HIV test among 60 MSM reporting prior HIV negative test result



Risk factors for HIV

Bivariate and multivariate analysis of factors associated with HIV prevalence is shown in Table 6. Reporting any RAI in the past three months was strongly associated with being HIV positive (unadjusted OR 4.6, 95% CI 2.3 – 9.1). This association persisted when adjusted for other identified risk factors including age group, religious group, partner preference, AI without condom (3 months), injecting drug use (3 months), paying for sex (3 months), perianal warts or ulcers, and prior negative testing for HIV. Recent injecting drug use was strongly associated with HIV positivity, but this was rarely reported. Increasing age (modelled as a continuous variable) was associated with increasing HIV prevalence in confounder adjusted models, and both Muslim and Protestant observing MSM had a higher HIV prevalence than MSM observing Roman Catholicism, even after confounder adjustment.

The odds of HIV-1 infection were 5 times higher among MSM who exclusively had sex with men, compared to behaviourally bisexual men. Exclusive MSM were also more likely to report RAI in the previous 3 months than were bisexual MSM (63.1 vs. 38.7%, χ^2 p=0.001), but were no more likely to have reported unprotected AI (82.3% vs. 78.5%, χ^2 p=0.692) and slightly less likely to report having sold sex in the previous 3 months (72.3% vs. 76.0%, χ^2 p=0.566). Further, adjustment for potential behavioural confounders strengthened rather than weakened the measure of association between exclusive MSM behaviour and HIV prevalence (aOR HIV (exclusive vs. bisexual) 6.3, CI 2.3 – 17.0).

MSM who reported being paid for sex by another person in the past three months were slightly less likely to be HIV positive than MSM who denied such behaviour (not statistically significant). MSM who reported paying someone else for sex in the past three months were significantly less likely to be HIV positive than those who did not, even after confounder adjustment (Table 6).

Clinical evidence of perianal condylomata was independently associated with HIV positivity (aOR 5.1, 95% CI 1.1 - 24). An apparent relationship between perianal ulceration and prevalent HIV was not statistically significant. Associations of other risk factors were not markedly affected by the choice to include other STIs as model covariates (data not shown).

Table 6: Selected crude and adjusted risk factors for HIV †

		HIV positive n (%)	N	*Crude HIV prevalence OR* OR	95% CI	Wald p value	*Adjusted HIV prevalence OR‡* OR	95% CI	Wald p value
Age	*18-24*	17 (17.4)	98	1.03 per year	0.99-1.07	0.185	1.10 per year	1.04 - 1.2	0.001
	25-34	35 (26.5)	132						
	35+	12 (25.0)	48						
Religion	*Catholic*	8 (11.6)	69	ref			ref		
	Protestant	19 (31.7)	60	3.5	1.4-8.8	0.007	4.2	1.4-13.0	0.012
	Muslim	25 (22.3)	112	2.2	0.9-5.2	0.074	2.4	0.9-6.8	0.098
	Other	12 (32.4)	37	3.7	1.3-10.0	0.012	9.9	2.7-36.2	0.001
Sexual Behaviour									
Receptive anal sex (3 months)	*Yes*	51 (34.0)	150	4.6	2.3-9.1	<0.001	6.1	2.4 – 15.5	<0.001
	No	13 (10.2)	128	ref			ref	-	
Any unprotected anal sex (3 months)§§	*Yes*	56 (25.0)	224	1.9	0.8-4.3	0.111	2.3	0.8 - 6.7	0.147
	No	8 (14.8)	54	ref			ref	-	
Sexual Partners									
Partner gender (3 months)	*Men only*	44 (40.4)	109	5.0	2.7 – 9.6	<0.001	6.3	2.3 – 17	<0.001
	Men and women	20 (11.8)	169	ref			ref		
Paid another person for sex (3 months)	*Yes*	14 (13.0)	108	0.36	0.18-0.69	0.002	0.38	0.15-0.99	0.049
	No	50 (29.4)	170	ref			ref		
Paid by another person for sex (3 months)	*Yes*	44 (21.6)	204	0.74	0.4-1.37	0.340	-	-	
	No	20 (27.0)	74	ref					
Other risk behaviour									
Injecting drug use (3 months)	*Yes*	2 (50)	4	3.4	0.5 – 25.0	0.198	13.1	0.95– 180	0.055
	No	62 (22.6)	274	ref			ref		
Weekly alcohol use (one month)	*Yes*	30 (22.9)	131	0.99	0.56-1.73	0.964	-	-	
	No	34 (23.1)	147	ref					
Clinical									
Perianal condylomata on examination §	*Yes*	7 (70.0)	10	7.8	1.9-32.4	<0.001	5.1	1.1 – 24	0.040
	No	54 (23.0)	235	ref			ref	-	
Perianal ulceration on examination §	*Yes*	3 (60.0)	5	4.7	0.8-29.3	0.068	5.9	0.6 – 57	0.124
	No	56 (24.2)	231	ref			ref	-	

† Restricted to 278 participants not known to be HIV positive prior to study (7 excluded).
‡ Multivariate adjustments also made for testing negative prior to study (y/n). Bold text indicates statistically significant adjusted risk factor associations (p<0.05). Education and socio-economic measures were not associated
§ Information complete for *perianal condylomata* (245/278), *perianal ulceration* (236/278): missing data analysed as dummy variable (not significant, data not shown) §§ not gender specific

Discussion

This was the first study describing HIV-1 prevalence and behavioural risk factors in a large group of East African MSM, mostly claiming to be unaware of their HIV status. MSM were younger than adult Kenyan men in general and reported comparatively low levels of income (47% <USD$1/day), limited ownership of basic household assets and poor education (61% with primary schooling or less). Regarding sexual behaviour, most MSM reported selling sex in the previous three months, most reported receptive anal intercourse (RAI) and 81.7% reported inconsistent condom use for anal sex during the same period. Conversely, injecting drug use was infrequently reported. The majority of MSM reported sex with women, although a minority were married.

The HIV prevalence of 24.6% among MSM was markedly higher than estimates of HIV prevalence among the general population (2005 UNAIDS estimate for adult prevalence (15-49 years) of 6.1% (95% CI 5.2% -7.0%) in Kenya. Consistent with the known biological risks of HIV transmission by route[108 109], receptive anal intercourse (RAI) and injecting drug use were strongly associated with HIV-1 infection. The relative prevalence of these behaviours however suggests that HIV exposure risk in this population is predominantly driven through sexual behavioural rather than injecting drug use behaviour, assuming behaviours reported at enrolment reflect those pertinent at the time of HIV infection.

Prevalence of other STIs was also considerable. Anal human papillomavirus (HPV)[110] and ulcerative STIs such as HSV-2[111] are known risk factors for HIV acquisition, however co-infection with HIV may also be explained by the common behavioural risk factors for each infection, the likelihood of co-transmission during high risk sexual partnerships or a tendency for increased clinical severity or frequency of HPV and HSV2 among HIV positive persons.

The differences in HIV prevalence by partner gender and sex purchase persisted after adjustment for differences in RAI reporting and were not explained by other behavioural measures collected in this study. The strong independent negative association between bisexual behaviour and HIV prevalence was considered particularly important to clarify given the high proportion of MSM reporting heterosexual contact.

The study design and manner of data collection suffered from two key limitations that precluded further characterisation of HIV risk behaviour among MSM based on enrolment characteristics: the risk of reverse causation and suboptimal measurement and scaling of sexual risk behaviour. In HIV prevalence studies it is potentially impossible to distinguish whether the behaviours observed among HIV positive subjects reflect those responsible for risk at the time of HIV infection, or instead reflect behaviour change resulting from knowledge of HIV status (for example, changing behaviour to reduce the risk to partners) or as a consequence of poor health. Whilst most participants claimed not to know their HIV status at enrolment, it was widely known that the study was seeking HIV negative volunteers but would provide services for volunteers found to be HIV positive at enrolment, likely representing a bias toward false reporting among enrolment volunteers.

Whilst the problem of reverse causation might reasonably be resolved by follow up, the poor precision and potential for behavioural misclassification within cohort assessments would not be. IAVI risk assessments had been subject to hasty amendment upon the identification of an unanticipated MSM population, and the resolution and specificity of MSM behavioural measures were, with hindsight, not ideal. The long or unstated recall periods for MSM-specific questions (3 months) were insufficient to capture heterogeneity among men reporting high frequencies of behaviour, and may have been prone to memory error[112 113]. Behavioural measures of short-term frequency and longer-term anal sex practice that were ideal to characterise heterosexual behaviour had not been appropriately adapted to disaggregate homosexual and heterosexual behaviours, meaning that partner frequencies and insertive anal sex measures were not specific to gender. Finally, reports of negative attitudes of interviewers toward MSM emerging at face-to-face study assessments was already acknowledged to be a problem[114], enhancing the already significant risk of social desirability bias is measures collected in this manner.

The limited potential for the existing IAVI study to characterise sexual behaviour sufficiently, even with further follow up, mandated further behavioural study in this population (Chapter 5).

Chapter 4

REVIEW OF MSM STUDIES IN SUB-SAHARAN AFRICA 2000-2010

Introduction

The previous chapter reported a cross-sectional analysis of risk factors for HIV positivity among a newly identified MSM population enrolling to an IAVI vaccine feasibility cohort in Mombasa, Kenya. This study was among the first highlighting the existence and HIV burden among MSM populations in sub-Saharan Africa. As a result of these initial findings and a new emphasis upon surveillance of most at risk populations within HIV epidemics globally, a number of similar studies of sexual behaviour and HIV risk among African MSM populations have followed.

The following review of this literature was built up over three years of study. The first review was conducted in preparation for the field component of my research, at which time the product of the review was minimal. The review was updated in July 2008, synthesizing new data on MSM in Africa and contemporary policy developments in the WHO, UNAIDS and UNDP and published in the Lancet in 2009[115]. The review described here represents a further update conducted in 2010-11 covering data sources published through December 2009. This contemporary overview of African cross-sectional studies permits comparison of behaviours and HIV risk among MSM populations across sub-Saharan Africa, and situates the specific study population engaged for primary research in coastal Kenya in the following chapters. It should be noted that the emergence of this literature occurred in parallel to field work, and most post-dated the process of prospective research design described in subsequent chapters. The study reported in Chapter 3 is indicated within this review as Sanders et al 2007, consistent with the first authorship of the published article[62]. This is indicated with an asterisk in figures and tables for ease of reference, as such: Sanders at al 2007 *.

Aims

The aims of this review were:

1. To collate and synthesize published data of HIV prevalence/incidence among MSM in sub-Saharan Africa, and to compare this with country-level measures of HIV prevalence in adult men.

2. To collate published data on individual sexual risk behaviours among MSM in sub-Saharan Africa.

3. To collate published individual HIV risk factor analyses, and synthesize these findings using meta-analysis.

Search strategy

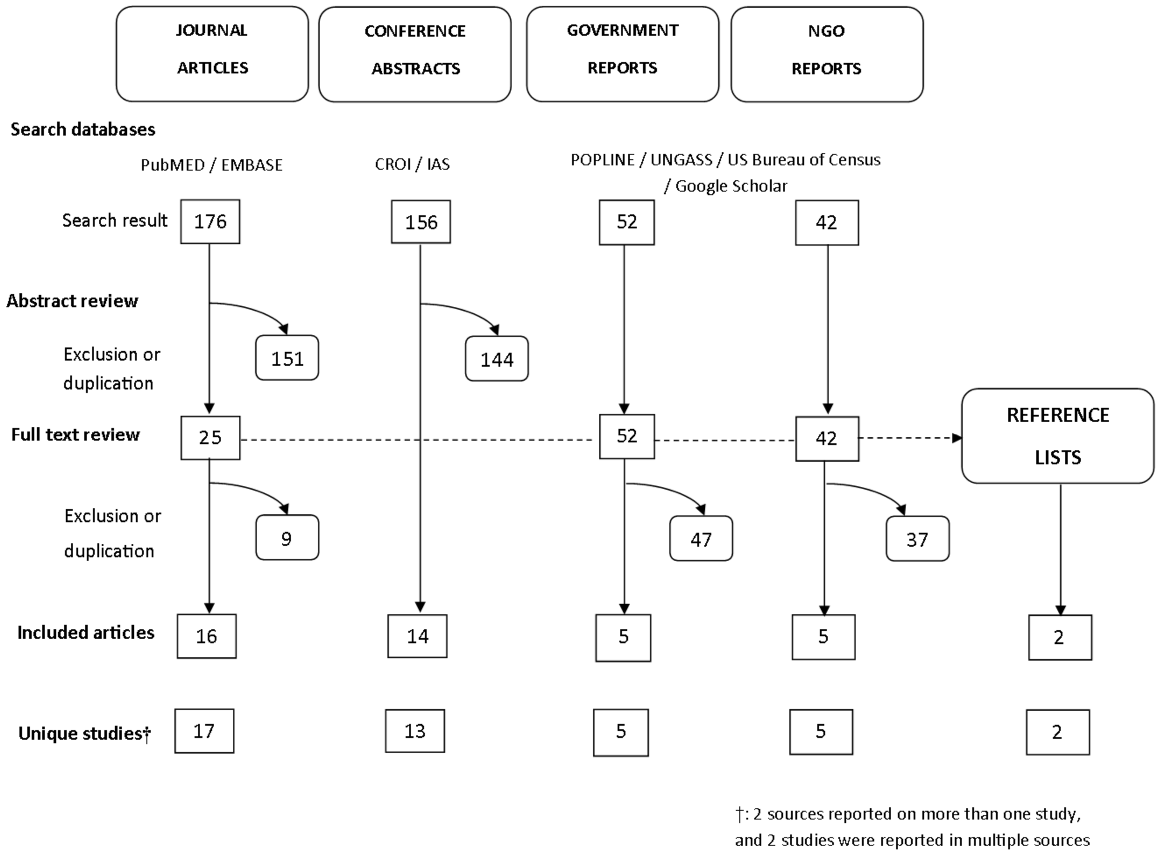
The author performed searches of electronic databases and conference proceedings in July 2010. The electronic databases of peer-reviewed literature included PubMED, MEDLINE and EMBASE (1980-2009). The author also searched the online, CD and text conference proceedings of the International AIDS conference, IAS Conference on HIV Pathogenesis and Treatment[116] and the Conference on Retroviruses and Opportunistic Infections[117]. In addition, the author searched online databases of UNAIDS[118], MEASURE DHS[119], POPLINE[120] and the US Bureau of Census HIV/AIDS Surveillance Data Base[121] to identify governmental and non-governmental reports. Reference lists from all retrieved articles and reports (including reviews) were also searched. No date or language limits were specified. A detailed account of search terms and results by each literature source can be found in Appendix 4.1. Inclusion criteria were specified prior to conducting searches.

Inclusion criteria were:

- studies of cohort, case-control or cross-sectional design
- studies recruiting MSM (including homosexual, bisexual, male sex workers, transgendered individuals)
- studies conducted in sub-Saharan countries (defined as countries within Western, Central, Eastern and Southern African UN administrative region and Sudan)
- studies reporting quantitative data on sexual behaviour and/or HIV prevalence
- articles reporting original data

Inclusion criteria were applied to the abstract in the first instance, and again to the full report after retrieval. Review articles were excluded. Articles that reported on studies that had adopted purely qualitative methods, or that had focussed on characteristics of MSM groups other than sexual behaviour or HIV risk were excluded. Quality of study reporting and study design was assessed for each report using a template (Appendix 4.2) based upon the STROBE guidelines for reporting observational studies [122]. The process is summarised in Figure 10.

Figure 10: Schematic summary of literature search results



Sensitivity of search strategy

The sensitivity of the search was assessed by comparison with other published systematic reviews of MSM in low and middle income countries. Baral et al reviewed studies reporting HIV prevalence amongst MSM populations in low and middle-income countries between 2000-2006[123] identifying three studies from sub-Saharan countries, each also identified by this review.[63 99 124] Cáceres at al conducted a broader review of studies reporting either HIV prevalence or sexual behaviours among MSM [125], finding eight such surveys of MSM from sub-Saharan African countries, all also identified by this literature review[61 63 99 101 124 126-128]. This review identified relevant studies during the respective search periods of the Baral and Cáceres reviews that were not identified by those reviews, suggesting that this search strategy was more sensitive.

Data abstraction

For each included study, the tables and text were explored for reports of whether or not specific socio-demographic, behavioural or clinical variables had been collected from participants in the conduct of each study. Where present, the following data points were extracted from each study, and entered into a Microsoft Access database:

1. **Study characteristics** (date of survey, region of study, sampling method, sample size)

2. **HIV prevalence, risk factors for HIV positive status and previous HIV testing**: for the subgroup of studies reporting both HIV prevalence and sexual behaviour, information was recorded on the analysis of risk factors for HIV positive status.

3. **Anal intercourse**: AI role; unprotected AI; knowledge of HIV risk from AI.

4. **Transactional sex**: exchange of money or goods for sex (sex purchased or sex sold, by period)

5. **Behavioural sexuality**: sexual intercourse with a female; unprotected heterosexual intercourse; current and prior marital status.

6. **Self-identified sexuality** (gay, homosexual, bisexual, straight, heterosexual, transgender, or locally identified terms)

7. **Non sexual risk behaviours**: alcohol consumption and injecting drug use

Reference data

Adult male HIV prevalence by country

National estimates of HIV prevalence amongst the adult male population (15 years and above) and HIV testing uptake were sourced for comparison to estimates reported by included studies of MSM. The numerator (number of male adults (15 years +) living with HIV/AIDS by country) in 2007 was extracted from the 2008 UNAIDS epidemic report[129]. For Zanzibar (an island province of Tanzania with its own AIDS Commission (ZAC) and surveillance mechanisms), adult male prevalence was extracted from the Tanzania HIV/AIDS Indicator Survey 2007.[130]. The denominator (number of adult males (15 years +) by region & country for 2007) was extracted from the US Bureau of Census International Data Base [131].

Uptake of adult male HIV testing by country

The proportion of adult men who had taken and received the results of an HIV test in the last 12 months was abstracted from UNGASS country reports[118] and Measure DHS [119], where either was available.

Data analysis

Descriptive analysis of abstracted data was performed in Microsoft Excel (version 10) and Stata (version 10)[132]. HIV prevalence ratios represent the ratio of observed HIV prevalence amongst MSM (extracted from identified studies) to the estimated HIV prevalence amongst adult males. Where not reported by studies, unadjusted confidence intervals for prevalence ratios were calculated using exact methods[133].

Ecologic meta-analysis

Fixed and random effects meta-analysis was used to summarise study estimates of HIV prevalence and HIV prevalence ratios. Prevalence studies that did not report sample size or sample variance were excluded from meta-analysis. For studies employing respondent driven sampling (RDS) methods, the sample weighted prevalence and variance were used, if reported. HIV prevalence ratios and standard errors were log-transformed for analysis, whilst prevalence measures were analysed without adjustment. Studies were weighted using the inverse variance method for fixed effects (FE) and DerSimonian & Laird (D&L) for random effects analyses[134]. Heterogeneity was statistically quantified by the I^2 (indicating the proportion of heterogeneity beyond chance) and significance tests for heterogeneity[135]. For analyses with evidence of heterogeneity, random-effects pooled measures as well as median estimates were presented in preference to fixed effects. Sub-group meta-analyses were conducted to explore the effect of country, sampling method, year of study and HIV testing method upon heterogeneity.

Correlation between estimates of HIV prevalence among MSM versus adult men were directly explored using weighted linear regression. Ratio measures were log transformed to assume normal distribution, assessed using Shapiro-Wilk test of normality[136]. Units for regression analysis were individual MSM studies, weighted by their sample size (Stata 10 command option: *aweight*[132]). Regression analyses were tested for evidence of heteroskedascity[137].

Risk factor meta-analysis

Fixed and random effects meta-analysis methods were also used to summarise reported associations between HIV prevalence and individual risk factors across studies from which the crude bivariate HIV prevalence ratio and variance had been abstracted (directly or by calculation). Bivariate HIV prevalence ratios were abstracted for 12 studies for the following independent variables: unprotected AI, transactional sex, self-identified sexuality, behavioural sexuality, injecting drug use and alcohol consumption, though most studies omitted to report all covariates of interest. Study authors were approached to clarify relevant data where variables were reported as measured but not included in reported analyses. The meta-analysis methods used were as described above.

Characteristics of identified studies

The literature review identified 42 distinct studies of MSM populations which satisfied the inclusion criteria (Figure 10). HIV prevalence was measured in 24 distinct MSM populations (reported in 25 studies), with sexual behaviours in 21 populations and formal HIV prevalence risk factor analysis in 12 MSM populations (Table 7). 20 studies reported sexual behaviours among 18 additional MSM populations, but did not measure HIV status during the study (Table 8).

The 42 surveys represented MSM populations from 19 of 47 sub-Saharan African countries (9 West African Countries (Mali, Senegal, Mauritania, Burkina Faso, Cote D'Ivoire, Ghana, Togo, Nigeria and Cameroon), 4 East African Countries (Kenya, Uganda, Tanzania (Zanzibar only) and Rwanda), 5 Southern African countries (Malawi, Namibia, Bostwana, Zambia and South Africa) and Sudan. South Africa (11), Kenya (4), Nigeria (4) and Senegal (3) stood out as countries with markedly more MSM studies. Most studies (31) were published in the two years preceding this review. The first review of this literature in 2007 (in preparation for fieldwork in Chapters 5-7) yielded only 9 studies, just two of which included HIV status measurement[63 101].

Quality of study design and reporting

Sources

Overall, 30 studies had been subject to peer-review prior to publication, either appearing in a peer-reviewed journal (17 surveys) or as material presented at conferences employing a peer-review based scientific selection process (13 surveys). Of the remaining 12 surveys, 5 were reported in governmental documents, and seven were reports from non-governmental organisations.

Study design

Despite not being an inclusion criterion, all identified studies were of cross-sectional design, including all risk factor studies. No examples of reported cohort or case-control studies of HIV risk were identified.

Eligibility criteria

26 (62%) of the 42 studies reported a clear definition of the population recruited, based either on sexual behaviour or sexual orientation. 16 reports merely assert that the study population were 'MSM'. Most studies defined MSM as men reporting same-sex practices over a period of time

(Table 7 & Table 8), although these varied markedly from lifetime behaviour(e.g. 'ever had sex with a man'[63]) to proximate behaviour (e.g. 'AI with a man in the last 3 months'[101]). Two studies recruited MSM based on self-identified orientation (gay or bisexual) rather than behaviour[60 127] and one study recruited only MSM identifying themselves as sex workers[138].

Sample size

Sample sizes ranged from 21 to 1125 MSM, with three studies recruiting populations lower than 50 men. One study did not report sample size [139]. The sample size was higher for studies that measured HIV status (median 360 persons (IQR 158-590) vs. 278 (behaviour only studies)), and for studies employing respondent-driven sampling designs (7 studies: median 674 persons (IQR 347-1023) vs. VCT (2 studies: sample sizes 370 & 780) and snowball samples (10 studies: median 322, IQR 213 – 456).

Sampling strategy

Five studies did not report sampling method: four government reports[139-142] and one conference abstract[128]. One further conference abstract reported the sampling method to be 'purposeful', without detail [143]. Most studies applied one or more convenience approaches to sampling: 21 studies relied upon a single approach to sampling: 18 studies used snowball referral only, three studies used venue-based sampling only, and five applied a combination of convenience approaches

Nine studies used sampling methods potentially yielding estimates representative of a wider population of MSM. Seven studies reported using respondent driven sampling (RDS) yet three studies did not adjust the survey results for this design[144-146], and two did so only in part[127 147-149]. Only two studies applied direct population based sampling methods, one identifying MSM from representative national household survey[150], and one identifying MSM from men attending VCT services[99].

Ethnicity

Objective ethnicity was infrequently reported with the exception of studies in South Africa. Within South Africa the ethnicity of study subjects varied. Most reported on predominantly Black African MSM (Lane et al (Soweto/Guateng) – 100% (2004[143]) 94% (2008[151]) 99% (2009[152]), Rispel (Johannesburg & Durban) – 88%[149].Burrel reports on two populations, a predominantly Black

African peri-urban population and a 'White/Coloured' urban population (personal communication) [153]. Parry and Sandfort samples predominantly represent 'White/Coloured' (82%[154] & 58%[155]) and smaller proportions of Black Africans (15%[154] & 35%[155] respectively).

Study measures

1. HIV measurement

The features of studies reporting the HIV prevalence amongst MSM populations are listed in Table 9. All studies were cross-sectional in design. 24 studies included a laboratory measure of HIV status, of which fifteen studies used rapid blood tests to declared testing algorithms. Diagnostic algorithms based on two rapid blood tests are known to have high sensitivity (99.7%) and specificity (99.9%). Six studies used HIV tests of oral fluid, known to have a lower but still high diagnostic accuracy than blood tests (sensitivity 99.1%, specificity of 99.6%[156]). Three studies did not specify the manner of laboratory HIV diagnosis.

2. Behaviour measurement

Thirty-five studies report collection of socio-demographic and sexual behaviour information via structured recall-based questionnaires. In most cases, behavioural measures were collected by interview with research staff (30 studies), some noting representation of MSM amongst interview staff. Five studies administered self-completion questionnaires, but in only one case with no contact between research staff and participants[60]. One further study provided the option of self-completed questionnaires (by internet or post) and face to face interviews with research staff[155]. Three studies reported quantitative measures of behaviour derived entirely from transcripts of semi-structured interviews[143 154 157].

Behaviour measures differed both in their scope and specific wording of questions. In particular, studies varied in the duration of recall, the specificity of sexual act measures and the resolution of the measurement (binary vs. count measures). Beyond sexual behaviour measures, the number of other potential risk behaviours measured varied: most studies also collected either clinical or self-reported measures of recent or current sexually transmitted diseases and collected data regarding participation with transaction sex, drug and alcohol use.

Table 7: MSM studies including measurement of HIV status

Country	First author & publication year	Publication type	Region of study	Inclusion criteria	Sampling strategy	Sample size	Behaviour measures†	HIV test	HIV risk factor analysis
Botswana	Baral 2009[158]	Journal	Gaborone	AI with another man, ever	Snowball	117	IAQ	Oral	Y
Cote D'Ivoire	Republique De Cote D'Ivoire 2008[140]	Government report	Not stated	Not stated	Not stated	54	N/A	Not stated	N
Ghana	AED/SHARP 2007[159 160]	NGO report	Accra	Oral or AI with another man, last 12 months	Snowball	385	IAQ	Blood	N
Kenya	Angala 2006[99]	Conference abstract	Nairobi	Not stated	VCT	780	IAQ	Blood	Y
	Sanders 2007*[101]	Journal	Mombasa	Sex with another man, last 3 months	Snowball	285	IAQ	Blood	Y
Malawi	Baral 2009[158 161]	Journal	Blantyre, Lilongwe	AI with another man, ever	Snowball	201	IAQ	Oral	Y
Mali	CSLS 2009[162]	NGO report	Bamako	Not stated	Snowball	417	IAQ	Blood	N
	Republique du Mali 2008[139]	Government report	Bamako	Not stated	Not stated	Not stated	N/A	Not stated	N
Mauritania	Republique Islamique de Mauritanie 2008[141]	Government report	Not stated	Not stated	Not stated	21	N/A	Not stated	N
Namibia	Baral 2009[158]	Journal	Windhoek	AI with another man, ever	Snowball	218	IAQ	Oral	Y
Nigeria	Adebajo 2008[144]	NGO report	Lagos & Ibadan	Self-identified as MSM	RDS	1125	IAQ	Blood	Y
	Federal Republic of Nigeria 2008[145]	Government report	Lagos, Kano, Cross River	Sex with another man, last 6 months	RDS	879	IAQ	Blood	Y

Country	First author & publication year	Publication type	Region of study	Inclusion criteria	Sampling strategy	Sample size	Behaviour measures†	HIV test	HIV risk factor analysis
Senegal	Wade 2005[63]	Journal	Dakar and other cities	Sex with another man, ever	Snowball	463	IAQ	Blood	Y
	Wade 2008[163]	Conference abstract	Dakar and other cities	Sex with another man, ever	Snowball	501	IAQ	Blood	N
South Africa	Parry 2008[154]	Journal	Durban, Cape Town, Pretoria	MSM using illicit drugs last month	Snowball and street intercept	76	IDI/FGD	Blood	N
	Burrell 2008[153]	Conference abstract	Cape Town, peri-urban	Not stated	Venue-based	73	Self	Oral	N
	Burrell 2008[153]	Conference abstract	Cape Town, urban	Not stated	Venue-based	540	Self	Oral	Y
	Lane 2009[152]	Journal	Soweto	Oral or AI with another man, last 6 months	RDS	363	IAQ	Blood	Y
	Rispel / Metcalf 2009[148 149]	Conference abstract	Johannesburg, Durban	Sex with another man, last12 months	RDS	282	Self	Blood	Y
	Baral 2009[164]	Conference abstract	Cape Town	AI with a man, ever	Venue-based	200	IAQ	Oral	Y
	Shisana 2009[150]	Government report	National	Not stated	Household survey	86	IAQ	Blood	N
Sudan	Elrashied 2006[124]	Conference abstract	Khartoum	RAI with a man	Snowball	713	IAQ	Blood	N
	Elrashied 2008[165]	Conference abstract	Khartoum	IAI with a man	Snowball	406	IAQ	Blood	N
Tanzania	Dahoma 2009[166-168]	Journal	Zanzibar	AI with a man, last 3 months	RDS	509	IAQ	Blood	Y

† **IAQ**: Interviewer administered questionnaire **Self**: Self-completed questionnaire **IDI**: In-depth interview **FGD**: Focus group discussion **N/A:** No behavioural assessment reported

Table 8: MSM behavioural studies not including measurement of HIV status

Country	First author & publication year	Publication type	Region of study	Inclusion criteria	Sampling strategy	Sample size	Behaviour measures †	Self report HIV status
Botswana	Ehlers 2001[60]	Journal	Not stated	Self-identified gay or bisexual man	Snowball	42	Self	N
Burkina Faso	Kalifa 2008[142]	Conference abstract	Ouagadougou	Not stated	Not stated	62	IAQ	N
Cameroon	Henry 2009[169]	Journal	Douala	Sexual intercourse with a man (6 months)	Snowball	142	IAQ / IDI	N
Ghana	Attipoe 2004[170]	Online report	Not stated	Not stated	Snowball	150	IAQ	N
Kenya	Onyanyo-Ouma 2005[92]	NGO report	Nairobi	Sexual intercourse with another man (ever)	Snowball and Venue-based	500	IAQ/ IDI	N
	Geibel 2008[138]	Journal	Mombasa	Male sex worker selling sex to men	Time-location	425	IAQ	N
Malawi	Ntata 2008[171]	Journal	Central & south east regions	Men having sex with other men	Snowball	97	IAQ	N
Nigeria	Allman 2007[126]	Journal	Not stated	Not stated	Snowball	58	Self	N
	Centre for the Right to Health 2008[172 173]	NGO report	Abuja	Manual, oral or AI with another man (ever)	Snowball, internet, venues	400	IAQ	N
Rwanda	Binagwaho 2009[174]	NGO report	Kigali	Oral or AI with another man (last 12 months)	Snowball	99	IAQ	N
Senegal	Niang 2003[61]	Journal	Dakar	Intimate sexual relations with another man (lifetime)	Snowball	250	IAQ/IDI	N
South Africa	Lane 2004[143]	Conference abstract	Johannesburg	Not stated	'Purposive'	48	IDI	N
	Lane 2008[151]	Journal	Johannesburg	Manual, oral or AI with another man (lifetime)	Snowball and venue-based	199	IAQ	N
	Sandfort 2008[155]	Journal	Gauteng, KwaZulu-Natal, Western Cape	Not stated	Snowball and Venue-based	1045	IAQ / Self	N
	Middelkoop 2009[146]	Conference abstract	Johannesburg	Not stated	RDS	100	IAQ	Y
Togo	Geiss 2008[157]	Conference abstract	Four cities	Not stated	Snowball	122	IDI	N
Uganda	Kajubi 2007/Fisher Raymond 2009[127 147]	Journal	Kampala	Self-identified as gay or bisexual	RDS	224	IAQ	N
Zambia	Zulu 2006[128]	Conference abstract	Lusaka	Not stated	Not stated	641	IAQ	Y

† **IAQ**: Interviewer administered questionnaire **Self**: Self-completed questionnaire **IDI**: In-depth interview **FGD**: Focus group discussion

HIV prevalence among MSM

As of January 2010, HIV prevalence studies had been conducted in thirteen sub-Saharan African countries (Table 9). One study was identified from Botswana, Ghana, Mauritania, Malawi, Namibia, Mali, Cote D'Ivoire and Zanzibar. Two studies were identified from Senegal, Nigeria, Kenya and Sudan. A total of seven studies were identified from South Africa. No HIV prevalence data existed for the majority of countries in sub-Saharan Africa.

MSM HIV prevalence ranged from 7.8% among MSM reporting insertive anal sex with men in Sudan[165] to 44% among MSM recruited in Johannesburg and Durban, South Africa[149](Table 9). There was significant heterogeneity in prevalence estimates (I^2 = 92.7%, test for heterogeneity p<0.001, Figure 11). Pooled HIV prevalence for sub-Saharan Africa using random effects meta-analysis was 18.6% (CI 15.6 – 21.4%) and the median HIV prevalence across studies was 19.0% (IQR 12.3 – 24.5%).

For countries with more than one study, HIV prevalence estimates were homogenous within Senegal, Sudan and Nigeria (I^2=0%), but heterogenous between studies conducted within Kenya (I^2 =96.4%) and within South Africa (I^2 =95.4%). This may reflect similarities between study methods and study locations: Senegal, Sudan and Nigeria used the same sampling methods across studies, and studies in Senegal and Sudan were conducted in the same location. In contrast, Kenyan and South African studies applied a range of sampling methods (Table 7), were conducted in different locations (Table 7), and in South Africa reflected different ethnic and racial groups.

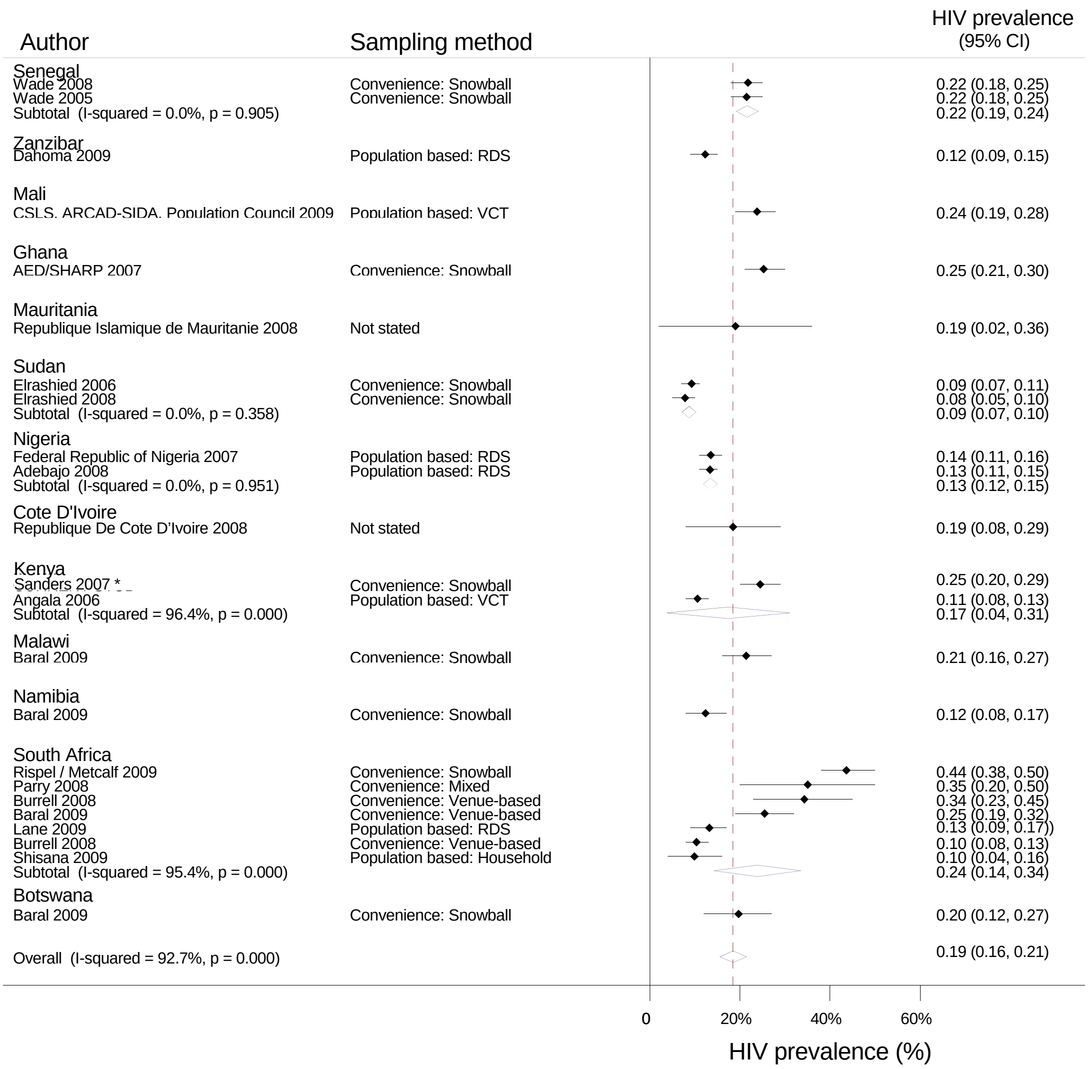
Sub-group meta-analysis indicated significant differences in HIV prevalence estimation by mode of study sampling where stated: convenience sampling (14 studies): RE-pooled HIV prevalence 21.5% (CI 16.7-26.4), vs. population based sampling (7 studies): RE-pooled HIV prevalence 13.7% (CI 11.2-16.2). Sub-group meta-analysis by method of HIV testing (oral, blood, unstated) and year of study did not indicate heterogeneity by these factors.

Table 9: Literature review: HIV prevalence amongst MSM

Country	Study (author & year)	Year of study	Sample size (tested)	Age (median)	HIV positive (n)	HIV positive (%)	95% confidence interval (%)	Estimated national HIV prevalence (males, %)
Botswana	Baral 2009 [158]	2008	117	24	23	19.7%	14 – 28	18.1
Cote D'Ivoire	Rep Cote D'Ivoire 2008 [140]	2006	54	NA	10	18.5%	8 – 29	2.9
Ghana	AED/SHARP 2007 [159 160]	2006	360	23	91	25.3%	21 – 30	1.4
Kenya	Angala 2006 [99]	2002-05	780	NA	83	10.6%	8 – 13	6.1
	Sanders 2007* [101]	2005-06	285	27	70	24.6%	19 – 30	
Malawi	Baral 2009 [158 161]	2008	201	25	43	21.4%	16 – 28	9.6
Mali	CSLS 2009[162]	2007-08	370	27	88	23.8%	19 – 28	1.2
	Rep Mali 2008 [139]	2007	NA	NA	NA	17.0%	-	
Mauritania	Rep Mauritania 2008 [141]	2007	21	NA	4	19.0%	2 – 36	1.2
Namibia	Baral 2009 [158]	2008	218	23	27	12.4%	9 – 17	10.8
Nigeria	Adebajo 2008 [144]	2006	1085	20-29*	145	13.4%	11 – 15	2.4
	FR Nigeria 2008 [145]	2007	839	22	113	13.5%	11 – 16	
Senegal	Wade 2005 [63]	2004	442	24	95	21.5%	18 – 26	0.7
	Wade 2008 [163]	2007	501	NA	109	21.8%	18 – 26	
South Africa	Parry 2008 [154]	2005	37	NA	13	35.1%	20 – 50	13.1
	Burrell 2008 [153]	2007-08	73	NA	25	34.3%	23 – 45	
	Burrell 2008[153]	2007-08	540	27	56	10.4%	8 – 13	
	Lane 2009 [152]	2008	293	23††	69	13.2%†	12 - 14†	
	Rispel / Metcalf 2009 [148 149]	2008	266	22††	117	44%††	38 – 50††	
	Baral 2009 [164]	2008	200	24	51	25.5%	19 – 32	
	Shisana 2009 [150]	2008	86	NA	NA	9.9%	5 – 20	
Sudan	Elrashied 2006 [124]	2005	713	NA	66	9.3%	7 – 11	1.0
	Elrashied 2008 [165]	2006	406	NA	32	7.8%†	5 – 10	
Tanzania	Dahoma 2009 [166-168]	2007	509	28††	63	12.3%†	9 – 16†	0.6

†adjusted for sampling design ††not adjusted for RDS design * median age group

Figure 11: MSM HIV prevalence estimates and random effects meta-analysis by country



MSM HIV prevalence compared to national HIV prevalence

Crude HIV prevalence among MSM in most, but not all, African settings was markedly higher than HIV prevalence amongst adult males (Figure 12). MSM HIV prevalence was little different to general population prevalence in Southern African countries with the highest general population HIV prevalence rates (Namibia[158], South Africa[150 152 153] & Botswana[158]). By contrast, MSM HIV prevalence in countries with low-level generalised HIV epidemics was markedly higher than the prevalence among the general male population. Although it would have been ideal to age-standardise HIV measures, this was not possible due to the variety of approaches to age reporting in different studies: however, where reported, MSM in these studies were young (Table 9) implying adjustment for age composition would likely increase the disparity between HIV prevalence among MSM compared to the general population.

Individual estimates of HIV prevalence ratio (MSM vs. adult male HIV prevalence) demonstrated considerable heterogeneity (I^2=98.9% p<0.001). The RE- pooled HIV prevalence ratio was 4.4 (CI 2.8 – 7.2, Figure 13) and the median study HIV prevalence ratio was 4.0. HIV prevalence ratios varied nine-fold difference across the interquartile range (OR 1.7 – 15.8), compared to a two-fold difference in MSM HIV prevalence across studies (12.3% - 24.5%), attributable to the marked heterogeneity in HIV prevalence in the general male population.

Weighted linear regression of log prevalence ratios against national adult HIV prevalence (Figure 14) estimated a 1.97 fold reduction in log prevalence ratio per 10% increase in national male HIV prevalence (95% CI 1.4 to 2.5, p<0.001; Cook-Weisburg test p=0.762). By contrast, there was only weak positive correlation between increasing national adult HIV prevalence and MSM prevalence (0.3% increase in MSM HIV prevalence per 1% increase in national male HIV prevalence, Figure 15). This was not statistically significant (CI -0.36 to 1.03%, p =0.329) and there was evidence of significant heteroskedasticity (Cook-Weisburg test p=0.021) arising from variety in South African estimates.

To summarise, pooled HIV prevalence was 18.6% in studies of African MSM and on average 4.4 times the HIV prevalence among adult men in the same country. There was little evidence of a relationship between HIV prevalence among MSM and general populations, MSM prevalence estimates being similar across countries with markedly different population HIV prevalence.

Figure 12: HIV prevalence in 24 sub-Saharan African MSM population samples (2001-2009)

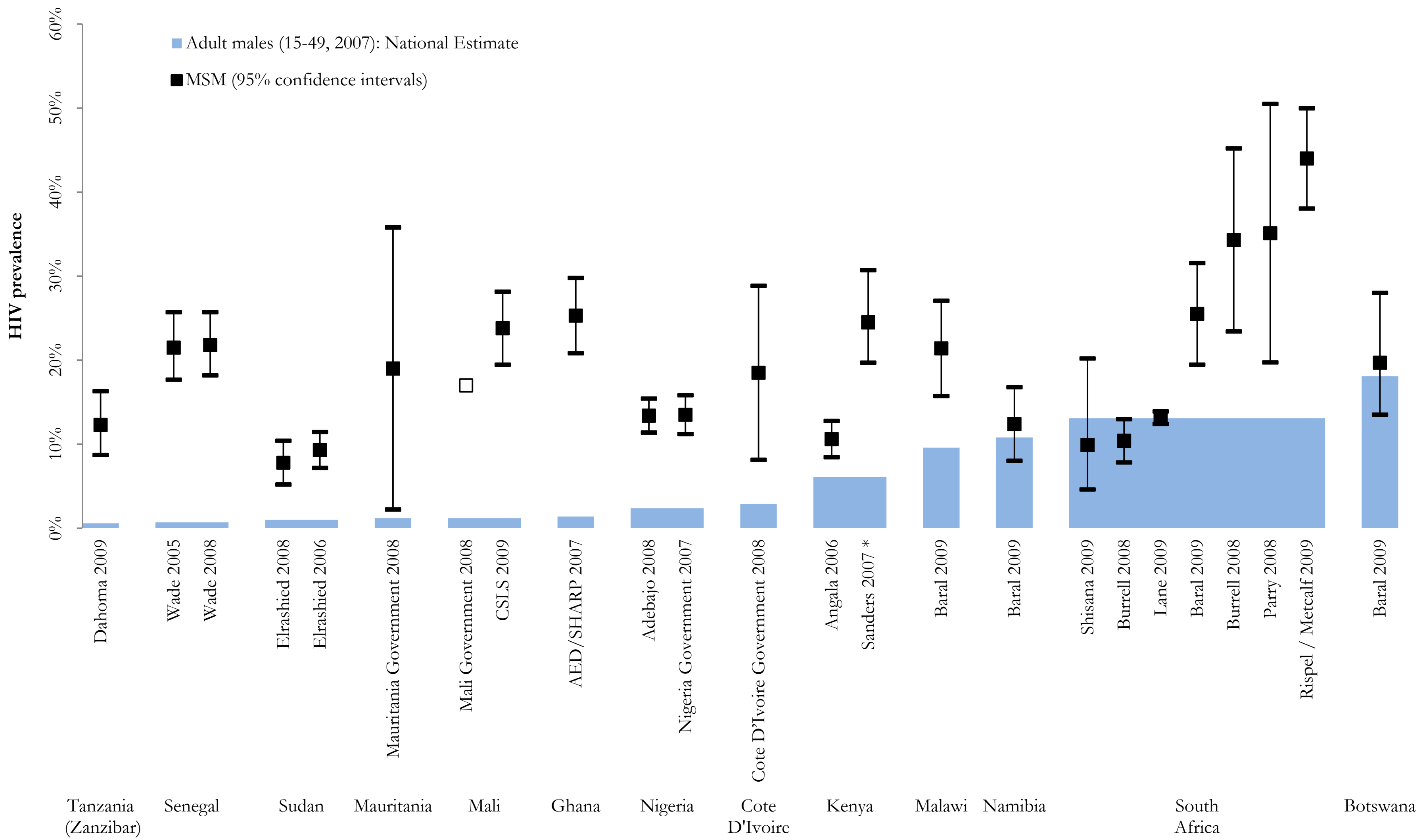


Figure 13: HIV prevalence ratio (MSM vs. adult male) and random effects meta-analysis by country

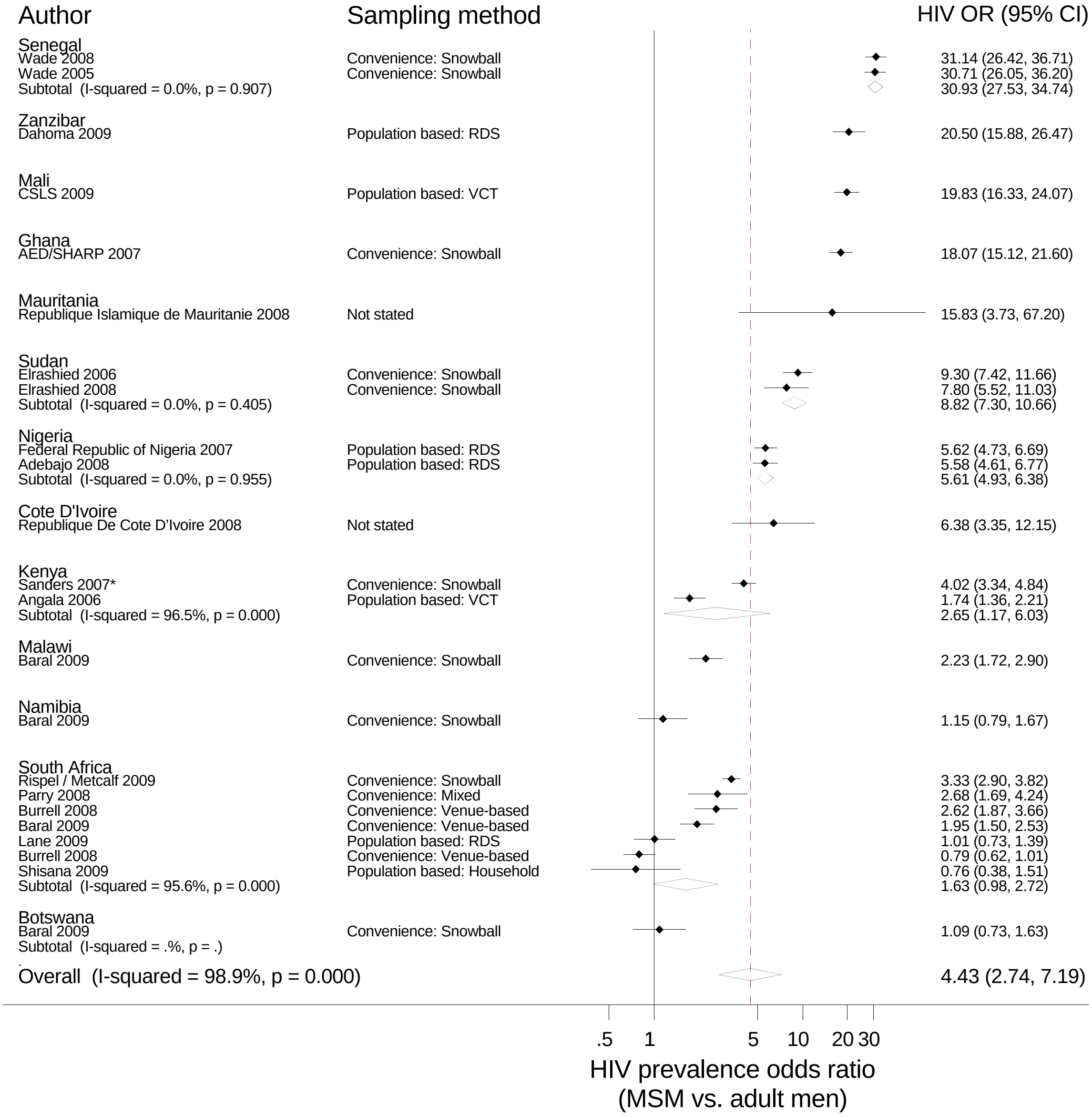
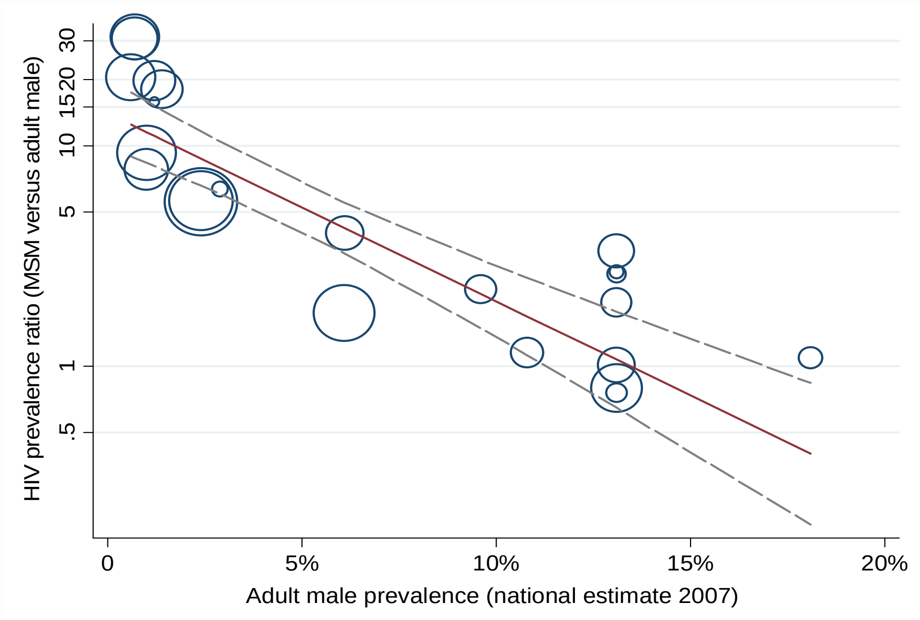
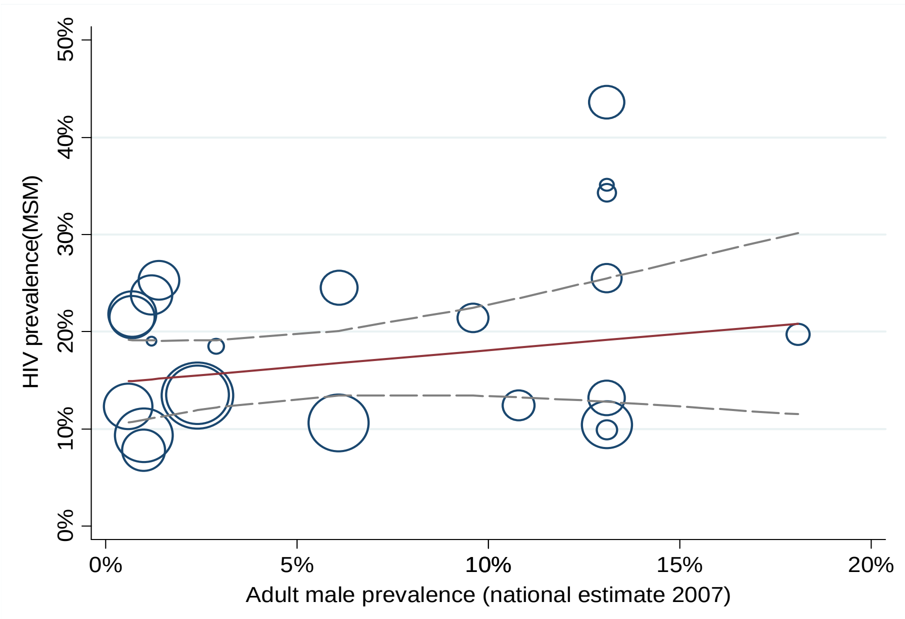


Figure 14: HIV prevalence ratio by national male HIV prevalence



Points represent MSM studies, with volume proportional to study sample size

Figure 15: HIV prevalence among MSM by national male HIV prevalence



Points represent MSM studies, with volume proportional to study sample size

HIV testing and risk knowledge

Nineteen studies assessed previous HIV testing practices amongst MSM (Table 10) comparable to national indicators of HIV testing uptake amongst adult men. MSM were more likely to report prior HIV testing than were adult men in general, with the exception of two studies from South Africa and Zanzibar[152 166]. Similarly, testing within the last 12 months amongst MSM from five studies in Nigeria, Rwanda and South Africa was higher than estimated of testing amongst adult men generally[145 149 153 155 174]. The proportion of MSM reporting HIV testing was positively and strongly correlated with the adult male national HIV prevalence, but only weakly so with prevalence of HIV among MSM where measured by the study.

Correspondence between self-reported and measured with current HIV status was assessed in Southern Africa[158]. MSM in Southern Africa reported variable rates of lifetime testing - Malawi 35.2%, Namibia 59.4% and Botswana 82.9%. However, only 4.7% (2/43) of HIV positive MSM in Malawi, 17.4% (4/23) in Botswana and 59.2% (16/27) in Namibia reported being aware of this prior to testing in this study.

Two studies offer some insight into the determinants of HIV testing among MSM, and the relationship between testing and HIV risk behaviour. Sandfort et al assessed determinants of testing among South African MSM: previous testing was associated with increasing age, openness about sexual identity and homosexual (rather than bisexual) attraction. Black MSM were less likely to have HIV tested, compared to other racial groups (adjusted OR 0.52, CI 0.28 – 0.94)[155]. In Kenya, Geibel at al note that MSM sex workers who reported testing were less likely to have reported unprotected AI in the last month (adjusted OR 0.60, CI 0.39 – 0.93)[138].

HIV risk knowledge

Six studies specifically assessed the level of knowledge of HIV transmission risks associated with same sex behaviour. When asked whether it was possible to transmit HIV through anal intercourse, 6% MSM in Namibia[158], 7% Botswana[158], 8% Malawi[158], 29% Nigerian[144] and 55% Sudanese[124] MSM believed this not to be possible. Among Kenyan male sex workers, despite many of these men reporting some access to MSM friendly services, 35% shared the belief that there was no HIV risk attached to AI[138]. In this study, male sex workers who were unaware of the HIV transmission risks associated with anal intercourse were more likely to report uAI in the past 30 days (75% vs. 58%, aOR 1.9, CI 1.2 – 3.2)[138]. Regarding the relative risks of heterosexual sex, MSM in Togo[157] and Zambia[128] were more likely to know that HIV can be transmitted by vaginal intercourse than AI, whilst MSM in Malawi, Namibia and Botswana believed AI to pose less risk than vaginal sex[158].

Table 10: HIV testing among African MSM and adult men by country

Country	**Author / Publication year**	**MSM reporting previous HIV test (ever)**		**Adult male HIV testing (ever)**
		N	%	%, (year of survey)††
Botswana	Baral 2008[158]	97/117	82.9%	9% (2001)
Kenya	Geibel 2008[138]	237/425	55.8%	14% (2007)
	Sanders 2007 * [101]	72/278	25.9%	
Malawi	Ntata 2008[171]	57/97	58.8%	17% (2004)
	Baral 2009[158]	69/196	35.2%	
Mali	CSLS [162]	136/374	36.4%	7% (2006)
Namibia	Baral 2008[158]	129/217	59.4%	34% (2006)
Nigeria	Adebajo 2008[144]	283/1125	25.2%	15% (2003)
	CRH 2008[172]	180/294	61.2%	
	FR Nigeria 2008[145]	299/879	34.0%	
Rwanda	Binagwaho 2009[174]	57/99	57.6%	22% (2005)
South Africa	Lane 2004[143]	27/48	56.3%	43% (2007)
	Lane 2008[151]	99/147	67.3%	
	Lane 2009[152]	158/363	37.9%†	
	Rispel / Metcalf 2009[148 149]	209/282	74.1%	
Tanzania (Zanzibar)	Dahoma 2009[166-168]	112/508	19.2% †	27% (2007)
Togo	Geiss 2008[157]	67/132	50.7%	No data

† RDS weighted
†† MEASURE DHS database [119]

Anal intercourse

For most studies, eligibility criteria included the requirement to have participated in AI with another man. Most participants in studies with broader behavioural inclusion criteria (for example, 'sexual intercourse with another man') also reported AI at some point in the past: Cameroon 85%[169], Ghana 98%[170], Kenya 100%[92], Senegal 99%[63], but for the two studies recruiting on self-identified sexual orientation, AI practices are less well reported (Ehlers et al (Botswana) 50% reported AI ever[60]; Kajubi et al (Uganda): no data reported[142]).

Anal intercourse roles with male partners

Ten studies differentiated the occurrence of RAI and IAI (Table 11) as a binary measure for very different periods of recall. Few documented anal sex 'role segregation' (MSM who only practice RAI or only IAI), or 'role versatility' (practice of both RAI and IAI). MSM were more likely to report RAI than IAI in Ghana (75% vs. 69%)[170], Nigeria (78% vs. 77%)[145], Zanzibar (74% vs. 39%)[166]; South Africa (56% vs. 42%)[143]. MSM were more likely to report IAI than RAI in two Kenyan studies [92 138], in Senegal (43% vs. 34%) [63] and in a different South African study (86% vs. 30.3%)[152]. As previously mentioned, the Mtwapa cross-sectional study was unable distinguish between homosexual and heterosexual IAI[62].

Unprotected AI

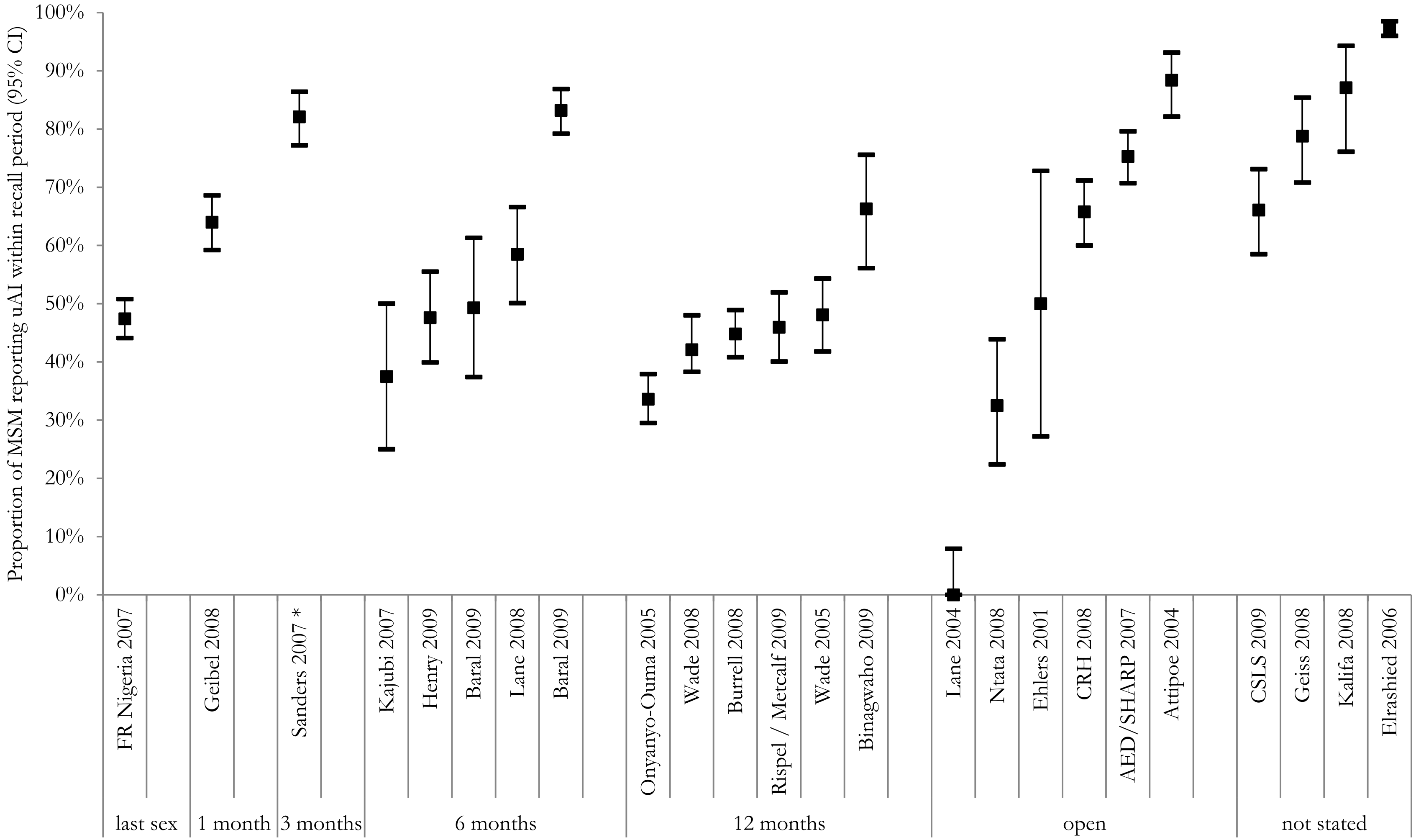
The proportion of MSM participants reporting one or more unprotected AI act are shown in Table 11 and Figure 16, by the period of recall. The proportion of men reporting one or more unprotected AI act in the previous 6 months ranged from 37% to 59%; previous 12 months: 42% to 66%. For those studies using no recall timeframe, the proportion of men reporting any unprotected AI varied widely from 0% in a small study of predominantly Caucasian South African MSM[143] to 88% amongst Ghanaian MSM in 2004 [170]. A small number of studies also reported the proportion of MSM who had not used a condom for any AI (Table 11).

Table 11: Condom use and anal sex role among African MSM

Country	First author (publication year)	Condom use for AI				AI role		
		n	Inconsistent (%)	Never (%)	Period	Receptive (%)	Insertive (%)	Period
Botswana	Ehlers 2001[60]	20	50%	-	Open	-	-	-
Burkina Faso	Kalifa 2008[142]	62	87%	-	NS	-	-	-
Cameroon	Henry 2009[169]	168	48%	-	6m	-	-	-
Ghana	Attipoe 2004[170]	147	67%	21%	open	75%	69%	open
	AED/SHARP 2007[159 160]	385	59%	16%	open	-	-	
Kenya	Onyanyo-Ouma 2005[92]	500	31%	11%	12m	77%	86%	ever
	Sanders 2007 * [101]	285	44%‡	37%‡	3m	54%	73%‡	3m
	Geibel 2008[138]	425	64%	-	1m	42%	65%	last sex
Malawi	Ntata 2008 [171]	80	33%	-	open	-	-	-
Mali	CSLS 2009[162]	171	66%	-	NS	-	-	
Nigeria	FR Nigeria 2008[145]	857	-	-	-	78%	77%	6m
	CRH 2008[172]	295	66%	-	open	-	-	-
Rwanda	Binagwaho 2009[174]	98	42%	24%	12m	-	-	-
Senegal	Wade 2005[63]	258	48%	-	12m	34%	43%	1m
	Wade 2008[163]	290	42%	-	12m	40%	39%	1m
South Africa	Lane 2004[143]	48	0%	-	open	56%	35%	open
	Lane 2008[151]	147	59%	-	6m	-	-	-
	Burrell 2008[153]	607	45%	-	12m	-	-	-
	Lane 2009[152]	363	-	-	-	30%	86%	ever
	Rispel / Metcalf 2009[148 149]	285	46%	-	12m	-	-	
	Baral 2009[164]	73	49%	-	6m	-	-	
Sudan	Elrashied 2006[124]	713	97%	-	NS	(Inclusion criteria)	-	
Tanzania (Zanzibar)	Dahoma 2009[166-168]	509		-		74%**	39%**	1m
Togo	Geiss 2008[157]	132	79%	-	NS	-	-	
Uganda	Kajubi 2007[127 147]	224	37%✝	-	6m	-	-	
Pooled (Namibia, Malawi, Bostwana*	Baral 2009[158]	389	83%		6m			

✝ adjusted for RDS sampling ‡ not disaggregated by gender
* data pooled from more than one study ** non-transactional partners NS: not stated

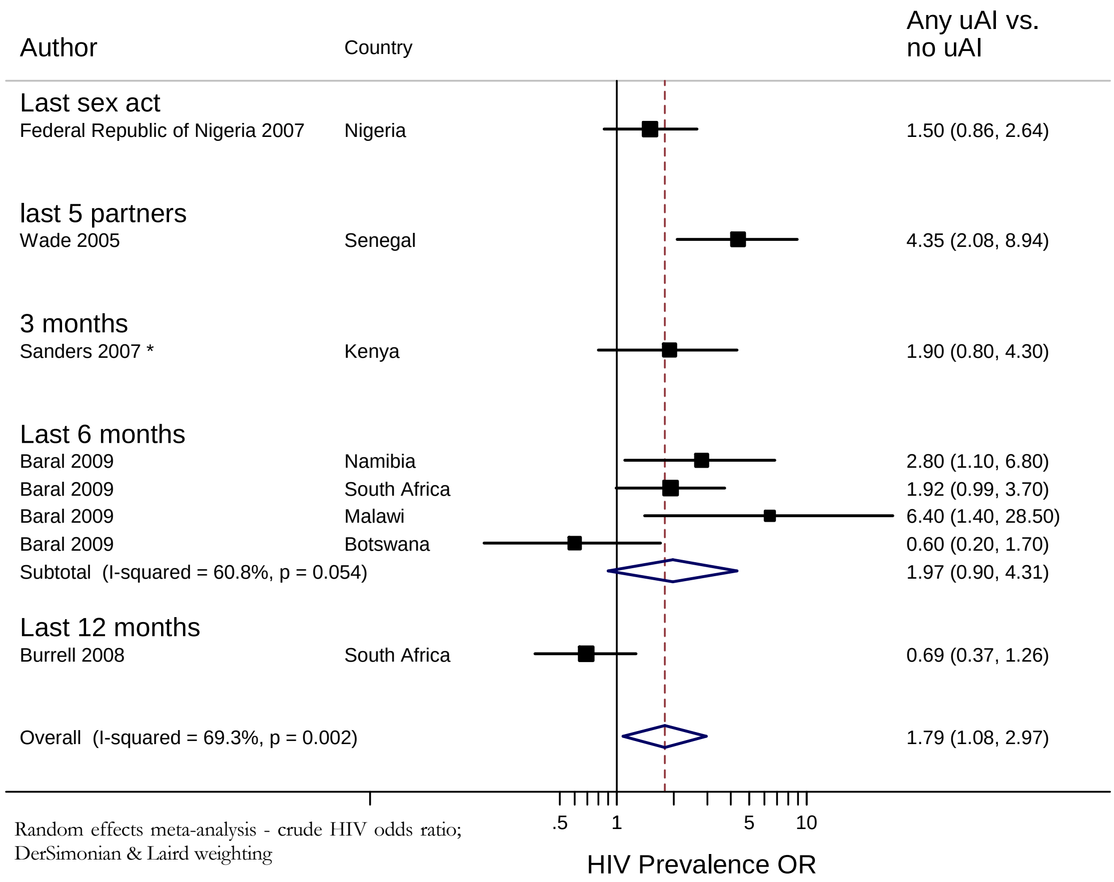
Figure 16: Unprotected anal sex with men among African MSM, by recall period



Association between unprotected AI and HIV prevalence

Eight studies reported the association between unprotected AI and HIV prevalence, three of which showed statistically significant positive associations[63 158]. Adebajo reported no significant association between condom use for AI and HIV prevalence amongst MSM in Nigeria, but does not report data[144]. Meta-analysis of studies reporting crude HIV prevalence ORs by unprotected AI practice is shown in Figure 17. The pooled HIV OR was 1.79 (CI 1.08-2.97) comparing MSM who reported uAI to MSM who did not, in the presence of significant heterogeneity between studies (I^2=69.3%). There was little evidence for a differing association by period of recall, although the number of studies was small.

Figure 17: Random effects meta-analysis: unprotected AI and HIV prevalence



Only one study other than the Mtwapa cross-sectional study (chapter 3) reported associations between specific AI role and HIV status. Lane at al found a significant association between reporting recent unprotected RAI (last 5 partners) and HIV status (OR 4.4, CI 3.5 – 5.7), but no association between recent unprotected IAI and HIV status (OR 1.1, CI 0.9 – 1.3)[152].

Transactional sex

Two studies recruiting MSM reported the proportion of MSM self-identifying as 'sex workers' as their principal occupation; Ghana 1.3% (2/150)[170] & Kenya 14%[92]. In addition, amongst a sample of MSM using illicit drugs in South Africa, more than half also identified themselves as male sex workers.

About half of studies reported whether participants had sold to another man or had paid another man for sex during a period of recall (Table 12). Four studies (including the Mtwapa cross-sectional study) report only an aggregate measure of transactional sex for both partner genders[92 101 127 149]. Further, the occurrence of transactional sex was assessed over recall periods ranging from the last sexual encounter to lifetime experience.

The proportion of MSM reporting having sold sex to male clients was generally high, but also variable between studies, ranging from 18% (previous 12 months, Rwandan MSM[174]) to 76% (current practice, Sudanese MSM (RAI only) [124]). The proportion of MSM reporting purchasing of sex from men was similarly variable: range 5.2% (past month, Senegal [63]) to 80.3% (unspecified period, Sudanese MSM (IAI only)[165]. The proportion of MSM selling sex in the Mtwapa study was particularly high compared to other MSM populations, despite a relatively brief recall period (Figure 18).

In every study reporting both measures, MSM were more likely to report selling sex than purchasing sex from men, and likely indicating a generic selection bias toward recruitment of male sex workers over male clients. Men who sell sex may be likely to be identified to researchers through their larger sexual networks. The effect of network weighting in all the RDS studies had the effect of revising the proportion of MSM who sell sex down and of revising the proportion of MSM who buy sex up[127 145 148 152 166], but imbalance persisted even after adjustment. Alternatively, men who sell sex were more identifiable through sex work venues, or perceived less threat through disclosure of MSM behaviours than was the case for clients of male sex workers.

Table 12: Transactional sex among African MSM

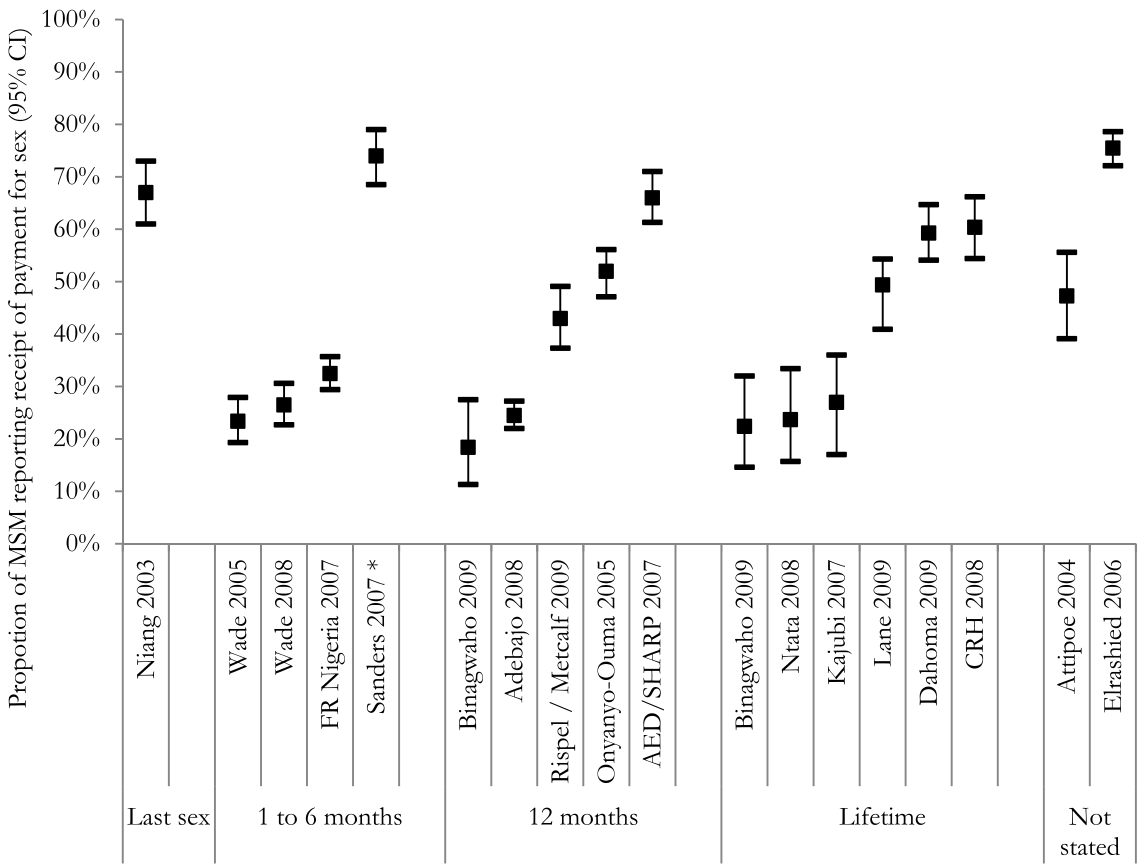
Country	First author and year	Total	Period	Sold sex to another person		Paid for sex with another person	
				N	%	N	%
Ghana	Attipoe 2004[170]	150	Not stated	71	47	-	
	AED/SHARP 2007[159 160]	383	12 m	254	31	112	11
Kenya	Onyanyo-Ouma 2005[92]	500	12 m	258	52‡	145	29‡
	Sanders 2007*[101]	285	3 m	211	74‡	114	40‡
Malawi	Ntata 2008	97	Lifetime	23	24	-	-
Nigeria	FR Nigeria 2008[145]	844	6 m	286	33†	126	14†
	Adebajo 2008[144]	1125	Not stated	276	25	-	-
	CRH 2008[172]	278	Lifetime	168	60	128	44
Rwanda	Binagwaho 2009[174]	98	Lifetime	22	22	18	18
			12m	18	18	12	12
Senegal	Niang 2003[61]	250	Last sex	168	67	15	6
	Wade 2005[63]	397	1 m	93	23	21	5
	Wade 2008[163]	501	1 m	133	27	26	5
South Africa	Lane 2009[152]	363	Lifetime	175	49†	86	22†
	Rispel / Metcalf 2009[148 149]	285	12m	123	43‡	83	29‡
Sudan	Elrashied 2006[124]	713	Not stated	538	76	-	-
	Elrashied 2008[165]	406	Not stated	-	-	326	80
Tanzania (Zanzibar)	Dahoma 2009[166-168]	509	Lifetime	405	59†	236	48†
Uganda	Kajubi 2007[127 147]	224	Lifetime	62	27†‡	57	18†

†: adjusted for RDS design ‡: aggregate measure of sex with either male or female partners

Association between transactional sex and HIV prevalence

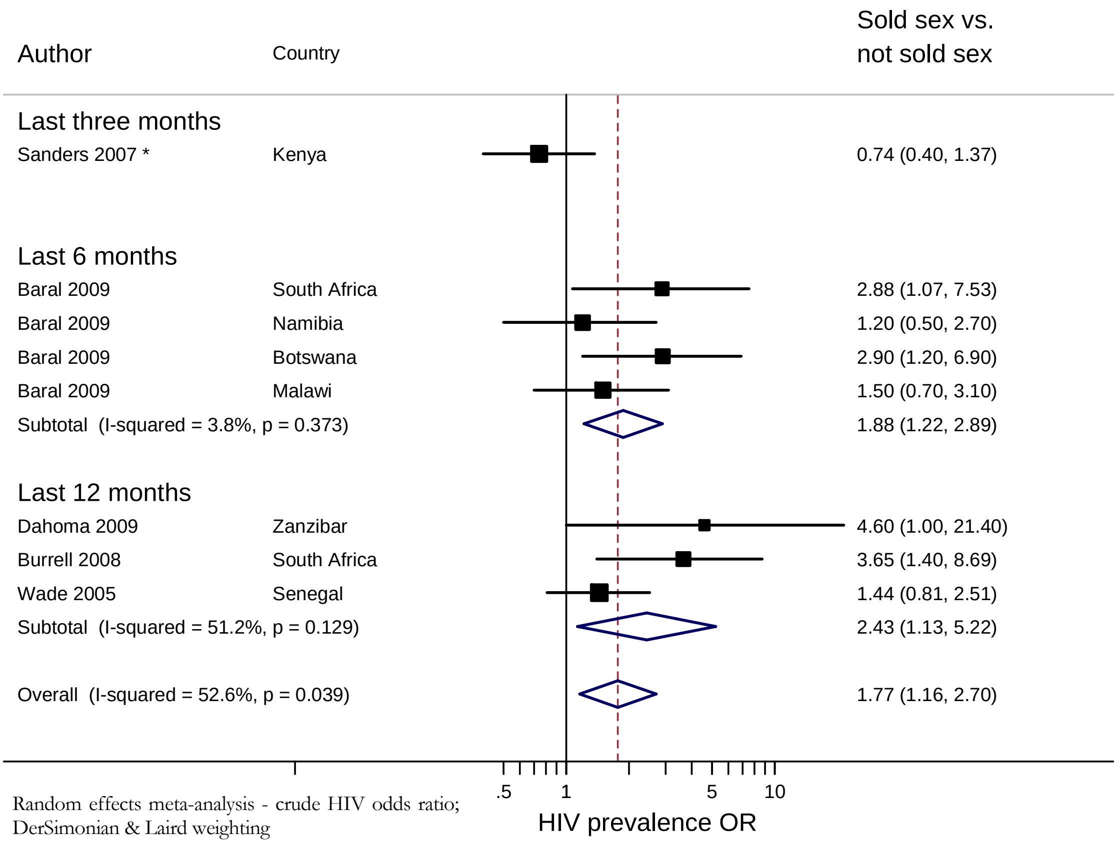
Eight studies assessed the relationship between transactional sex and HIV status, and crude associations are shown in Figure 19. From South Africa, Baral et al report a univariate association between receipt of money for transactional sex and HIV status (OR 2.9, CI 1.2-6.9), however this association is not significant after adjustment for number of sexual partners and condom practices[164]. From Zanzibar, Dahoma et al report crude association between selling sex in the previous 12 months and HIV status, remaining significant after adjustment for drug use, education, age and marital status[166]. Baral et al report a significant univariate association between 'having transactional sex' and HIV status, indicating a significant crude association in pooled analysis (Botswana, Malawi, Namibia: OR 1.7, CI 1.1 – 2.7), disappearing with adjustment for age, condom use and STI diagnosis[158]. Random-effect meta-analysis estimated a pooled HIV prevalence OR of 1.77 (1.16-2.70) for MSM reporting participation in transactional sex vs. MSM who did not.

Figure 18: Receipt of payment for sex among African MSM, by period of recall



The Mtwapa cross-sectional study (chapter 3) differed from other study results in reporting a negative association between selling sex and HIV prevalence, and was responsible for heterogeneity in the meta-analysis (I^2 with Mtwapa study included: 52.6%, p=0.039; I^2 excluding Mtwapa study: 17.5%, p=0.296). It was also unique in reporting any association between purchase of sex and HIV negative status.

Figure 19: Random effects meta-analysis: transactional sex and HIV prevalence



Sexuality

Self-identified sexuality

Twenty-two studies (Table 13) included measures of self-identified sexuality Only one study restricted inclusion to only men self-identifying as homosexual or gay[127]. 'Homosexual or gay' was the predominant self-identity in 14 (64%) of studies, and ranged from 16% [152] to 94%[153] of study samples (median 54%). In six studies (27%), the majority of participants identified as bisexual. The proportion of men self-identifying as bisexual ranged from 12.1% in South Africa [151] to 66% in Nigeria [126] (median 38%). In 11 studies, some men self-identified as heterosexual or straight, although this identity predominated in only one study[152]. Six studies also reported the prevalence of transgender identity; Botswana 3.4%[158] Malawi 0%[158] Namibia 3.0%[158] & Nigeria 0.1%[144] South Africa 4.0%[164].

It was notable that five of the six studies from South Africa accounted for the highest proportion of MSM self-identifying as homosexual/gay amongst all the studies identified (78 – 94%)[149 151 153 155], and all South African studies included a measure of self-identified sexuality. As previously discussed, some South African studies are distinct in this literature in representing majority White/Coloured MSM, for whom international terms to describe sexuality might resound more directly. By contrast, two studies combined local terms for sexuality with international terms[92 138], offering options from both local Swahili and English descriptions of sexual identity. Geibel et al demonstrated that MSM in Mombasa infrequently identified with English terms (homosexual (7.7%) and bisexual (7.0%)), whilst 82% preferred local Swahili terms[138]. Together, these studies likely indicated the contrasting utility of 'international' descriptions of sexual identity in different African contexts.

Association between self-identified sexuality and HIV risk

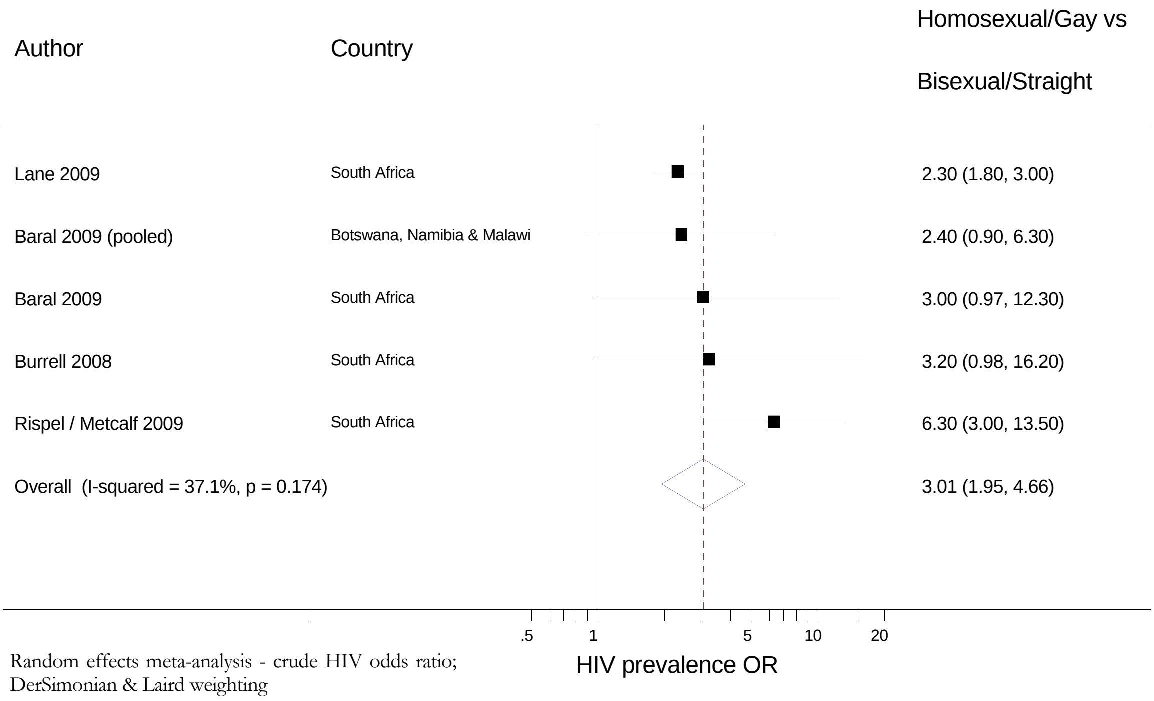
The relationship between self-identified sexuality and HIV prevalence was only reported from Southern African countries, where a consistent association between homosexual self-identification and HIV infection was observed (Figure 20). Amongst MSM in Soweto, Lane reports that gay identified MSM had a considerably higher HIV prevalence (33.9%) than straight-identified (10.1%) or bisexual identified MSM (6.4%). Pooled estimates indicate a 3-fold HIV prevalence among homosexual/gay-identified MSM vs. bisexual/straight-identified MSM (OR 3.01 (1.95-4.66)) and limited evidence of heterogeneity between studies (I^2 37.1%, p=0.174, Figure 20).

Table 13: Self-identified sexuality among African MSM

Country	First author and year	N	Self-identified gay/homosexual		Self-identified bisexual orientation		Self-identified heterosexual / straight	
			n	**%**	**n**	**%**	**n**	**%**
Botswana	Ehlers 2001[60]	42	42	100	0	0	0	0
	Baral 2009[158]	117	78	67	34	29	4	3
Burkina Faso	Kalifa 2008[142]	62	Not stated		37	60	Not stated	
Ghana	Attipoe 2004[170]	150	81	54	69	46	0	0
	AED/SHARP 2007[159 160]	385	151	39	234	61	0	0
Kenya	Onyanyo-Ouma 2005[92]	499	319	64	114	23	Not stated	
	Geibel 2008[138]	425	33	8	30	7	Not stated	
Malawi	Baral 2009[158 161]	200	81	41	106	53	13	7
	Ntata[171]	97	47	49	Not stated		Not stated	
Namibia	Baral 2009[158]	216	105	49	63	29	42	19
Nigeria	Adebajo 2008[144]	1125	500	44	621	55	3	<1
	Allman 2007[126]	58	18	31	38	66	1	2
	CRH 2008[172]	300	106	35	189	63	4	1
Rwanda	Binagwaho 2009[174]	94	46	49	31	33	4	4
South Africa	Lane 2008[151]	199	165	85	24	12	1	<1
	Sandfort 2008[155]	1019	890	87	120	12	Not stated	
	Lane 2009[152]	363	120	16†	112	34†	118	43†
	Rispel/Metcalf [148 149]	282	220	78	54	19	Not stated	
	Burrell[153]	70	64	94	Not stated		Not stated	
	Burrell[153]	537	458	85	Not stated		Not stated	
	Baral 2009[164]	200	154	77	36	18	2	1
Uganda	Kajubi 2007[127 147]	222	142	60†	80	40†	0	0

†: adjusted for RDS design

Figure 20: Random effects meta-analysis: self-identified sexuality (homosexual/gay vs. bisexual/straight) and HIV prevalence



Behavioural sexuality

26 studies reported measures of MSM sexual behaviour with female partners, summarised in Table 14. Thirteen studies reported lifetime heterosexual intercourse, whilst 21 studies described the reporting of heterosexual intercourse over a given period of recent recall. There was little consistency in recall period used, although six months and twelve months were the most frequently used.

Measures of heterosexual intercourse among MSM by recall period are shown in Figure 21. As might be expected, the proportion of MSM reporting any heterosexual intercourse over their lifetime tended to be highest (median study estimate (n=13): 72%, range 25 - 94%), compared to shorter periods of recall: 12 months (median study estimate (n=5): 50%, range 26 – 74%); 6 months (median study estimate (n=9): 44%, range 0 - 63%); 1 month (median study estimate (n=6) 32%, range 13 – 71%).

Comparing studies within periods of recall there is marked heterogeneity in estimates. With the exception of Lane et al, South African MSM samples were consistently the least likely to report heterosexual contact for any given recall period – lifetime recall: range 25-40%[146 149 151] ; 6 months recall: range 0-17%[146 151 164].

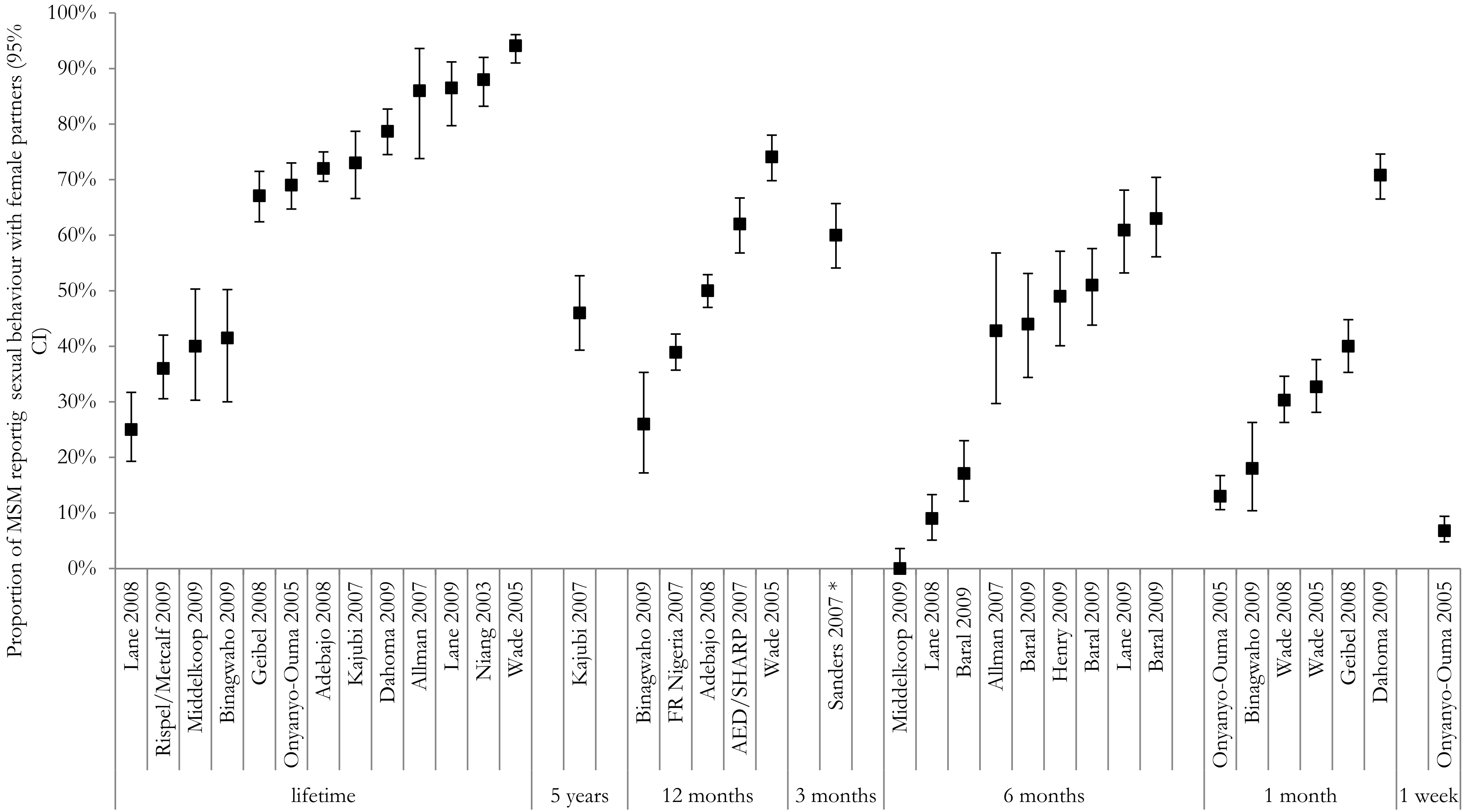
Table 14 also shows the proportion of men reporting sexual behaviour with female partners, not referent to a specific time period, as reported in 13 studies (including the Mtwapa cross-sectional study). The proportion of MSM reporting a current female partner ranged from 4% to 69%. The two studies reporting from West African countries had the highest proportion of MSM with current female partners (69% and 67%), whilst MSM in South Africa, again with the exception of Lane et al[152] (63%), reported the lowest proportions (4 – 8%)[143 149 151 164].

Table 14: Heterosexual contact among African MSM

Country	First author (publication year)	Lifetime			Specific recall period				Current		
		Total	**N**	%	Total	N	%	Period	Total	N	%
Botswana	Baral 2009[158]	-	-	-	117	51	44	6 m	114	24	21
Cameroon	Henry 2009[169]	-	-	-	142	69	49	6 m	-	-	-
Ghana	AED/SHARP 2007[159 160]	-	-	-	385	238	62	12 m	-	-	-
Kenya	Angala 2006[99]	-	-	-	-	-	-	-	780	541	69
	Onyanyo-Ouma 2005[92]	499	344	69	499	67	13	1 m	-	-	-
					499	34	7	1 wk			
	Sanders 2007* [101]	-	-	-	-	-	-	-	285	171	60
	Geibel 2008[138]	425	285	67	425	170	40	1 m	-	-	-
Malawi	Baral 2009[158 161]	-	-	-	186	118	63	6 m	196	93	47
Mali	CSLS 2009[162]	-	-	-	-	-	-	-	417	279	67
Namibia	Baral 2009[158]	-	-	-	213	108	51	6 m	214	59	28
Nigeria	Adebajo 2008[144]	1125	815	72	1125	562	50	12 m	-	-	-
	FR Nigeria 2008[145]	-	-	-	879	342	39	12 m	-	-	-
	Allman 2007[126]	56	48	86	56	24	43	6 m	-	-	-
Rwanda	Binagwaho 2009[174]	94	39	41	98	25	26	12 m	98	15	15
					17	17	18	1 m			
Senegal	Niang 2003[61]	250	220	88	-	-	-	-	-	-	-
	Wade 2005[63]	463	436	94	463	343	74	12 m	-	-	-
					397	130	33	1 m	-		
	Wade 2008[163]	-	-	-	501	152	30	1 m	-	-	-
South Africa	Lane 2004[143]	-	-	-	-	-	-	-	48	2	4
	Lane 2008[151]	199	50	25	199	17	9	6 m	199	8	4
	Lane 2009[152]	363	261	87✝	363	179	61✝	6 m	363	186	63✝
	Baral 2009[164]	-	-	-	199	34	17	6 m	200	16	8
	Middelkoop 2009[146]	100	40	40	100	0	0	6 m	-	-	-
	Rispel/Metcalf [148 149]	285	103	36	-	-	-	-	285	21	8
Tanzania (Zanzibar)	Dahoma 2009[166-168]	509	396	79✝	509	360	71✝	1 m	-	-	-
Uganda	Kajubi 2007[127 147]	222	162	73	222	102	46	5 yr	-	-	-
Zambia	Zulu 2006[128]	-	-	-	-	-	-	-	641	288	45

✝: adjusted for RDS design

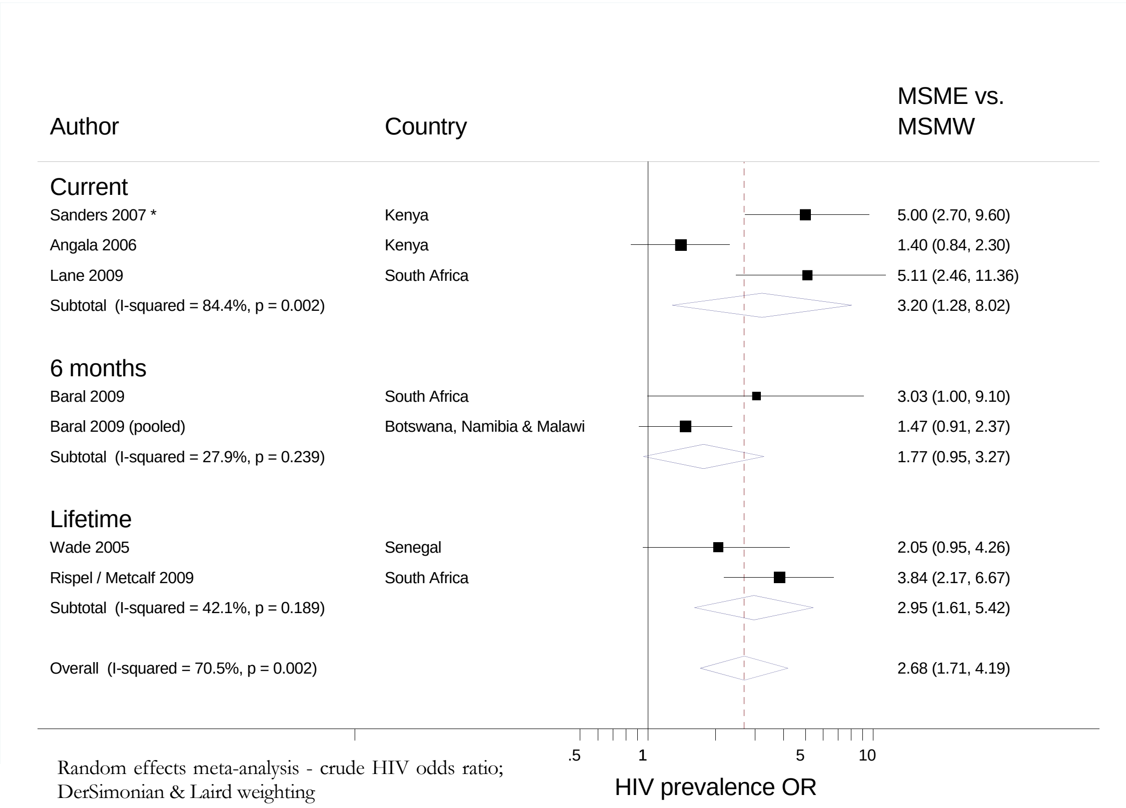
Figure 21: Heterosexual sex amongst MSM, by period of recall



Association between behavioural sexuality and HIV risk

Seven studies, including that reported in Chapter 3, assessed the relationship between behavioural sexuality and HIV prevalence. In keeping with evidence of a relationship between self-identified sexuality and HIV risk, pooled analysis of studies reporting crude associations between behavioural sexuality and HIV prevalence (Figure 22) strongly suggested that behaviourally bisexual men (MSMW) were less likely to be HIV positive than MSM with exclusively male partners (MSME). There was significant heterogeneity between studies, not accounted for by differing period of behavioural recall (Figure 22) or country of study. Within Kenya, the Mtwapa cross-sectional study reported behaviourally exclusive MSM were markedly more likely to be HIV positive than behaviourally bisexual MSM, whilst Angala et al reported a more modest excess among MSM attending VCT clinics in Nairobi (13.0% MSME vs. 9.6% MSMW) [99]. In Senegal, Wade at al report that MSM who have ever had sex with a woman are less likely to be HIV positive (20.2% vs. 34.1%, *p*=0.038), but this difference was not statistically significant after adjustment for other predictors (aOR 2.1, CI 0.9 – 4.7).

Figure 22: Random effects meta-analysis: behavioural sexuality (MSME vs. MSMW) and HIV prevalence



Random effects meta-analysis - crude HIV odds ratio; DerSimonian & Laird weighting

Marital status

Fifteen studies reported current marital status, and thirteen reported previous marriage (divorce, widowhood, separation). In contrast to the high proportion of MSM reporting recent sexual behaviours with women or current female partners, the proportion of MSM reporting being married was low: median study estimate 7.5%, range 3% (Rwanda[174]) - 29% (Zanzibar[166]). Two studies reported the proportions of MSM currently married as well as MSM with current female partners: respectively Rwanda 3% vs. 15%[174] , and Mali 5% vs. 67%[162]. In addition, a considerably higher proportion of MSM reported ever having had sex with women than reported ever having been married: Kenya 69% vs. 14%[92]; Nigeria 72% vs. 3.4%[144]; Rwanda 41% vs. 6.2%[174]; Senegal 94% vs. 9.9%[63]; Tanzania (Zanzibar) 78.7% vs. 41.1%[166]; Uganda 73% vs. 16.9%[127]. These disparities suggest that most sexual activity among MSM occurs with non-spousal female partners, consistent with the relatively young age of MSM in these studies.

Marital status and HIV risk

The only study reporting an association between marital status and HIV is from Nigeria. Adebajo et al report that MSM who were currently married had a higher HIV prevalence than those who were not (crude OR 4.46 (CI 2.0 – 9.7))[144], but this was unadjusted for age.

Table 15: Marital status among African MSM

Country	First author (publication year)	Total	Currently married to female spouse N	Currently married to female spouse %	Previously married to female spouse N	Previously married to female spouse %
Burkina Faso	Kalifa 2008[142]	62	11	18	-	-
Cameroon	Henry 2009[169]	142	18	13	4	3
Ghana	Attipoe 2004[170]	150	12	8	13	8
Kenya	Onyanyo-Ouma 2005[92]	500	35	7	35	7
	Sanders 2007[101]	285	20	7	24	8.4
Malawi	Ntata 2008[171]	99	19	19	2	2
Mali	CSLS 2009[162]	413	21	5	24	6
Nigeria	Adebajo 2008[144]	1125	33	3	6	0.5
	Nigeria Government 2007[145]	879	33	2	6	0.7
	CRH 2008[172]	297	14	5	8	3
Rwanda	Binagwaho 2009[174]	98	3	3	3	3
Senegal	Niang 2003[61]	250	38	15	-	-
	Wade 2005[63]	463	36	8	10	2
Tanzania (Zanzibar)	Dahoma 2009[166-168]	509	121	29	68	13
Uganda	Kajubi 2007[127 147]	224	11	5	27	12

Substance use

Relatively few studies reported measures of injecting drug use (9 studies) and frequency of alcohol consumption among MSM (6 studies), details of which are shown in Table 16.

Table 16: Substance use among African MSM

Country	First author (publication year)	Injecting drug use				Alcohol use		
		Total	N	%	Period	N	%	Frequency
Botswana	Baral 2009[158]	88	4	3.4	6m	-	-	-
Kenya	Geibel 2008[138]	424	-	-	-	144	34.0	3 times per week or more
	Sanders 2007 *[101]	285	4	1.4	3 m	133	46.7	Weekly or more
Malawi	Baral 2009[158]	147	18	12.2	6m	-	-	-
Namibia	Baral 2009[158]	200	16	8.0	6m	-	-	-
Rwanda	Binagwaho 2009[174]	99	1	1.0	12m	62	62.9	Weekly or more
Senegal	Wade 2005[63]	442	-	-	-	79	17.9	Weekly or more
South Africa	Parry 2008 [154]	78	33	42.3	Current	-	-	-
	Baral 2009[164]	200	5	2.5	Lifetime	-	-	-
	Lane 2009[152]	363	2	2.1†	Lifetime	149	40.1†	Weekly or more
	Lane 2008[151]	147	-	-	-	35	23.8	Weekly or more
Tanzania (Zanzibar)	Dahoma 2009[166-168]	509	66	13.0	3 m	-	-	-

† sex whilst intoxicated

Injecting and illicit drug use

IDU behaviours were not commonly reported in most studies, with the exception of Parry et al who reported on a population in urban South Africa specifically selected for a history of drug use[154]. Injecting drug use was rarely reported in studies of Black South African township residents [152 158]. In other South African settings, a modest proportion of MSM reported injecting illegal drugs during the previous 6 months: Malawi and Namibia [158], although the author noted that a high proportion of MSM refused to answer this question.

Outside southern Africa, injecting drug use was rarely reported with the exception of MSM in Zanzibar[166]. Overall, 61.2% of MSM in Zanzibar had used illicit drugs of whom 23.1% had injected drugs within the past three months. The prominent role of IDU among MSM in this context is also implied by a high prevalence of hepatitis C infection (14.7% MSM) and co-infection of HCV-HIV in 5.3%.

Reports of non-injecting recreational drug use all derive from studies in South Africa, and are of doubtful generalizability outside that setting. Parry reports the commonplace use of crack cocaine, heroin, cannabis, cocaine, ecstasy, crystal methamphetamine by MSM in urban Cape Town, Durban & Pretoria, frequently in conjunction with male sex work. Among MSM in two South African township studies, Lane et al report frequent use of marijuana (25%[152] & 29%[151]), but less frequent use of ecstasy (2.0%[152]), crystal methamphetamine (0.5%[152]), methcathinone (0.2%[152] & 3%[151]) reported in urban settings.

Injecting drug use and HIV risk

Three studies that evaluated recent injecting drug use behaviours as potential HIV risk factors status suggest an association between the two. Dahoma et al report an association between injecting drug use in the past 3 months and HIV status (aOR 2.4, CI 1.1 – 5.3)[166]. The Mtwapa cross-sectional study (Chapter 3) found a borderline significant association between injecting drug use in the prior 3 months and HIV status (aOR 13.1 CI 0.95 – 180, p=0.055)[101]. Baral found no association between lifetime injecting drug use and HIV status[158] in Southern African countries.

Alcohol use

Six studies report the frequency of alcohol use among MSM, demonstrating considerable use of alcohol among different MSM populations. In a study of Soweto MSM, 87.9% reported drinking alcohol at least once a month and 75.9% of MSM drinking habits were consistent with problem drinking (AUDIT >9 [175])[152]. In a study of Gauteng township MSM, 78% of participants reported using alcohol and 40% regularly to intoxication (drunk more than once per week)[151]. Compared to men who drank less than once a week, regular drinkers were more likely to report unprotected AI (OR 4.1, CI 1.4 – 12.6), as were MSM who drank to intoxication (OR 2.6, CI 1.0 – 6.8). Geibel reported on alcohol use amongst male sex workers in Mombasa, Kenya, among whom 25% of sex workers reported 'hazardous or harmful' drinking habits (as defined by an AUDIT score of 16 or above[175].)[138].

Alcohol use and HIV risk

Whilst some studies do identify significant associations between level of alcohol consumption and sexual risk taking behaviours, this was not replicated in studies that assessed both HIV status and alcohol consumption. In Senegal, Wade et al reported that MSM who reported any alcohol consumption in the past week were more likely to be HIV positive (27.8% vs. 20.1%) but this difference was not statistically significant (p=0.130)[63]. Lane et al did observe an association between buying drugs or alcohol in exchange for sex with male partners and HIV status (OR 3.9, CI 3.2 – 5.7) but no association between problem drinking and HIV status (OR 0.91, p=0.14)[152]. The Mtwapa cross-sectional study observed no association between weekly alcohol consumption and HIV status.

In summary, existing studies suggest widespread alcohol use among MSM, a few identifying associations between higher alcohol consumption and sexual risk taking, but no association with HIV prevalence was demonstrated. By contrast, there was evidence for HIV risk associated with IDU behaviours, but little evidence of considerable overlap of IDU and MSM populations outside specific populations in Zanzibar and South Africa.

Violence and discrimination

In addition to those risk factors identified *a priori*, descriptions of stigma, discrimination and denial of services feature as major components of a number of studies identified.

Sexual assault

Sexual assault, or rape, by other men was commonly reported. Rape by another man was reported by 11% of MSM in Malawi, Botswana and Namibia[158], 13% of South African MSM [146] and 18% of Nigerian MSM [172] at some point, and 10% MSM Mombasa sex workers in the previous year [138]. 17% of Rwandan MSM [174], 12% of Ugandan MSM[127] and 30% of Senegalese MSM reported having been forced to have sex with a man during their lifetime [63]. Niang et al reported that 43% of Senegalese MSM had been raped outside the family home, 13% by a police or government official[61].

Physical and verbal abuse

In South Africa, Middelkoop et al report that 37% of MSM report physical abuse[146], and Baral et al reports that 12.2% of MSM reported having been physically assaulted by government or police officials in three Southern African countries (Malawi 8%, Namibia 22%, Botswana 1.7%)[164]. In Western Africa, 7% Nigerian MSM reported having been physically assaulted by a family member, whilst 3% reported physical abuse from police or government officials[172]. Similarly, in Senegal, the most frequent context of verbal and physical abuse was by family: 49% reported verbal abuse and 28% physical assault by a family member, compared to 40% and 12% respectively by a member of the wider community[61]. In East Africa, Onyanyo-Ouma et al reported that 22% MSM had been the victim of physical or verbal violence during the previous year (14% verbal, 12 % physical). 26% reported aggression from members of the public, and 8% reported harassment by family or neighbours (8%)[92]. In coastal Kenya, 12.2% of MSM sex workers had been subject to physical abuse in the last 12 months. In Rwanda, 15% reported verbal abuse and 12% physical abuse, most frequently from family members[174]. 8% of MSM reported physical abuse in public spaces, but this was also reported at workplaces, school, bars & prisons. 22% of Ugandan MSM reported violence considered to be due to their sexuality[127]. The most common perpetrator of violence was a family member (40%).

Blackmail

Three studies report the commonplace practice of blackmail by a member of the family or local community regarding the disclosure of sexual behaviour or sexual orientation in five countries: In Nigeria, 39% [172], Botswana 27% [158], Namibia 21%[158], Malawi 18%[158] and South Africa 11% [164] MSM report having been blackmailed on the basis of their sexuality.

Denial of services

The focus of one South African study was upon the reluctance of black African MSM to use public sector health services due to experiences of judgemental attitudes and discrimination from health care staff[149]. MSM avoided disclosure of their sexual orientation in public health clinics due to such previous experiences. In another South African study, 33% MSM had experienced discrimination and harassment in public health clinics[143]. In Southern Africa, MSM were frequently fearful to access health services: Malawi 17.6%, Namibia 18.3% and Botswana 20.5%. Elsewhere, MSM were also unlikely to have ever disclosed their sexual orientation to health care workers: Malawi 9%[158], Nigeria 18.2%[172], Namibia 21.6%[158] and Botswana 24.1%[158].

Given that most MSM may not disclose their sexual behaviour to health workers, nonetheless in some studies a significant minority of MSM reported having been denied access to health services on the basis of their sexuality. In Southern Africa, 5.3% MSM reported having been denied health care because of their sexuality (Malawi 4%, Namibia 8.3%, Botswana 0.9%). This was reported by 3% of MSM in Nairobi, Kenya[92] and 1% MSM in Abuja, Nigeria[172].

Violence, discrimination and HIV risk

A number of studies suggest an association between sexual assault and HIV status. In Senegal, Wade et al MSM who reported ever having been raped were more likely to be HIV positive than those who did not (31.1% vs. 17.3% respectively, p=0.001), although this was not statistically significant after adjustment for other model variables (OR 1.6 (95% CI 0.91 – 2.82))[63]. Baral et al demonstrated a higher prevalence of HIV among MSM who reported being raped in Botswana (OR 6.3, CI 1.5-25.6), and a weaker trend in Malawi (OR 3.3, CI 0.8-14.7) and Namibia (OR 1.5, CI 0.8-14.7)[158].

Baral et al also reported blackmail as an independent risk factor for HIV. HIV prevalence in MSM who reported being blackmailed by a member of the community because of their sexuality was 42.9% compared to 23.4% amongst those who did not (adjusted OR 3.7, CI 1.2 – 11.3) [164]. This study also reported associations between denial of service, fear of accessing services and HIV status.

Regarding physical assault, no study identified a direct association with HIV prevalence. However, in Kenyan MSM, those who reported being a victim of violence were more likely to report unprotected sex with their last partner (unprotected RAI OR 2.4 (CI 1.4 – 4.4), unprotected IAI OR 2.0 (CI 1.1 – 3.4)) or to report never using condoms for anal sex (OR 2.5, CI 1.2 – 4.8)[92].

Discussion

This review highlighted a dramatic increase in the study of MSM populations and their HIV risks in sub-Saharan Africa over a relatively brief period. At the time of reporting the Mtwapa cross-sectional study (chapter 3), this literature consisted only three other studies including HIV prevalence, only one of which had been published[63]. This emerging literature permitted exploration of both the ecological relationship between HIV prevalence among MSM groups compared to the general population, and synthesis of evidence implicating individual risks of HIV prevalence across the region.

Limitations of the current literature

The quality of studies identified, and the quality of their reporting was variable. This was an anticipated consequence of broad and inclusive search and selection criteria, set with the intention of identifying as much pertinent published material as possible. In many cases it was possible to add detail through contact with authors, but for a few studies some design elements remained unclear.

It was notable that a number of initial studies reported in abstract form have not since resulted in publication, despite significant intervals since first releasing information. Although not necessarily the explanation, the process of compiling the review highlighted local barriers to disseminating information about MSM. Placide Tapsoba clearly documented the stigma toward researchers working in MSM research in Senegal[54], and a number of countries have been accused of hindering either the ethical and scientific approval of MSM research proposals hindering the completion of research or the dissemination of its findings. A clear example is the AED/SHARP study from Ghana, which was temporarily widely disseminated by the research group through an open-access dedicated web portal, before being taken out of circulation on governmental instruction[159].

A general methodological limitation was the reliance upon convenience methods of sampling in most studies, well known to introduce selection bias and limit generalizability of findings. Only two studies utilised true population-based probability sampling, and few others utilised methods to approximate population based samples (RDS and VCT-based recruitment). These methods likely reflect the difficulties in reaching highly marginalised and covert individuals by means other than peer contact and trusted recommendation, but nevertheless indicate findings from these populations may not be reflective of the 'true' wider population of MSM. The relatively lower HIV prevalence in population-based studies compared to convenience-based studies did indeed suggest sampling strategy may have limited generalizability, whilst the predominance of MSM reporting selling sex over those reporting buying sex even in RDS studies employing network-weighting suggests incomplete control of selection bias by even sophisticated sampling methods widely utilised for the study of hard-to-reach populations[176].

Although MSM studies were identified from 19 countries, HIV prevalence estimates were identified from only thirteen and risk factor studies from only eight, inevitably limiting the generalizability of findings to the region as whole. Direct comparison of studies was further limited by variability in behavioural measurement. Time frames for the principal behavioural measures varied significantly when specified (1 week to 5 years) but were often either highly subjective (for example, 'do you have sex with women?') or simply not stated at all. Finally, most studied utilised interviewer-based approaches to behaviour measurement with attendant risks of social desirability bias, particularly in marginalised populations such as described[177 178].

HIV prevalence among MSM in the context of wider HIV epidemics

By 2010, in every sub-Saharan African setting so far studied, HIV prevalence amongst MSM was high. As a region, the pooled MSM prevalence estimate of 18.6% (CI 15.6-21.4) exceeded regional MSM comparators in low- and middle-income countries in the Americas (median 13.0%, range 7.9 – 25.6%, 15 studies), Asia (median 7.8%, range 2.8 – 24.6%, 7 studies) and Eastern Europe (median 0.7%, range 0.0 – 8.7%, 12 studies) estimated between 2000-2006[123]. Similarly, MSM-HIV prevalence in sub-Saharan Africa exceeded estimates among MSM surveyed in high-income settings: Belgium 11% (2004), France 13-15% (2004-5), UK 11-12% (2001-02), USA 13-17% (2002-05), Germany 6-12% (1991-2007), Australia 6-16% (2001-06)[179]. This observation alone is of serious concern set against the dearth of HIV surveillance and control directed towards MSM in sub-Saharan Africa (Chapter 1).

Further, prevalence among MSM populations in sub-Saharan settings was, outside countries with hyper-endemic HIV epidemics, markedly higher than the general population in the same setting. Pronounced inter-country variation in the burden of HIV infection in the general population is well documented within Africa and globally. However this analysis found no epidemiological relationship between HIV prevalence in the general population and MSM populations of African countries. Although not statistically homogenous, MSM epidemics were remarkably similar in their severity across countries, despite a 50-fold variation in HIV prevalence ratio between MSM and men in the general populations within which these sexual networks exist, suggesting that HIV risk to African MSM is driven by factors other than the prevailing epidemic in the wider population.

Yet MSM studies documented considerable heterosexual behaviour among MSM. African studies reported 25-94% of MSM reporting lifetime heterosexual sex, and 26-74% of MSM reporting female partners within the last year. These exceed similar measures among MSM populations in other regions. Among 17 MSM studies in low and middle income countries outside Africa, 25 – 73% MSM reported lifetime heterosexual sex, and 8 – 98% MSM reported heterosexual sex in the past year[125]. In industrialised countries, community-based studies suggest lower rates, for example in the UK, 52-61% MSM reported a female partner within their lifetime[180-182], 44% in the last five years[183] and 10-36% in last year[180 181 182 184].

Behavioural associations with HIV prevalence among African MSM

Although meta-analysis of the few individual risk factors comparable between studies were limited to random effects methods given evidence of between-study heterogeneity, pooled estimates suggested association between HIV prevalence and uAI with men (pooled OR 1.8 (1.1-3.0)) and transactional sex (pooled OR 1.8 (1.2-2.7). The Mtwapa study (Chapter 3) was the sole study not to find an association between selling sex and HIV prevalence, but also had a relatively high proportion of MSM claiming to sell sex.

Unprotected AI in most studies was commonplace: ranging from 37% to 59% over 6 months and 42% to 66% over 12 months. According to UNGASS reporting for 2008, MSM in sub-Saharan Africa were less likely to report condom use at last AI compared to other regions: Africa (8 studies, median 47%,range 25 – 82%); Eastern Europe (15 states, median 60%, range 32-84); Asia (14 studies, median 61%, range 24-88%); Caribbean (7 states, median 73%, range 47-81%); Central & South America (11 states, median 78%, range 29-91%)[185]. Where measured, misconceptions about the safety of AI and homosexual partnering compared to heterosexual sex were apparent, and in one instance were associated with unprotected AI[138].

Demographic risk factors for MSM HIV prevalence included an expected association with increasing age (data not shown). Consistent with the known biological transmission risk, IDU behaviours were associated with HIV prevalence, but were comparatively unusual behaviours reported by MSM outside a few specific contexts (South Africa and Zanzibar). Meanwhile, use of alcohol was commonplace when measured, but not consistently associated with HIV prevalence.

Interestingly, pooled associations between HIV and measures of sexuality (self-identified and behavioural homosexual exclusivity) were more consistent and stronger than direct measures of MSM behaviour (pooled ORs 3.0 (2.0-4.7) and 2.7 (1.7-4.2) respectively), a finding in keeping with the Mtwapa cross-sectional study reported in Chapter 3. These findings are consistent with studies in the USA, UK, Thailand, the Netherlands, Indonesia, Mexico, India and Australia which also suggest that HIV prevalence amongst bisexual men is, in general, lower than among exclusively homosexual men but higher than heterosexual men[186].

Disparities in HIV prevalence between homosexually and bisexually active or oriented MSM were not explained within the identified studies, and could not be further explored within the accumulated literature. Beyond weaknesses in study quality and reporting across the identified literature that limited comparability, even those examples of well-conducted research that were well reported shared the intrinsic limitations of cross-sectional design and prevalence outcome measurement in deriving insights into risk factors for HIV infection (discussed in Chapter 3). Very few studies described unprotected RAI and IAI roles discretely, despite a known 10-fold difference in per-act transmission risk between behaviours[108], binary or nominal behaviour measures predominated (offering little attenuation of cumulative risk), and other factors that may influence transmission risks within MSM populations were rarely reported (e.g. anal sex role segregation or versatility[178], relationship concurrency[9 187]).

Such differences are important to understand in reaching an understanding of how HIV epidemics among MSM might interact with epidemics in the general population. The apparent lack of association between HIV prevalence in the general population and that among MSM might well indicate that HIV risks to MSM have not been principally driven by HIV prevalence within prevailing heterosexual epidemics. Yet this observation cannot be taken as evidence that MSM epidemics do not influence wider epidemics as long as it is assumed that MSM populations represent a minority within any national population. Set against the observation that HIV prevalence was lower among MSM who might act as bridges between transmission within MSM networks to heterosexual networks is the observations that, in most African contexts, MSM epidemics were markedly more severe.

Chapter 5

DEVELOPMENT AND VALIDATION OF PROSPECTIVE BEHAVIOUR STUDIES

Introduction

The previous two chapters presented evidence that MSM populations exist in Coastal Kenya and elsewhere in sub-Saharan Africa, have a high burden of HIV infection that had passed largely unrecognised until recent years, and report proximal risk factors for HIV infection known be strong biological routes of transmission outside sub-Saharan Africa, namely unprotected receptive anal intercourse and injecting drug use in a few settings. Yet the Mtwapa cross-sectional study also indicated other factors associated with HIV prevalence not fully explained by behavioural risk measures in that study. In particular, the relatively low HIV prevalence among the majority of MSM who reported heterosexual sex merited further exploration. This chapter describes the development, piloting and validation of methods aiming to prospectively measure sexual behaviour, sexual partnerships and partner characteristics among a sample of MSM also enrolled into the IAVI cohort studies. The contents of this chapter were presented as an oral presentation at the AIDS Vaccine conference in Bangkok, 2011[188].

Aims

1. To accurately measure sexual risk behaviour for a sample of MSM enrolled in the IAVI cohorts
    a. To explore heterogeneity in frequency of behaviours associated with HIV acquisition and transmission risk among MSM
    b. To explore relationships between individual characteristics and unprotected sex among MSM at risk of HIV infection in Coastal Kenya.
2. To describe proximate sexual networks of MSM enrolled in the IAVI cohorts in terms of partner, partnership and situational characteristics
    a. To describe the demographic and behavioural patterns of partnership mixing
    b. To explore the relationship between partner, partnership and situational characteristics and unprotected sex.
    c. To assess the extent to which MSM enrolled in research represent the unknown wider MSM population in Kenya.

3. To consider both MSM behavioural risk and insights into MSM networks
    a. To consider transmission risks within MSM populations, and bridging transmission risk with heterosexual populations in Kenya.
    b. To inform options for HIV/AIDS prevention, treatment and care for MSM in Kenya

The study was enabled by funding from IAVI, whose key interest was in the accurate measurement of sexual risk behaviour against which existing IAVI risk assessments could be compared and improved. This aspect of the work is not reported in this thesis.

Overview of study components

Diary study participants

IAVI study volunteers were invited and enrolled to a specific behavioural sub-study, referred to as 'the diary study'. This study was in addition to their scheduled quarterly follow up in either HIV positive or HIV negative IAVI cohorts, subsequent to enrolment procedures described in Chapter 3. A schematic overview of diary study procedures is shown in Figure 23.

After completing informed consent (Appendix 5.1) participants undertook a three week training program on study procedures, led by the author, in a choice of one of four supervision locations (zone HQs) across Mombasa (Likoni, Mombasa Town, Changamwe and Mtwapa (Figure 24). Supervision locations were selected to allow both interaction between study trainers with up to thirty study participants as well as private interaction between participants and research staff during follow up visits.

At commencement of the study proper, participants were asked to complete the sociodemographic and retrospective behavioural modules of a computer assisted interview (CAPI), self-administered with assistance from study staff if required. On completion, participants were issued with their first event diary booklet, condoms/lubricants, a formal letter of participation from KEMRI, a copy of consent materials and emergency contact details of a study supervisor on 24-hour standby.

Figure 23: Schematic of study elements

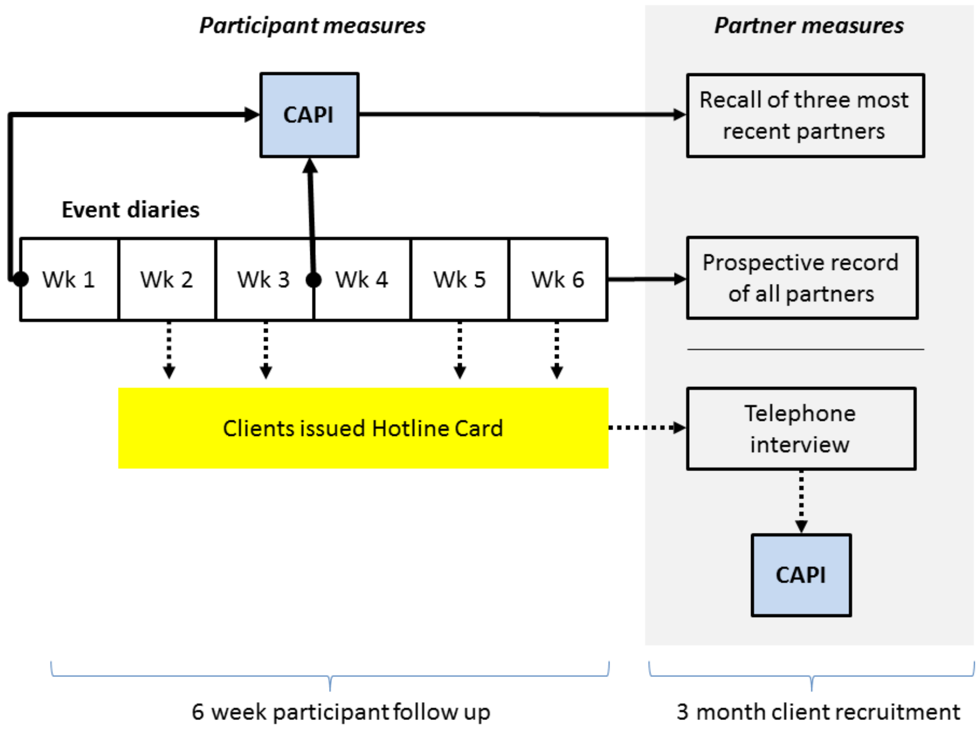


Figure 24: Map of study area: Zone HQ locations

Study participants completed and returned event diaries to zone HQs on a weekly basis at a private, one-to-one meeting with a member of study staff. Diary deposit appointments included (a) verification of diary entries between study facilitator and participant (guided by a pre-defined algorithm of error checking procedures), (b) verification of accounts of Hotline cards and collection of unused Hotline cards (if applicable), (c) issue of a new diary and Hotline cards (if applicable), (d) issue of condoms/lubricants as required (e) reimbursement for travel (500 KSH). Errors in event records were resolved between participant and supervisor. Alterations to event diaries by supervisors were made in red ink, signed and recorded on a monitoring sheet at the back of the diary.

At visits 2 - 3, and 5 - 6, study participants were also issued with ten numbered Hotline cards advertising a confidential telephone counselling service and instructed to offer these cards to any sexual partners who paid for sex with the study participant. During these periods, participants were also required to document whether a card was shown to the partner and whether the client had been offered one before for events with clients. At the 4th visit, study participants completed the partnerships module of the CAPI interview, with reference to the three most recent partners identified in diaries to that point. This module was conducted with assistance from supervisors. At the 7th and final visit, study participants participated in a group discussion reflecting on the study process, and self-completed an anonymous exit survey.

Clients of diary study participants

For three months after the diary study, a toll-free 24-hour telephone and SMS response service was maintained to respond to calls / SMS messages initiated by clients who had received a Hotline card during the diary study. The service was operated by KEMRI-IAVI HIV counsellors, who offered both an individual sexual health counselling service according to existing cohort study protocols (either in telephone, in person or by referral), and asked the caller if they would like to participate in a brief telephone survey and/or a more extensive questionnaire based at the Mtwapa clinic. Clients who agreed to participate in a telephone survey undertook verbal assessment of inclusion criteria and verbal consent (Appendix 5.2) Telephone interviews lasted approximately 15 minutes, and concluded with an invitation to attend the Mtwapa research station to complete the same interview conducted for diary study participants (CAPI)

Inclusion criteria

Diary study participants

We aimed to invite all men who reported sex with men enrolled in quarterly follow up in either HIV positive or HIV negative IAVI cohort studies to participate in the diary study. The population eligible for this study was estimated to be approximately 200 MSM, but the achievable sample size was limited by practical considerations of the intensity and duration of demands on existing staff and physical resources through the implementation of study procedures. A maximum group size of 30 participants was considered manageable at four locations around Mombasa, yielding a technical maximum study capacity of 120 MSM volunteers.

Criteria for inclusion of subjects

- Male aged 18 years or over enrolled in either HIV+ or HIV- IAVI cohort
- Reported sex with men at initial cohort enrolment
- Reported one or more sexual contact in the last month
- Willing to
    - receive risk reduction counselling and education about HIV and STD transmission
    - receive training on study procedures in a group with other study participants
    - keep detailed diaries on sexual acts during a period of 6 weeks
    - extend a hotline telephone toll-free-calling card to their sex clients (if applicable)
    - provide written informed consent

Criteria for exclusion

- Lost to IAVI cohort follow up
- No IAVI risk assessment within the cohort during the previous 6 months
- Under investigation for recent HIV seroconversion

Consent procedures for diary study participants

Eligible cohort participants for the diary study were invited to the Mtwapa clinic and informed about the study. Interested persons underwent a process of informed consent in either Swahili or English (Appendix 5.2) and enrolled for the diary training program. Scheduled quarterly IAVI cohort appointments continued as usual during the diary studies.

Clients of diary study participants

All clients making contact with the telephone hot-line were invited for an immediate telephone interview.

Criteria for inclusion of subjects

- Aged 18 years or over
- Able to verify receipt of a Hotline Card from a diary study participant (valid card number and week of receipt)
- Willing to participate in a face-to-face or telephone interview
- Willing to provide verbal informed consent

Study instruments

The study involved the development of four measurement tools applied to either participants recruited from the cohort studies, or to their sex clients directly identifying themselves to the study team.

1. Prospective event diaries (diary study participants only)
2. Computer assisted personal interview (diary study participants and clients of diary study participants)
3. Telephone questionnaire (clients of diary study participants only)
4. Exit survey (diary study participants only)

Role of MSM representatives to development and piloting of study instruments

The development of study instruments was informed by a Piloting and Steering Group formed in the 6 months prior to study commencement and comprising key members of the study team and 7 representatives of the MSM within the IAVI cohorts. MSM already acting as peer-educators, community mobilisers or support group leads were invited to this group, as the most informed representatives of the population. Members of this group were not invited to participate in the study proper.

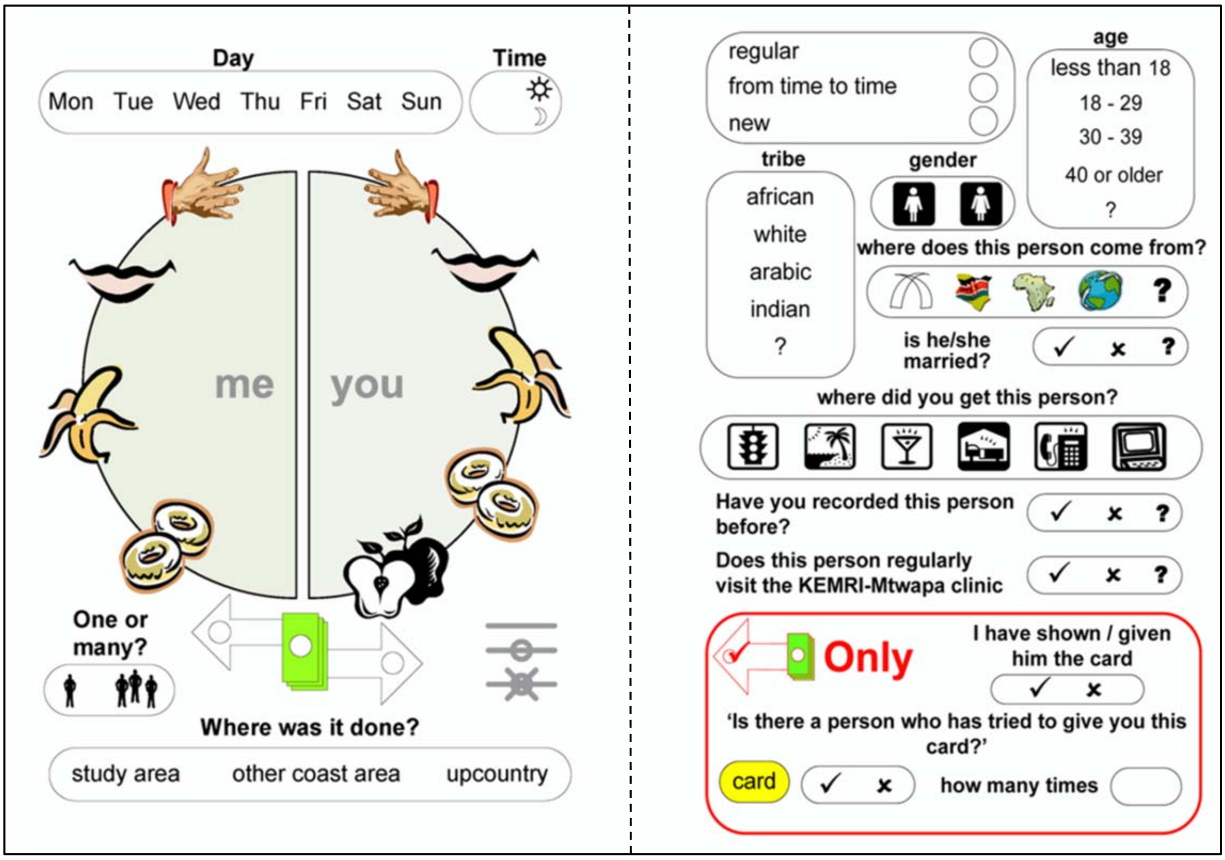
MSM members of the Piloting and Steering Group participated in a range of study development exercises. The author facilitated three formative focus group discussions with MSM representatives to inform the scope of study processes. Focus groups explored the definitions, measurement and importance of exchange sex (including sex work identities, motivations for sex work), sexualities (including local definitions, concordance between personal sexual desire and sexual behaviour, pressures on externalised sexuality) and HIV (including motivations for testing, consequences of positive testing and disclosure of HIV status between partners).

Pilot and Steering Group members directly participated in the preliminary design and content of the prospective event diaries, Hotline cards and structured questionnaires, offering specific comment on the ease of use, safety and confidentiality of self-completed and self-maintained measures. All MSM representatives participated in a formal one week pilot of preliminary event diaries, and four participated in a timed pilot of the computer assisted interviews.

Prospective event diaries

A novel approach to self-completed prospective sexual event and sexual partner recording was developed and successfully piloted with the assistance of the piloting and steering group. Final event diaries were colour printed in pocket-size paper format, containing sufficient space to record up to 21 different sexual events and corresponding partners over the course of one week follow up. Information on the sexual behaviours and basic situational, partnership and partner characteristics comprising each sexual event was recorded on a double page measurement tool combining pictographic and icon-based recording formats (Figure 25).

Figure 25: Event measure format in prospective event diaries (English back-translated from Swahili, double page spread)

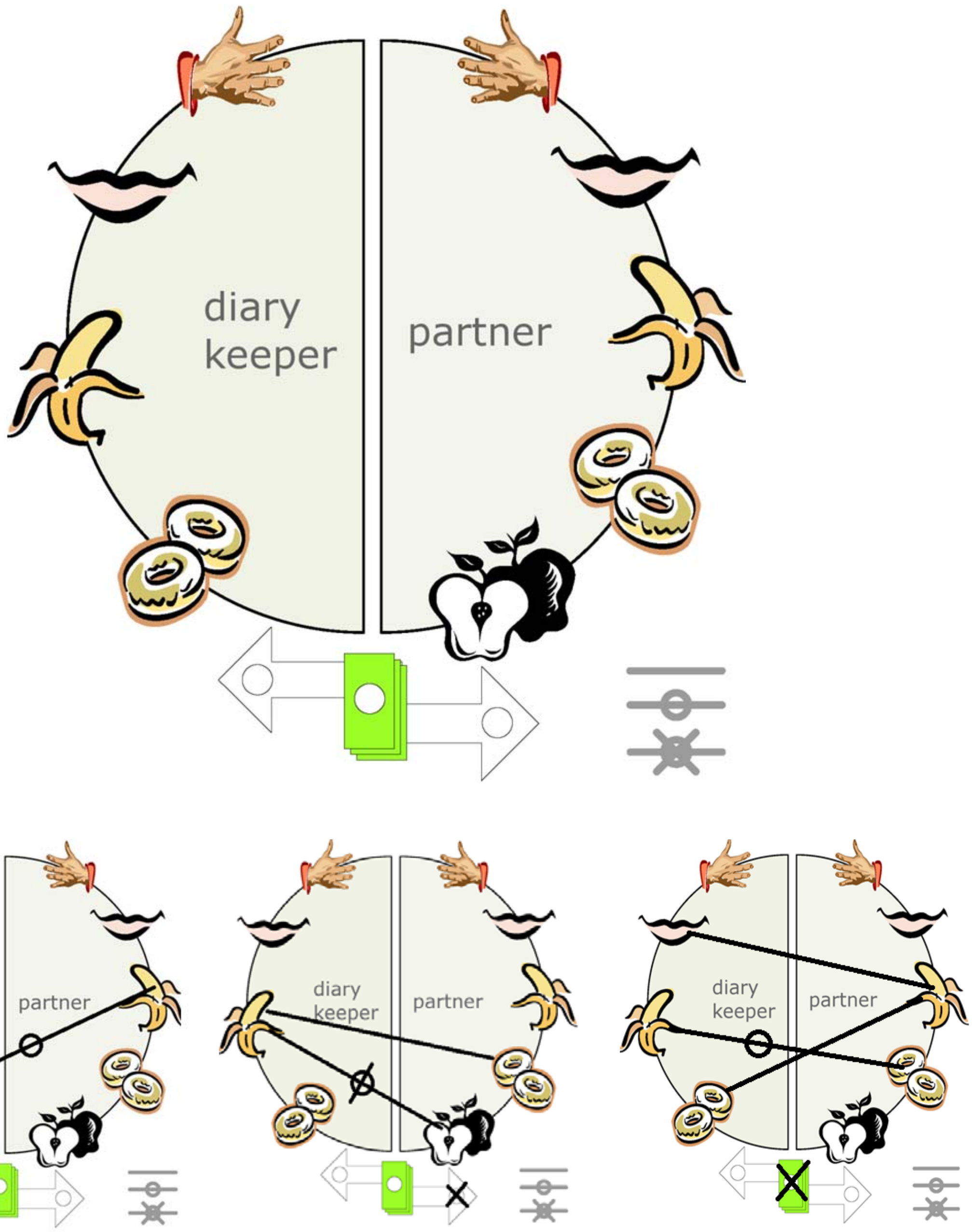


Diary content and format were designed both to be concise and unambiguous for trained participants to accurately self-complete (accommodating for low literacy among some potential participants), whilst not compromising either the security or privacy of participants if diaries were mislaid or observed by a third party. Successive drafting following feedback from piloting largely removed the requirement of participants to write text responses and increased the use of symbolic recording options.

Event-level sexual behaviour measurement

The most innovative component of the event diary was the pictographic approach to recording sexual behaviour and condom use using a visual behaviour disc shown below (Figure 26).

Figure 26: The visual sexual behaviour disc



Condom protected RAI: cash payment by partner

Unprotected AI and partially protected vaginal sex: cash payment by participant

Unprotected receptive anal and oral sex and protected IAI: no payment

Icons arranged around the outside of the left semicircle represent body parts of the diary keeper, whilst those on the right represent body parts of their sexual partner for that event. Icons represent penis (*banana*), anus (*donut*) and vagina (*apple*), with direct representation of mouth and hand. Recording a sex act entailed the diary keepers drawing a line to connect the relevant body parts of participant and partner for each round of sex, whereby round referred to a sexual activity leading to ejaculation (locally referred to as a 'shot'). Thus, one line from the left donut to the right banana represents one round of RAI leading to ejaculation (from the diary keeper's perspective). The addition of an unbroken circle to a line recorded the use of a condom throughout whilst a crossed-through circle recorded condom breakage or removed. Finally, the directional arrows at the base of the disc recorded the direction of cash exchange for the event, if this took place.

Combining records of separate acts, diaries elicited binary event-level measures of the occurrence and co-occurrence of three bidirectional sex acts with men (anal, oral, and manual sex by role) and two fixed direction (heterosexual vaginal and anal intercourse) plus two bidirectional sex acts with women (oral and manual sex by role), and respective binary event-level measures of unprotected sex, comprising either no condom use or partial condom use by act.

Event-level partner, partnership and situational measures

Diaries also recorded limited details of partner, partnership and situational characteristics. Referring to Figure 25, the right hand page recorded objective measures of the partner's gender, age group, ethnicity ('tribe'), geographic origin ('where does this person come from?'), marital status and attendance at KEMRI clinics. Diary keepers also recorded whether their partnership with the recorded partners was regular, casual recurrent ('from time to time') or new (based on relationship categories already in use in the IAVI cohorts). Selection of category definitions and ranges was guided by pilot feedback indicating those aspects of partners that would be objectively measurable without prompting diary keepers to question the partner. To avoid a perceived necessity to directly question partners and any attendant risk to participants should such questioning be unwelcome to sexual partners, an 'unknown' response item was included to all objective measures of partner characteristics. Situational measures were limited to the day and time of the event, where the event occurred, meeting place, whether sex took place in a group and whether the event involved exchange of cash payment.

Partner and client tracking measures

Event records also included partner tracking measures. Beyond distinguishing between new and recurrent partners (regular or casual), diary keepers also recorded whether or not the partner in a sexual event had ever been recorded *in any previous diary* during the study. Having ruled out methods to uniquely identify partners recurring within a specific partnership or between different diary keepers, this measure was required to distinguish different partners within an individual's prospective behavioural record.

Secondly, the framed red box (bottom right, Figure 25) recorded whether or not Hotline cards were issued to partners recorded as having paid cash for sex, and how the partner responded to the standard question 'is there a person who has tried to give you this card?' (back-translation from Swahili). This element was active only for periods of Hotline card issue, together representing 4 weeks of follow-up.

Computer assisted personal interviews

A self-completed computer assisted personal interview (CAPI) was developed and implemented on laptop computers on a QDS platform (Appendix 5.3). The CAPI featured an automated sequence of questions displayed on screen, with text or audio (Swahili or English) instructions, and requiring yes/no, check-box or minimal fee text response. CAPI self-risk assessment methods were in routine use in cohort follow up at this time, and had proved to be acceptable to most of the study population[189]. Skip patterns and cross-checks for data consistency were inbuilt and real-time. Three modules of the CAPI were self-completed by diary participants at baseline. The last module (recent partnership survey) was completed mid-way through the study with a member of the research team to identify the three most recent partners recorded in diaries.

The CAPI was also intended as the standalone collection tool for clients choosing to attend the Mtwapa clinic after the client telephone interview.

Measures in CAPI modules 1-3

The sociodemographic module replicated information recorded at behavioural assessments conducted during IAVI cohort follow up visits for purposes of validation (Appendices 3.1 and 5.3).

The retrospective behavioural assessment reproduced measures collected in cohort follow up for purposes of comparison, and added additional questions on details of sexual debut (age at debut, age and gender of debut partner, coercion at sexual debut), lifetime measures of sexual behaviour (lifetime partner count, lifetime partner gender, lifetime exchange sex), current sexual attraction and measures of substance use (lifetime non-injecting and injecting drug use; frequency of alcohol use and alcohol intoxication during the prior month). The knowledge and attitude module included questions on disclosure of MSM behaviour to family, friends and health workers, sources of trustworthy information about sexual health, knowledge of absolute and relative HIV transmission risks of sexual acts with male and female partners, intention to use various HIV risk reduction measures, and self-reported HIV status and testing.

Measures in CAPI module 4

Referring to recent partners, the final module of the CAPI profiled the partnership characteristics of the three most recent partners recorded in event diaries to that point, based in part upon the UNAIDS sexual network questionnaire[190]. Relationship start date and duration (for recurrent partnerships) and binary measures of sex roles (anal, vaginal and oral) and exchange sex over the entire duration of the relationship were recorded. Condom use by sex role (always, sometimes or never) and frequency of sex during the relationship were recorded. The exact age of each partner was estimated if not known.

Client telephone interviews

A structured narrative and questionnaire was developed for clients calling the number printed on Hotline Cards, and detailing eligibility of the caller, verbal consent procedures, sociodemographic and behavioural questions and procedures for referral for further participation (Appendix 5.4). Questionnaire items were deliberately brief and general, since this was originally intended as a means to invite full research participation.

Exit interview

Diary study participants offered feedback on the study process by means of a brief anonymous exit questionnaire (Appendix 5.5), intended to elicit honest personal reflections on the ease and accuracy of the study tools, honesty and adherence to instructed methods and overall impressions of the safety, confidentiality and potential for embarrassment compared to existing methods.

Data management and data security

Participant identifying information did not appear on the diary or any other data collection form, except on the consent form. Only the two principal investigators were able to link the diary study number to the IAVI study number.

Formative qualitative data

Focus group discussions were audio-recorded in digital format. Audio records of interviews were transcribed and translated into English soon after collection, and destroyed subsequently. Individually identifying content of transcripts (names and locations) was replaced by alphanumeric codes, accessible only to the two principal investigators.

CAPI

Participant responses were entered directly onto password protected portable workstations. Data was downloaded daily at the Mtwapa headquarters and archived in anonymised, securely encrypted formats.

Event diaries

After errors checking and correction of diaries (if necessary), supervisors returned hard copies of the diaries, consent documentation and supervisor notes to the secure study office for storage pending data extraction. After data entry, hard copies of individual research materials were permanently archived in a secure environment in KEMRI/IAVI facilities.

Due to the potential for transcription error in data extraction form visual diaries to databases, various technical approaches were tested for operator reliability and accuracy. Conventional data entry tools proved to have poor inter-operator reliability and accuracy in abstracting sexual activity data based on a pilot sample of diary extractions. Consequently, a bespoke visual data entry method was developed, implemented on Microsoft FoxPro, with a graphic interactive user interface that mirrored the manner of participant data entry. All diary data was extracted by two independent research assistants. Discordant or ambiguous records were verified by one of the principal investigators with reference to supervisors' notes. Overall accuracy was maintained through internal logical consistency algorithms, and checked by two random sample checks of 10% of diaries conducted by the author.

Data cleaning, merging and recoding

Data on individuals from prospective diaries, CAPI responses and IAVI cohort measures were merged to a unified dataset of over 4,500 sex rounds. Data was aggregated to events, partnerships and individuals appropriate for different level of analyses. A very small proportion of responses were missing (as opposed to unknown), an expected and important advantage of using electronic questionnaires with inbuilt error checking and real-time audit routines, and of standardised error checking and correction of event diaries conducted by supervisors.

Sexual behaviour measures

To reflect the known differences in per-route HIV transmission risks of different types of sex act, the key proxies of HIV transmission risk were considered to be unprotected penetrative peno-vaginal or peno-anal intercourse[108 191 192]. Per-contact HIV transmission risks to men differs markedly between receptive and insertive AI, less so between peno-vaginal and peno-anal [108]. Sexual behaviour measures were simplified to a summary measure of any type of unprotected penetrative intercourse, any unprotected AI between men (uAI), unprotected heterosexual sex with women (uHET), and role specific measures of unprotected receptive AI (uRAI) and unprotected insertive AI (uIAI).

Levels of response measurement

The linked methods of data collection generated three levels of sexual behaviour measurement – event level, partnership level and person level - requiring different analytic approaches:

1. Event level measures of sexual behaviour

Specific sex acts recorded in each diary event were merged into binary responses summarising whether or not the event included any penetrative sex act with male partners (AI, RAI or IAI), or any heterosexual sex act with female partners. For each such behaviour, unprotected sex (uAI, uHET, uRAI and uIAI) were defined as occurring where one or more sex rounds was unprotected (completely or in part). Dichotomisation of role-specific sex rounds to a summary event measure did reduce the maximum resolution of data, but was justified by the assumption that presence or absence of a sex act was more likely to be consistently reported between participants, whereas recall or definition of a sex round was more prone to reporting variation.

Analyses exploring the association between event-level binary responses and dyadic factors also recorded at event-level (referred to as 'event dyads', see Chapter 6) excluded events repeated with partners previously reported in a diary kept by the reporting participant, since it was not possible to relate repeat events to specific dyads in the absence of unique partner identifiers. Event-level associations between behaviour and dyad characteristics were analysed using multilevel models, which controlled for the non-independence of observations for dyads within the same study participant's record.

2. Partnership level measures of sexual behaviour

Partnership level sexual behaviour within the three most recent partnerships of diary keepers was collected in CAPI: Module 4. Variables differed from diary-based measures in being referent to practices throughout the partnership and in summarising the occurrence of unprotected sex as an ordinal categorical measure (condom use during partnership: always, sometimes or never). Analyses exploring the association between the proportional odds of declining condom use (i.e. unprotected sex practice) and explanatory individual, partner and partnership characteristics utilised ordered logistic regression. Results of partnership-level analysis are reported in Chapter 6.

3. Person level measures of sexual behaviour

A summary of person level measures of sexual behaviour is shown below (Table 17). Summation of prospective reported behaviours in the diary study yielded cumulative personal counts of each type of sexual behaviour for each study participant over follow up. Counts were expressed as incidence rates with a standardized denominator of follow up (4 weeks), for ease of comparison. In addition, summary count measures of prospectively reported behaviours were further simplified to binary measures dichotomising any versus no occurrence of specific behaviours over follow up.

In addition to count measures of behaviour based on cumulative individual diary entries, the association between event-level binary measures of unprotected sex and personal characteristics of the study participant were analysed using multilevel models, permitting estimation of a summary individual proportion of unprotected sex over all reported sexual events, adjusted for event-level determinants. Results of person level analyses are presented in Chapter 7.

Table 17: Participant-level behaviour measures and approach to analysis

Descriptive / outcome variable	Numerator	Denominator	Method of comparison within individuals	Method of between individual comparison
Absolute frequency of unprotected sexual behaviours	Count of unprotected AI episodes (total, receptive, insertive) with male partners Count of unprotected vaginal/AI episodes with female partners	Completed weeks of follow up	Wilcoxon sign test for matched pairs *No adjustment*	Negative binomial regression or Zero-inflated negative binomial regression *Adjustment for other individual covariates*
Absolute frequency of sexual behaviours	Count of AI episodes (total, receptive, insertive) with male partners Count of vaginal/AI episodes with female partners			
Proportion of unprotected sexual behaviours	Count of unprotected AI episodes (total, receptive, insertive) with male partners Count of unprotected vaginal/AI episodes with female partners	Count of AI episodes (total, receptive, insertive) with male partners Count of vaginal/AI episodes with female partners	McNemar's test *No adjustment*	Mixed effects logistic regression, with individual random effect *Adjustment for other individual, partnership and event covariates*

Independent variables

Table 18 summarises the characteristics of individuals (study participants and their sexual partners), dyads (partnership characteristics and individual mixing within dyads) and events that were measured and assessed as potential explanatory factors for individual, dyad and event-level sexual behaviours. Most individual sociodemographic and clinical measures were extracted from the most recent IAVI follow up record (within 3 months), and merged with measures of long-term sexual and drug use behaviour, expressed sexual preference, and knowledge and attitude toward HIV prevention. Dyadic measurements in the CAPI survey elicited features of the entire sexual partnership (duration, transaction, frequency of sex etc.), whilst features elicited from diaries reflected the recorded event only.

Table 18: Selected measures of independent individual, dyadic and event factors

Level of measurement	Source of measurement	Item of measurement
Individual	CAPI Modules 1 – 3[a] *and* IAVI cohort[b]	**Sociodemographic:** Age, Religion, Ethnicity, Location of birth and residence, Education, Current socioeconomic status (employment, earnings, household possessions), Marital status **Behavioural (lifetime)**: Sexual partner count and gender, Sexual debut (age and gender), Transactional sex (sold sex and paid for sex), Injecting and illicit drug use **Behavioural (current)**: Sexual gender preference, Alcohol use and intoxication. **HIV**: HIV knowledge, sources of information, HIV prevention intention HIV status, clinical HIV stage, CD 4 count
	Event diaries[c]	**Behavioural**: Regular sexual partner (by gender), Current behavioural sexuality , Transactional sex
Sexual partner characteristics	CAPI Module 4 [a]	**Partner:** Exact age
	Event diaries[c]	**Partner:** Gender, age group, ethnicity, geographic origin, marital status, IAVI study participation
Dyad characteristics	CAPI Module 4 [a]	**Partnership:** Relationship duration, Frequency of sex, Transaction (entire partnership), Marital relationship **Individual mixing:** exact age difference
	Event diaries[c]	**Partnership:** Relationship type (categorical), Means of initial contact with partner, Transaction (event only), **Individual mixing:** Mixing by gender, age group, ethnicity, geographic origin.
Event characteristics	Event diaries[c]	**Situational:** Location (study area, other Coastal location, other inland location), Time and date

[a]: Appendix 5.3 [b] Appendix 3.1 [c] page 103

Sexuality of study participants

The appropriate choice of self-identified measures of sexuality and sexual attraction were explored in a formative focus group discussion and informed by the findings of a new module of cohort assessment questions introduced into IAVI risk assessments prior to the study (designed by the author). Focus groups yielded a wide array of both English and Swahili terms used to describe personal sexual identity, rooted in gender preferences, sex role preferences, affiliation with sex work and masculinity/femininity, further discussion of which is beyond this thesis. Such discussion clearly indicated a lack of objective consistency between how IAVI volunteers assigned or identified with local and 'international' terms for different sexual orientations. Sexuality was thus described by three key indicators, two that were behaviourally defined (lifetime and prospective heterosexual sex) and one reflecting personal gendered sexual attraction.

Sex work

Considering the many potential notions of 'sex work', a separate focus group explored these notions to determine an unambiguous approach to measurement. Further to piloting the diary study, MSM representatives described nuanced but variable perceptions of what different men viewed as exchange sex (from receiving drinks to pre-arranged cash payment of the other), and the various manifestation of selling sex (from one-off, street-based encounters with strangers for cash, iPods, telephone credit, to long-term emotional relationships with partners who provided housing or shelter). To encourage consistency, transactional sex for the diary study was defined as 'payment in cash for sex, before or after the event', mindful that this restrictive definition would likely under-ascertain events seen by some participants as transactional.

Overall, the scope and resolution of many of the independent variables measures was admittedly limited, many of which did not approach gold standard approaches. This largely reflected the fact that the key purpose of the study to funders was the description of sexual behaviour, which already presented participants and staff with demanding measurement procedures to which the addition of further study procedures would have been difficult. Further there were implicit concerns about limiting any potential for self-incrimination through the maintenance of self-held diaries or disclosure through association with MSM studies in general. Event-level approaches to alcohol use, drug use, exact transactional exchange, precise location of sex and perceived HIV status of partner were all considered as diary measures as they are known elsewhere to influence event-level risk taking, but were rejected for these reasons.

Ethical considerations

Research protocols, consent forms and study materials were approved by research ethics committees in Kenya (KEMRI ERB – Nairobi) and the UK (OXTREC - Oxford) (Appendix 5.6)

Potential risks to study participants were carefully considered by the piloting and steering groups in the design of the study, and were fully described in ethical review applications. The need for study participants to maintain records of illegal behaviour and exchange sex was considered to represent some risk to the safety of participants, especially as MSM anecdotally report regular harassment and interrogation by police, and was the motivation to develop a recording tool that, even if discovered by authorities or other individuals, could not incriminate the diary keeper.

The design of the diary study was directly influenced by representatives of the intended study population, and the final design was subjected to review (including by ethics review boards). Safety was optimised by negating the requirement for text entry, design intended to be objectively meaningless to a third party, and by avoiding identifying characteristics of the purpose of the study or the diary owner in participant-held materials. As a secondary measure, all study participants were provided with 24-hr contact details of an on-call staff member for emergency contact, and an official letter confirming participation in a study authorised by KEMRI and the Provincial Medical Office.

Extending an invitation to clients also required consideration of participant risk. To mitigate this, study participants were instructed never to record information in diaries in the presence of another person and the explicit option to record partner characteristics as 'unknown' was included as an optional response item in diary measures. Further partner characteristics of research interest, such as HIV status, contact with other MSM, drug use and alcohol consumption were not included in case participants felt obligated to question partners directly about these issues. The one requirement to interact with clients for the purposes of the study was the request to offer a Hotline card to the client, and to ask if they had seen this before. This interaction was role-played a number of times during training, again emphasizing that participants should not ask these questions if *any* threat from the clients was perceived.

Statistical analysis plan

Analysis of event-level risk of unprotected sex

Factors associated with binary event-level behavioural measures were explored using multilevel mixed effects logistic regression. This is one of a number of statistical approaches that take account of the tendency for multiple events reported by the same individual to be correlated or non-independent. This method was preferred over other approaches to repeated measures, such as generalised estimating equations, in reportedly being more tolerant of data sparsity in grouping variables and in providing a direct method of estimating the variance between events and between individuals.

Event-level measures (i.e. sexual encounters) were assigned as level 2 and nested within level 1 individual measures (i.e. diary study participants). Binary response variables represented whether or not each sexual behaviour event was unprotected or not (Y/N), restricted to events that included that behaviour (AI, RAI, IAI or HET). Null two-level models were fitted in the first instance, specifying only the binary response variable and model hierarchy, and estimated the intercept (β_0) and individual-level random effect only (u_{0j}, where i = discrete individuals and j = discrete events), with an independent structure for the level 1 covariance matrix.

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + u_{0j}$$

Stata 10 estimation procedures are limited to maximum likelihood estimation using adaptive quadrature. Estimated intercepts and between-individual variance were compared for 5 to 15 integration points, 7 being adequate. The likelihood ratio statistic for the null hypothesis $\hat{\sigma}_{u0}^2 = 0$ and corresponding p value offered strong evidence that between-individual variance was non-zero for all models (p<0.001). Caterpillar plots of ranked level 1 residuals ($\hat{u}_{0j}$) and 95% confidence intervals were produced, indicating a number of individuals significantly above and below the mean residual (Figure 27).

The variance partition coefficient (VPC) is the fraction of total estimated variance attributable to between-individual variance. The variance partition coefficient was calculated for null and fitted multivariate models, as follows and where $\pi^2/3$ represents the variance of the logistic level-2 error term.

$$VPC = \frac{\sigma_{0j}^2}{\sigma_{0j}^2 + \pi^2/3}$$

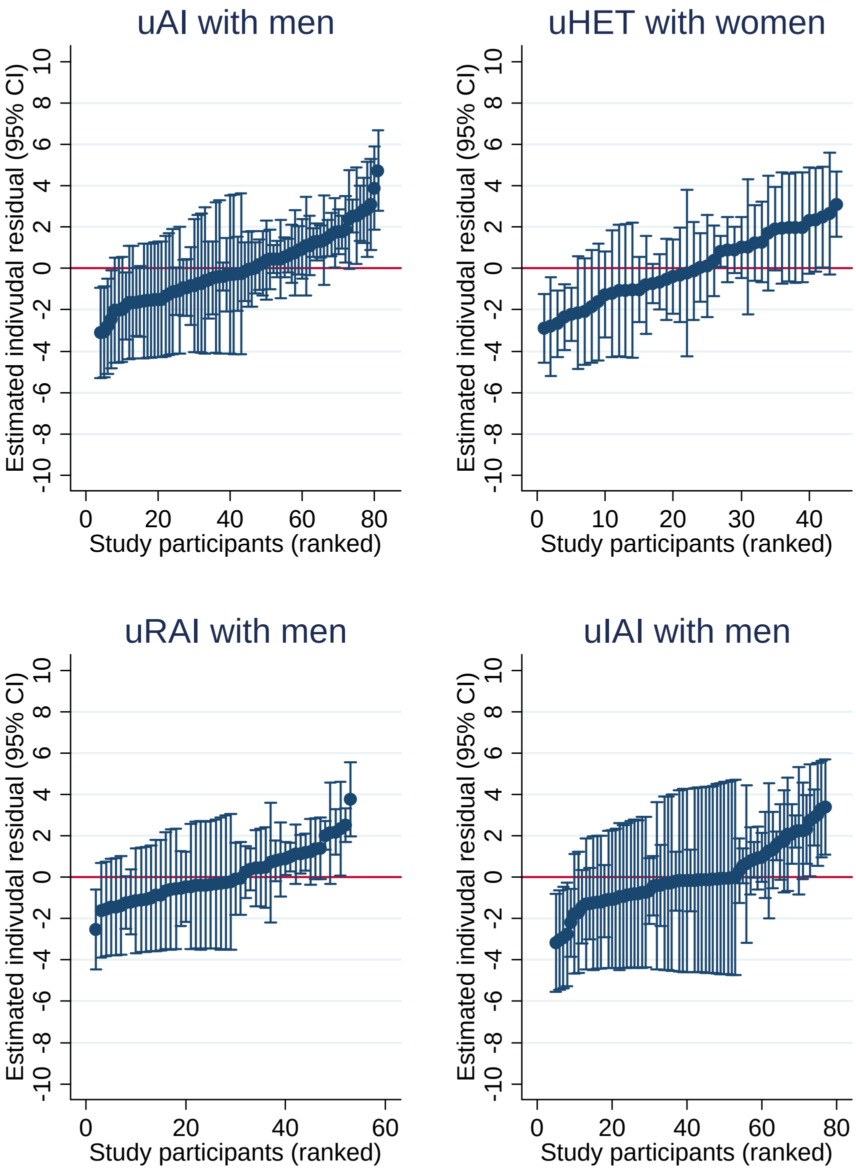
Event-level explanatory variables, including situational, partnership and partner variables, were estimated as the fixed effect components of these models (i.e. level 2 covariates). Individual-level independent variables were evaluated as level 1 covariates in random coefficient models.

Assumptions for multilevel logistic regression models

Statistical assumptions pertinent to multilevel logistic models include (a) that level 2 events are independent of each other between different level 1 groups and (b) that level 1 random effects are independent of each other but follow a generalised distribution that can be simulated using maximum likelihood [193]. In the context reported, a potential violation of independence of level 2 measures arises from non-independence of *partners'* observations where the partner featured repeatedly in a single participant's record, or featured in the records of multiple diary participants. Non-independence of partners' behaviours could not be estimated directly since partners were not uniquely identified. The potential non-independence of events with the same partner within a single participant's record was mitigated by limiting analysis to the first sexual encounter with each partner (Chapter 6) however no approaches were identified to control for potential non-independence of measures between partners recorded by multiple participants

Figure 27 charts estimated level 1 residuals for each study participant (with 95% confidence intervals) with respect to the average residual for all participants (horizontal line at zero). For a substantial number of participants, the 95% confidence interval did not overlap zero indicating that the probability of condom unprotected sex for some individual participants was significantly higher or lower than average. With respect to the distribution of residuals, Figure 27 suggests mild deviation from normality at rank extremes, also apparent from standardized normal probability plots of predicted deviance residuals. The impact of breaching strict assumptions about the parametric distribution of the random effect has historically been contentious. A recent review, including theoretic and data-driven simulation studies, suggested that most aspects of statistical inference are robust to even radical misspecification of random effects distributions with group sizes of greater than 5, but that bias is most frequently observed in the estimation of the level 1 intercept[194 195].

Figure 27: Caterpillar plots of predicted standardised level 1 residuals of unprotected sex probability (95% confidence intervals; null models)



The appropriate minimum number of level 1 groups and the minimum number of level 2 events per level 1 group also lack clear consensus. Simulations suggest a relatively modest number of groups (<10 level 1 groups[196 197]), average group sizes (<5 subjects/group[196]) and proportion of singletons in groups (<20% with 50 level 1 groups[198]) are sufficient to avoid bias in the estimation of level 1 standard error, whilst others suggest higher sampling requirements (e.g. 'at least 50 groups with 50 subjects per group'[199], >50 groups [200]). For the smallest samples analysed (HIV negative subjects only, Chapter 7), the level 1 count & average group size for respective outcomes is shown below (Table 19). The stratification of level 1 and level 2 samples was fairly balanced, but the achieved samples were small (<50 HIV negative individuals reporting RAI or heterosexual sex), indicating the need for caution in interpretation of the event-probability of unprotected sex for HIV negative subjects.

Table 19: Level 1 and level 2 samples characteristics for multilevel analyses

	Events (level 2) N	Individuals (level 1) N	Events per individual (mean)	Level 2 units with singleton events (%)
AI with men	840	61	13.7	1 (1.6%)
Heterosexual sex	309	44	7.0	4 (9.1%)
RAI with men	344	33	10.4	4 (12.2%)
IAI with men	583	59	9.9	6 (10.2%)

Associations between event or individual characteristics and the event probability of unprotected sex were expressed as the crude and confounder-adjusted odds ratio (OR and aOR respectively), reported with 95% confidence intervals and two-sided Wald *p* values.

Analysis of partnership-level risk of unprotected sex

Factors associated with partnership-level risk of unprotected sex, represented by a retrospective, ordered categorical measure of condom-use throughout the sexual partnership were explored using ordinal logistic regression. In keeping with event-level analysis discussed above, analysis required adjustment for within-individual non-independence of partnership observations. Multilevel and panel methods were not appropriate since each individual reported a maximum of only three partnerships: as discussed above, average group sizes of less than 5 indicate a significant risk of bias[196]. Instead, individuals were specified as a cluster variable resulting in robust estimation of coefficient standard errors.

The key assumption of ordinal logistic regression, the assumption of proportional odds, was formally tested using the Wald test of parallel lines assumption (Stata command: *gologit2*). There was no evidence of violation of this assumption.

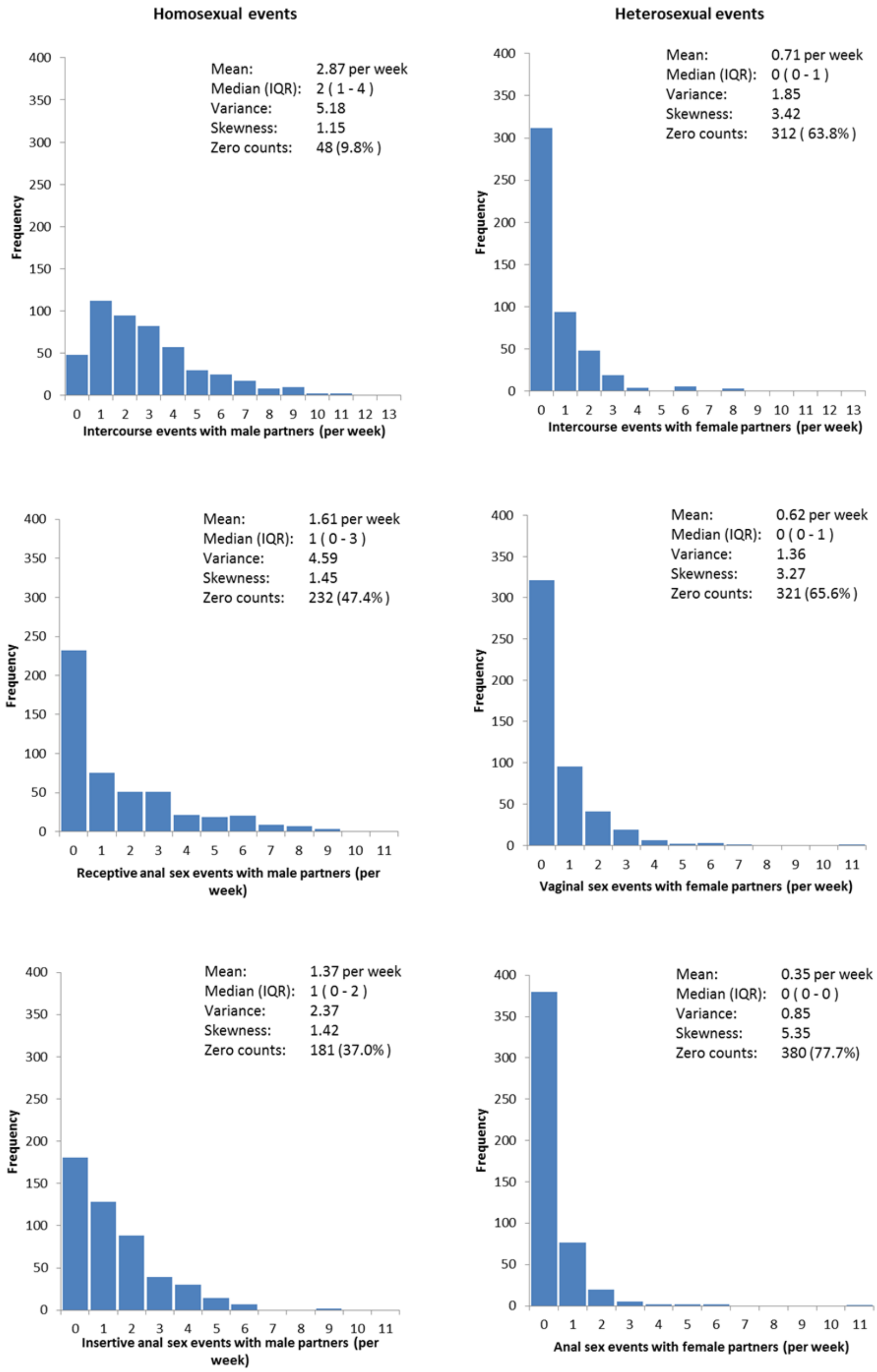
Analysis of individual-level unprotected event counts

Counts of specific sexual behaviours occurring during individual follow up were expressed both as raw counts and as incidence rates to permit comparison accounting for differing follow up periods. The numerator for each incidence measure was the cumulative count of separate sexual episodes that included occurrence of that behaviour across each participant's diary record. The denominator for each incidence measure is the individual follow up time within the diary study, standardised to 4 weeks for comparison. The denominator excluded periods of time where the participant was enrolled in the study, but unable to complete their daily diary. Therefore, where expressed, incidence rates represent the average incidence of behaviour over the course of an individual's, or group of individuals', combined diary follow up.

Weekly and total individual sexual behaviours counts were severely non-normally distributed for all behaviours, in particular for receptive anal and heterosexual behaviour counts (Figure 28). Distributions were strongly positively skewed and accompanied by a high proportion of zero counts together resulting in significant over-dispersion for all individual behaviour measures (i.e. the variance of counts exceeded the mean).

Approximation to the Gaussian distribution was tested formally using the Kolmogorov-Smirnov test on raw counts, and after application of various data transformations, using both the ladder command in Stata 10 (testing normality of log, inverse, square root and cubic root transformations) and after manual transformation to $\log_{10}(x + 1)$ (a traditional transformation for sexual behaviour data)[201]. In all cases, data transformation alone proved insufficient to permit linear parametric analysis.

Figure 28: Frequency distribution of weekly sexual event counts for 489 diaries



Within-individual comparison of behavioural counts

For comparisons of different behaviour counts within the same individual, non-parametric tests of matched count data were used for statistical comparison of the count of different behaviours recorded by the same individual for their complete follow up, specifically the Wilcoxon sign test of matched pairs (Stata command: *signrank*). This significance test evaluates the null hypothesis that the median of the difference between two counts is zero, and makes no distributional assumptions. Within-individual comparisons were not adjusted for other covariates.

Between-individual comparison of behavioural counts

For comparisons of behaviour counts between groups of individuals with differing follow-up period, the most appropriate method for modelling counts was assessed. For all behaviour counts the conditional variance of behavioural counts markedly exceeded the conditional mean (overdispersion), invalidating the key assumption for the parametric analysis based on the Poisson distribution (Figure 28). The negative binomial distribution is a discrete probability distribution of the number of successes in Bernoulli trials before a specified number of failures occur, and which includes an additional dispersion parameter allowing the mean of the Poisson distribution to be treated as a random variable and permitting account of overdispersion[202]. These distributional properties account or the widespread use of negative binomial regression for parametric analysis of sexual behaviour frequency [201].

A related consideration was the high number of zero counts (Figure 28) which alone may violate assumptions of Poisson or negative binomial regression. Furthermore, where zero counts are frequent, it is reasonable to consider whether the net behavioural count is better determined by factors related to behaviour frequency *and* others that relate to whether the behaviour occurs at all[202]. Zero-inflated Poisson (ZIP) and zero-inflated negative binomial regression (ZINB) methods combine a binary response component (logit) predicting zero or non-zero responses with either a Poisson model or negative binominal model for predicting counts[202].

The optimum univariable and multivariable model fit of these various count options were compared firstly by evaluating the likelihood ratio test between negative binomial and Poisson regression models. In all cases, negative binomial regression represented a significant statistical improvement in fit over Poisson regression. The comparative fit of negative binomial and ZINB were further assessed for null and fully specified models by fitting each model covariate as a prospective independent determinant of the logit model. Fit statistics were compared using The Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) values and Vuong tests, as implemented by the *countfit* suite of Stata commands[203]. In all but one model specification (where ZINB fit was a marginally better than negative binomial), conventional negative binomial regression was the preferred model choice and for ease of comparison. This method was adopted throughout for tabled comparative analysis, although the specific exception is highlighted in the accompanying text.

Associations between individual characteristics and the incidence of specific behaviours are expressed as the crude and adjusted incidence rate ratio (IRR and aIRR respectively), with 95% confidence intervals and two-sided Wald significance tests unless otherwise specified.

Multivariable modelling strategy

Since the data represent a small sample, multivariable analysis of counts, ordinal categorical and binary behavioural responses was conducted carefully and with limited numbers of covariates. The widely observed rule in model specification is that the number of events per variable (EPV) should exceed 10, below which simulation studies indicate a risk of bias in estimation of regression coefficients[204 205]. At EPVs below 10, Steyerberg et al also demonstrate the risk of covariate selection bias in stepwise approaches to model specification with α=0.05 [205], not present with less stringent approaches. A related consideration was the potential for collinearity between correlated explanatory covariates (for example, lifetime and prospective behavioural sexuality).

Models were pre-specified using a limited number of candidate covariates, defined *a priori* informed by observed effects identified in studies of HIV prevalence (Chapter 3 and 4), and used to specify models of both count and binary behavioural responses. Covariates anticipated to be correlated with each other were evaluated by replacement in the model, and comparison of model fit.

Optimization models were also fitted through incremental addition, or removal, of covariates in bivariate association with response to a relaxed criterion for selection (p<0.200) for comparison.

The AIC and BIC were used to quantify the degree to which model fit was improved through addition of covariates[206]. These measures favour parsimony by penalising fit with increasing number of covariates[i]. Guidelines for interpretation of between model differences in BIC were applied (0-2, weak evidence; 2-6, positive evidence; 6-10 strong evidence; >10 very strong)[207].

Power of expected sample

The projected power of the anticipated sample for event-analysis methods were estimated assuming 1080 events (90 participants (*m*) completing follow up (assuming 25% drop out after enrolment) reporting an average of two events per week (total 12 during follow up (*n*)), a within-participant event correlation (ICC) of either 0.25 or 0.50 (p), and α = 0.05. 'Conservative' and 'liberal' design effect estimates (methods in Twisk[208] and below) yielded widely ranging design effect estimates of 3.8 & 1.3 for an ICC of 0.25 (effective sample size 288 and 833 respectively), and 6.5 & 1.8 for an ICC of 0.50 (effective sample sizes 166 and 585 respectively) for event-level analysis.

Conservative design effect estimation: $N_{effective} = \frac{N}{(1+(n-1)p)}$

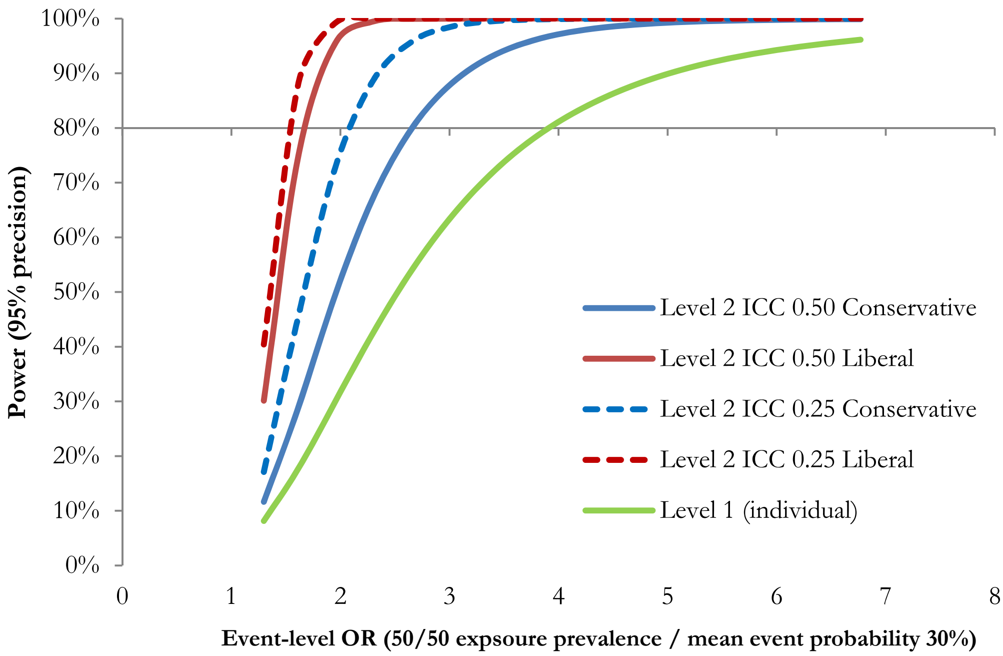
Liberal design effect estimation: $N_{effective} = m(1 + (n-1)(1-p))$

Assuming a mean 30% probability of unprotected sex (based on Chapter 2), Figure 29 charts the power of the effective sample size to distinguish differing probabilities by a binary explanatory covariate (50% exposed: 50% unexposed) for various projected effect sizes, by covariate level , ICC and design effect estimation method.

Depending on the design effect estimates used, the expected sample size would have 80% power to detect a 1.5-2 fold difference in unprotected sex probability by an event-level explanatory factor with a 25% individual ICC, a 1.6-2.6 fold difference with a 50% individual ICC, and an approximately 4-fold difference in an individual-level factor.

i AIC: by 2 x the parameter count; BIC by ln(sample size x parameter count).

Figure 29: Power analysis, multilevel logistic regression



Performance of behavioural measures

Accuracy of self-completion and supervisor corrections

Supervisors reported one or more errors in the completion of the diary in 209 cases (42.7%), and this proportion did not decline as the study progressed. Most of these errors referred to inaccuracies in self-reporting card issue/client recognition components of the diary rather than reporting of behaviour and partner characteristics (20.1% of diaries without card issue components had errors)

In the exit interview, 98% (78/80) of participants claimed to have fully understood how to use the diary by themselves. 41% (33/80) reported forgetting to record a relevant measure in any of their diaries during the study, but only 9 (11.3%) reported that the supervisor had not noticed and corrected such an error. A minority of participants reported completing the whole diary at the end of the week (12/80, 15%), rather than daily as instructed.

Agreement between prospective and retrospective behavioural measures

Sixty-five participants had contemporary recall-based measures (established from FTFI in cohort follow up) and prospective records of behaviours (established from diaries) for the same seven day period. Insufficient participants (16) had matching measures covering the previous month for analysis.

Agreement between diary and cohort weekly measures is shown in Table 20 and Table 21. Participants were more likely to report any sex (+6.2%), any unprotected sex (+4.6%) and any exchange sex (+7.7%) in their diaries than at recall in the cohort study, but differences were not significant (Table 20). Agreement between binary measures was moderate (Kappa 0.41 to 0.60), and statistically significantly better than chance alone.

There was no difference between diaries and retrospective median counts of different sexual partners for the same week (Table 21), and within-individual agreement was moderate (Kappa = 0.56). Retrospective measures tended to report slightly higher counts of recurrent sexual partners than diary measures, but this difference was not significant. Diaries reported higher counts of new partners and sex clients, however the difference was not statistically significant and within-individual agreement was substantial (Kappa 0.6-0.8).

In contrast to counts of partners, there were significant differences in the counts of anal and vaginal intercourse acts between measurement methods. Prospective measures recorded a higher mean and median act count than recall measures, and this difference was statistically significant (Wilcoxon p = 0.002). As a consequence, absolute measures of absolute count agreement between methods was relatively low (Kappa = 0.37)

Table 20: Agreement between prospective and retrospective binary measures

Binary Measures	Prospective N = 65	Retrospective N = 65	Differences between binary measures		Agreement between binary measures		
(one week)	n (%)	n (%)	% difference (95% CI)	McNemar's test p	Agreement (unweighted)	Kappa (unweighted)	p
Any penetrative sex	61 (93.9%)	57 (87.7%)	6.2% (-2.6 – 14.9%)	0.103	90.8%	0.455	<0.0001
Any unprotected sex	34 (52.3%)	31 (47.7%)	4.6% (-9.3 – 18.6%)	0.467	73.9%	0.478	0.0001
Any sold sex	59 (90.8%)	54 (83.1%)	7.7% (-2.6 – 18.1%)	0.096	86.2%	0.399	0.0003

Table 21: Agreement between prospective and retrospective count measures

Count measures	Prospective N = 65	Retrospective N = 65	Differences between count measures	Agreement between count measures		
(one week)	Median (IQR) Mean	Median (IQR) Mean	Wilcoxon matched-pairs signed-rank p	Agreement (quadratic weighted)	Weighted Kappa (quadratic weighted)	p
Total partners	3 (2 - 5) 3.4	3 (1.5 – 5) 3.4	0.751	95.3%	0.564	<0.0001
Recurrent partners	1 (0 - 2) 1.4	1 (0 – 2.5) 1.7	0.088	90.4%	0.503	<0.0001
New partners	1 (1 – 3) 1.9	1 (0 – 2) 1.7	0.391	97.0%	0.688	<0.0001
Paying clients	2 (1 – 5) 3.1	2 (1 – 4) 2.8	0.386	96.8%	0.626	<0.0001
Total sex acts	7 (4 – 14) 9.4	6 (2 – 10) 6.8	0.002	92.2%	0.372	0.0005

59% of diary keepers considered diary reporting to be less embarrassing than cohort FTFI (and 13% no worse), and 70% (55/79) thought that diaries were a more accurate account of their behaviour, whilst 72.7% (56/77) thought they had been more honest in diaries compared to experiences in the IAVI cohort.

Correlation of diary study behaviour measures with subsequent HIV incidence

The cohort records of 61 participants who were known to be HIV negative during the prospective behavioural study were reviewed 12 months after completion of the diary study. Of the 44 MSM remaining in follow up, 5 had HIV seroconverted and 39 remained HIV seronegative, together representing 50.0 person-years of follow up (average 299 days, median 365 days). The results are shown in Table 22.

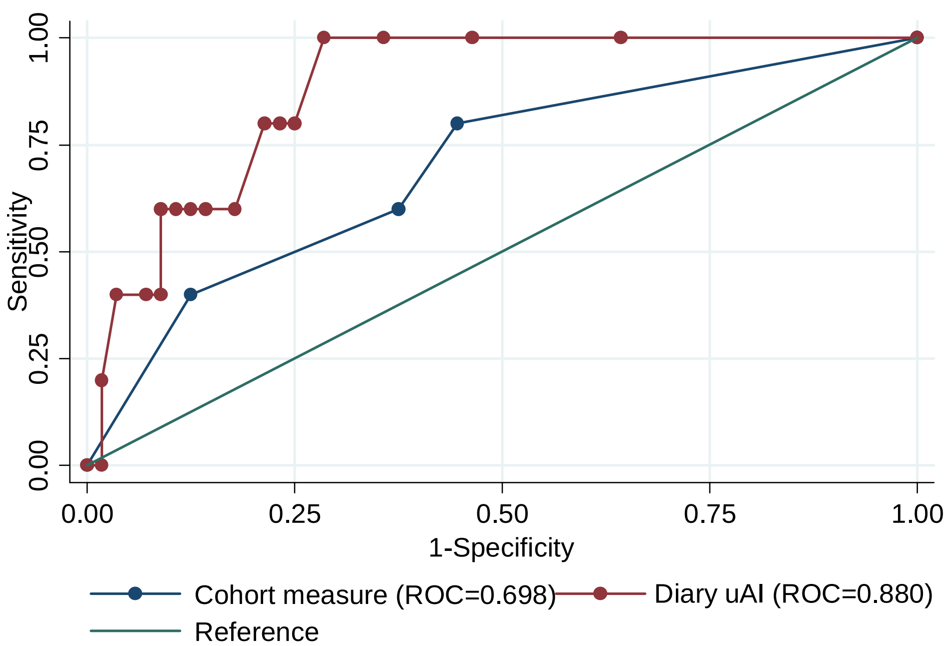
Table 22: Comparison of diary behaviour frequencies by HIV seroconversion within 12 months of diary study

Prospective event counts in event diaries (per week)	HIV seroconversion within 12 months of diary study		Crude hazard ratio of HIV seroconversion per unit increase in event count (95% CI)	Wald *p* value
	Yes N = 5	No N = 39		
Sexual partners				
Male partners	5.2	2.3	1.14 (1.04-1.25)	0.004
Female partners	0.2	1.0	0.70 (0.43-1.13)	0.149
Male clients	4.7	2.0	1.19 (1.06-1.33)	0.002
Female clients	0.1	0.7	0.63 (0.31-1.28)	0.199
Sexual behaviour				
RAI	3.7	0.8	1.11 (1.04-1.18)	0.002
uRAI	1.4	0.1	1.20 (1.07-1.35)	0.002
IAI	1.3	1.7	0.95 (0.83-1.09)	0.454
uIAI	0.8	0.6	1.02 (0.90-1.14)	0.794
HET (vaginal or anal sex)	0.2	1.0	0.70 (0.43-1.13)	0.148
uHET	0.2	0.4	0.85 (0.53-1.35)	0.479

These indicate that diary measures of the average weekly frequency of male partners, male clients, RAI and unprotected RAI were predictive of HIV seroconversion within 12 months. MSM who became HIV infected within 12 months had reported approximately twice as many male partners and male clients during the diary study, approximately seven times more RAI episodes and 17 times as many uRAI episodes as MSM who did not become infected. Although a small number of events, these results suggest that expected behavioural proxies of HIV risk were related to actual long-term HIV risk, despite diary measures representing only a brief period of follow up.

The sensitivity and specificity of increments in measures of sexual behavioural risk in determining longer term HIV incident risk was compared for diary measures and routine risk assessment measures conducted in IAVI cohort follow up. Diary measurement of uAI frequency was more discriminatory of subsequent HIV seroconversion in the 12 month period following the diary study than were measures of uAI from contemporary cohort risk assessment for the same assessment period, quantified by the area under the ROC curve (0.88 & 0.70 respectively, Figure 30).

Figure 30: Sensitivity and specificity of cohort and diary measures of uAI activity against 12 month HIV infection

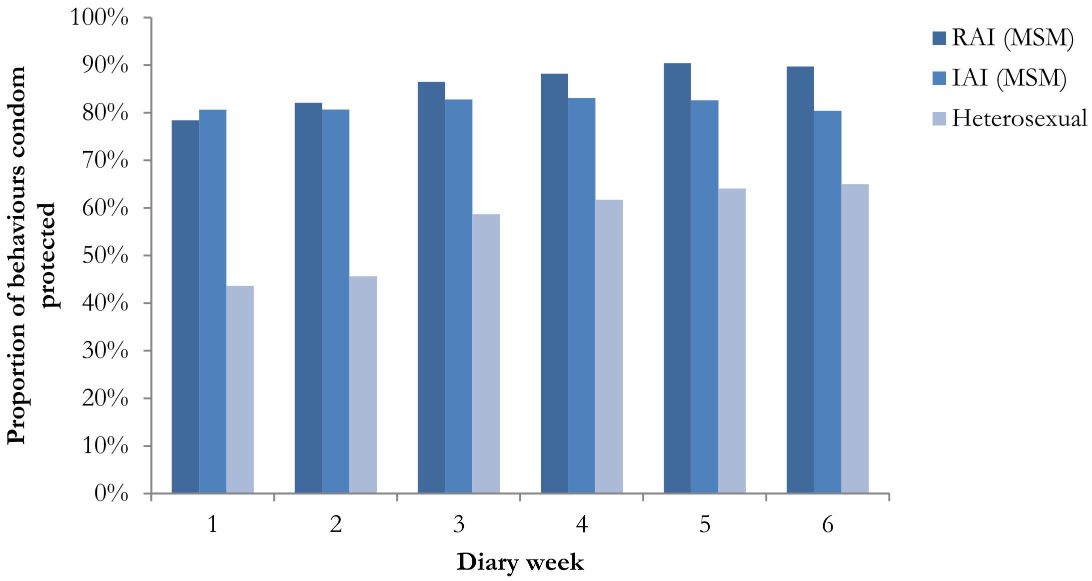


Cohort measure: categorical condom use for AI in the previous 3 months
Diary measures: count of uAI events over 6 weeks

Reactivity

A limitation of prospective sexual behaviour diaries is the tendency for behavioural practices under study to be influenced by the research process itself, known as reactivity. The effect of cumulative diary weeks of follow up upon the individual frequency of behaviours and the probability that behaviours were unprotected was explored. There was no evidence for a change in the frequency of RAI, IAI or heterosexual events by increasing study week. However, there was evidence for significant increases in the proportion of RAI and heterosexual events that were condom protected with increasing study week after controlling for repeated observations among individuals, but not for IAI (OR event-level condom use per advancing study week: RAI 1.29 (1.14-1.48) $p<0.001$; IAI 1.05 (0.92-1.21) $p=0.461$; Heterosexual 1.36 (1.12-1.66) $p=0.02$). These findings suggest reactivity in condom use over the study process, perhaps bought about by repeated reflection on personal risk behaviour, or simply through better access free and regular access to safe sex materials through the research process.

Figure 31: Proportion of condom-protected events by progressive week of diary follow up



In summary, preliminary performance assessment of visual diaries suggested higher predictive performance even for long-term HIV infection, higher behaviour recording for most MSM and sex work behaviours, and higher participant-reported acceptability than corresponding approaches in IAVI cohorts. However, there was evidence of increases in per-event condom use as the study progressed.

Performance of client recruitment approaches

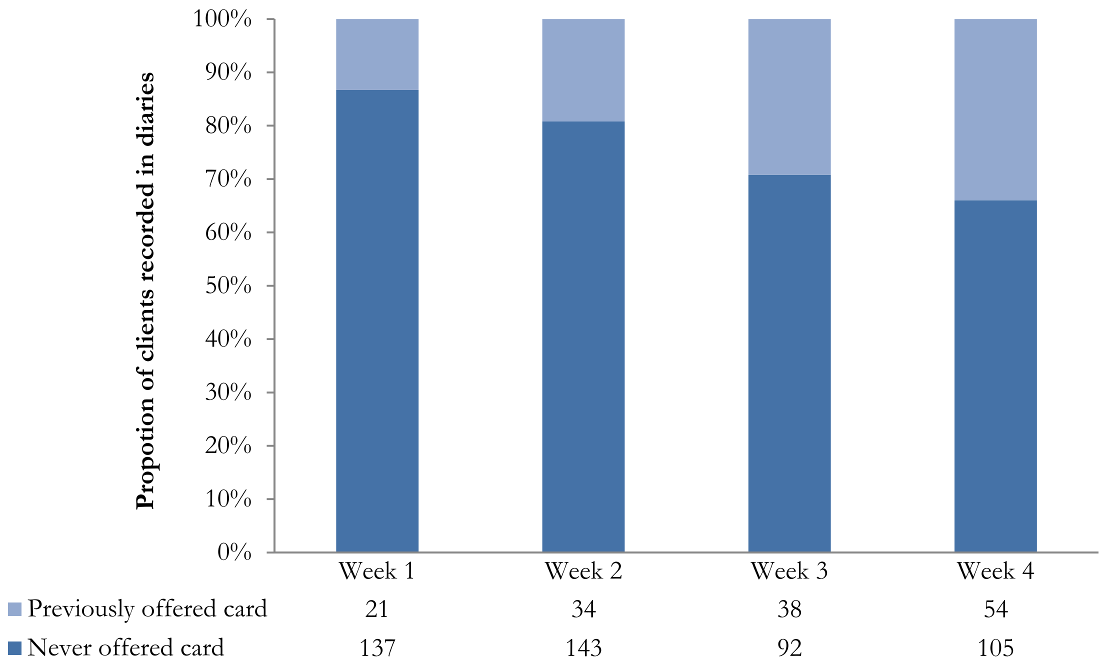
Study participants kept a record of whether or not a Hotline Card had been issued to partners identified as paying clients, and whether or not that client recalled having been offered a Hotline Card by another study participant previously. For the 713 participants identified as paying clients during diary in weeks 2-3 and 5-6 of the prospective study, 624 (87.5%) were documented as having been shown the Hotline Card by the study participants as well as whether or not the individual had been offered this card on a previous occasion by another study participant. For the 89 clients for whom this information was not recorded, in 75 cases (10.5% of all clients) this was due the study participant opting not to / being unable to show the client a card after sex, whilst for 14 clients the card was recorded as having being shown but information about the clients prior receipt of the card was not recorded or the recording was not decipherable.

Female clients were more likely not to have been offered the Hotline Card by participants (16.2% vs. 9.5% of male clients, χ^2 p=0.040), possibly due to a perception among participants that the Hotline service was only relevant to MSM. Further, regular clients were significantly more likely not to have been offered the hotline card than casual clients (22.2% regular clients vs. 1.9% casual clients (recurrent and single encounter), χ^2 p=0.019), evident for both male and female clients. The likelihood of offering a hotline card was not associated with other objective client characteristics (age, location of usual residence, marital status and ethnicity) or the situational characteristics of the sexual encounter.

In total, study participants reported offering Hotline cards to 477 different clients during 4 weeks of follow up. In the 3 months following the diary study, 50 individuals called the SMS/telephone hotline, 37 of whom were able to quote a valid identity number corresponding to those issued by study participants during the study, and volunteered that they had been given the card by a man they had paid for sex with. All callers gave verbal consent to complete a telephone interview. 29 of the 37 verified callers expressed interest in participating in face-to-face interviews at the Mtwapa clinic, but only 4 did so.

In summary, participants were able to offer clinic information to most of their clients, however very few clients chose to use the advertised resource within the 3-month period during and following the study: only 7.8% (CI 5.5 – 10.5) of all clients given a Hotline card used the confidential telephone counselling service printed on the Hotline Card from the start of the prospective study, and 0.8% (CI 0.2 – 2.1) of all clients given a Hotline card attended for a face-to-face interview.

Figure 32: Proportion of first time clients reporting a previous offer of a Hotline Card by another study participant, by increasing study period



Chapter 6

SEXUAL PARTNERS AND PARTNERSHIPS IN THE DIARY STUDY

Introduction

This chapter describes the characteristics of study participants and their sexual partners, the sexual partnerships formed between participants and their partners (dyads) and the sexual behaviours occurring within these partnerships that were elicited by the prospective methods described in the last chapter. The chapter goes on to explore patterns of demographic mixing, transaction and relationship significance within partnerships, and analyses the relationship between these factors and the likelihood of condom unprotected sex within partnerships. The contents of this chapter were presented as an oral presentation at the CROI conference in San Francisco, 2010[209].

Methods

The analysis in this chapter centres on the characteristics and sexual behaviours within dyads. In this context dyads represent the pairs of individuals in a sexual interaction or relationship i.e. a study participant and a sexual partner. Study methods did not succeed in mobilising a sufficient number of sexual partners willing to identify themselves to the project and provide self-reported measures, hence all information about partners (gender, age, ethnicity, usual residence, marital status), dyad characteristics (cash exchange, relationship significance, relationship duration, manner of initial contact) and situational characteristics (time, date, place) were those reported by the study participant, from their own perspective.

Analysis of the relationship between partner characteristics, dyad characteristics and sexual behaviour used two data sources - event diaries and the CAPI partnership survey. Identifying different sexual partners within a study participant's diary record relied upon a diary variable recording for each event whether (or not) that partner had been recorded in any previous diary. Diary events with partners not previously recorded were assumed to represent distinct dyads, and are hereafter referred to as *event dyads*.

The CAPI survey collected additional partner and partnership information for study participants' last three sexual partnerships. These partnerships are referred to as *partnership dyads.* In contrast to event dyads which characterised event-level behaviour for all dyads recorded during the diary study, partnership dyads reported whole partnership behaviour, but for only a fraction of dyads occurring during the study.

In the absence of a unique identifier of each sexual partner, it was not possible to directly measure how many study participants a specific partner had sex with during the study (partner recurrence). However, recognition of Hotline cards when first offered by diary study participants did indicate the proportion of partners who had previously paid for sex with another study participant during the study period, albeit limited to transactional events and a limited period of recapture.

To assess the association between partner, dyadic and situational attributes upon the likelihood of non-penetrative sex and unprotected sex, analysis was conducted using methods described in the previous chapter: multilevel random effects logistic regression, grouped by diary participant, for event dyads with binary event-level responses, and ordinal logistic regression for partnership dyads with categorical measures of unprotected sex during partnerships. Partner and partnership covariates were evaluated for both models. Situational covariates were evaluated in event dyad analyses only.

Diary study participants

Enrolment

215 MSM were registered as being in active IAVI cohort follow up in September 2007. 24 men were ineligible for diary enrolment based upon reporting no sexual activity in the previous month and three due to investigation for HIV seroconversion at their last cohort visit (Figure 33). Thus 188 MSM cohort participants were technically eligible to participate in the diary study, who were invited to participate through cohort follow-up, tagging of research records, posted clinic flyers, or direct contact in the community (through community tracers) during the 6 week period before the start of the diary study enrolment.

Enrolment to the diary study

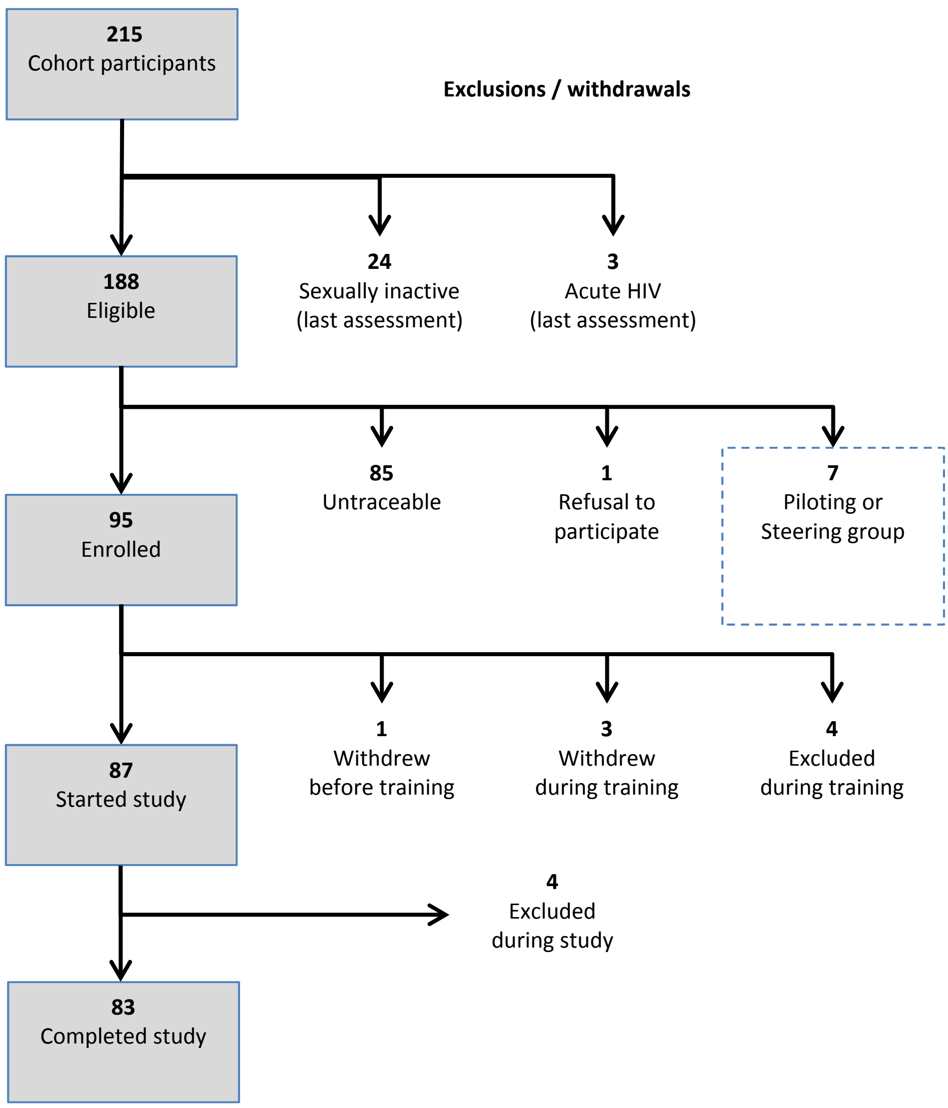
103 IAVI cohort participants were traced. 7 peer-educators and community mobilisers were invited to form the study Piloting and Steering Group, and were thus excluded from the diary study. 96 MSM were formally invited to participate in the diary study, of which number 95 agreed, completed informed consent and were enrolled into the diary training program. One man withdrew participation after consenting (due to anticipated relocation). A further 7 volunteers failed to complete the full diary training course, either due to sporadic attendance at the necessary training sessions (3), intoxication or disruption at training events (2) or inability to achieve a sufficient standard of accurate diary keeping by the end of training (2).

Follow up and retention

Four of 87 diary study participants were excluded after the start of the study due to irreconcilable inconsistencies between diary records and weekly verbal accounts to supervisors, and their diary data to that point was excluded from further analysis. The remaining 83 participants all completed the baseline survey in the first week of the study, 82 completed the partnership questionnaire in the fourth week of the study (one participant was hospitalised during week 4), and together completed 489 weekly diaries of a possible 498 (average individual follow up: 41.2 days). 78 volunteers (95%) completed the full six weeks of diary keeping, 2 participants completed five; 2 participants completed four, and one participant completed only three. Discontinuity in follow-up was due to imprisonment/detention (3 participants) and hospitalisation due to illness (2 participants). Volunteers who re-joined follow-up after a period of absence were asked to discount any partners or behaviours during period of absence from supervised follow up when resuming diary keeping.

In summary, among MSM identified and eligible for the diary study, interest in the study was very high, 92% (87/95) MSM were successfully trained to self-complete event diaries, and 95.4% (83/87) were retained throughout 6 weeks of intensive follow up. However, enrolment fell short of the anticipated sample size, due principally to a very high proportion of MSM who were believed to be in active IAVI cohort follow up, but who were in the event untraceable. This finding itself prompted a separate audit of the accuracy of personal records and study retention, the results of which are not presented here.

Figure 33: Diary study recruitment schematic



Characteristics of diary study participants

The characteristics of diary study participants are shown in Table 23. The sociodemographic, behavioural and clinical characteristics of study participants were largely comparable to eligible men in the IAVI cohort studies who did not complete the diary study (i.e. could not be traced, declined to participate, withdrew or were excluded from the study). Participants all had received some schooling compared to only 88.6% of non-participating MSM, although median duration of educational attendance was the same for both groups (8 years). Educational attainment was not related to attrition during training or follow up, but may conceivably have been a selection factor during mobilisation and advertisement for the diary study. Study participants were more likely to report affiliation to organised religion and longer median duration of local residence than non-participants (not statistically significant), which perhaps accounted for their relative ease of tracing for diary study invitation.

Diary study participants were slightly more likely to report sex in the week prior to their last cohort appointment, were more likely to disclose sex work and to report exclusive same sex behaviours in the prior three months, but differences were not statistically significant. Reports of recent RAI, unprotected AI and HIV prevalence were similar, and both diary participants and non-participants rarely reported recent injecting drug use.

In summary, these comparisons suggest that despite difficulties in tracing IAVI participants, the achieved diary study sample was broadly representative of the cohort population from which they derived and among whom HIV prevalence risks were studied in Chapter 3. Yet, given the small sample size, it is impossible to rule out the possibility that methods of mobilization, training and supervision did not preferentially select either men with systematically higher sexual activity and/or men more prepared to disclose their behaviours to research staff.

Table 23: Characteristics of eligible IAVI cohort participants who completed diary follow up vs. those who did not

		Eligible MSM completing diary study N = 83		Eligible MSM not completing diary study N = 105		P value (*χ^2 unless indicated)*
		n	%	n	%	
Age	*Years (Median/IQR)*	27 (23-31)		27 (22-33)		0.985 †
Marital status	Single	64	77.1	85	81.0	0.472‡
	Married	9	10.8	6	5.7	
	Divorced / Widowed	10	12.0	14	13.3	
Religion	Catholic	26	31.3	27	25.7	0.063‡
	Protestant	20	24.1	18	17.1	
	Muslim	30	36.1	35	33.3	
	Other	0	0	3	2.9	
	None	7	8.4	22	21.0	
Highest educational enrolment	None	0	0	12	11.4	0.005‡
	Primary	45	54.2	47	44.8	
	Secondary	30	36.1	33	31.4	
	Higher	8	9.6	13	12.4	
Location of local residence	North Coast	26	31.3	38	36.2	0.882
	Mombasa Island	25	30.1	31	29.5	
	South Coast	19	22.9	20	19.1	
	Changamwe	13	15.7	13	15.2	
Duration of local residence	*Years (Median/IQR)*	6 (2-20)		3 (0 – 18)		0.097†
Employment	Formal employment	11	13.3	18	17.1	0.641
	Self-employment	34	41.0	37	35.2	
	Unemployed	38	45.8	50	47.6	
Earnings from any source (1 month)	<2000 KSH	20	24.4	20	28.9	0.784
	2-5000 KSH	31	37.8	36	34.6	
	5000+ KSH	31	37.8	38	36.5	
Cohort behavioural measures						
Behavioural sexuality (period unspecified)	Exclusive MSM	29	34.9	31	29.5	0.429
	Bisexual MSM	54	65.1	74	70.5	
Sold sex (3 months)	Yes	54	65.1	62	59.1	0.400
	No	29	34.9	43	40.9	
Sexual activity (previous week)	Yes	65	78.3	72	68.6	0.136
	No	18	21.7	33	31.4	
RAI (3 months)	Yes	46	55.4	59	56.2	0.916
	No	37	44.6	46	43.8	
Unprotected AI (3 months)	Yes	39	47.0	48	45.7	0.862
	No	44	53.0	57	54.3	
Injecting drug use (3 months)	Yes	1	1.0	1	1.2	0.689‡
	No	82	99.0	82	98.8	
Clinical						
Circumcised	Yes	68	86.1	92	91.1	0.288
	No	11	13.9	9	8.9	
HIV status	Positive	22	26.5	26	24.8	0.785
	Negative	61	73.5	79	75.2	

†: Wilcoxon rank-sum ‡ Fisher's exact test

Sources of partner information

The sources of partner information are summarised in Table 24.

Table 24: Sources of information about sex partners of study participants

	All partners (participant reported)		**Clients (self-reported)**	
Source	Diary	Partnership survey	Telephone interview	Face to face interview
	n	n	n	n
Male	1015	193	34	4
Female	215	49	3	0
Total	1230	242	37	4

Participant-reported partner characteristics and behaviours
1. Diaries

Of the 1751 sexual episodes in prospective diaries, 1230 (70.2%) were with sexual partners that were unique within the record of the diary keeper (i.e. had not previously been documented in any prior diary by that study participant). For these partners, participants recorded basic objective characteristics of the partner (gender, age group, ethnicity, place of residence, marital status and participant in KEMRI studies) and the type of partnership (regular recurrent, casual recurrent or new) where they felt confident to record a response.

Partners described in diaries represented the complete population of sexual partners encountered by study participants over 489 weeks of study follow up. Gender and relationship type of all partners was recorded, but the proportion of unknown characteristics increased for more subjective measures (missing values: ethnicity 2/1230; age group 15/1230) and characteristics that were not be directly observable (missing values: usual residence 6/1230, marital status 322/1230; KEMRI study participation 494/1230). All partner information, especially marital status and KEMRI study participation, was significantly more likely to be unknown for partners not previously encountered by the study participant (31.5% and 43.8% respectively) compared to recurrent partners (12.9% and 31.3%, both $p<0.001$).

2. Partnership sample (CAPI)

82 participants also provided additional information on partnerships recorded in their diary sequence in CAPI Module 4. Additional details of 242 (19.7%) of the 1230 diary partnerships were collected in this manner of 246 expected. 78 participants offered information on their three most recent sexual partners, whilst four participants had accumulated only two partners in their diaries for reference by the time of the questionnaire.

Comparison between the CAPI partner sample and all partners recorded in event diaries is shown in Table 25, indicating that CAPI partnerships were not a random sample of all partnerships. CAPI partners were significantly more likely to be partners in recurrent relationships with the study participants, and correspondingly less likely to be single encounter partners. In comparison to the complete sample of partners, the CAPI sample over-represented partners with characteristics associated with being a regular or recurrent sexual partner of diary participants: female gender: 20.3% vs. 17.5%; female spousal partner: 1.2% (3/242) vs. 0.3% (4/1230), and Black African partners (68.3% vs. 64.9%).

Table 25: Comparison of partner characteristics, by source of information

		Partners of study participants				
		Diary N= 1230		CAPI N=242		χ^2 *p* value
		n	(% of known)	n	(% of known)	
Gender	Male	1015	82.5	193	79.8	0.305
	Female	215	17.5	49	20.3	
Age group	<18	23	1.9	6	2.5	0.662
	18 to 29	547	45.0	110	45.6	
	30 to 39	532	43.8	98	40.7	
	40 +	113	9.3	27	11.2	
	Unknown	15		1		
Usual residence	Study area	969	79.2	184	77.3	0.759
	Elsewhere in Kenya	173	14.1	38	16.0	
	Outside Kenya	82	6.7	16	6.7	
	Unknown	6		4		
Ethnicity	Black	797	64.9	164	68.3	0.067
	Arab	263	21.4	37	15.4	
	Indian	119	9.7	23	9.6	
	Caucasian	49	4.0	16	6.7	
	Unknown	2		2		
Marital status	Single	580	63.9	105	61.8	0.600
	Married	328	36.1	65	38.2	
	Unknown	322		72		
Relationship	Regular partner	97	7.9	36	14.9	0.001
	Casual partner	1133	92.1	206	85.1	
Partner recurrence	Single event	875	71.1	124	51.2	<0.001
	Recurrent	355	28.9	118	48.8	
Transaction	Yes	1120	91.1	209	86.4	0.024
	No	110	8.9	33	13.6	

Characteristics of sexual partners recorded by study participants

The participant reported characteristics of partners recorded in event diaries during follow up are shown in Table 26.

Table 26: Characteristics of study participants and their sexual partners identified in event diaries

		Participants N=83		Partners of participants in event diaries: Male N = 1015			Female N=215			Total N=1230		
		N	%	N	%	*p* value†	N	%	*p* value†	N	%	*p* value†
Age group	<18	0	0	15	1.5	<0.001	8	3.7	0.005	23	1.9	<0.001
	18 to 29	60	72.3	438	43.8		109	50.9		547	45.0	
	30 to 39	18	21.7	449	44.9		83	38.8		532	532	
	40 +	5	6.0	99	9.9		14	6.5		113	9.3	
Usual residence	Study area	83*	100	810	80.2	<0.001	159	74.3	<0.001	969	79.2	<0.001
	Other part of Kenya	0	0	134	13.3		39	18.2		173	14.1	
	Outside Kenya	0	0	66	6.5		16	7.5		82	6.7	
Ethnicity	Black	81	97.6	627	61.8	<0.001	170	79.4	0.002	797	64.9	<0.001
	Arab	2	2.4	235	23.2		28	13.1		263	21.4	
	Indian	0	0	112	11.1		7	3.3		119	9.7	
	Caucasian	0	0	40	3.9		9	4.2		49	4.0	
Marital status	Single	74	89.2	464	62.8	<0.001	116	68.6	<0.001	580	63.9	<0.001
	Married	9	10.8	275	37.2		53**	31.4		328	36.1	
KEMRI study participation	Yes	83*	100	19	3.2	<0.001	3	2.1	<0.001	22	3.0	<0.001
	No	0	0	572	96.8		142	97.9		714	97.0	

Excluding 'unknown' responses: age group 15, usual residence 6, ethnicity 2, marital status 322, KEMRI study participation 494 *Diary study inclusion criteria **Includes 4 women who were spouses of participant †: χ^2 test: comparison with diary study participants

Gender

There were marked differences in the basic characteristics of male and female partners (as assessed by study participants) compared to the study population (Table 26). Of the 1230 partners recorded in 83 study participants events diaries, 1015 (82.5%) partners were male and 215 (27.5%) were female.

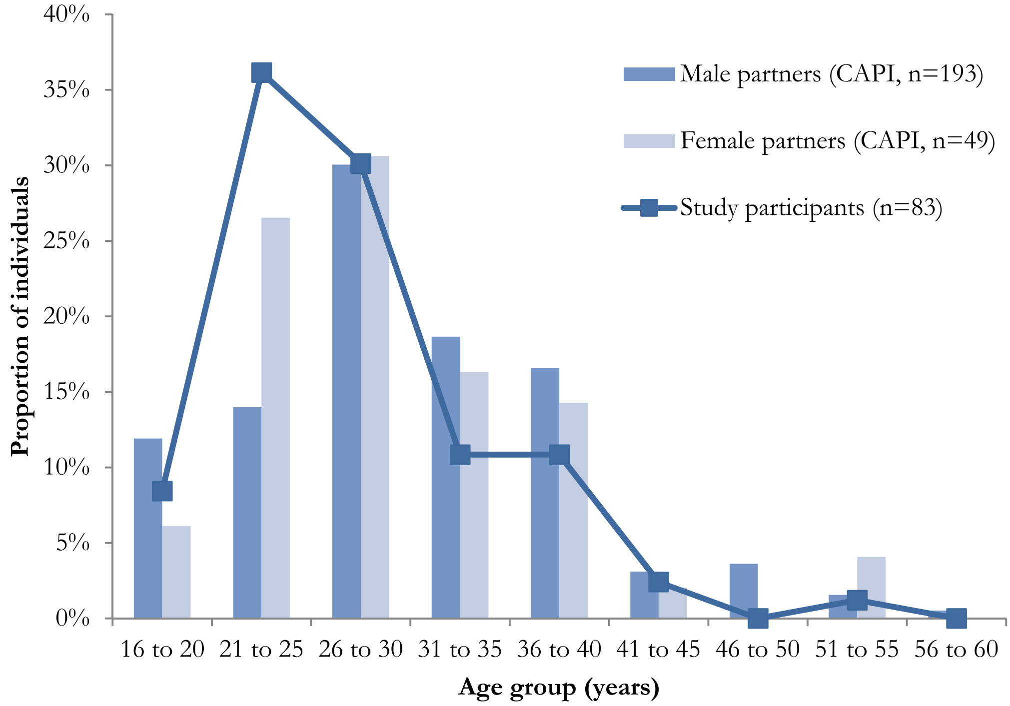
Male partners were significantly older than female partners (χ^2 p=0.016). A similar proportion of male and female partners were international visitors to Kenya. Among Kenyan partners, male partners were significantly more likely to be residents in and around the study area than were female partners (χ^2 p=0.05). This corresponds with differences in the ethnicity of partners by their gender. Female partners were more likely to be of Black African ethnicity than were male partners (χ^2 p<0.001). 34.2% of male partners were described as Arabic or Indian, compared to only 16.3% of female partners. A similar and small fraction of both male and female partners were White.

Marital status of male partners more frequently recorded as unknown (27.2% vs. 21.4% female, χ^2 p=0.079), but where recorded male partners were more likely to be married than were female partners (χ^2 p=0.153). Similarly, whether or not partners attended KEMRI research clinics was significantly more likely to be recorded as unknown for male partners (41.8% vs. 32.6%, χ^2 p=0.033), however there was no significant difference in the proportion of male and female attending KEMRI research clinics when known (χ^2 p=0.468).

Age

Age differed by most other measured characteristics of partners. Male partners tended to be slightly older than female partners (diary partners: (Table 26) χ^2 p=0.008, CAPI partners: median male: 30 years vs. female: 29 years, Mann Whitney p=0.317, Figure 34). The proportion of partners over 30 years old was higher among Kenyan visitors to Mombasa (57.6% (68/118), χ^2 p=0.133) and international visitors to Mombasa (79.7% (47/59) χ^2 p<0.001) compared to locally resident partners (50.3% (453/901)). Black African partners tended to be younger than partners from other ethnicities: the proportion of Black African partners over 30 years old was 49.1%, compared to 59.1% Arabic (χ^2 p=0.009); 65.2% Indian (χ^2 p=0.002) and 89.7% of White partners (χ^2 p<0.001). Partners married to another person were significantly older than partners known to be single (74.0% vs. 41.8%, χ^2 p<0.001). Finally, although not statistically significant, the few partners known to participate in other KEMRI studies were younger than those not known to attend the research clinic (63.2% vs. 43.7% under 30 years respectively, χ^2 p=0.093).

Figure 34: Age distribution of study participants and CAPI partners



Ethnicity, usual residence and location of sex

Of the 1230 diary events including the first record of partners, 1095 (89.1%) occurred in the study area. Most partners who had sex with study participants in and around Mombasa were themselves local residents (83.0% (909/1095)), whilst 11.0% (120/1095) were visitors from other parts of Kenya and 5.5% (60/1095) were international visitors. Most partners encountered in and around Mombasa were of Black African ethnicity (65.2%), however a substantial minority were of Arabic (21.5%) or Indian (10.1%) ethnicity.

Sex with 11.1% (136/1230) of partners took place outside the study area: 91 in other coastal towns (e.g. Malindi and Lamu), and 44 elsewhere in the interior of Kenya (e.g. Nairobi and Kisumu). Partners encountered outside the study area were significantly more likely to be international visitors to Kenya (5.5% of partners in Mombasa vs. 16.3% partners in other locations in Kenya, χ^2 $p<0.001$), and to be of White ethnicity (3.1% of partners in Mombasa vs. 11.2% partners in other locations in Kenya, χ^2 $p<0.001$). Partners of Arabic and Indian ethnicity constituted a similar proportion of partners encountered in coastal towns outside Mombasa compared to the study area itself (Arabic 30.8% (28/91); Indian 7.7% (77/91)). 84.1% (37/44) partners encountered in the Kenyan interior were of Black ethnicity and were more likely to be female than partners on the coast (Kenyan interior: 36.4% (16/44) vs. coastal: 16.8% (199/1186), χ^2 p=0.001).

Comparison of sexual partners with study participants

In addition to describing the characteristics of partners, Table 26 indicates marked differences between the sample of study participants in the study, and the male and female partner populations. Both male and female partners identified in event diaries were significantly older than study participants, in spite of the age restriction at study enrolment to MSM over 18 years of age. 54.8% of male partners and 45.3% of female partners identified in event diaries were over the age of 30 years, compared to only 27.7% of study participants. Similar categorical age differences were evident in the CAPI sample which also assessed exact partner age (Figure 34). In the CAPI sample, the median age of male partners was 30 years (IQR 25-36), significantly higher than the median age of study participants (median 27 years, IQR 23-31 Mann-Whitney p<0.001). The median age of female partners was 29 years (IQR 24-34), and their age distribution was not significantly different from study participants (Mann-Whitney p=0.122). Where marital status of the partner was known to the study participant, both male and female partners were more likely to be married than were study participants.

These comparisons indicate that diary study participants were not a demographically representative sample of the wider MSM population identified through characterising male partners. This notion is supported by the observation that study participants rarely identified partners from among other men or women attending KEMRI research studies. Although participants frequently did not know whether a partner did or did not attend these services, the finding does imply that few partnerships were being established within the study population associated with the existing studies, and that partner populations largely represented MSM unknown to the limited local research or prevention services.

Client recognition of Hotline Cards

Client recall of previous offers of Hotline Cards from study participants permitted indirect insight into the client's recent sexual contact with other card bearing study participants during the study. Of 624 clients offered a Hotline Card by a study participant, 147 (23.6%) reported having been offered that card previously by another participant. The proportion of clients reporting previously having been offered a card by another participant rose from 21/158 (13.3%) within the first week of hotline card issue to 54/159 (34.0%) in the final fourth week of hotline card issue (χ^2 test for categorical trend p<0.001), indicative of a somewhat stable client population.

The crude proportions of newly encountered clients who recalled being offered a Hotline Card by another study participant are shown in Table 27, by selected characteristics of clients and partnership. Overall, 24.8% of male clients and 15.7% of female clients recalled being offered the card previously over a maximum of 4 weeks of card issue. Younger clients and local residents were more likely to report a previous offer, and other IAVI study participants were significantly more likely to have been offered the card. Most notable, however, was the lack of association between card recognition and relationship type: clients described by the participant as regular were somewhat *more* likely to have been offered the card by another study participant than were new partners.

These findings suggest a recurrent, predominantly locally resident clientele, members of which regularly access different sex workers, and further that clients considered 'regular partners' by study participants were no less likely to be in contact with other sex workers than opportunistic partners. However this aspect of study process was markedly more difficult to quality control than others, and recording of client recall of cards was the diary item most prone to user error, thus findings should be viewed with caution.

Table 27: Client card issue and client recapture

Client characteristics		A. Clients identified in diaries	B. Clients shown card	Clients self-reporting previous receipt of card (from a different participant) n	%	χ^2 *p* value	Estimate adjusted for clients not shown card‡ (%)
Gender	Male	608	541	134	24.8	0.069	25.8
	Female	105	83	13	15.7		17.3
Age	<29	311	272	70	25.7	0.085†	28.5
	30-39	311	277	62	22.4		24.8
	40+	83	69	11	15.9		18.9
Usual residence	Local	555	493	123	25.0	0.343	27.7
	Kenya	108	87	16	18.4		21.1
	Visitor to Kenya	45	40	8	20.0		22.5
Ethnicity	Black African	445	384	91	23.7	0.891	26.6
	Arabic	157	144	36	25.0		27.3
	Indian	76	68	14	20.6		22.7
	Caucasian	33	267	6	23.1		28.2
Visits Mtwapa clinic	Yes	11	10	7	70.0	0.002	77.0
	No	410	350	81	23.1		26.3
	Unknown	*292*	*264*	*59*	22.4		24.4
Relationship type	Casual: new	551	481	115	23.9	0.642	26.7
	Casual: recurrent	126	115	24	20.9		22.7
	Regular	36	28	8	28.6		36.7

†: score test for trend ‡ first event recorded in weeks 2, 3, 5 or 6 ‡: numerator (self-reported prior receipt of card) adjusted to account for the proportion of clients who were not shown a Hotline card (i.e. multiplied by column A / column B)

Summary

Partners of study participants were predominantly male, local, and of Black African or Arabic origin. A minority of male and female partners were domestic or international visitors. Male partners tended to be older than female partners, and both were significantly older than study participants. Over the course of a month, about a quarter of men who paid for sex were identified by more than one study participants, yet most partners were identified as not being members of the wider, research-engaged population.

Dyads

Dyads (pairs of study participants and partners) were described at event level and at partnership level using diary and CAPI sources respectively. For 1230 event dyads, the following characteristics were reported: characteristics of the dyad (transactional, recurrence, relationship type and manner of contact), individual mixing (mixing of gender, age group, ethnicity, location of residence and marital status) and situational characteristics of the event (location, group sex, time and day).

For 242 partnership level dyads, in addition to the event level information to which CAPI entries were linked, the following additional characteristics were collected: characteristics of the dyad (exact duration of dyad, frequency of sex, transaction during dyad), individual mixing (average age of individuals, age difference between individuals).

Dyad characteristics

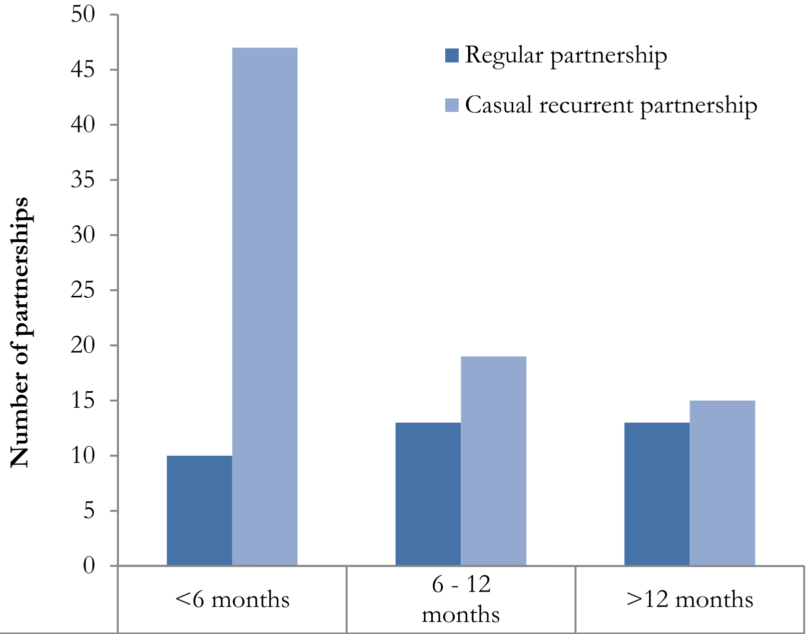
1. Relationship significance and duration

71.1% (875/1230) event dyads represented the first ever sexual contact between the specific study participant and partner. The CAPI sample, which assessed exact duration of partnership, indicated that the vast majority of new partnerships did not recur again during further follow up: only 2 (1.6%) of 127 new partnerships recorded in the diary study and the CAPI survey at the study mid-point, had been recorded again in subsequent diaries - 125 (98.4%) had not.

355 event dyads were reported as recurrent partnerships at the first recorded sexual contact. 258 (72.7%) were reported as casual recurrent partnerships, and 97 (27.3%) as regular recurrent partnerships. Overall, regular partnerships represented only 7.9% of all partnerships recorded over 6 weeks of follow up.

In the CAPI sample, 117 recurrent partnerships were reported. Regular partnerships tended to be of longer duration than casual recurrent partnerships (Figure 35). The median duration of regular partnerships was 355 days (IQR 177 - 728), significantly longer than casual recurrent partnerships (median 120 days; IQR 27 – 362, Mann-Whitney p=0.0011). 58.0% of casual recurrent partnerships had lasted less than 6 months to the date of diary recording, compared to 27.8% of regular partnerships, χ^2 p<0.001). Although dyads were increasingly likely to be reported as regular partnerships as partnership duration increased, casual partnerships represented the majority of relationships at any duration (Figure 36, 82.4% <6 months; 59.4% 6 – 12 months; 53.6% >12 months).

Figure 35: Duration of partnership of recurrent partnerships (source: CAPI)



	<6 months	6 - 12 months	>12 months
Regular partnership	10	13	13
Casual recurrent partnership	47	19	15

The frequency of sexual contact between partners in recurrent partnerships was associated with both the relationship type and duration of relationship. 75.0% of regular partnerships reported sex every week compared to 55.7% of casual recurrent relationships (χ^2 p=0.048). Conversely, there was a non-significant trend for frequency of sex to decline slightly by increasing duration of relationship (weekly sex: 63.6% (< 6 months); 62.5% (6-12 months); 57.1% (over 12 months), χ^2 p=0.843).

2. Transaction

The vast majority of partnerships involved cash transaction. 1120 of the 1230 (91.1%) event dyads involved the transfer of cash between partners in exchange for the recorded sex event. In the CAPI sample 86.3% (209/242) of partnership dyads had involved exchange of cash for sex at some point during the partnership, of which 198 (94.7%) also reported exchange of cash for sex at the last diary event. In 94.0% (1053/1120) transactional event dyads and 95.2% (119/209) transactional partnership dyads, the study participant was paid by the partner at the event or at some point of the relationship respectively, the remainder being partnerships where the study participant paid the partner for sex.

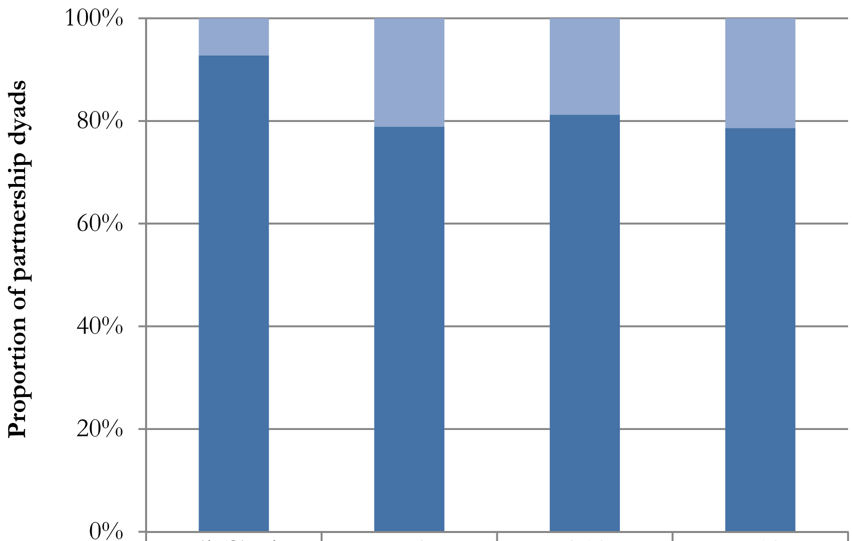
There was a clear association between transaction and relationship type (Table 28). In both event and partnership dyads, newly formed dyads were most likely and regular partnerships were least likely to be transactional (Figure 36). Yet transactional partnerships exceeded non-transactional partnerships in all relationship categories.

Table 28: Dyad transaction and relationship type

	Event dyads		**Partnership dyads**	
	Transactional	Non-transactional	Transactional	Non-transactional
	N (%)	N (%)	N (%)	N (%)
New	821 (93.8)	54 (6.2)	117 (92.1)	10 (7.9)
Casual recurrent	230 (89.2)	28 (10.9)	67 (84.8)	12 (15.2)
Regular recurrent	69 (71.1)	28 (28.9)	25 (69.4)	11 (30.6)
χ^2 *p* value	<0.001		0.002	

The association between relationship type and transaction was only partly explained by differences in relationship duration in the CAPI sample. Single episode dyads were more likely to be transactional partnerships (92.8%) than were recurrent partnerships (79.5%, χ^2 p=0.003). But among recurrent partnerships there was no association between relationship duration and transaction (Figure 36, χ^2 p=0.958), transactional relationships still accounting for more than three-quarters of all partnerships that were over a year in duration. These findings indicate the presence of enduring transactional partnerships in addition to single-encounter sex work in this context.

Figure 36: Dyad transaction and relationship duration (CAPI partners)



	Nil (Single event)	<6 months	6-12 months	>12 months
Non transactional	7.2	21.1	18.8	21.4
Transactional	92.8	78.9	81.3	78.6

Relationship duration

3. Contact initiation

Of 875 new partners recorded in event diaries, 463 (52.9%) first met the study participant at open air locations (either the street or beach), 249 (28.5%) at alcohol-serving establishments (bars or nightclubs) and 64 (7.3%) at a private dwelling (rented guest house or private home). Of 695 new partnerships established by face-to-face contact in the study area, 643 (92.5%) were transactional. Most of these transactional dyads were established after contact on the street or beach (61.7%), in bars or nightclubs (30.8%) and unusually in private dwellings (7.5%).

Few new partnerships (99 dyads, 11.3%) were initiated via the internet or phone prior to meeting, and all such partnerships were transactional. Internet or phone contact was associated with partnerships occurring outside the study area: 21.4% (22/103) new transactional partnerships occurring in other parts of Kenya were initiated by telephone or internet contact, compared to 10.0% (77/772) of those occurring locally.

Dyadic gender mixing

Gender and relationship duration

Homosexual dyads reported in diaries were more likely to be new encounters than were heterosexual dyads (72.6% (737/1015) vs. 64.2% (138/215) respectively, χ^2 p=0.013). Prospectively, 38.0% (132/347) of heterosexual events were with partners already identified in previous diaries, compared to 27.7% (389/1404) of homosexual events (χ^2 p<0.001). Heterosexual dyads were more likely to be regular relationships than were homosexual dyads (12.1% (26/215) vs. 7.0% (71/1015) respectively, χ^2 p=0.012).

In the CAPI sample, the mean duration of homosexual dyads was 148 days (median 0 days, IQR 0 – 171), compared to a mean duration of 448 days for heterosexual dyads (median 16 days, IQR 0 – 284; Mann-Whitney p=0.114). The tendency for longer-lasting heterosexual dyads was apparent even after excluding single event dyads (homosexual: median 178 (IQR 36-362); heterosexual: median 211 (IQR 90-729); Mann-Whitney p=0.118). Heterosexual dyads were significantly more likely to have lasted 12 months or more by the date of diary recording (homosexual: 9.3% v heterosexual: 20.4% χ^2 p=0.030).

Gender and transaction

The majority of both homosexual and heterosexual dyads involved transactional exchange at the first recorded diary event (homosexual 92.3% (937/1015); heterosexual 85.1% 183/215), χ^2 p=0.001). Among 937 transactional MSM dyads, 909 (97.0%) recorded payment *to* the study participant *from* the partner, and 28 (3.0%) the reverse. Compared to homosexual dyads, transactional heterosexual dyads (n=183) less often involved payment *to* the study participant (78.9%) and more often involved the study participant paying for sex (21.3% vs. 3.0% homosexual dyads, χ^2 p=0.001). Nonetheless, it is notable that 67.0% of all heterosexual dyads recorded payment from the female partner to the male study participant, indicative of a hitherto unrecognised element of male sex work catering to local female clients in coastal Kenya. Overall, paying clients of study participants (n=1053) were predominantly male (86.3% (909) vs. 13.7% (144) female), whilst partners whom the study participants paid for sex (n=67) were predominantly female (58.2% (39) vs. 41.8% (28)).

Dyadic age mixing

Age group mixing matrices for homosexual and heterosexual dyads event dyads are shown in Table 29. Overall, study participants were younger than their male sexual partners, but were more likely to be of similar age to female partners.

Table 29: Age mixing and agreement between age group of study participants and their partners (source: diary events)

	Partners age group (years)	Study participants age (n, %[a])			Agreement	Kappa (unweighted)	P value
		< 29	**30 – 39**	**40+**			
All partners N = 1215†	**< 29‡**	443 *36.5*	115 *9.5*	12 *1.0*	45.4%	-0.003	0.568
	30 -39	415 *34.2*	106 *8.7*	11 *0.9*			
	40+	98 *8.1*	13 *1.1*	2 *0.2*			
		< 29	**30 – 39**	**40+**			
Male partners N=1001†	**< 29‡**	360 *36.0*	83 *8.3*	10 *1.0*	42.9%	-0.033	0.950
	30 -39	378 *37.8*	68 *6.8*	3 *0.3*			
	40+	88 *8.8*	10 *1.0*	1 *0.1*			
		< 29	**30 – 39**	**40+**			
Female partners N=214†	**< 29‡**	83 *38.8*	32 *15.0*	2 *0.9*	57.1%	0.192	<0.001
	30 – 39	37 *17.3*	38 *17.8*	8 *3.7*			
	40 +	10 *4.7*	3 *1.4*	1 *0.5*			

† Age group missing for 15 partners (14 male, 1 female)
‡ includes 23 partners <18 years of age (15 male, 8 female).
[a]: Percentages represent the proportion of total dyads in each cell

Gender and age mixing

In homosexual dyads, there was little agreement between the age group of study participants and that of their male partners (Table 29). In 47.6% (476/1001) homosexual event dyads, the male partner was older than the study participant, in 45.4% the partner and participant were in the same age group, and in 10.4% (104/1001) the study participant was older than their sexual partner. Similarly, in the CAPI sample, male partners in homosexual dyads tended to be older than study participants (median 4 years older, IQR: 3 years younger to 10 years older). The average age of men in homosexual dyads in the CAPI sample was 28.9 years (median 28.5 IQR 25 – 32.5)

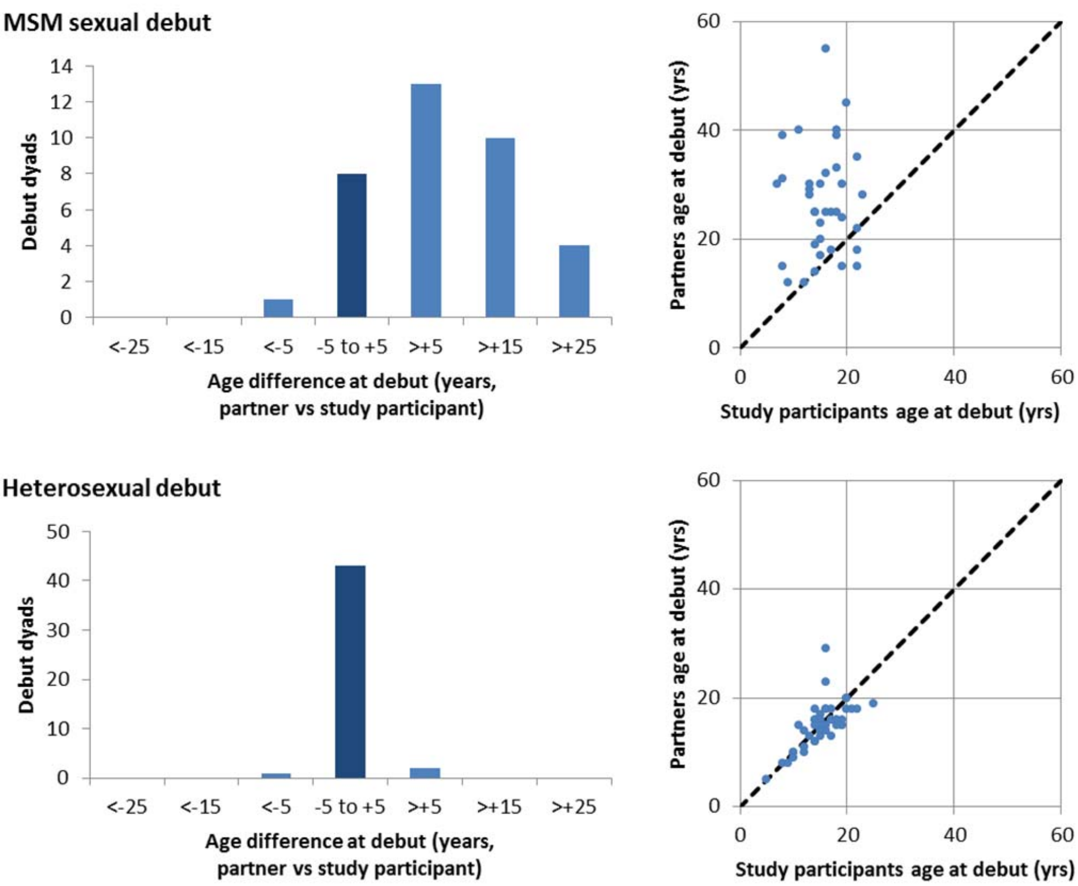
Heterosexual dyads, by contrast, were more age balanced with evidence of significant agreement between the age of the male participants and their female partners (Table 29). In 23.4% of heterosexual event dyads, the female partner was older than the study participant, compared to 19.6% wherein the study participant was older than the female partner. In 38.8% of heterosexual dyads, both individuals were under 30 years of age, similar to homosexual dyads (36.0%). In heterosexual partnership dyads, female partners tended to be slightly younger than study participants (median 2 years younger, IQR 7 years younger to 5 years older), significantly different to age differences in homosexual dyads (Mann-Whitney p=0.0049). Average age of individuals in heterosexual dyads was little different to homosexual dyads (median 27.5, IQR 25.5 – 31), and the difference was not statistically significant (Mann-Whitney p=0.255).

Age gradients within MSM dyads corresponded to the observation that male partners were, as a group, older than study participants. The apparently dissonant observation that heterosexual dyads were more age-balanced despite female partners also being, as a group, older than study participants was due to the increasing tendency for study participants to report heterosexual partnerships with increasing age. This issue is explored further in the following chapter.

Gender and age mixing at sexual debut

Age differentials at sexual debut were more extreme than in contemporary dyads (Figure 37). Age of the study participants at sexual debut was similar for the 36 participants whose debut was with a man (median 15.5, IQR 13-19) compared to the 47 participants whose debut was with a woman (median 15, IQR 14-18, Mann-Whitney p=0.782). The age of first male partners was significantly higher than age of first female partners (male: median 25 (IQR 18-32) vs. female: median 15 (IQR 13-18); Mann-Whitney $p<0.001$). This represented a partner-participant median age difference of +10 years for homosexual debuts (IQR 4 – 17), and -1 years for heterosexual debuts (IQR -2 to +1; Mann-Whitney $p<0.001$).

Figure 37: Debut dyad age differences (source: baseline questionnaire)

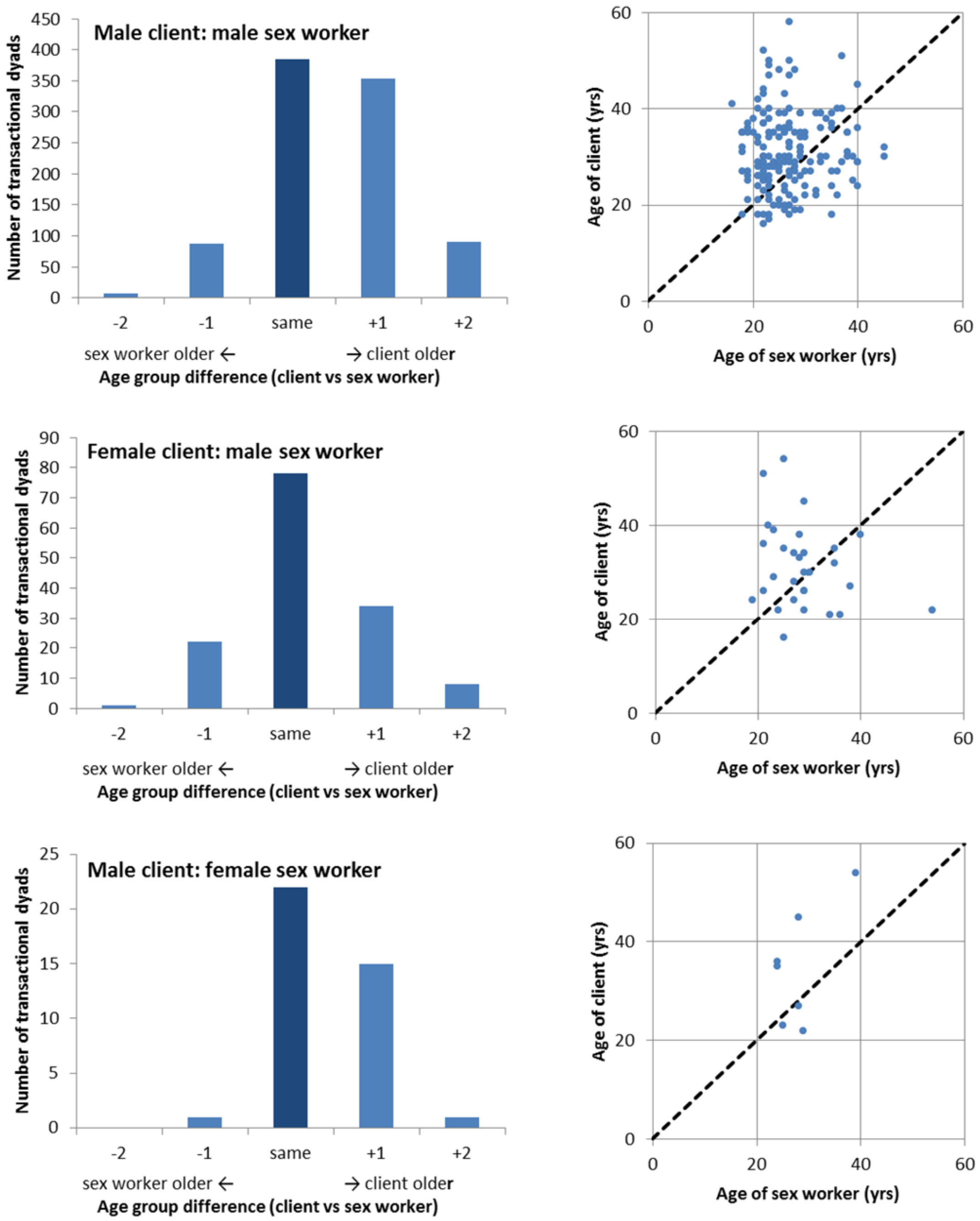


Transaction and age mixing

Dyadic age differences were also strongly related to whether or not the dyad was transactional, and the direction of transaction. Transactional homosexual dyads tended to be more age differentiated: in 58.3% paired individuals were from differing age groups, compared to 53.9% in non-transactional dyads (χ^2 $p=0.445$). By contrast, the median age difference between study participants and their male partners in non-transactional homosexual CAPI dyads was 0 years (-6 to +9). In 48.0% (443/923) transactional MSM dyads in diaries the individual paying for sex was in a higher age group than the payee, whilst in 10.3% the reverse was true (Figure 38). In the 171 transactional MSM dyads in the

CAPI sample, the median age of the individual paying for sex was 4 years older than the payee (IQR -3 to 10, Figure 38) and the age of sex workers and clients matched by dyad was a statistically significant difference (Wilcoxon sign test of matched pairs $p<0.001$).

Figure 38: Dyadic age differences between clients and sex workers



sources: *left* diary events; *right* CAPI

In keeping with the more balanced age-mixing of all heterosexual dyads, transactional heterosexual dyads (representing 85.2% (183/215) heterosexual event dyads and 75.5% (37/49) heterosexual partnership dyads) were similarly age-balanced overall. In event diaries, 54% (100/182) of men and women were from the same age group, in 23.6% the woman was in an older age group, and in 22.6% the man was in an older age group. In partnership dyads, the median age difference between female and male partners was +1 year (IQR -8 to +7), and a comparison of the age of male and female partners matched by dyad did not indicate a statistically significant difference (Wilcoxon sign test of matched pairs p=0.736).

However, when disaggregated by the direction of heterosexual transaction, age differentials are apparent (Figure 38). Female partners were from higher age groups than their male partners in 29.4% (42/143) of dyads where the female partner paid for sex, but in only 2.6% (1/39) of dyads where the male partner paid for sex. Correspondingly, male partners were older in 41.0% (16/39) of dyads where they paid for sex, but only in 16.1% (23/143) of dyads where the female partner paid. The age difference between men and women was statistically significant by the direction of transaction for diary events (χ^2 p=0.001) and of borderline significance for CAPI dyads (male vs. female age difference: male client 11 years older (IQR -2 to +15, n=7); female client 1 year older (IQR -3 to +10, n=30); Mann-Whitney p=0.091). Thus, the overall age-balancing of men and women in transactional heterosexual dyads represented a fairly consistent pattern of age difference between client and sex worker (as described for transactional MSM dyads) but with a mixture of transaction directions between men and women.

Non-transactional heterosexual dyads were clearly age-differentiated by gender. In the 32 non-transactional heterosexual diary dyads, 34.4% of female partners were in a younger age group, 43.8% in the same age group and 21.9% in an older age group than their partner. In the small number of non-transactional heterosexual dyads captured in the CAPI sample (n=7), female partners were, on average, 4.5 years younger than their male counterparts (median 5 years IQR 1- 7).

Other dyadic associations with age mixing

Despite the clear influence of transaction upon age mixing within MSM dyads, there was also evidence for an independent association between relationship type and dyadic age differentiation irrespective of transaction. Homosexual dyads described as regular partnerships were more age differentiated than casual partnerships (73.1% vs. 57.4% were separated by one age group or more, χ^2 p=0.026). This was not apparent for heterosexual dyads (47.1% (regular) vs. 44.9% (casual), χ^2 p=0.862).

Summary

The vast majority of homosexual partnerships involved payment of cash to the study participant at the diary event. Heterosexual partnerships were more likely to be non-transactional or involve payment from the study participant to the partner, but still were predominated by partnerships in which the female partner paid the study participant. This highlights a previously unrecognised element of the local sex trade predicated on demand for sex from predominantly Kenyan women.

Most partners, particularly male partners, identified in diaries were first encounters established after meeting on the streets, beach or alcohol-serving establishments. However recurrent partnerships accounted for approximately half of *on-going* sexual activity reported by study participants. Whilst regular sexual partners were more likely to be the non-transactional partners of study participants, the majority of even long-standing sexual partnerships involved payment to the participant.

Age differences between individual within homosexual partnerships were more pronounced than within heterosexual dyads, particularly at sexual debut, and were consistently correlated with the direction of transaction (older clients with younger sex workers) irrespective of gender.

Sexual behaviour

For event level dyads, sexual behaviours represent only those sex acts that occurred on the first recorded event in the diary, since it was only possible to distinguish different partners at this point. For partnership level dyads, sexual behaviour measures represent the occurrence of sex and frequency of condom use over the duration of the partnership. A summary of sexual behaviours recorded in homosexual and heterosexual dyads occurring during event diaries and sampled for the CAPI survey are shown in Table 30.

Table 30: Event and partnership sexual behaviours (sources: diary events and CAPI)

			Sexual behaviour during single diary event				**Sexual behaviour during complete partnership** (CAPI)	
			All events†		Event dyads‡			
			N	%	N	%	N	%
Homosexual behaviour	Penetrative sex	*Segregated AI**	1198	85.3	855	84.2	139	72.0
		*Versatile AI**	129	9.2	99	9.8	45	23.3
	Non-penetrative sex		77	5.5	61	6.0	9	4.7
	Total		1404		1015		193	
Heterosexual behaviour	Penetrative sex	*Vaginal*	168	48.4	95	44.2	23	46.9
		Anal	37	10.7	26	12.1	3	6.1
		Both	136	36.2	91	42.3	23	46.9
	Non-penetrative sex		6	1.7	3	1.4	0	0
	Total		347		215		49	

† includes / ‡ excludes sexual events with partners previously recorded in participant diaries.
* Segregated AI defined as exclusive practice of either RAI *or* IAI; Versatile AI defined as the practice of RAI *and* IAI

The 83 study participants recorded 1404 different sexual events in 1015 different homosexual dyads over the course of follow up. 94% (954/1015) of homosexual event dyads in the diary study included penetrative sex (RAI and/or IAI), compared to 93.5% of total homosexual events (1327/1404). Homosexual AI events consisted of an average of 1.67 AI rounds per event (median 2, IQR 1-2). Although the median count of AI rounds was the same for both versatile and segregated MSM events, the distribution of counts was predictably somewhat higher in versatile acts (median 2 IQR 2 – 3) compared to segregated acts (median 2 IQR 1 – 2, Mann-Whitney $p<0.001$). Forty-nine participants (59.0%) recorded 347 different sexual events within 215 different heterosexual dyads during follow up. 98.6% (212/215) of first events with distinct female partners, and 98.3% (341/347) of all heterosexual events, included penetrative sex (vaginal and/or anal sex). Where reported, heterosexual penetrative sex events represented an average of 1.99 vaginal or anal sex rounds per event (median 2 rounds, IQR 1-2).

Non penetrative sex

Oral sex acts were reported in the majority of MSM and heterosexual dyads. In MSM dyads, 55.0% (558/1015) of sexual events and 62.2% (120/193) of sexual partnerships included oral intercourse. However in very few dyads was non-penetrative sex the *only* form of sexual behaviour: 5.2% of event dyads (64/1,230) and 3.7% of partnership dyads (9/242). Homosexual event dyads were significantly more likely to only involve non-penetrative sex than were heterosexual dyads. (6.0% vs. 1.4%, OR adjusting for within-participant correlation 3.65 (1.01-13.3) $p=0.049$). Similarly, in partnership dyads, more homosexual dyads had practiced exclusive non-penetrative sex throughout the partnership, compared to no such examples among heterosexual dyads. The scarcity of heterosexual exclusive non-penetrative sexual behaviours (3 event dyads, 0 partnership dyads) restricted further analysis of determinants of exclusive non-penetrative sex to homosexual dyads

Determinants of exclusive non-penetrative sex in homosexual dyads.

Bivariate and multivariate associations between partner, dyadic and situational characteristics with event-level exclusive non-penetrative sexual behaviour in homosexual dyads are shown in Table 31. Crude associations were observed between increasing absolute age group of the partner and a higher likelihood of exclusive non-penetrative sex, dominated by the observation that over one-fifth of dyads including a male partner over 40 years did not involve AI. There was a corresponding crude association between increasing relative age group difference and increasing non-penetrative sex practice, which was retained in the multivariable model in preference to absolute age group due to a slightly lower BIC for the specified model (422 relative vs. 425 absolute) indicating a significant association between non-penetrative sexual behaviour in dyads where the age group of individuals differed by 2 groups or more. The aOR of non-penetrative sex by partner age group, adjusted for covariates other than age difference, were 30-39 years: 1.04 (0.48-2.25); 40+ years 5.30 (2.10-13.42) compared to partners <29 years.

Patterns of ethnic mixing were also associated with non-penetrative MSM sex practices. MSM dyads consisting of two Black African partners were significantly more likely to involve AI than any other ethnic mix (96.3% vs. 90.2%, OR grouped by study participant: 4.67 (2.31 – 9.43) p<0.001), and by specific comparison to Black-Arab and Black-Indian dyadic mixes after multivariable adjustment.

Although there was only borderline evidence of an association between a lower probability of non-penetrative sex with partners normally resident in Kenya (Table 31) compared with those resident elsewhere, there was some evidence of effect modification between location of usual residence and location of sex. MSM dyads involving a visitor to the study area from elsewhere in Kenya were significantly less likely to have non-penetrative sex compared to dyads of MSM both resident locally: crude OR (adjusted for repeated observations among participants) 0.17 (0.04-0.80) p=0.024, aOR 0.20 (0.04-1.0) p=0.050. By contrast, MSM dyads with Kenya partners where the study participant had travelled outside Mombasa were more likely to only involve non-penetrative sex, although this difference was not statistically significant (aOR 2.64 (0.42-16.6) p=0.300).

A trend was apparent between the increasing stability of the dyadic relationship and declining likelihood of non-penetrative sex, with only 1.4% regular MSM partnerships practising only non-penetrative sex at the first reported event, compared to 6.5% of newly formed MSM dyads. The scarcity of exclusively non-penetrative events in regular partnerships was replicated in the CAPI sample. Of nine exclusively non-penetrative MSM partnerships (5.7% of the total MSM sample), eight were single episode encounters and none of the 60 partnerships over 6 months in duration were exclusively non-penetrative.

Finally, no association was demonstrated between the probability of non-penetrative sex and situational factors (group sex, time or day), or contact method when adjustment was made for the non-independence of events reported by the same individuals. Transactional exchange was not associated with non-penetrative sexual practices.

Table 31: Bivariate and multivariate associations between partner, dyad and situational characteristics with event-level exclusive non-penetrative MSM sexual behaviour

		Events			Crude OR unprotected event†		Adjusted OR unprotected event ††	
		Total	Non-penetrative					
		N	N	%	OR (95% CI)	*p* value	aOR (95% CI)	*p* value
Partner characteristics								
Age group	< 29	453	18	4.0	ref		-	-
	30 – 39	449	19	4.2	1.05 (0.50-2.18)	0.903		
	40 +	99	22	22.2	**6.43 (2.69-15.4)**	**<0.001**		
Married	Yes	275	23	8.4	ref	0.237	-	-
	No	464	22	4.7	0.66 (0.33-1.32)			
Location of residence	Local	810	53	6.5	ref		ref	
	Kenya	134	4	3.0	0.35 (0.11-1.07)	0.067	0.40 (0.12-1.35)	0.141
	Outside Kenya	66	4	6.1	0.69 (0.18-2.63)	0.583	0.74 (0.15-3.70)	0.710
Dyad characteristics								
Relationship type	New	737	48	6.5	ref		ref	
	Casual	207	12	5.8	0.89 (0.43-1.85)	0.763	0.82 (0.35-1.90)	0.639
	Regular	71	1	1.4	0.18 (0.02-1.47)	0.098	0.19 (0.03-1.63)	0.130
Exchange sex	Yes	937	58	6.2	1.66 (0.43-6.35)	0.460	-	-
	No	78	3	3.9	ref			
Both local residents	Yes	810	53	6.5	2.25 (0.92-5.50)	0.074	-	-
	No	200	8	4.0	ref			
Age group mixing	Same group	421	19	4.5	ref		ref	
	One group	476	17	3.6	0.81 (0.39-1.71)	0.584	0.82 (0.38-1.79)	0.626
	Two groups	104	23	22.1	5.75 (2.45-13.53)	<0.001	**4.91 (1.94-12.46)**	**0.001**
Ethnic mixing	Black-Black	622	23	3.7	ref		ref	
	Black-Arab	237	19	8.0	**4.09 (1.82-9.18)**	**0.001**	**3.12 (1.33-7.31)**	**0.009**
	Black-Indian	112	17	15.2	**7.80 (3.25-18.74)**	**<0.001**	**5.23 (2.05-13.32)**	**0.001**
	Black-White	39	2	5.1	1.37 (0.18- 10.55)	0.760	1.54 (0.16-15.19)	0.712
Contact route	Street	514	35	6.8	ref		-	-
	Bar	256	7	2.7	0.46 (0.17-1.23)	0.121		
	Private house	86	6	7.0	0.71 (0.23-2.18)	0.551		
	Web/Phone	159	13	8.2	0.80 (0.32-2.03)	0.645		
Encounter characteristics								
Location	In study area	909	57	6.3	ref		-	-
	Outside study area	106	4	3.9	0.99 (0.29-3.36)	0.984		
Group sex	Yes	49	7	14.3	1.55 (0.57 – 4.24)	0.391	-	-
	No	966	54	5.6	ref			
Time of sex	7am – 6pm	293	21	7.2	ref		-	-
	7pm – 12 am	504	21	4.2	0.79 (0.36-1.70)	0.545		
	1 am – 6 am	218	19	8.7	1.58 (0.66-3.78)	0.300		
Day of sex	Mon-Thur	487	31	6.4	Ref		-	-
	Fri - Sun	528	30	5.7	0.87 (0.49 – 1.54)	0.626		

† Multilevel random effects logistic regression (level 1: study participant, level 2: event)
††: Multilevel random effects logistic regression (level 1: study participant, level 2: event) and adjusted for tabled variables
Models excluded missing or unknown values (age group/age difference 14; ethnicity 5; usual residence 5; marital status 276)

Homosexual anal sex roles

One or more AI act featured in 94.0% (954/1015) of homosexual event dyads, 10.4% (99/954) of which documented IAI and RAI acts by both individuals (role versatile), 49.5% (472/954) RAI role by the study participant only, and 40.1% (383/855) RAI role by the sexual partner only (i.e. a total of 89.6% homosexual event dyads were role segregated). The imbalance in RAI reporting by study participants in event dyads was mirrored in all events (RAI: study participant only 49.4% (656/1327); partner only 40.8% (542/1327); both 9.7% (129/1327). In both event dyads and all events that included any AI, study participants were significantly more likely to be in the receptive role for anal sex (Wilcoxon signed-rank test: event dyads p= 0.003; all events p= 0.001).

Slightly more homosexual partnership dyads than event dyads reported AI during the relationship (95.3% (184/193)). As might be expected, a higher proportion of partnerships dyads reported AI role versatility over the entire course of their partnership (24.5% (45/184)) than was apparent from one event, yet still the majority (75.5%) were role segregated throughout. Aside relationship duration, no crude or adjusted association was apparent between dyadic or interpersonal characteristics and the likelihood of versatile rather than segregated homosexual AI practices in event or partnership dyads. Between-partner AI versatility among study participants will be discussed in Chapter 7.

Dyadic characteristics of segregated homosexual event dyads

Figure 39 compares the age distribution of study participants and male partners reported in AI event dyads. The most pronounced observation was the younger age distribution of study participants for all homosexual AI roles: over 75% of segregated RAI, segregated IAI and versatile AI events involved a study participant under the age of 30 years, whereas over 50% of partners in any AI role were over the age of 30 years (Figure 39). In segregated AI event dyads, which represented most of homosexual event dyads, the age distribution of study participants in receptive roles was slightly younger than participants in insertive roles, and although male partners tended to be older, there was evidence of the same role-related age differences among male partners. These age differences persisted for dyadic unprotected AI: participants reporting uRAI and uIAI were younger than partners reporting these behaviours. However, although partners reporting uRAI were slightly younger than partners reporting uIAI, this trend was not apparent among study participants (discussed further in Chapter 7).

Figure 39: Age distribution of study participants and male partners by AI role segregation (MSM event dyads)

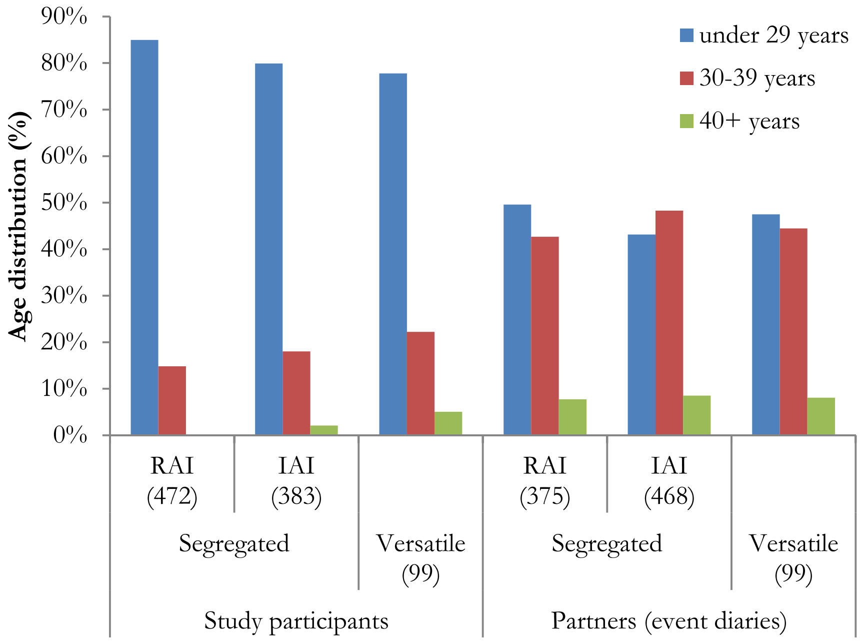
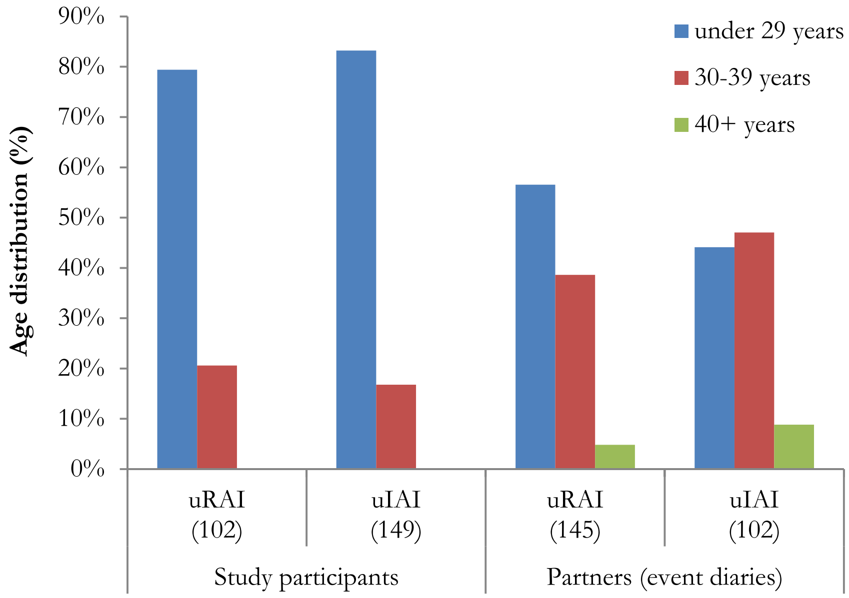
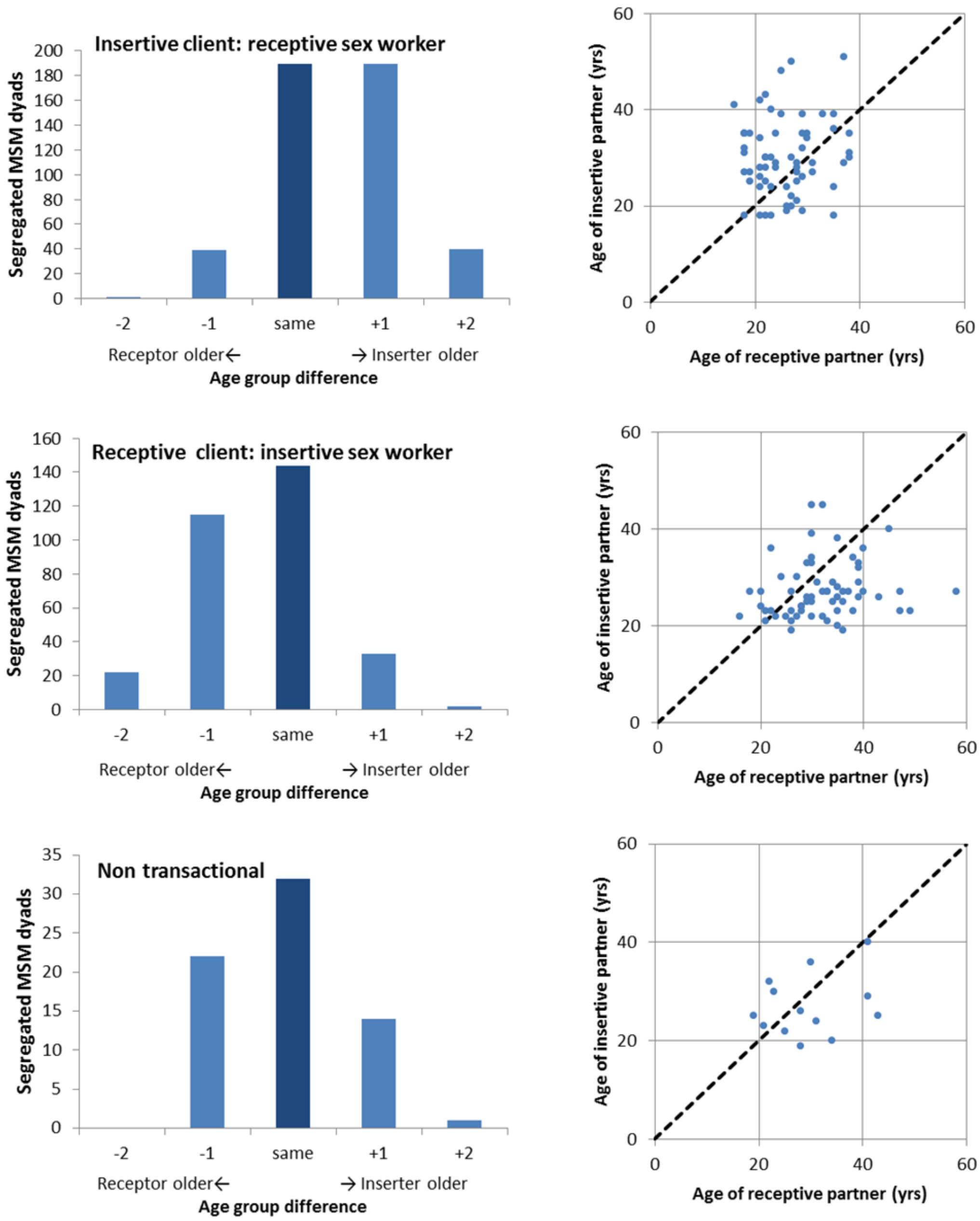


Figure 40: Age distribution of study participants and male partners for uRAI and uIAI (MSM event dyads)



The modest age differences between participant and partner populations were largely explained by dyadic age gradients between men purchasing and selling sex (Figure 41). Overall, the insertive partner was more likely to be the older partner than the receptive partner in event dyads: insertive partner older: 33.1% (2/843) vs. receptive partner older: 23.6% (199/843). These apparent age-gradients by anal sex role simply reflected the relative excess of men who paid for IAI rather than RAI, rather than intrinsic age differentiation by anal sex role. As Figure 41 clearly shows, male clients tended to be older than the paid partner irrespective of whether they purchased IAI or RAI (sign tests p=0.020 & p=0.007 respectively). There was no significant difference between the age of insertive and receptive partners in non-transactional dyads (sign test p=0.581), nor was there evidence of association with relationship type.

Figure 41: Dyadic age differences between insertive and receptive men in AI segregated homosexual dyads



sources: *left* diary events; *right* CAPI

Unprotected penetrative sex in event dyads

Table 32 shows the proportion of all recorded penetrative sex events within which at least one penetrative sex act was unprotected, by various characteristics of the sexual partner, the dyad and the context of the event. Gender-stratified models were also specified, and are reported in the text where relevant.

Partner characteristics and unprotected sex

Of 1,116 homosexual and heterosexual event dyads, 28.6% included one or more unprotected penetrative sex act at the first recorded event. Where penetrative sex occurred this was over three times more likely to have been unprotected in heterosexual dyads compared to homosexual dyads (Table 32), even after confounder adjustment. Amongst heterosexual dyads, AI events were slightly more likely to be unprotected than vaginal sex events (46.2% (54/117) vs. 37.6% (70/186), χ^2 p=0.142).

Increasing partner age was associated with a declining probability of event level unprotected sex (test for categorical trend: OR 0.74 per increasing partner age group 0.56-0.98 p=0.038), but this was not significant after multivariable adjustment (aOR: 0.80 (0.59-1.09) p=0.159). In both homosexual and heterosexual dyads, there was a declining, but not statistically significant, probability of unprotected sex with increasing partner age group (homosexual: OR unprotected AI event: 0.84 (0.59 – 1.19) p=0.328; heterosexual: OR unprotected VI/AI event 0.55 (0.27-1.17) p = 0.102). Both homosexual and heterosexual dyads demonstrated a weak and statistically non-significant trend between increasing age difference between individuals and declining probability of unprotected sex (homosexual: OR 0.84 (0.60-1.19) per increasing age group separation between individuals (p = 0.339); heterosexual: OR 0.72 (0.37-1.44, p=0.346). Neither marital status nor usual residential location of the partner, as assessed by study participant, was associated with unprotected sex in event dyads.

Table 32: Bivariate and multivariate associations between partner, dyad and situational characteristics and event-level unprotected sex

		Penetrative sex			Crude OR unprotected event†		Adjusted OR unprotected event ††	
		Total	Unprotected					
		N	N	%	OR (95% CI)	*p* value	aOR (95% CI)	*p* value
Partner characteristics								
Gender	Male	954	241	25.3	ref	**<0.001**	ref	**<0.001**
	Female	212	92	43.4	**3.71 (2.16-6.36)**		**3.19 (1.81-5.62)**	
Age	18 – 29	550	169	30.7	ref		ref	
	30 – 39	512	143	27.9	0.86 (0.59-1.26)	0.443	0.97 (0.65-1.46)	0.902
	40 +	91	17	18.7	**0.46 (0.22-0.95)**	**0.037**	0.52 (0.23-1.13)	0.099
Married	Yes	304	94	30.9	ref	0.585	-	-
	No	557	157	28.2	0.89 (0.58-1.37)			
Usual residence	Local	972	286	29.4	ref			
	Kenya	117	25	21.4	0.63 (0.34-1.17)	0.143	-	-
	Outside Kenya	77	22	28.6	0.87 (0.42-1.78)	0.700		
Dyad characteristics								
Relationship type	New	824	209	25.4	ref		ref	
	Casual	246	83	33.7	**1.71 (1.11-2.62)**	**0.014**	**1.60 (1.01-2.52)**	**0.045**
	Regular	96	41	42.7	**4.69 (2.41-9.14)**	**<0.001**	**3.90 (1.93-7.90)**	**<0.001**
Exchange sex	Yes	1059	288	27.2	**0.34 (0.19-0.61)**	**<0.001**	0.54 (0.29-1.01)	0.054
	No	107	45	42.1	ref		ref	
Both local residents	Yes	915	276	30.2	1.70 (1.07-2.68)	0.024	1.26 (0.76-2.09)	0.376
	No	245	55	22.5	ref		ref	
Age group mixing‡	Same group	514	165	32.1	ref			
	One group	546	147	26.9	0.94 (0.64-1.37)	0.731	-	-
	Two groups	93	17	18.3	0.54 (0.26-1.13)	0.102		
Ethnic mixing	Black-Black	764	215	28.1	ref			
	Black-Arab	248	79	31.9	1.38 (0.87-2.19)	0.170	-	-
	Black-Indian	102	28	27.5	0.91 (0.48 – 1.73)	0.763		
	Black-White	44	8	18.2	0.66 (0.24 – 1.85)	0.432		
Contact route	Street	433	94	21.7	ref			
	Bar	241	53	22.0	0.57 (0.30-1.08)	0.084	0.73 (0.43-1.24)	0.250
	Private house	60	27	45.0	1.61 (0.72-3.61)	0.243	1.01 (0.55-1.85)	0.986
	Web/Phone	90	35	38.9	0.48 (0.21-1.11)	0.087	0.64 (0.35-1.18)	0.154
Encounter characteristics								
Location	In study area	1035	303	29.3	ref		ref	
	Outside area	130	29	22.3	**0.36 (0.18-0.74)**	**0.024**	0.48 (0.22-1.05)	0.065
Group sex	Yes	49	17	34.7	1.06 (0.44-2.60)	0.891	-	-
	No	1117	316	28.3	ref			
Time	7am – 6pm	326	87	26.7	ref			
	7pm – 12 am	595	179	30.1	1.21 (0.78-1.87)	0.387	-	-
	1 am – 6 am	245	67	27.4	1.25 (0.72-2.17)	0.429		
Day	Mon-Thur	562	154	27.4	ref		-	-
	Fri - Sun	604	179	29.6	1.07 (0.76-1.51)	0.705		

‡: test for categorical trend Crude OR 0.82 per increasing age group difference (0.61-1.11) 0.204; aOR 0.85 (0.62-1.16) p=0.303
†: Multilevel random effects logistic regression (level 1: study participant, level 2: event)
††: Multilevel random effects logistic regression (level 1: study participant, level 2: event) and adjusted for tabled variables
Models excluded missing or unknown values (age group/age difference 14; ethnicity 5; usual residence 5; marital status 276)

Unprotected sexual events and dyadic characteristics

Overall, increasing relationship significance was strongly associated with the probability of unprotected sex. Events within regular partnerships were most likely to include unprotected penetrative sex, and more so than events in casual partnerships (OR 4.03 (2.11-7.72), $p<0.001$). Among casual partnerships, unprotected penetrative sex was significantly less likely to feature in the event if this was the first sexual encounter between individuals, compared to casual recurrent partnerships (OR 0.56 (0.36-0.86) $p=0.009$). Association with relationship significance was consistent in models stratified by gender. Compared to new dyads, the crude ORs of unprotected AI in casual recurrent and regular homosexual dyads were 1.69 (1.02-2.81, $p=0.042$) and 3.96 (1.77-8.86, $p=0.001$) respectively. Consistent associations were apparent in heterosexual dyads (casual recurrent dyads OR 1.69 (1.02-2.81, $p=0.042$); regular dyads OR 3.96 (1.77-8.86, $p=0.001$).

Exchange of cash payment for sex within the dyad was, overall, associated with a lower probability of unprotected penetrative sex. This was apparent for both homosexual and heterosexual dyads in stratified analysis (homosexual transactional (24.6%) vs. non-transactional dyads (33.3%), OR 0.48 (0.23-1.00) $p=0.050$; heterosexual transactional (40.0%) vs. non-transactional dyads (62.5%), OR 0.26 (0.08-0.87) $p=0.029$). The probability of unprotected sex was also determined by the direction of transaction between study participants and their partners: overall, 46.3% (31/67) of events for which the study participant paid the partner were unprotected, compared to 25.9% (257/992) of events where the partner paid the study participant (OR participant paid vs. partner paid: 4.52 (1.89-10.82) $p=0.001$). In gender stratified analysis, this association was strong and statistically significant for heterosexual dyads (OR male study participant paid vs. female partner paid: 8.10 (1.90-34.4), $p=0.005$), but was weaker and not-statistically significant for homosexual dyads (OR male participants paid vs. male partner paid 1.66 (0.41-6.78), $p=0.480$).

Unprotected sexual events and situational characteristics

Unprotected sex was significantly less likely to occur where the event took place outside the study area (homosexual: OR 0.42 (0.19-0.93), $p=0.033$; heterosexual: OR 0.08 (0.01-0.51) $p=0.008$ vs. events within the study area). In keeping with non-penetrative sex (see earlier) there was interaction between whether or not sex took place within the study area and whether the dyad represented two local individuals. Dyads where the partner was resident in a part of Kenya other than the study area *and* the sexual event took place outside the study area were significantly less likely to involve unprotected sex compared to sex taking place in the study area between locally resident individuals (homosexual: OR 0.28 (0.08-0.99) p=0.050; heterosexual: OR 0.10 (0.01-0.67) p = 0.018). Other situational factors (time, day and group sex) were not associated with the event probability of unprotected sex.

Variance partition coefficient

Estimates of the variance partition coefficient for the event-level probability of unprotected sex in the fully specified overall model (61.6%), MSM dyad model (68.8%) and heterosexual dyad model (55.5%) suggested greater variability in the event-level probability of unprotected sex due to differences *between study participants* than *between different events* within each study participant's record (39.4%, 31.1% and 44.5% respectively). Patterns of absolute and relative sexual risk behaviour in relation to the characteristics of study participants will be discussed in detail in the following chapter.

Unprotected penetrative sex in partnership dyads

Unprotected penetrative sex practices were reported in the CAPI survey as an ordered categorical variable (condom use: always, sometimes or never) for the duration of the partnership. Table 33 shows a tabulation of dyadic measures and categorical measures of condom use for the entire duration of partnership and the crude proportional OR (POR) for declining category of condom use in bivariate comparisons. The POR was estimated from ordinal logistic regression with clustering on study participant to adjust for potential non-independence of within-participant measures.

Overall, of 233 partnership dyads in the CAPI survey which reported any penetrative sex, 54.1% reported consistent condom use over the duration of the partnerships, 31.8% inconsistent use and 14.2% had never used a condom. In keeping with event-level analysis, heterosexual partnerships were more likely to report unprotected penetrative sex, although this was a weaker association than apparent in event dyad analysis (perhaps due to the preferential selection of recurrent partners in the CAPI survey).

Table 33: Bivariate associations between dyadic characteristics and partnership-level condom use

			Condom use (entire partnership)						Proportional OR of declining category of condom use	
			Never		**Sometimes**		**Always**			
		N	n	%	n	%	n	%	Crude OR (95% CI)	*p* value
Gender mix	Homosexual	184	22	12.0	58	31.5	104	56.5	ref	0.098
	Heterosexual	49	11	22.5	16	32.7	22	44.9	1.73 (0.90-3.32)	
Relationship duration (months)	Nil	116	23	19.8	9††	7.8	84	72.4	ref††	ref
	0 - 6	57	6	10.5	23	40.4	28	49.1	1.95 (0.88 – 4.34)	0.102
	6 – 12	32	4	12.5	17	53.1	11	34.4	**2.90 (1.29 – 6.55)**	**0.010**
	Over 12	28	6	21.4	12	42.9	10	35.7	**3.30 (1.27 – 8.56)**	**0.014**
Relationship type	Regular	36	9	25.0	14	38.9	13	36.1	**2.39 (1.15 – 4.96)**	**0.019**
	Casual	197	24	12.2	60	30.5	113	57.4	ref	
Exchange sex (ever)	Yes	200	28	14.0	51	25.5	121	60.5	**0.35 (0.15 – 0.80)**	**0.013**
	No	33	11	33.3	10	30.3	12	36.4	ref	
Average age	Under 25	50	6	12.0	17	34.0	27	54.0	ref†	ref
	25-29	83	14	16.9	18	21.7	51	61.5	0.85 (0.44-1.63)	0.627
	30 -34	62	13	21.0	14	22.6	35	56.5	1.07 (0.49-2.36)	0.857
	35 or over	37	5	13.5	12	32.4	20	54.1	1.02 (0.49-2.15)	0.953
Age difference	<5 years	79	15	19.0	20	25.3	44	55.7	ref‡	ref
	5-9 years	76	11	14.5	15	19.7	50	65.8	0.66 (0.35-1.24)	0.198
	10+ years	77	12	15.6	26	33.8	39	50.7	1.10 (0.58-2.06)	0.774

† Test for trend (continuous average age): 1.04 (0.79-1.36) *p*=0.788
‡ Test for trend (continuous age difference): 1.001 (0.949-1.056) *p*=0.961
†† Variable condom use for different sex acts in single event

Also consistent with trends observed in the event analysis of unprotected sex, regular partnerships reported significantly lower condom use throughout the relationship compared to casual partners. Further, a clear incremental trend toward increasing proportional odds of unprotected sex with increasing duration of partnership was also apparent (linear test for trend between exact relationship duration (days) and proportional odds of unprotected sex: POR 1.20 per year (1.01-1.37) p=0.037). Further, transactional exchange at any point during the partnership was associated with higher condom use.

Finally, no association between exact age difference and proportional odds of unprotected sex was apparent in partnership dyad analysis, compared to some indication of a negative association between age difference and unprotected sex in the event dyad analysis. Further, there was no evidence from this analysis that the average age of dyad individuals contributed to the proportional odds of unprotected sex in partnerships.

Summary

The vast majority of homosexual and heterosexual partnerships included penetrative sex practices, few transactional or non-transactional events including only oral sex. Study participants were marginally more likely to report receptive anal sex than were their male partners, and whilst there was some evidence for both participants and partners to report less receptive anal sex with increasing age, there was very little evidence of role-dependent age differences within partnerships. Approximately half of heterosexual partnerships included anal intercourse.

Study participants reported unprotected penetrative sex with 28.6% of their partners at the first diary record, and 46.0% across entire partnerships. Analysis of the effect of partner and dyadic characteristics upon penetrative sex practices indicated that heterosexual partnership (compared to homosexual), increasing duration or significance of the partnership (compared to new or single encounter partnership) were all significantly independently associated with condom-unprotected sex at single events, and across the duration of partnerships. Further, although most partnerships were transactional in nature, study participants within transactional dyads were significantly more likely to report consistent condom use in those partnerships than in non-transactional partnerships, and similarly at recorded diary events (borderline significant).

Chapter 7

SEXUAL BEHAVIOURS OF STUDY PARTICIPANTS

Introduction

The previous chapter described the structure of the proximate sexual network of study participants, in terms of their sexual partners, the key types of partnerships formed between participants and partners, and the interpersonal mixing patterns within partnerships. Although some of these factors were predictive of the safer sex practices in partnerships, variance partition coefficients indicated that more variance in risk of event-level non-penetrative sex and unprotected sex was attributable to the differences between study participants than the differences between partnerships themselves.

This chapter describes the cumulative sexual behaviour of the 83 study participants, comprising all diary recorded events for each participant accrued over their period of diary follow up. Diaries provided cumulative measures of the frequency of unprotected sex, by sex role and gender, over a known period of follow up. The chapter describes evidence for heterogeneity in homosexual and heterosexual risk behaviour arising from differences in the frequency of sex and differences in condom use at sex episodes. The chapter goes on to explore the extent to which measured individual characteristics are associated with heterogeneity in behaviour, which for HIV negative participants directly represented heterogeneity in HIV sexual acquisition risk during the study.

The chapter concludes by summarising comparable information for the few transactional partners who participated in telephone interviews.

Justification

The count or rate of unprotected sex is widely accepted as the most precise behavioural proxy of HIV contraction or transmission risk[201 210-212]. In most circumstances, the risk of HIV infection that an uninfected person takes increases as a function of the number of times that person exposes themselves through unprotected sex to HIV-infected (or status-unknown) partners, as each single event adds to the risk of HIV contraction.

Individual counts of condom-unprotected sexual behaviours reflect two individual behavioural components: the frequency of intercourse and the probability that intercourse is unprotected. There is no mathematical basis on which to assume these measures correlate with each other, nor independently with the frequency of unprotected sex[201 213], but the latter is often assumed to indicate an individual's latent disposition toward safe sex. Since this has often been the goal of behavioural interventions, a number of intervention studies have measured both frequency and proportion of unprotected sex as study outcomes[214-219]. Outside intervention research however, few studies distinguish frequency and relative measures of unprotected sex.

Methods

Individual measures of the frequency of unprotected sex (uAI, uRAI, uIAI & uHET), the total frequency of intercourse events (AI, RAI, IAI & HET) and probability of condom-unprotected sex for intercourse events were determined from individual diary records. Individual covariates were explored for association with these twelve dependent behavioural measures.

Further individual measures of dyadic frequency (e.g. gender, dyadic transaction and relationship significance), as well as measures of behavioural frequencies specific to different transactional and relationship categories were determined. Although each such measure was thoroughly analysed, it was not possible to include all results in this document.

Measures of frequency were expressed as total counts per study participant and behaviour rates per 4 weeks follow up. Different behaviour frequencies reported by the same individual were compared without the need for adjustment for follow up, and using non-parametric methods for matched pairs with no distributional assumptions. Comparing the frequency of the same behaviour in different individuals utilised either standard or zero-inflated negative binomial regression adjusted for duration of individual follow up. Bivariate and multivariate comparisons measures of association were expressed as the crude (IRR) and adjusted incidence rate ratio (aIRR) respectively.

Crude individual proportions of condom-unprotected sex were calculated from the fraction of total intercourse events that were incompletely protected by use of a condom. The crude individual proportion of condom-unprotected behaviours and standard error was derived from the level-1 intercept and coefficient estimates from bivariate-specified random effects logistic regression models, and comparisons were expressed as crude odds ratios. Adjusted ORs (aOR) were estimated from random effects logistic regression models adjusting for both level-1 and level-2 covariates.

Stratification by HIV status

The principal objective of analysis was to explore predictors of HIV behavioural risk to the study participant, most pertinent to HIV negative participants. Since all study participants were aware of their HIV status, it was anticipated that the motivations for safe sex practice among HIV negative participants would be fundamentally different to those participants who were already HIV seropositive, the latter presumably having less motivation toward personal protection. Further, whether contemporary risk behaviours among HIV positive participants were adaptive to recent knowledge of status or representative of longer term high risk would not be clear. Lastly, although IAVI measures suggested very few participants believed they knew their regular partner's HIV status, this could have been an unmeasured and selective influence on behaviour of HIV positive participants. These concerns mandated against including HIV status as a covariate in multivariable models. Consequently, the relationships between prospective behaviours and HIV status were explored for all study participants, but the relationship between other individual characteristics and prospective behaviour was restricted to HIV negative participants (n = 61) or stratified for comparison.

Model specification

Individual-level variables demonstrating borderline bivariate association ($p<0.100$) with either frequency of unprotected homosexual or heterosexual sex were arranged into seven sets of covariates applied to all models. These comprised (a) age (continuous/categorical), (b) socioeconomic (earnings / residential utilities / employment), (c) religion, (d) sexuality (prospective, lifetime, expressed), (e) alcohol consumption (use / intoxication) (f) injecting drug use and (g) sex during travel. Given the small sample size and potential for collinearity between covariates within sets, covariates within sets were evaluated by replacement. For example, models evaluating prospective sexuality would not contain another sexuality covariate.

To explore the stability and specification of the fixed covariate modelling approach and mindful of the cautions identified in Chapter 5, each model was optimised by the systematic removal of fixed covariates to reach a minimally specified model, and subsequent re-addition of all individual covariates guided both by changes in overall fit and effect on other covariate effect estimates. Changes in the BIC of >2 were taken as an indicator of a relevant change in model specification. For models of count responses, optimisation also included evaluation of zero-inflation associations of covariates demonstrating bivariate association with *binary* measures of cumulative behaviour incidence.

Presentation of tabled results

For purposes of readability and ease of comparison, crude and adjusted measures of associations between covariates and behavioural response measures are tabled by covariate, rather than by response measure. Thus, tables 39, 41, 43-46 and 48-49 summarise crude and adjusted measures of association specific to the covariate derived from twelve different multivariable analyses: four models of unprotected intercourse frequency, four models of intercourse frequency (estimating the IRR) and four models of the proportion of condom-unprotected sex (estimating the OR). Tabled multivariate estimates were all adjusted for the same covariate sets, whilst the estimates from optimised models are discussed in text where relevant.

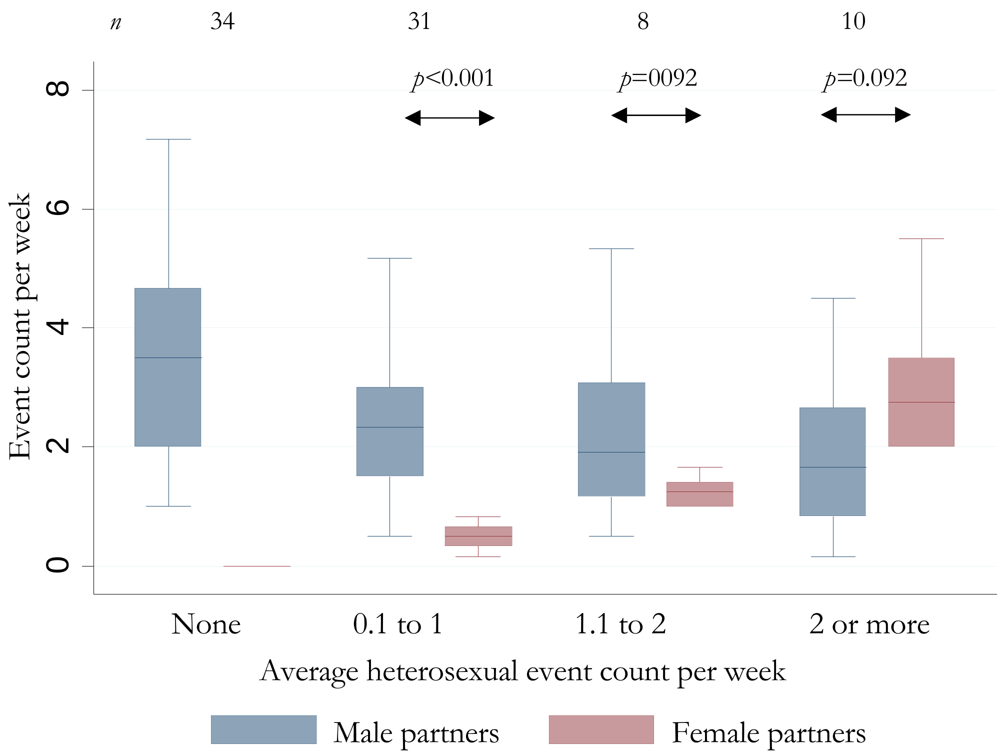
Frequency of sexual partnerships among study participants

The basic characteristics of study participants have previously been described (Table 23, page 134). Study participants reported a median of 13 different partners during follow up (range 3 to 35) - an average of 10.1 per 4 weeks (CI 9.0 – 11.3), and a median of 19 sexual encounters during follow up (range 5 to 63) - an average of 14.4 per 4 weeks (CI 12.8 – 16.1). 9.6% (8/83) participants reported an average of more than 20 partners per 4 weeks, whilst 2.4% (2/83) reported an average of more than 40 events per 4 weeks.

All study participants reported at least one male sexual partner (range 1 – 35) whilst 59.0% (CI 48.2-69.8) reported one or more female partners (range 0-33). Overall, participants were significantly more likely to report any sex with men (exact McNemar's test $p<0.001$), reported more male partners (partner rate ratio (male vs. female): 4.6, Wilcoxon signed-rank text $p<0.001$) and a higher frequency of homosexual events during follow up (event rate ratio (homosexual vs. heterosexual) 4.0, Wilcoxon signed-rank text p<0.001). In total, 14.5% (12/83) of participants reported a higher heterosexual than homosexual event frequency, 2.4% (2/83) an equal event frequency and 83.1% (69/83) a higher homosexual than heterosexual event frequency.

A relative excess of male partners and homosexual events remained apparent even when limiting comparisons to the 49 participants who did report heterosexual behaviours. There was a significant trend for reducing MSM event frequency with increasing heterosexual frequency (Cuzick's test for trend $p=0.008$ and Figure 42), yet the average frequency of MSM events exceeded heterosexual events for participants reporting fewer than two heterosexual contacts per week. Whereas homosexual event frequency was higher among participants who only reported male partners (13.8 vs. 9.9 events per 4 weeks follow up (exclusive MSM vs. heterosexually active MSM), IRR 1.38 (1.06-1.81) $p=0.018$), homosexual event frequency still exceeded heterosexual event frequency among heterosexually active participants (9.9 homosexual vs. 4.8 heterosexual events per 4 weeks follow up, Wilcoxon signed-rank test for matched pairs $p=0.0002$).

Figure 42: Box and whisker plot of participant weekly event counts with male and female sexual partners†



†: Bars represent median, boxes represent 25th & 75th centiles; Whiskers represent next adjacent value
p values: within-category Wilcoxon signed-rank test for matched pairs

Transactional sex

All participants reported transactional sex with male partners (Table 34), including 82/83 (98.8%) who reported being paid by a male partner for sex and 15/83 (18.1%) who reported paying a male partner on at least one occasion (16.9% (14/83) reported both buying and selling sex to men). Overall, study participants reported an average of 7.4 (6.4 – 8.7) different paying male customers and 10.1 (8.7 – 11.7) events with paying male partners per 4 week follow up. Paying clients accounted for 89.6% of all male partners and 87.7% all homosexual events with men during diary follow up.

Table 34: Cumulative partnerships and sexual events reported by study participants during follow up

Gender of partner	Dyad features	Number of study participants		Event dyads	Events dyads per participant during follow up†		Events	Events per participant during follow up†	
		N	%	N	Median (IQR)	Rate per 4 weeks (95% CI[NB])	N	Median (IQR)	Rate per 4 weeks (95% CI[NB])
Male	All	83	All	1015	10 (6 – 17)	8.3 (7.2 – 9.5)	1404	14 (8 – 24)	11.5 (10.0 – 13.1)
	Transaction (partner to participant)	82	98.8	909	9 (5 – 16)	7.4 (6.4– 8.7)	1232	12 (7 – 21)	10.1 (8.7 – 11.7)
	Transaction (participant to partner)	15	18.1	28	0 (0 – 0)	0.2 (0.1 – 0.4)	43	0 (0 – 0)	0.4 (0.2 – 0.7)
	Non transactional	38	45.8	78	2 (1 – 3)	1.6 (1.2 – 2.1)	129	0 (0 – 2)	1.1 (0.7 – 1.6)
	Recurrent partner	82	98.8	278	3 (2 – 5)	2.4 (2.0 – 2.9)	640	6 (3 – 11)	5.2 (4.5 – 6.1)
	New partner	79	95.2	737‡	8 (4 – 12)	6.0 (5.1 – 7.1)	764‡	8 (4 – 12)	6.3 (5.3 – 7.4)
Female	All	49	59.0	215	1 (0 – 4)	1.8 (1.3 – 2.5)	347	2 (0 – 6)	2.9 (2.0 – 4.2)
	Transaction (partner to participant)	42	50.6	144	0 (0 – 3)	1.2 (0.8 - 1.8)	222	1 (0 – 3)	1.8 (1.3 – 2.8)
	Transaction (participant to partner)	23	27.7	39	0 (0 - 1)	0.3 (0.2 – 0.5)	50	0 (0 – 1)	0.4 (0.3 – 0.7)
	Non transactional	21	25.3	32	0 (0 – 0)	0.3 (0.2 – 0.4)	75	0 (0 – 1)	0.6 (0.3 – 1.1)
	Recurrent partner	41	49.4	77	0 (0 - 2)	0.6 (0.4 – 0.9)	200	0 (0 – 3)	1.6 (1.1 – 2.4)
	New partner	42	50.6	138‡	1 (0 – 2)	1.2 (0.8 – 1.7)	147‡	1 (0 – 2)	1.2 (0.8 – 1.8)

†: average 5.9 weeks per participant
‡: 27 MSM events and 9 heterosexual events were documented as ‘new partners’ but had also been reported in a previous diary.

A majority of participants - 50.6% (42/83) - also reported having been paid for sex by female partners during follow up. 27.7% (23/83) of all participants reported having paid for sex with a female partner. Female clients made up 67.0% (144/215) of all female partners, and accounted for 64.0% (212/347) of heterosexual events. Restricted to heterosexually active participants, 85.7% (42/49) reported having been paid by a female partner for sex and 46.9% (23/49) reported having paid for sex (38.8% (19/49) reported both). Heterosexually active study participants were more likely to report selling sex to men (98.0%) than women (85.7%; exact McNemar's test $p=0.031$), had higher male client counts (6.5 vs. female: 2.0 per 4 weeks, Wilcoxon matched-pairs signed-ranks test $p<0.001$) and higher events counts for which they received payment with men (8.6 vs. female: 3.1 per 4 weeks, Wilcoxon matched-pairs signed-ranks test $p<0.001$).

Sex purchased by study participants represented a small fraction of all sexual behaviour reported (93 events: average 0.8 events (0.5 – 1.2) per 4 weeks follow up), but when reported more frequently involved a female payee. 27.7% of all participants and 46.9% of heterosexually active participants reported paying a female partner (compared to 18.1% and 20.4% who paid male partners). The total rate of purchased heterosexual events was marginally higher than purchased MSM events (0.41 vs. 0.35 per 4 weeks, respectively, Wilcoxon matched-pairs signed-ranks test $p=0.200$).

Non-transactional sex

Thirty-six participants (43.4%) only reported transactional sex events for the period of follow up. Of the 47 participants who did report non-transactional events, 11 (57.9%) reported these with only male partners, 2 (10.5%) with only female partners and 6 (31.6%) with both male and female non-transactional partners (Table 34). For four participants, the non-transactional female partner was their legal spouse. Overall, participants were significantly more likely to report male non-transactional partners than female (Table 34, exact McNemar's test $p=0.006$).

This difference was also apparent in the rate of non-transactional events. Overall, participants recorded 1.7 non-transactional events per 4 weeks (CI 1.2 – 2.4), together accounting for only 6.3% of all reported behaviours. Overall, participants reported about twice the rate of non-transactional events with male partners than female (1.1 vs. 0.6 events per 4 weeks, Wilcoxon matched-pairs signed-ranks test p=0.009). No such difference was apparent when considering only heterosexually active participants (0.9 male vs. 1.0 female, Wilcoxon matched-pairs signed-ranks test p=0.828).

Relationship types

As reported in Chapter 6, recurrent partners represented only 28.9% of event dyads recorded during follow up in a dyad network of predominantly new and single event partnering. These 335 recurrent dyads were recorded at 840 events, representing 48.0% (840/1751) of all events, and indicating that recurrent dyads were recorded on average at 2.4 events during follow up. Events with recurrent partners consisted 245 events (with 97 regular partners) and 595 events (with 258 casual recurrent partners), representing 14.0% and 34.0% of all events.

Consequently, participants reported sex within recurrent partnerships was only slightly less frequently than sex with new partners overall (events per 4 weeks: recurrent partnerships 6.9 vs. new partnerships 7.5, Wilcoxon matched-pairs signed-ranks test p=0.724). Restricted to heterosexual events, participants reported a higher frequency of sex with recurrent female partners than sex with new female partners (Table 34). This difference was not statistically significant (Wilcoxon matched-pairs signed-ranks test p=0.205).

The number of different recurrent dyads reported by study participants during follow up is shown in Table 35. 95.2% (79/83) of participants reported sex with a recurrent partner, 88.0% (73/83) with a casual recurrent and 53.0% (44/84) with a regular partner. Only one participant reported *only* having sex with recurrent partners.

Participants were more likely to report having a regular male than female partner (45.8% vs. 22.9%, exact McNemar's test p=0.0013), and to report casual recurrent male than female partners (81.9% vs. 35.3%, exact McNemar's test p<0.0001). Overall, participants reported more different recurrent male partners during follow up than female (median/IQR: 2 (1-5) male vs. 0 (0-2) female, Wilcoxon matched-pairs signed-ranks test p<0.001), and a higher frequency of sex with recurrent male than recurrent female partners (median (IQR): 6 (3-11) male vs. 0 (0-3) female, Wilcoxon matched-pairs signed-ranks test p<0.001). Frequency of sex with recurrent male partners was higher among participants who only reported male partners (6.6 vs. 4.3 events per 4 weeks follow up (exclusive

MSM vs. heterosexually active MSM), IRR 1.51 (1.12-2.05) p=0.006), however frequency of sex with recurrent male partners still exceeded that with recurrent female partners among heterosexually active participants (4.3 male vs. 2.8 female events per 4 weeks follow up, Wilcoxon signed-rank test for matched pairs p=0.021).

Table 35: Recurrent dyads per study participant

Recurrent relationship type	Number of current partners	Male partners		Female partners		All partners	
		n	%	n	%	n	%
Regular	None	45	54.2	69	83.1	39	47.0
	1	24	28.9	6	7.2	22	26.5
	2+	14	16.9	8	9.6	22	26.5
Casual	None	15	18.1	54	65.1	10	12.1
	1	21	25.3	15	18.1	13	15.7
	2+	47	56.6	14	16.9	60	72.2
Regular or casual	None	6	7.2	47	56.6	4	4.8
	1	19	22.9	15	18.1	11	13.3
	2+	58	69.9	21	25.3	68	81.9

Multiple concurrent partnerships

As shown in Table 35, a high proportion of participants reported multiple concurrent partnerships[ii] during diary follow up. Overall, 69.9% of participants reported sexual activity with two or more male partners reportedly in on-going relationships with the participant, whilst 25.3% reported sex with two or more recurrent female partners. This difference was statistically significant (χ^2 <0.001). These patterns of concurrency also bridged partner gender (bisexual concurrency). Whereas 54.2% (45/83) of participants reported gender exclusive concurrent partners (both male: 51.8%; both female: 2.4%), 41.0% (34/83) of participants recorded both recurrent male and female partners

[ii] For partnerships identified in event diaries, concurrent partnership was defined as 'two or more event dyads with different casual or regular recurrent partners at any time during diary follow up'. For partnerships identified in the CAPI partnership module, concurrent partnership was defined as 'two or more partnership dyads of stated duration which overlap in time'

during follow up, including 14.5% (12/83) who were sexually active with both male and female regular partners.

Summary

Overall, 80.2% of sexual events reported by study participants were with male partners. All but one participant reported selling sex to other men, and transactional events represented the vast majority of homosexual interaction. Less than one in ten homosexual events was non-transactional. Whereas all participants reported sex with male partners, 59% of participants also reported sex with female partners and participants who reported higher frequencies of heterosexual events tended to report lower frequencies of homosexual events. Whilst most heterosexual events were also accompanied by payment of the participant, approximately one in five were non-transactional, and one in seven were interactions paid for by the participant themselves.

Only 45.8% of participants reported sex with a man they viewed as a regular partner during follow up, compared to 16.8% who reported a regular female partner. However most study participants recorded recurrent male partners. More than two-thirds reported two or more recurrent male partners during the limited period of follow up, and 41% reported both recurrent male and female partners.

Prospective sexual behaviours of study participants

All study participants reported penetrative sex (receptive or insertive anal intercourse) with one or more male partners, and no participant reported only non-penetrative sex with men. Similarly, of the 59% of participants who were heterosexually active during follow up, all reported penetrative sex with female partners (insertive vaginal or anal sex). Consistent with differences in partner rates (Table 34), participants reported a considerably higher frequency of penetrative sex with men than with women (Table 36 , homosexual 10.8 vs. heterosexual 2.8 events per 4 weeks, IRR 3.9, Wilcoxon signed-rank test for matched pairs p<0.001).

Overall, participants were more likely to report any unprotected sex with men rather than with women (any unprotected homosexual sex: 66.3% (55/83) vs. any unprotected heterosexual sex: 44.6% (37/83); exact McNemar's test p=0.010), and participants reported a higher frequency of unprotected homosexual sex than unprotected heterosexual sex (Table 36, 2.9 vs. 1.2 per 4 weeks respectively, Wilcoxon signed-rank test for matched pairs p <0.001). Differences in unprotected sex frequency by gender (homosexual vs. heterosexual: IRR 2.4) were more modest than differences in total frequency of penetrative sex (IRR 3.9) since, as reported in Chapter 6, penetrative heterosexual events were significantly more likely to be condom-unprotected than penetrative MSM events (43.1% vs. 27.4%, OR 4.1 (2.6-6.3) p<0.001). This difference was similar when restricted to heterosexually active participants (OR, 4.0 (2.5-6.3) p<0.001).

Participants reporting exclusively male partners during follow up were more likely to report any unprotected homosexual sex than were heterosexually active participants (homosexually exclusive: 75.2% vs. heterosexually active: 61.2%, Fisher's exact p=0.345), and reported a higher frequency of unprotected MSM sex (3.6 vs. 2.6 unprotected events per 4 weeks respectively, p=0.310) but neither observations were statistically significant. Among heterosexually active participants, participants were more likely to reported unprotected sex with women than men (75.5% vs. 61.2% respectively). This difference was also not statistically significant (exact McNemar's test p=0.167). Differences in AI roles by behavioural sexuality will be considered in more detail among HIV negative participants later (page 197).

Table 36: Frequencies of total and unprotected sexual behaviour and proportion of unprotected sexual behaviour by study participants during follow up

	Number of study participants behaviour		Sexual events			Unprotected sexual events			Proportion of condom-unprotected sexual events	
	N	%	N	Median (IQR)	Rate per 4 weeks (95% CI)	N	Median (IQR)	Rate per 4 weeks (95% CI)	% (95% CI)	Average % per individual (95% CI)
Homosexual										
Penetrative sex (AI)	83	100	1327	14 (8 – 23)	10.8 (9.5 – 12.4)	364	1 (0 – 7)	2.9 (2.1 – 4.1)	27.4 (25.0 – 29.8)	25.5 (18.7 – 32.2)
Receptive anal intercourse (RAI)	54	65.1	785	6 (0 – 17)	6.4 (4.5 – 9.1)	162	0 (0 – 1)	1.3 (0.8 – 2.2)	20.6 (17.8 – 23.5)	19.8 (11.9 – 27.6)
Insertive anal intercourse (IAI)	78	94.0	671	6 (2 – 11)	5.5 (4.5 – 6.7)	214	0 (0 – 2)	1.8 (1.1 – 2.7)	31.9 (28.4 – 35.4)	24.7 (16.9 – 32.4)
Heterosexual										
Penetrative sex (HET)	49	59.0	341	2 (0 – 6)	2.8 (2.0 – 4.1)	147	0 (0 – 2)	1.2 (0.8 – 1.8)	43.1 (37.8 – 48.4)	44.0 (33.0 – 55.1)
Vaginal sex	48	57.8	304	2 (0 – 6)	2.5 (1.8 – 3.6)	117	0 (0 – 1)	1.0 (0.6 – 1.5)	38.5 (33.0 – 44.0)	36.7 (26.1 – 47.3)
Anal sex	38	45.8	173	0 (0 – 2)	1.4 (0.9 – 2.2)	75	0 (0 – 1)	0.6 (0.4 – 1.1)	43.4 (35.9 – 50.8)	39.8 (26.6 – 53.0)

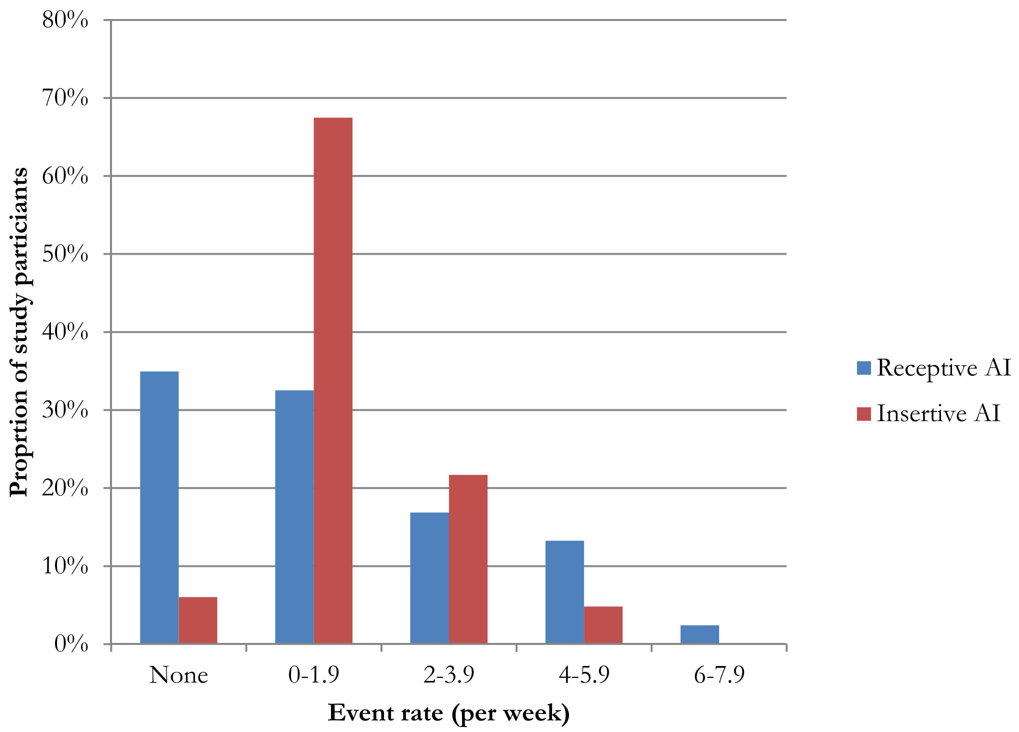
Sex with male partners

Thirty participants (36.1%) reported one or more uRAI event during follow up, compared to 38 (45.8%) who reported one or more uIAI event (exact McNemar's test p=0.280), and 15.8% (13/83) who reported both. In contrast to the higher frequency of RAI, participants more frequently reported uIAI events than uRAI events during follow up (1.8 vs. 1.3 events per 4 weeks (Table 36), Wilcoxon signed-rank test for matched pairs p=0.333) indicating differences in role-specific condom use. Restricted to participants who reported any IAI or RAI respectively, unprotected sex frequency by role was very similar (uIAI 1.9 vs. uRAI 2.0 events per 4 weeks), but reflected significant differences in the proportion of events that were condom-unprotected overall (unprotected IAI events: 31.9% vs. uRAI events: 20.6%, χ^2 p<0.001). No difference was observed in role-specific condom use in the 129 events at which both IAI and RAI occurred (13.2% condom-unprotected vs. 14.7% condom-unprotected respectively, exact McNemar's p=0.774).

Consistent with analysis of distinct dyads in Chapter 5, study participants were more frequently AI role receptive than insertive in events with male partners. In all 1327 homosexual events including AI, study participants were more often receptive than insertive (59.1% vs. 50.6% respectively, OR 1.21 (1.08-1.36)). This difference was statistically significant at event-level (McNemar's χ^2 p=0.001). By individual, however, there was no overall difference in the average frequency of RAI and IAI (6.4 vs. 5.5 events per 4 weeks follow up, Wilcoxon signed-rank test for matched pairs p=0.635) and over the complete duration of follow up, participants were less likely to report any RAI than any IAI (65.1% vs. 94.0%, McNemar's χ^2 p<0.001).

These seemingly dissonant results reflect differences in the frequency distribution of RAI and IAI among study participants. As shown in Figure 43, IAI was a more ubiquitous behaviour reported at low frequency for the majority of participants. By contrast, higher proportions of participants report no RAI, but those who did tended to report higher frequency of this behaviour. Among the 54 participants who reported any RAI, frequency of RAI was 9.8 events per 4 weeks (CI 8.0-12.2), compared to 5.9 IAI events per 4 weeks (CI 4.9-7.0) among 78 participants reporting any IAI (negative binomial test p<0.001).

Figure 43: Same-sex anal intercourse rates by sex role



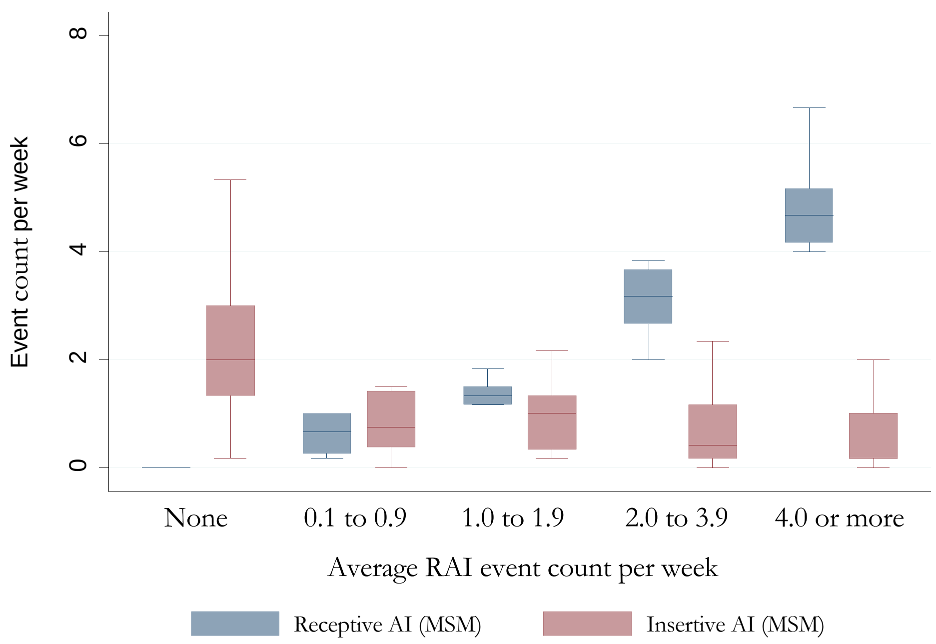
Anal sex role versatility and segregation

In total, 9.7% (129/1327; CI 8.1-11.4) AI events involved both RAI and IAI acts, and 48.2% (40/83) participants recorded at least one versatile event during follow up. In addition, a further 9 participants (10.8%) were role segregated at each event, but reported both AI roles at different events during follow-up. Thus 59.0% (CI 47.7-69.7) of participants were role versatile between different sexual partners. Of the remaining 41.0% of participants who were not role versatile during follow up, 85.3% (29/34) only reported IAI during follow up (*insertive role segregated)* whilst 14.7% (5/34) only reported RAI (*receptive role segregated*).

Prospective behaviours reported by participant role versatility and segregation are shown in Table 37. Participants reporting either segregated RAI or IAI roles throughout follow up reported considerably higher rates of those behaviours (and unprotected behaviours) than did versatile participants (note segregated RAI participants number only five individuals). In relation to homosexual behaviours, the proportion of RAI and IAI events that were condom-unprotected was lower for versatile participants than for participants segregated to either receptive or insertive roles: uRAI: 19.3% (versatile) vs. 27.9% (segregated); uIAI : 26.2% vs. 35.8% respectively.

In addition to heterogeneity in absolute categories of AI role (versatility and segregation over follow up), heterogeneity in IAI and RAI event frequency was apparent across the whole distribution of participant AI frequency. Figure 44 shows a divergent relationship between individual RAI and IAI frequency. As noted above, variance in IAI frequency between individuals is less pronounced than variance in RAI frequency. Individual IAI rates were highest among participants who reported no RAI, beyond which IAI frequency declined by 0.60 events per week (0.51-0.70) per increasing category of RAI frequency (Cuzick's test for non-parametric trend $p<0.001$).

Figure 44: Box plot comparison of insertive and receptive AI, sorted by increasing frequency of RAI†



†: Bars represent median, boxes represent 25th & 75th centiles; Whiskers represent next adjacent value

Table 37: Prospective sexual behaviours by versatility in study participant MSM role

	Versatile AI (N=49) FU 287 weeks		Segregated *RAI* (N=5) FU 30 weeks				Segregated IAI (N= 29) FU 172 weeks			
	Number of episodes	Rate per 4wks	Number of episodes	Rate per 4wks	IRR vs. versatile (CI)	*p*	Number of episodes	Rate per 4wks	IRR vs. versatile (CI)	*p*
MSM behaviours										
Total (AI)	938	13.1	118	15.7	1.21 (0.72-2.01)	0.474	400	9.3	0.71 (0.55-0.93)	0.012
RAI	667	9.3	118	15.7	1.70 (0.85-3.42)	0.136	-	-	-	-
uRAI	129	1.8	33	4.4	2.48 (0.52-11.76)	0.251	-	-	-	-
IAI	271	3.8	-	-	-	-	400	9.3	2.45 (1.77-3.40)	<0.001
uIAI	71	1.0	-	-	-	-	143	3.3	3.37 (1.44-7.89)	0.005
Heterosexual behaviours										
Total (VI/AI)	147	2.0	1	0.1	0.06 (0.01-0.68)	0.022	193	4.5	2.10 (1.04-4.23)	0.039
uVI/uAI	45	0.6	0	0	-	NA	102	2.4	3.79 (1.77-8.09)	0.001

Sex with female partners

Overall, 57.8% (48/83) reported one or more episodes of vaginal intercourse, 45.8% (38/83) one or more episode of AI with a female partner (exact McNemar's χ^2 p=0.006). Of the 59% of MSM participants who were heterosexually active over follow up, 22.5% (11/49) reported only vaginal intercourse, 2.0% (1/49) reported only AI and 75.5% (37/49) reported both behaviours. Vaginal intercourse events were more frequently reported than heterosexual AI events by participants overall (Table 36). Heterosexually active participants reported 4.24 (CI^{NB} 3.37- 5.36) vaginal sex episodes and 2.4, (CI^{NB} 1.7-3.4) heterosexual anal episodes per 4 weeks (Wilcoxon signed-rank test for matched pairs p<0.001).

The majority of participants who reported vaginal or anal sex roles with women also reported one or more unprotected events (vaginal: 68.8% (33/48); anal: 60.5% (23/38)), and overall 39.8% of all study participants recorded unprotected vaginal sex and 27.7% recorded unprotected heterosexual AI. Heterosexually active participants reported a higher frequency of unprotected vaginal than unprotected anal intercourse (1.63 vs. 1.05 respectively, Wilcoxon signed-rank test for matched pairs p=0.006). In contrast to differences between homosexual roles, individual rates of unprotected heterosexual vaginal and anal sex closely followed the frequency of those behaviours: anal intercourse was slightly more likely to be condom-unprotected than vaginal sex events with women (Table 36, VI: 38.5% vs. AI: 43.4%, OR 1.22 (0.82-1.81) p=0.296), however this difference was not statistically significant. Heterosexual AI events were, however, significantly more likely to be condom unprotected than were either homosexual IAI episodes (43.4% vs. 32.1% respectively, OR 1.63 (1.14 – 2.33) χ^2 p=0.028) or RAI episodes with men (43.4% vs. 20.6%, OR 2.94 (2.05-4.22) χ^2 p<0.0001).

Heterogeneity between heterosexual and homosexual behaviour

As discussed above, there was negative correlation between participants' homosexual and heterosexual event counts, and separately between the frequency of participants' homosexual RAI and IAI event counts. Figure 45 clearly indicates that the overall correlation of homosexual and heterosexual event frequency comprised different patterns of correlation for RAI and IAI frequencies. Participants reporting only sex with men during follow up reported significantly more RAI than IAI events (10.7 vs. 3.7 per 4 weeks respectively), whilst participants reporting heterosexual activity reported significantly more IAI than RAI events (6.8 vs. 3.7 per 4 weeks respectively, Wilcoxon signed-rank test for matched pairs p=0.004). Participants reporting any heterosexual contact had markedly lower rates of RAI with male partners than did homosexually exclusive participants (3.4 vs. 10.7 per 4 weeks respectively, IRR 0.32 (0.18-0.57) p<0.001), but there was no apparent correlation between RAI and heterosexual sex frequency for participants who reported any heterosexual sex (IRR: 1.06 per increasing category of heterosexual frequency, (0.52-2.16) p=0.869).

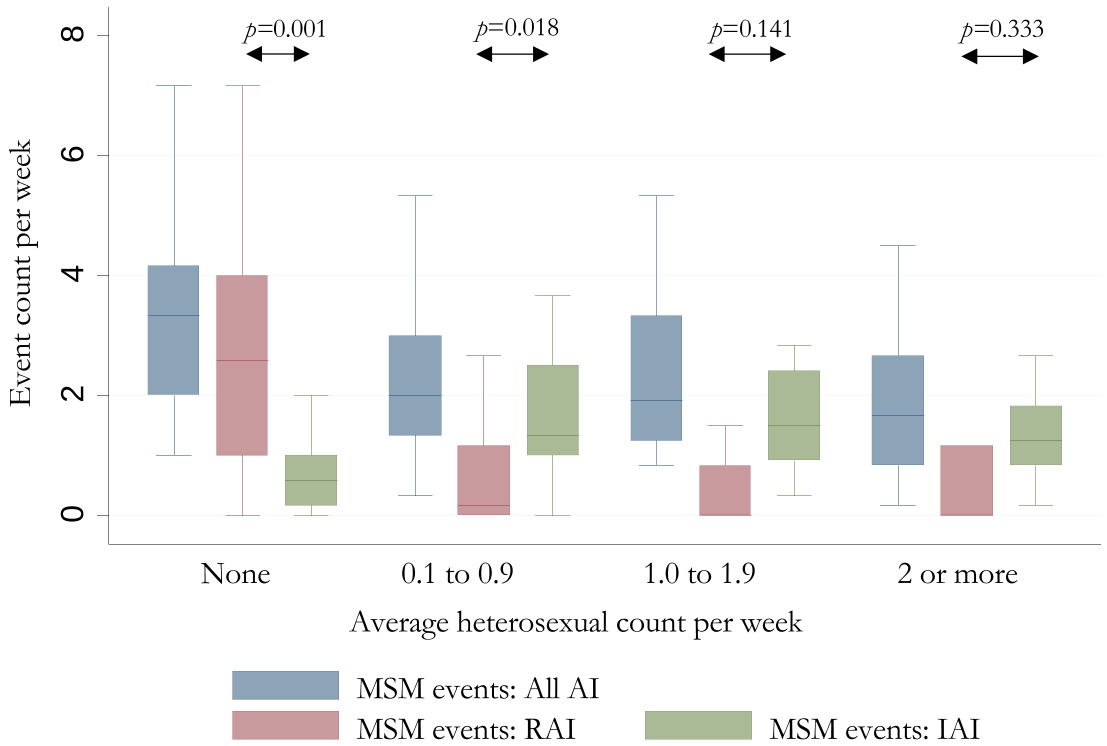
By contrast, IAI event frequency was highest among heterosexually active participants (Figure 45), many of whom were also insertive role segregated in homosexual behaviours. Participants who only reported homosexual IAI during follow up accounted for 56.6% (193/341) of heterosexual events and 69.4% (102/147) of unprotected heterosexual events. This reflected both higher rates of heterosexual sex (Table 37) and a higher proportion of unprotected sex in heterosexual events among MSM who only reported IAI (52.8%, 102/193) compared with participants who also reported RAI (30.6%, 45/147).

The divergent correlation between heterosexual and homosexual sex frequencies was also apparent in relation to unprotected heterosexual sex frequency. On average, frequency of reported unprotected RAI declined by 63% for each increasing category of heterosexual sex frequency (IRR uRAI 0.37 (0.19-0.72), test for categorical trend p=0.003), whereas there was no apparent linear association between increasing heterosexual sex and unprotected IAI frequency (IRR uIAI 1.09 (0.69-1.72) per increasing category of heterosexual sex frequency: test for categorical trend p=0.704).

Summary

Nearly all participants reported some homosexual IAI practices during follow up and 34.9% reported *only* IAI practices (role segregated). Nevertheless as a group, participants reported a higher total of RAI than IAI events, representing higher frequencies of homosexual behaviour among participants reporting receptive anal sex and particularly high frequencies among the small number of participants reporting *only* receptive anal sex. Across all participants, individual frequencies of receptive and insertive anal sex diverged markedly.

Figure 45: Box plot of total AI, IAI and RAI, by frequency of heterosexual sex



†: Bars represent median, boxes represent 25th & 75th centiles; Whiskers represent next adjacent value

Heterogeneity in homosexual practices was particularly related to whether participants reported heterosexual sex, and how frequently this occurred. The previous section noted a decline in frequency of sex with men with increasing sex with women. This reflected a pronounced decrease in frequency of RAI and uRAI among MSM reporting *any* heterosexual sex with little evidence of a declining association with IAI frequency. In 55.6% of heterosexual and 69.4% of unprotected heterosexual events recorded, the study participant had only reported IAI in homosexual events throughout follow up.

Participant HIV status and prospective behaviour

The prevalence of HIV among diary study participants was 26.5%. This compared closely to the HIV prevalence among all MSM enrolled in IAVI studies at the time of the diary study. Sociodemographic and retrospective behavioural associations with HIV prevalence among diary study participants were in keeping with those identified in Chapter 3.

All HIV positive participants had been confirmed HIV seropositive on enrolment to the IAVI cohort study (median 243 days prior to the diary study, range 61 – 682) and were aware of their status. Only 4 HIV positive participants reported knowing their HIV status prior to cohort enrolment (period since testing: 1 year (2 participants), 2 year (1 participant) and 9 year (1 participant)). The remaining 18 (81.8%) were unaware of their status prior to cohort screening. At cohort follow up prior to the diary study, 9 men (40.9%) were WHO clinical stage 1, 10 (45.5%) were stage 2 and 2 (9.1%) stage 3 (one participant had no clinical stage reported), and 5/22 (22.7%) were on ART.

61 participants were HIV seronegative at their most recent cohort screening prior to the diary study, thus within three months prior to diary study enrolment. 25/61 (41.0%) also reported HIV testing prior to joining the cohort: the median period since that last test was 1 year (range 0-7 year previous). Thus HIV negative diary study participants were men who tested recently tested HIV negative and were aware of their status.

HIV risk knowledge among participants
Sources of sexual health information

As previously mentioned, participants received HIV risk counselling as part of IAVI follow up procedures. All participants cited the IAVI research clinic as a source of personally relevant and trusted sexual health information. Few participants identified sources other than the research clinic where they encountered sexual health information relevant to their lifestyles (newspaper 15.7%, radio 13.3%, TV 12.1%, public meetings 8.4%, family 0%, friends 12.1%, public health clinics 8.4%, private health clinics 10.8%), and fewer still identified sources they placed trust in. Overall, 63.9% (53/83) cited the research clinic as the only source of MSM sexual health information known to them, and only 3.6% (3/83) cited any other sources of information that they trusted.

Quality of sexual health knowledge

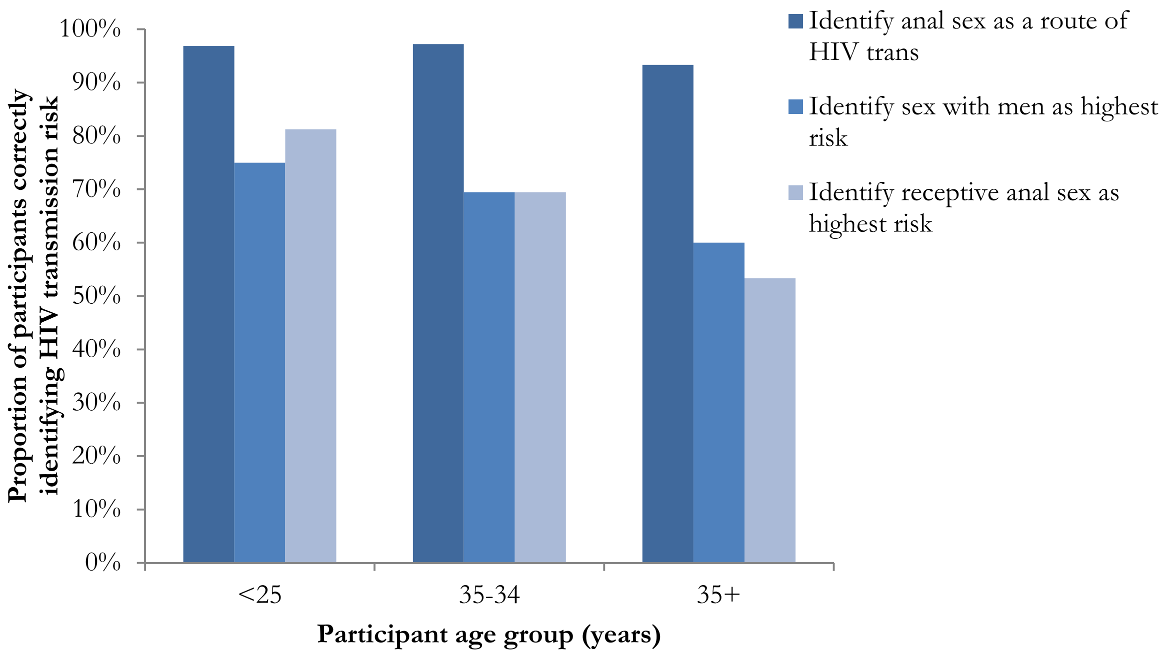
Participant's knowledge of HIV transmission risks are summarised in Table 38. 94.0% (78/83) participants correctly identified unprotected penile-anal and penile-vaginal intercourse as potential routes of HIV transmission; however 30.1% (25/83) were unaware of unprotected oral sex as a route of transmission. 28.9% of men considered that sex with women represented the highest risk of sexual transmission of HIV to a man, and a significant minority of men incorrectly perceived sex acts other than unprotected RAI as being the highest sexual transmission risk for men (28.9%) and women (45.8%).

Table 38: Knowledge of behavioural HIV transmission risks

Any HIV risk to HIV negative man	n	%	Highest HIV risk to an HIV negative man	n	%
Partner gender					
Unprotected sex with a man	81	97.6	Unprotected sex with a man	58	69.9
Unprotected sex with a woman	82	98.8	Unprotected sex with a woman	24	28.9
			Unsure	1	1.2
Sex roles with men					
Unprotected IAI	80	96.4	Unprotected IAI	20	24.1
Unprotected RAI	81	97.6	Unprotected RAI	59	71.1
Unprotected oral sex	61	73.5	Unprotected oral sex	3	3.6
			Unsure	1	1.2
Sex roles with women					
Unprotected vaginal sex	82	98.8	Unprotected vaginal sex	44	53.0
Unprotected AI	78	94.0	Unprotected AI	35	42.2
			Unsure	4	4.8
Any HIV risk to HIV negative woman			**Highest HIV risk to an HIV negative woman**		
Sex roles with men					
Unprotected vaginal sex	83	100	Unprotected vaginal sex	37	44.6
Unprotected AI	79	95.2	Unprotected AI	45	54.2
Unprotected oral sex	65	78.3	Unprotected oral sex	1	1.2
			Unsure	0	-

Participants who did not correctly identify all routes of sexual HIV transmission tended to have been enrolled into IAVI cohorts more recently (median 187 vs. 319 days, Mann-Whitney p =0.039), however correct recognition of unprotected RAI as the highest risk for HIV transmission was unrelated to duration of enrolment (enrolment duration for participants with correct knowledge: median 291 days vs. incorrect knowledge: median 321 days, Mann-Whitney p=0.330). Completed years of school attendance were no different for participants who correctly identified routes of transmission between men (correct: 8 years vs. incorrect: 8 years Mann-Whitey p=0.673), and were slightly lower for participants who correctly identified unprotected RAI as the principal behavioural risk (correct: 8 years vs. incorrect 9.5 years, Mann-Whitney p= 0.202).

Figure 46: Proportion of study participants correctly recognising HIV risk of various behaviours



Accordingly, as shown in Figure 46, there was a trend for increasing misconception about the risk posed by AI with men generally, and RAI specifically, by increasing participant age. Further, participants who reported sex with women during their lifetime were less likely to correctly identify unprotected RAI as the highest risk activity between men (42/66 (63.6%) v 17/17 (100%), Fisher's exact p=0.001), and more likely to incorrectly consider sex with women as the higher risk for HIV transmission (22 (33.3%) vs. 3/17 (17.7%), Fisher's exact p=0.251). HIV positive men were more likely to correctly recognise unprotected RAI as the higher HIV transmission route between men (21/22 vs. 38/61 (HIVN), p=0.034), but more likely to believe that sex with women posed a higher transmission risk to the male partner than sex with men (36.4% vs. 26.2%, p=0.262).

Prospective risk behaviour and participant HIV status

Table 39 summarises the sexual risk behaviour of study participants by their HIV status. Both HIV positive and HIV negative participants reported markedly more unprotected sexual episodes with male partners than female partners. However, with male partners, HIV positive participants reported significantly higher frequencies of uRAI than uIAI during follow up, the reverse being the case for HIV negative participants (Figure 47).

The overall incidence of unprotected AI with men was somewhat lower among HIV positive participants than HIV negative participants (Table 39.i.) however this obscured marked differences in unprotected AI role. HIV positive men reported a higher rate of unprotected RAI (borderline statistical significance) and a markedly lower incidence of unprotected IAI during follow up, compared to HIV negative men (Figure 47). Rates of unprotected heterosexual sex mirrored the profound differences in unprotected IAI with men: HIV positive men reported less than 1/7th the frequency of unprotected heterosexual sex reported by HIV negative men.

Figure 47: Prospective unprotected sexual episode rates by HIV status of participant

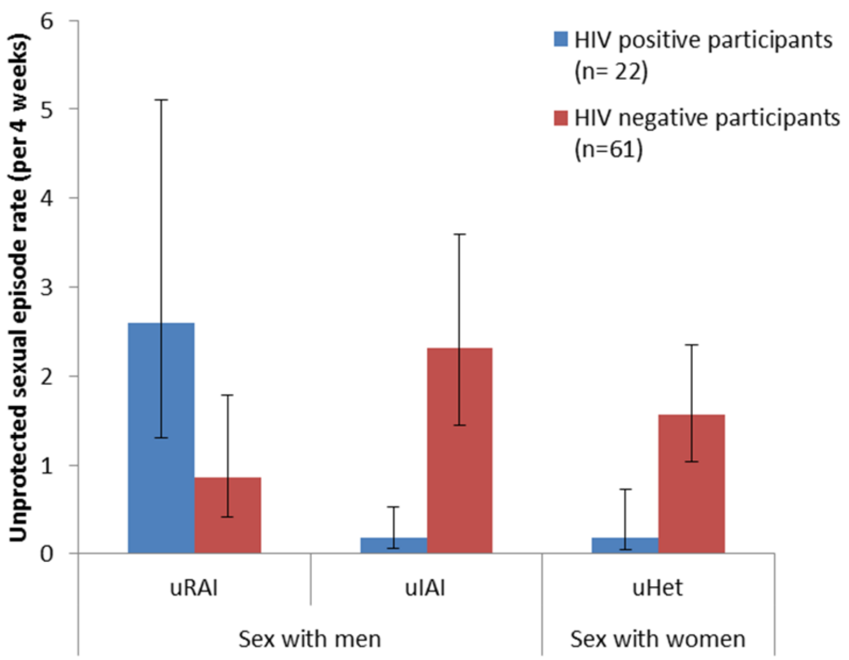


Table 39: HIV status and prospective participant behaviour

i. Response measure: Unprotected sex frequency

			HIV status		IRR[b] HIV+/HIV- (95% CI) *p* value	aIRR[c] /HIV- (95% CI) *p* value
			Positive	Negative		
Partner gender	Male	*Count*	86	278	0.86 (0.40-1.85)	0.88 (0.32-2.40)
		Rate†	2.6	3.1	0.697	0.796
	Female	*Count*	6	141	**0.12 (0.04-0.36)**	**0.14 (0.06-0.31)**
		Rate†	0.2	1.6	**<0.001**	**<0.001**
	p value[a]		0.001	0.010		
Homosexual AI role	Receptive	*Count*	85	77	3.06 (0.99-9.4)	5.28 (0.78-35.7)
		Rate†	2.6	0.9	0.051	0.088
	Insertive	*Count*	6	208	**0.08 (0.02-0.26)**	**0.14 (0.06-0.33)**
		Rate†	0.2	2.3	**<0.001**	**<0.001**
	p value[a]		<0.001	0.002		

ii. Response measure: Sex frequency

			HIV status		IRR[b] HIV+/HIV- (95% CI) *p* value	aIRR[c] HIV+ /HIV- (95% CI) *p* value
			Positive	Negative		
Partner gender	Male	*Count*	487	840	**1.66 (1.25-2.21)**	**1.74 (1.48-2.04)**
		Rate†	16.1	9.8	**0.001**	**<0.001**
	Female	*Count*	33	314	**0.29 (0.13-0.65)**	**0.17 (0.10-0.28)**
		Rate†	1.0	3.5	**0.003**	**<0.001**
	p value[a]		<0.001	<0.001		
Homosexual AI role	Receptive	*Count*	441	344	**3.55 (1.7-7.4)**	**4.48 (2.91-6.90)**
		Rate†	13.5	3.8	**0.001**	**<0.001**
	Insertive	*Count*	88	583	**0.42 (0.27-0.66)**	0.53 (0.26-1.07)
		Rate†	2.7	6.5	**<0.001**	0.077
	p value[a]		<0.001	0.010		

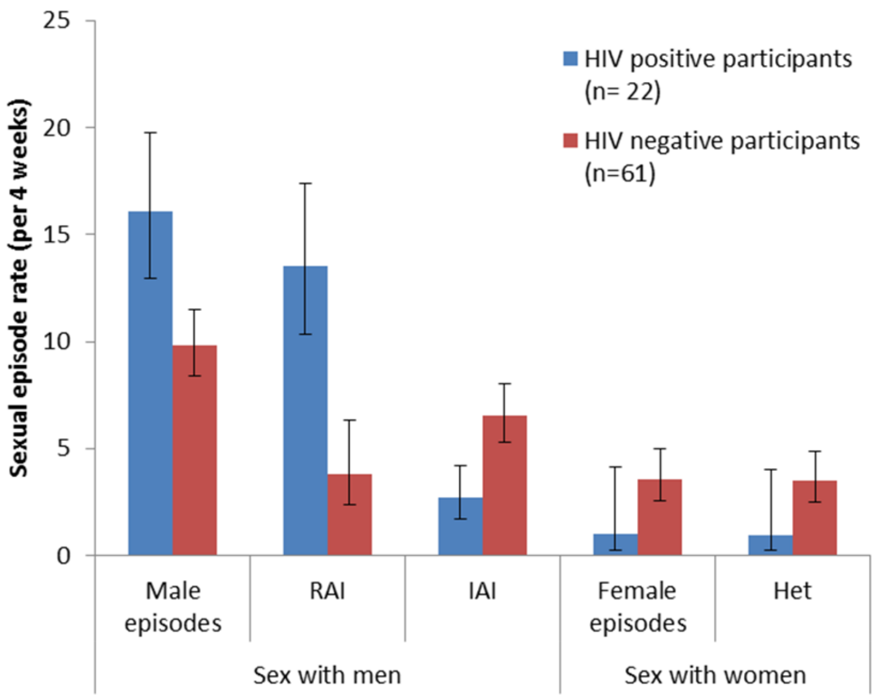
iii. Response measure: Proportion of condom-unprotected events

			HIV status		OR[d] HIV+/HIV- (95% CI) *p* value	aOR[e] HIV+ /HIV- (95% CI) *p* value
			Positive	Negative		
Partner gender	Male	*n/N*	86/487	278/840	0.28 (0.07-1.06)	0.36 (0.08-1.59)
		%	17.7	33.1	0.061	0.175
	Female	*N*	6/32	141/309	0.22 (0.02-2.96)	0.43(0.02-8.87)
		%	18.8	45.6	0.257	0.256
Homosexual AI role	Receptive	*n/N*	85/441	77/344	0.75 (0.19-2.94)	0.81 (0.20-3.33)
		%	19.3	22.4	0.678	0.768
	Insertive	*n/N*	6/88	208/583	**0.07 (0.01-0.58)**	**0.11 (0.01-1.10)**
		%	6.8	35.7	**<0.014**	**0.060**

†: Events per 4 weeks [a]. Within group comparison (Wilcoxon matched-pairs signed-ranks test) [b]. crude incidence rate ratio: negative binomial regression, no adjustment c. adjusted incidence rate ratio: negative binomial regression adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality [d]. adjusted OR: random coefficient logistic regression, adjusted for repeat observations among study participant only [e]. adjusted OR: random coefficient logistic regression, adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality and repeat observations among study participants

The increased rate of uRAI among HIV positive men predominantly reflected the considerable differences in the incidence of RAI in this group (Figure 48), rather than a difference in per event condom use. HIV positive men reported a median of 22 (IQR 11-28) RAI episodes compared to 1 (IQR 0-8) among HIV negative men. HIV positive men reported a slightly lower proportion of unprotected RAI episodes than HIV negative men, although this difference was not significant.

Figure 48: Prospective sexual episode rates by HIV status of participant



The low incidence of uIAI among HIV positive participants reflected both a lower frequency of IAI and a higher probability of condom-protected sex where IAI occurred compared to HIV negative participants (both statistically significant). Thus HIV positive men reported less than half the incidence of IAI compared to HIV negative participants and, where this occurred, they were significantly more likely to have used a condom. HIV positive participants also reported approximately one sixth the frequency of heterosexual sex than did HIV negative participants (statistically significant) and a lower probability of condom-unprotected sex from those events (not statistically significant).

Summary of HIV status and prospective behaviour

The observation that HIV positive MSM reported high rates of unprotected RAI, but low rates of unprotected IAI and heterosexual sex may have two explanations. The frequency of highest risk activities among HIV positive men might reflect longer-term personal risk tendencies that led to HIV infection. Secondly, amongst men who all know their HIV status and that for the most part were informed of HIV transmission risks, personal behaviour may have changed to reduce the risk of transmission to sexual partners. Whilst the high incidence of RAI among HIV positive participants is consistent with the former, there is also indirect evidence of selective condom use for behaviours posing disproportionate risk of transmission to partners (unprotected IAI with men or any unprotected heterosexual sex). The observations that HIV positive men were both more likely to use a condom for IAI than HIV negative men, and more likely to use a condom for IAI compared to RAI among HIV positive men would not be explained by longer-term risk tendencies, and are suggestive that HIV positive participants have selectively modified behaviours presumably to reduce risk to partners

Individual determinants of sexual risk behaviour among HIV negative participants

Further analysis of prospective individual behaviours was restricted to the diary records of HIV negative study participants, for whom cumulative frequencies of unprotected sexual behaviours over the study period reflect HIV contraction risks to the study participant. As with the comparison between behaviours reported by HIV positive and HIV negative participants in the last section, the frequency of unprotected sex, the total frequency of sex and the proportion of condom-unprotected sex were compared for various individual characteristics of HIV negative participants using negative binomial models (counts) and multilevel logistic regression models (proportions).

Preliminary bivariate analysis indicated a number of individual characteristics associated with the frequency of unprotected penetrative sex with either men or women at $p<0.100$. Given the aim of parsimonious model specification due to the small sample size, covariates were arranged into seven logically similar covariate sets (Table 40) and ordered categorical variables were analysed for trend rather than using dummy variables. Models were compared using all individual covariates by within-set covariate replacement to identify the optimum standard specification with the lowest BIC, and this specification was applied to all models.

Other individual characteristics collected from IAVI cohort or CAPI sources were not statistically associated with frequency of unprotected sex in bivariate analysis. These included years of education, ethnicity, lifetime partner count, lifetime forced sex, circumcision, disclosure of sexuality and knowledge of HIV transmission risks. These covariates were not further evaluated.

The following section of this chapter describes bivariate and multivariate associations between covariate sets with the frequency of unprotected sex, the total frequency of sex and the proportion of condom-unprotected models by gender of partners and MSM sex role. Although multivariate models included adjustment for religion, exploration of patterns of association between behaviour and religion were complex and beyond the scope of this text to fully explore.

Table 40: Covariate sets of individual covariates associated with frequency of unprotected MSM or heterosexual sex

Covariate set	Individual covariates	Values
Age	Age group (ordered categorical)	<25 years 25-34 years 35+ years
	Age (continuous)	Years of age
Socioeconomic status	Earnings from any source last month (ordered categorical;	<2000 KSH 2000-5000 KSH >5000 KSH
	Employment (categorical)	Waged Self-employed Unemployed
	Household amenities (ordered index of binary measures)	House with roof House with tap water House with toilet House with electricity
Religion	Religion (categorical)	Roman Catholic Protestant Muslim None / Other
Travel	Sex outside study area (binary)	Yes No
Alcohol use	Frequency of alcohol consumption (binary)	Weekly Less often
	Frequency of alcohol intoxication (binary)	Weekly Less often
Illicit drug use	Ever used illegal drugs (binary)	Yes No
	Ever injected illegal drugs (binary)	Yes No
Sexuality	Prospective bisexual behaviour (binary)	Yes No
	Lifetime bisexual behaviour (binary)	Yes No
	Expressed gender preference (categorical)	Men Women Both

Age and sexual behaviour among HIV negative participants

Age was analysed as both a continuous and categorical variable. Model fit was marginally better for continuous measures, but some behaviours exhibited non-linear associations with age, therefore categorical measures are tabled.

Participant age and incidence of unprotected sex

Table 41 summarises the sexual risk behaviour of HIV negative study participants by age group, and Figure 49 shows fitted and unadjusted event frequency estimates for continuous measures of participant age. The frequency of unprotected homosexual sex, both total AI and by sex role, was strongly related to participant age and age group in crude analyses. Frequency of overall uAI declined by 6.5% per year of increasing age (IRR 0.935 per year (0.89-0.98) p=0.011) representing declines in both the frequency of uRAI (IRR 0.927 per year (0.877-0.98) p=0.011) and frequency of uIAI (IRR 0.940 per year (0.89-0.99) p=0.028, see Figure 49). Crude negative associations between age group and unprotected homosexual sex frequency were similarly apparent (Figure 50). However, all crude age associations weakened with adjustment for confounding, specifically following adjustment for participant sexuality. In adjusted models there was a statistically significant independent relationship between increasing year of age and total frequency of uAI (aIRR 0.965 (0.95-0.98) p<0.001, however no such relationship was apparent for uRAI (aIRR 0.993 (0.94-1.05) p=0.807) or uIAI (aIRR 0.978 (0.94-1.02) p=0.268). Crude associations between age group and unprotected homosexual sex frequency did not persist with confounder adjustment, in particular when adjusted for measures of behavioural sexuality (Table 41.i).

By contrast, the frequency of unprotected heterosexual sex increased in relation to increasing participant age group (Table 41.i) and increasing year of age (IRR 1.072 (1.01-1.14) p=0.022). These associations persisted with confounder adjustment (age group: Table 41.i; age: aIRR 1.070 per year (1.01-1.13) p=0.017, Figure 49 and Figure 50).

Table 41: Participant age and prospective HIV negative participant behaviour

i. Response measure: Unprotected sex frequency

			Age group (years) <25	25 – 34	35+	IRR[b] trend (95% CI) *p* value	aIRR[c] trend (95% CI) *p* value
Partner gender	Male	*Count*	176	80	22	**0.74 (0.61 – 0.91)**	0.91 (0.78-1.05)
		Rate†	4.4	2.4	1.4	**0.005**	0.188
	Female	*Count*	42	44	55	**1.32 (1.03 – 1.67)**	**1.33 (1.14 – 1.55)**
		Rate†	1.0	1.3	3.4	**0.027**	**<0.001**
	p value[a]		*<0.001*	*0.167*	*0.141*		
Homosexual AI role	uRAI	*Count*	61	6	10	**0.73 (0.56 – 0.94)**	1.11 (0.88 – 1.39)
		Rate†	1.5	0.2	0.6	**0.018**	0.386
	uIAI	*Count*	119	77	12	**0.75 (0.58 – 0.96)**	0.92 (0.72 – 1.17)
		Rate†	3.0	2.3	0.8	**0.020**	0.505
	p value[a]		*0.089*	*0.002*	*0.888*		

ii. Response measure: Sex frequency

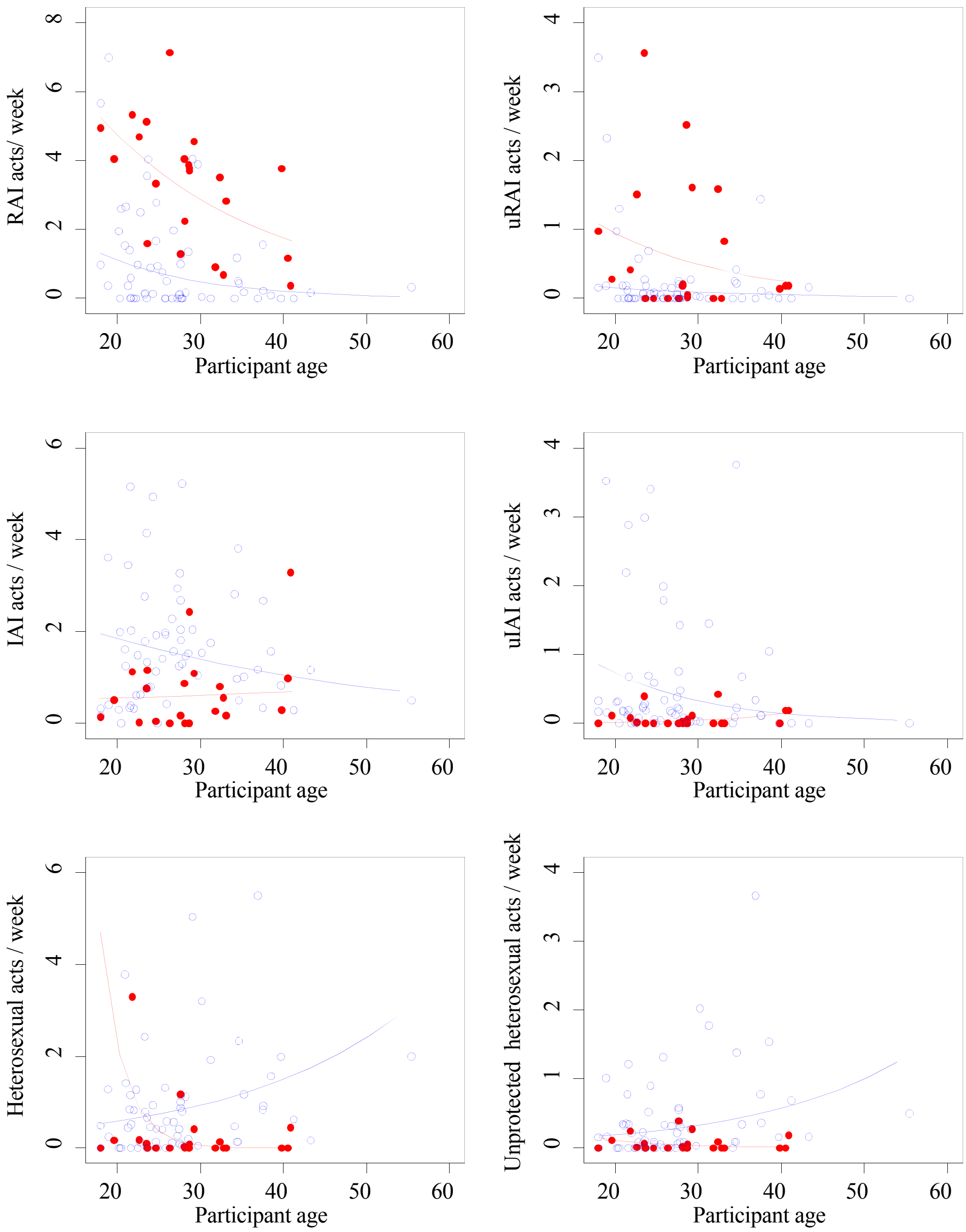
			Age group (years) <25	25 – 34	35+	IRR[b] trend (95% CI) *p* value	aIRR[c] trend (95% CI) *p* value
Partner gender	Male	*Count*	431	344	65	**0.84 (0.75 – 0.94)**	**0.92 (0.88 – 0.96)**
		Rate†	10.7	10.3	4.1	**0.002**	**<0.001**
	Female	*Count*	102	109	98	**1.23 (1.13 – 1.34)**	**1.25 (1.11 – 1.42)**
		Rate†	2.5	3.3	6.1	**<0.001**	**<0.001**
	p value[a]		*<0.001*	*<0.001*	*0.397*		
Homosexual AI role	RAI	*Count*	231	94	19	**0.68 (0.60 – 0.78)**	**0.69 (0.57 – 0.82)**
		Rate†	5.7	2.8	1.2	**<0.001**	**<0.001**
	IAI	*Count*	238	288	57	0.96 (0.83 – 1.11)	1.00 (0.95 – 1.06)
		Rate†	5.9	8.7	3.6	0.597	0.933
	p value[a]		*0.819*	*0.004*	*0.045*		

iii. Response measure: Proportion of condom-unprotected events

			Age group (years) <25	25 – 34	35+	OR[d] trend (95% CI) *p* value	aOR[e] trend (95% CI) *p* value
Partner gender	Male	*n/N*	171/431	80/344	22/65	0.72 (0.44 – 1.20)	0.74 (0.40 – 1.34)
		%	40.8	23.3	33.9	0.209	0.312
	Female	*N*	42/102	44/109	55/98	1.04 (0.93 – 1.16)	1.03 (0.60 – 1.78)
		%	41.2	40.4	56.1	0.491	0.917
Homosexual AI role	RAI	*n/N*	61/231	6/94	10/19	1.24 (0.61 – 2.54)	1.57 (0.71 – 0.99)
		%	26.4	6.4	52.6	0.552	0.266
	IAI	*n/N*	119/238	77/288	12/57	**0.46 (0.25 – 0.84)**	**0.51 (0.26 – 0.99)**
		%	50.0	26.7	21.1	**0.012**	**0.047**

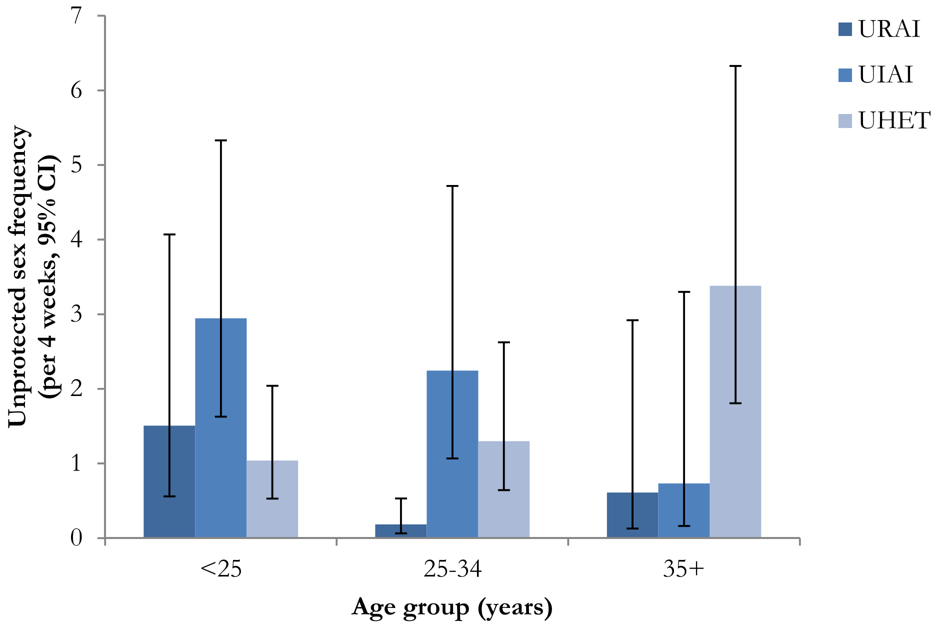
†: Events per 4 weeks [a]. Within group comparison (Wilcoxon matched-pairs signed-ranks test) [b]. crude incidence rate ratio: negative binomial regression, no adjustment c. adjusted incidence rate ratio: negative binomial regression adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality [d]. adjusted OR: random coefficient logistic regression, adjusted for repeat observations among study participant only [e]. adjusted OR: random coefficient logistic regression, adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality and repeat observations among study participants

Figure 49: Observed and fitted behavioural and unprotected event frequencies by participant age and HIV status



Lines represent predicted crude rate (negative binomial regression) red line: HIV positive; blue line HIV negative). Points represent observed measures.

Figure 50: Prospective unprotected sexual episode rates by participant age group

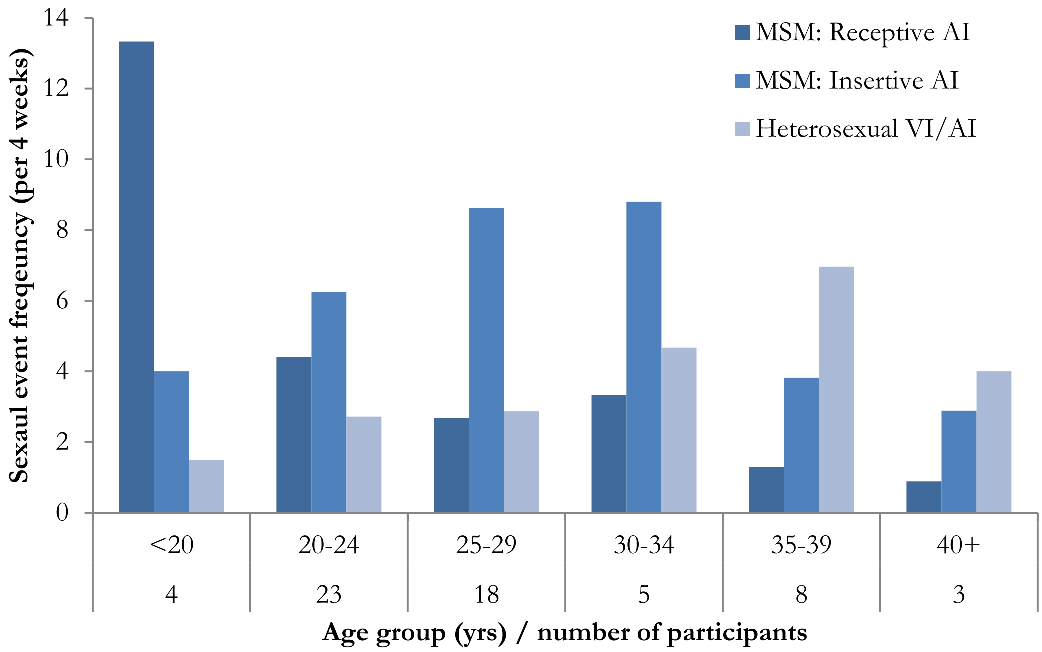


Participant age and sex frequency

The incidence of all sexual behaviour showed a downward trend with increasing age (crude IRR 0.981 (0.96-0.99) penetrative sex events per increasing year of age, p=0.006). This overall downward trend comprised differing trends in sex frequency with male and female partners (Figure 51).

The declining frequency of sex with male partners accounted for most of the decline in overall sexual behaviour with increasing age however this decline largely reflected dramatic declines in RAI frequency with increasing age group (Table 41.ii), with and without confounder adjustment. Participants under 25 years of age reported nearly 5 times the frequency of RAI than did participants over 35 years (Table 41.ii), and the decline appeared consistent across age groups (Figure 51). This was apparent also in a strong negative association between RAI frequency and year of age (IRR 0.923 (0.91-0.94) per increasing year of age p<0.001; aIRR (0.941 (0.91-0.98) p=0.002). Further, there was no evidence of a relationship between participant age and per-event condom use for RAI (Table 41.iii) implying that frequency of uRAI was predominantly determined by frequency of RAI.

Figure 51: Prospective sexual episode rates by participant age and HIV status



There was less evidence of a linear trend in IAI frequency with either categorical age group (Table 41.ii) or continuous age measures (IRR 0.986 per year (0.97-1.00) p=0.106; aIRR 0.996 per year (0.99-1.01) p=0.494). Indeed, as shown in Figure 51, frequency of IAI peaked between the ages of 25 to 34 years. By contrast to the components of uRAI frequency, the declining frequency of uIAI was related to a pronounced relationship between per-event condom use and participant age. For every increase in age group participants were approximately twice as likely to use condoms for IAI events (Table 41.iii, aOR condom unprotected IAI: 0.83 per increasing year of age (0.71-0.97) p=0.021).

The trend toward increasing unprotected heterosexual sex with increasing age reflected an increasing frequency of any heterosexual behaviour with increasing age (Table 41.ii), rather than any association between per-event condom use and increasing age (Table 41.iii).

To summarise, relationships between age and behaviours among HIV negative participants were strong and heterogeneous. High HIV contraction risk behaviours (i.e. uRAI) were most frequent among the very youngest participants, and driven by higher RAI frequency rather than age-related differences in condom use. This finding implies that condom access or safe sex knowledge is not, within this population, the driver of age differentials in personal safe sex practice.

Across participant age groups, there was evidence for an intriguing relationship. Although homosexual event frequencies declined generally with age, heterosexual event frequencies increased with age. The overall decline in homosexual event frequency represented a very rapid decline in RAI frequency from a young age (but little evidence of a change in tendency to use condoms), whilst IAI frequencies peaked between 25-34 but were accompanied by strong age-related increase in condom use.

Socioeconomic status and sexual behaviour among HIV negative participants

Measures of socioeconomic status

Three covariate measures indicative of participant socioeconomic status were explored, each of which was associated with measures of unprotected homosexual or heterosexual sex frequency in bivariate analysis. Separate measures showed a significant degree of correspondence with other measures within the socioeconomic set. Overall, 23.0% (14/61) of HIV negative participants reported cash earnings of less than 2000 Kenya Shillings (KSh) in the previous month (approximately equivalent to ~$1 USD per day). 47.5% of all participants, and 78.6% of participants earning <2000 KSH last month, reported no on-going form of employment. Participants who reported living in accommodation with roofing, tap water, latrine and electricity were most likely to report formal waged employment (22.2% (2/9)) and earnings of >5000 KSh in the prior month (66.7% (6/9)). Inclusion of more than one socioeconomic measure in models did not improve model fit. Monthly income proved to be a marginally better fit than other measures during model specification and was arguably the least ambiguous measures of economic circumstance.

Table 42: Measures of participant socioeconomic status

		Earnings from any source in previous month (Kenya Shillings)						
		5000+		2000 - 5000		<2000		Total
	Total (n)	21		26		14		
		n	%	n	%	n	%	
Household utility index†	4 (all)	6	28.6	3	11.5	0	0	9
	3	8	38.1	9	34.6	7	50.0	24
	2 or less	7	33.3	14	53.9	7	50.0	28
Current form of employment	Formal	2	9.5	4	15.4	2	14.3	9
	Self / informal	11	52.4	12	46.2	1	7.1	24
	Unemployed	8	38.1	10	38.5	11	78.6	29

†: unweighted count of household utilities: roofing + tap water + toilet + electricity

Participant earnings and incidence of unprotected sex

Table 43 and Figure 52 summarise the sexual risk behaviour of HIV negative study participants by their self-reported monthly earnings from any source at baseline. Total incidence of unprotected sex with male partners increased with declining level of monthly income. This trend was statistically significant for incidence of any unprotected AI with male partners, and participants earning less than 2000 KSh/month reported over double the prospective incidence of unprotected AI with men than did participants who earned 5000 KSh and over (5.0 vs. 2.4 uAI events per 4 weeks). However, this trend was not significant after confounder adjustment. This overall trend in unprotected AI with men comprised trends for increasing uRAI and uIAI frequency with lower income (being more pronounced for the former) however crude trends were not statistically significant. No trend was apparent for the incidence of unprotected heterosexual sex.

Figure 52: Prospective unprotected sexual episode rates by participant earnings

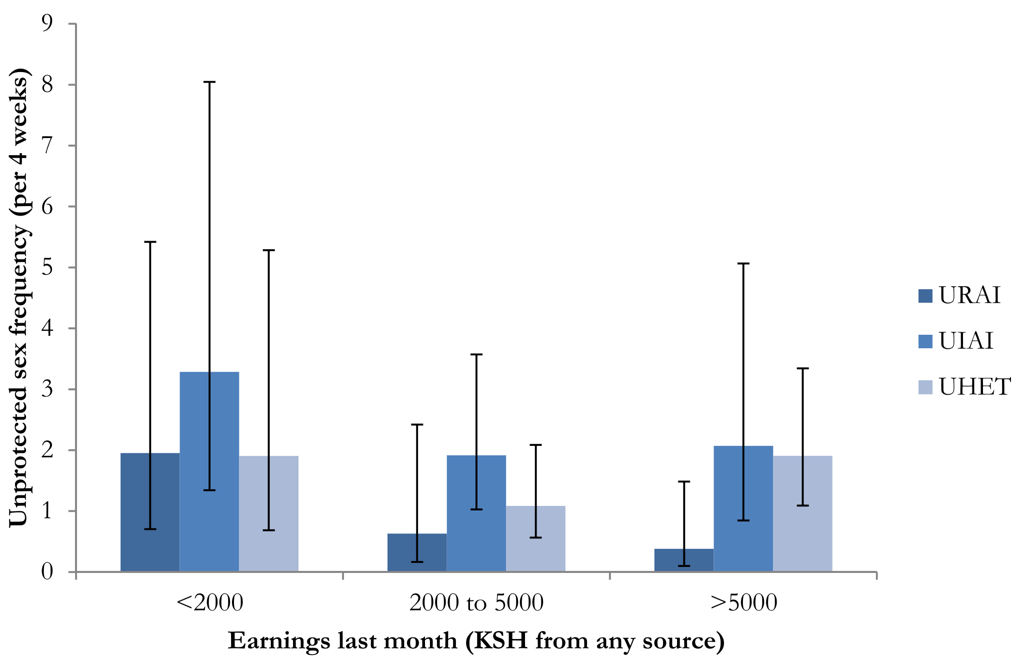


Table 43: Monthly cash earnings and prospective HIV negative participant behaviour

i. Response measure: Unprotected sex frequency

			Earnings (KSh) last month 5000+	2000 – 5000	<2000	IRR[b] trend (95% CI) *p* value	aIRR[c] trend (95% CI) *p* value
Partner gender	Male	*Count*	76	98	104	**1.40 (1.24 – 1.59)**	1.22 (0.86 – 1.75)
		Rate†	2.4	2.6	5.0	**<0.001**	0.267
	Female	*Count*	60	41	40	0.96 (0.57 – 1.61)	1.01 (0.81 – 1.25)
		Rate†	1.9	1.1	1.9	0.882	0.949
	p value[a]		*0.674*	*0.030*	*0.079*		
Homosexual AI role	uRAI	*Count*	12	24	41	2.23 (0.82 – 6.08)	1.41 (0.77 – 2.37)
		Rate†	0.4	0.6	2.0	0.115	0.263
	uIAI	*Count*	65	74	69	1.23 (0.86 – 1.76)	1.33 (0.88 – 2.00)
		Rate†	2.1	2.0	3.3	0.250	0.172
	p value[a]		*0.032*	*0.030*	*0.316*		

ii. Response measure: Sex frequency

			Earnings (KSh) last month 5000+	2000 – 5000	<2000	IRR[b] trend (95% CI) *p* value	aIRR[c] trend (95% CI) *p* value
Partner gender	Male	*Count*	269	344	227	1.12 (0.98 – 1.28)	1.06 (0.92 – 1.23)
		Rate†	8.6	9.2	10.8	0.104	0.400
	Female	*Count*	122	124	63	0.88 (0.65 –1.20)	0.87 (0.67 – 1.13)
		Rate†	3.9	3.3	3.0	0.417	0.300
	p value[a]		*0.014*	*<0.001*	*0.010*		
Homosexual AI role	RAI	*Count*	91	156	97	1.28 (0.68 – 2.41)	0.83 (0.42 – 1.65)
		Rate†	2.9	4.2	4.6	0.452	0.594
	IAI	*Count*	211	221	151	1.02 (0.65 – 1.61)	1.11 (0.75 – 1.64)
		Rate†	6.8	5.9	7.2	0.924	0.611
	p value[a]		*0.088*	*0.124*	*0.285*		

iii. Response measure: Proportion of condom-unprotected events

			Earnings (KSh) last month 5000+	2000 – 5000	<2000	OR[d] trend (95% CI) *p* value	aOR[e] trend (95% CI) *p* value
Partner gender	Male	*n/N*	76/269	98/344	104/227	2.40 (0.91 – 6.37)	2.62 (0.96 – 7.18)
		%	28.3	28.5	45.8	0.078	0.061
	Female	N	60/122	41/124	40/63	0.77 (0.26 – 2.33)	0.79 (0.27 – 2.35)
		%	49.2	33.1	63.5	0.648	0.677
Homosexual AI role	RAI	*n/N*	12/91	24/156	41/97	**4.23 (1.15 – 15.59)**	**3.28 (1.03 – 10.4)**
		%	13.2	15.4	42.3	**0.009**	**0.044**
	IAI	*n/N*	65/211	74/221	69/151	2.80 (0.87 – 8.97)	3.03 (0.96 – 9.58)
		%	30.8	35.1	46.7	0.083	0.059

†: Events per 4 weeks [a]. Within group comparison (Wilcoxon matched-pairs signed-ranks test) [b]. crude incidence rate ratio: negative binomial regression, no adjustment c. adjusted incidence rate ratio: negative binomial regression adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality [d]. adjusted OR: random coefficient logistic regression, adjusted for repeat observations among study participant only [e]. adjusted OR: random coefficient logistic regression, adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality and repeat observations among study participants

Participant earnings: behavioural incidence and condom use tendency

There was no evidence of association between participant earnings and frequency of either MSM or heterosexual sex (Table 43.ii), although the reported frequency of RAI did increase with declining earnings whilst frequency of heterosexual sex declined. There was, however evidence of a significant relationship between declining earnings and lower condom use for AI events with male partners (Table 43.iii). The proportion of condom-unprotected RAI events among participants reporting low cash earnings in the prior month was 42.3% compared to 13.8% among higher earners and this difference was statistically significant (aOR 3.28, Table 43.iii). Similar trends were also apparent for the proportion of condom unprotected IAI events, of borderline statistical significance. There was no indication of a similar association for heterosexual sex, which if anything indicated a higher tendency toward condom-unprotected events amongst higher earning participants (not significant).

In summary, there was some evidence that condoms were less likely to be used for homosexual sex, particularly RAI, where the participant reported very low levels of cash income, but correspondingly weaker evidence that this factor was an independent predictor of cumulative unprotected sex frequency.

Alcohol consumption and sexual behaviour among HIV negative participants

52.5% (32/61) of study participants recorded the consumption of alcohol at least once a week during the previous month. Of the 32 participants reporting weekly alcohol consumption, 96.9% (31/32) reported drinking to intoxication every week in the last month. Comparison of model fits including weekly alcohol consumption vs. weekly intoxication indicated marginally better specification using weekly alcohol consumption.

Among participants reporting weekly consumption of alcohol in the month prior to the study, the frequency of all measures of unprotected homosexual and heterosexual sex were higher than among participants who reported less frequent or no alcohol consumption in that period (Table 44). Crude IRRs were not statistically significant, but significant associations between alcohol consumption and the frequency of uAI, uRAI and unprotected heterosexual sex were apparent after adjustment for other model variables.

The higher frequency of unprotected sex among participants reporting weekly alcohol consumption corresponded with trends toward a higher proportion of condom-unprotected sex in this group. Homosexual and heterosexual events reported by this group were more than four times as likely to be condom-unprotected as less frequent alcohol users, but this did not reach statistical significance. This association was particularly strong with the proportion of RAI events that were condom unprotected (statistically significant after confounder adjustment), but not for IAI events.

Interestingly, in the context of some evidence of association between higher rates and event-probabilities of unprotected sex with alcohol use, there was no convincing evidence that behavioural incidence was related to alcohol consumption (with the possible exception of rates of heterosexual sex). This counters one plausible explanation that alcohol consumption might simply be a proxy for participant attendance at alcohol-serving venues for MSM partnering opportunity. Indeed, frequency of RAI among weekly alcohol users was significantly lower (after adjustment) than among less frequent users.

Table 44: Alcohol use and prospective HIV negative participant behaviour

i. Response measure: Unprotected sex frequency

			Alcohol consumption Weekly	Alcohol consumption Less often	IRR[b] (95% CI) *p* value	aIRR[c] (95% CI) *p* value
Partner gender	Male	*Count*	170	108	1.41 (0.78-2.57)	**2.24 (1.24 – 4.05)**
		Rate†	3.6	2.6	0.258	**0.007**
	Female	*Count*	99	42	2.11 (0.88-5.02)	**2.42 (1.35 – 4.32)**
		Rate†	2.1	1.0	0.093	**0.003**
	p value[a]		*0.044*	*0.091*		
Homosexual AI role	uRAI	*Count*	55	22	2.21 (0.82 – 5.94)	**5.27 (1.72 – 16.1)**
		Rate†	1.2	0.5	0.116	**0.003**
	uIAI	*Count*	119	89	1.20 (0.55-2.64)	1.32 (0.54 – 3.24)
		Rate†	2.5	2.1	0.642	0.541
	p value[a]		*0.025*	*0.029*		

ii. Response measure: Sex frequency

			Alcohol consumption Weekly	Alcohol consumption Less often	IRR[b] (95% CI) *p* value	aIRR[c] (95% CI) *p* value
Partner gender	Male	*Count*	452	388	1.03 (0.95-1.10)	**1.15 (1.01 – 1.31)**
		Rate†	9.5	9.2	0.482	**0.033**
	Female	*Count*	199	110	1.52 (0.55 – 4.17)	1.51 (0.66 – 1.13)
		Rate†	4.2	2.6	0.418	0.334
	p value[a]		*0.002*	*<0.001*		
Homosexual AI role	RAI	*Count*	174	170	0.88 (0.55-1.39)	**0.64 (0.43 – 0.95)**
		Rate†	3.7	4.0	0.572	**0.027**
	IAI	*Count*	326	257	1.13 (0.82-1.55)	1.12 (0.84 – 1.50)
		Rate†	6.9	6.1	0.454	0.438
	p value[a]		*0.013*	*0.226*		

iii. Response measure: Proportion of condom-unprotected events

			Alcohol consumption Weekly	Alcohol consumption Less often	OR[d] (95% CI) *p* value	aOR[e] (95% CI) *p* value
Partner gender	Male	*n/N*	170/452	108/388	2.14 (0.49-9.27)	4.09 (0.84 – 19.90)
		%	37.6	27.8	0.309	0.082
	Female	N	99/199	42/110	2.83 (0.53-15.10)	4.34 (0.72 – 26.2)
		%	49.8	38.2	0.224	0.109
Homosexual AI role	RAI	*n/N*	55/174	22/170	3.74 (0.48-28.9)	**11.00 (1.50 – 80.92)**
		%	31.6	12.9	0.207	**0.018**
	IAI	*n/N*	119/326	89/257	1.40 (0.25-7.80)	2.88 (0.49 – 16.9)
		%	36.5	34.6	0.698	0.240

†: Events per 4 weeks [a]. Within group comparison (Wilcoxon matched-pairs signed-ranks test) [b]. crude incidence rate ratio: negative binomial regression, no adjustment c. adjusted incidence rate ratio: negative binomial regression adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality [d]. adjusted OR: random coefficient logistic regression, adjusted for repeat observations among study participant only [e]. adjusted OR: random coefficient logistic regression, adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality and repeat observations among study participants

In summary, although the measures of alcohol consumption employed neither discriminated the intensity of periodic individual alcohol use, nor the use of alcohol specific to sexual event recording, results suggested that alcohol use and intoxication were commonplace within the study population, and that alcohol use may mediate a modest effect on cumulative unprotected sex frequency predominantly via a reduced likelihood of condom use for sex events.

Drug use and sexual behaviour among HIV negative participants

36.1% (22/61) of HIV negative participants reported lifetime use of illicit drugs previously, and 8.2% (5/61) reported ever having practiced injecting drug use (IDU). The five participants who reported injecting drug use all reported lifetime heroin use, three cocaine/crack cocaine and one benzodiazepine. All participants who reported lifetime IDU also reported female partners (100% (5/5) vs. 39/56 (69.6%), p= 0.309).

There was no evidence of association between non-injecting illicit drug use and frequency of unprotected MSM or heterosexual sex, and participants who reported the use of any recreational drug during their lifetime were similarly likely to report heterosexual activity in addition to homosexual behaviour than participants who had never used recreational drugs (72.7% v 71.8%, Fisher's exact p=1.00). Specifically, lifetime injecting drug users did not differ from non-users in expressed sexual attraction (heterosexual attraction only: IDU 20% (1/5) vs. other MSM 25.0% (14/56); Fisher's exact p=0.306).

By contrast, the prospective frequencies of uAI, uRAI and uIAI were markedly lower among HIV negative participants who reported lifetime IDU. In all cases crude associations were only of borderline statistical significance, although the difference in uAI frequency was statistically significant after confounder adjustment (Table 45.i). Overall, uAI frequency among lifetime injecting drug users was a quarter that of non-users, whilst uRAI frequency was approximately $1/7^{th}$ the frequency among non-users. By contrast, participants reporting IDU behaviour had a slightly higher crude frequency of unprotected heterosexual sex than did other men, not significant after adjustment. The lower frequency of unprotected homosexual events among injecting drug users reflected both a significantly lower overall frequency of homosexual behaviour as well as a markedly higher (but not statistically significant) proportion of homosexual events that were condom-protected.

Table 45: Lifetime injecting drug use and prospective HIV negative participant behaviour

i. Response measure: Unprotected sex frequency

			Lifetime IDU behaviour		IRR[b]	aIRR[c]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Partner gender	Male	*Count* Rate†	6 0.8	272 3.3	0.25 (0.05-1.24) 0.090	**0.21 (0.08 - 0.57) 0.002**
	Female	*Count* Rate†	25 3.3	116 1.4	2.38 (0.45-12.5) 0.305	1.60 (0.54 – 4.76) 0.396
	p value[a]		*0.681*	*0.005*		
Homosexual AI role	uRAI	*Count* Rate†	1 0.1	7 0.9	0.15 (0.02-1.39) 0.094	0.19 (0.01 – 3.29) 0.256
	uIAI	*Count* Rate†	5 0.7	203 2.5	0.27 (0.06-1.23) 0.092	0.33 (0.10 – 1.05) 0.061
	p value[a]		*0.088*	*0.005*		

ii. Response measure: Sex frequency

			Lifetime IDU behaviour		IRR[b]	aIRR [c]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Partner gender	Male	*Count* Rate†	54 7.2	786 9.6	0.75 (0.45-1.24) 0.260	**0.69 (0.54 – 0.89) 0.005**
	Female	*Count* Rate†	46 6.1	263 3.2	1.88 (0.86-4.08) 0.113	2.05 (0.62 – 6.77) 0.238
	p value[a]		*0.685*	*<0.001*		
Homosexual AI role	RAI	*Count* Rate†	22 2.9	322 3.9	0.74 (0.14-3.87) 0.722	0.57 (0.10 – 3.30) 0.531
	IAI	*Count* Rate†	41 5.5	542 6.6	0.83 (0.46-1.46) 0.515	0.85 (0.49 – 1.48) 0.572
	p value[a]		*0.500*	*0.015*		

iii. Response measure: Proportion of condom-unprotected events

			Lifetime IDU behaviour		aOR[d]	aOR[e]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Partner gender	Male	*n/N* %	6/54 11.1	272/786 34.6	0.26 (0.02-4.06) 0.336	0.15 (0.01-2.34) 0.118
	Female	*N* %	27/113 23.9	114/196 58.2	0.27 (0.02-3.77) 0.332	0.23 (0.04-2.35) 0.112
Homosexual AI role	RAI	*n/N* %	1/22 4.6	76/322 23.6	0.21 (0.01-17.7) 0.492	0.22 (0.01 – 37.6) 0.560
	IAI	*n/N* %	5/41 12.2	203/542 37.5	0.55 (0.02-12.4) 0.709	0.21 (0.01-27.2) 0.318

†: Events per 4 weeks [a]. Within group comparison (Wilcoxon matched-pairs signed-ranks test) [b]. crude incidence rate ratio: negative binomial regression, no adjustment c. adjusted incidence rate ratio: negative binomial regression adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality [d]. adjusted OR: random coefficient logistic regression, adjusted for repeat observations among study participant only [e]. adjusted OR: random coefficient logistic regression, adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality and repeat observations among study participants

In summary, the rarity of injecting drug use behaviours among members of this population precluded robust inference on any interaction between drug use and behaviours. That said, these data offer no support to prevailing local perceptions that MSM behaviours, and in particular male sex work, are largely motivated to generate income to purchase illicit drugs. Further, although lifetime measures of injecting drug may not relate to contemporary use, there was no evidence of behavioural dis-inhibition among participants reporting drug use generally, or injecting drug use specifically.

Travel and sexual behaviour among HIV negative participants

Approximately half of HIV negative study participants (49.2%, 30/61) reported events that took place outside the immediate study area during the diary study. Such events represented 10.0% (176/1751) of all sexual events recorded, and in 80.1% (141/176) the study participant was paid for the event. In Chapter 6, there was evidence that event dyads occurring outside the study area were less likely to be condom-unprotected than event dyads occurring in the study area (Table 32, page 165).

Consequently, it was notable that study participants who reported any sexual events during travel outside the study area recorded, overall, a higher frequency of unprotected sex with male partners (in any location) during follow up, although this was of borderline statistical significance and was further weakened after adjustment for other covariates (Table 45.i.). Exploration of the contributory influence of both individual behaviour frequency and event-probability of condom use suggested that MSM who had sex during travel outside the study area reported significantly higher frequencies of RAI (Table 45.ii.) but a markedly lower event-probability of unprotected sex for RAI events (Table 45.iii.).

Since most sexual encounters outside the study area were transactional, and formative focus group discussions anecdotally referred to travel to Nairobi and Malindi organised for the purpose of transactional sex, this pattern may point to a sub-group of 'higher class' or professional MSM sex workers who experience higher demand for RAI frequency but who also have higher awareness of /self-efficacy in condom use or condom negotiation for RAI. However, there was no objective difference in socioeconomic measures between MSM reporting sex outside the study area and those reporting activity only within the study area. Alternatively, this observation might imply regional differences in community or sex-trade norms for condom use.

Table 46: Sex during travel and prospective HIV negative participant behaviour

i. Response measure: Unprotected sex frequency

			Sex outside Mombasa		IRR[b]	aIRR[c]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Partner gender	Male	*Count* Rate†	170 3.8	108 2.4	1.62 (0.98-2.68) 0.061	1.19 (0.58 – 2.42) 0.633
	Female	*Count* Rate†	72 1.6	69 1.5	1.07 (0.67 – 1.71) 0.772	1.16 (0.81 – 1.66) 0.417
	p value[a]		0.051	0.066		
Homosexual AI role	uRAI	*Count* Rate†	45 1.0	32 0.7	1.46 (0.50-4.26) 0.487	0.69 (0.19 – 2.44) 0.564
	uIAI	*Count* Rate†	126 2.8	82 1.8	1.58 (0.72-3.45) 0.254	1.32 (0.54 – 3.24) 0.857
	p value[a]		0.038	0.026		

ii. Response measure: Sex frequency

			Sex outside Mombasa		IRR[b]	aIRR[c]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Partner gender	Male	*Count* Rate†	501 11.3	339 7.5	**1.50 (1.30-1.73) <0.001**	**1.36 (1.20 – 1.53) <0.001**
	Female	*Count* Rate†	159 3.6	150 3.3	1.13 (0.53-2.41) 0.745	1.19 (0.59 – 2.39) 0.636
	p value[a]		<0.001	<0.001		
Homosexual AI role	RAI	*Count* Rate†	220 4.9	124 2.8	**1.86(1.13-30.4) 0.014**	**1.83 (1.42 – 2.36) <0.001**
	IAI	*Count* Rate†	335 7.5	248 5.5	1.36 (0.93-1.99) 0.111	1.12 (0.88 – 1.43) 0.366
	p value[a]		0.159	0.027		

iii. Response measure: Proportion of condom-unprotected events

			Sex outside Mombasa		OR[d]	aOR[e]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Partner gender	Male	*n/N* %	170/501 33.9	108/339 31.9	0.62 (0.14-2.71) 0.522	0.43 (0.09 – 2.04) 0.289
	Female	*N* %	72/159 45.3	69/150 46.0	0.95 (0.19-4.81) 0.954	0.98 (0.17 – 5.73) 0.986
Homosexual AI role	RAI	*n/N* %	45/200 20.5	32/124 25.8	0.20 (0.03-1.52) 0.120	**0.15 (0.03 – 0.87) 0.034**
	IAI	*n/N* %	126/335 37.6	82/248 33.1	1.07 (0.20-5.90) 0.935	0.49 (0.08 – 2.83) 0.425

†: Events per 4 weeks [a]. Within group comparison (Wilcoxon matched-pairs signed-ranks test) [b]. crude incidence rate ratio: negative binomial regression, no adjustment c. adjusted incidence rate ratio: negative binomial regression adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality [d]. adjusted OR: random coefficient logistic regression, adjusted for repeat observations among study participant only [e]. adjusted OR: random coefficient logistic regression, adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area and prospective sexuality and repeat observations among study participants

Sexuality and sexual behaviour among HIV negative participants

Measurement of sexual gender preference

In response to the question 'when you have sex for pleasure, do you prefer sex with men or women?', 45.9% of HIV negative participants reported a preference for sex with men (28/61), 24.6% (15/61) stated a preference for sex with women, and 18 (29.5%) stated liking both. No participants reported a dislike for sex with both men and women.

Current gender preference was correlated with reported lifetime behaviours. Expressed sexual preference was largely consistent with recalled lifetime sexual behaviour for men expressing a preference for sex with men: 85.7% (24/28) reported having had more male partners during their lifetime. Expressed preference and reported behaviour were slightly less congruent for men reporting a preference for sex with women: 66.7% (10/15) reported mostly female lifetime partners, whilst 20.0% (3/15) reported mostly male partners.

Measures of behavioural sexuality

A minority of HIV negative participants reported only lifetime male sexual partners (9.8%, 6/61) compared to 27.9% (17/61) who reported only male sexual partners during diary follow up. The majority of participants (55/61, 90.2%) reported at least one female sexual partner in the past and 26.2% (16/61) reported mostly female partners. Only MSM under the age of 25 reported only ever having had male partners, whereas older participants were significantly more likely to report a majority of lifetime female partners than younger participants (35 years +: 45.5% (5/11) vs. <35 years: 22.0% (11/50) Fisher's exact p=0.113).

Prospective behavioural bisexuality was correlated with both lifetime behavioural sexuality and expressed sexual preference. 72.1% of HIV negative participants reported one or more female partner during follow up, compared to 70.5% during the month prior to the study (Kappa 0.64 p<0.001) and 90.2% over a lifetime (Kappa 0.34 p<0.001, Table 47). 78.2% (43/55) of participants who reported any lifetime sex with women also reported female partners prospectively (Table 47). 23 participants reported prior or current marriage to a female spouse, of whom 5 (21.7%) currently shared a dwelling with that person.

Table 47: Agreement between individual measures of sexuality among HIV negative participants

		Prospective heterosexual behaviour						
		Yes		**No**		Agreement	Kappa	*p*
		n	% (cell)	n	% (cell)			
Lifetime heterosexual behaviour	Yes	43	70.5	12	19.7	78.7%	0.34	<0.001
	No	1	1.6	5	8.2			
Current sexual preference	Heterosexual/Bisexual	31	50.8	2	3.3	75.4%	0.49	<0.001
	Homosexual	13	21.3	15	24.6			
Currently married	Yes	6	9.8	1	1.6	49.4%	0.05	0.197
	No	38	62.3	16	26.2			
Lifetime married	Yes	19	26.2	4	4.9	56.6%	0.13	0.079
	No	28	45.9	14	23.0			

As shown in Table 47, lifetime measures (behavioural and marital history) and contemporary preference measures (sexual attraction and current marital status) were generally in agreement with prospective measures of heterosexual behaviour during the diary study. Agreement between prospective heterosexual behaviour and marital status measures was relatively weak, compared to lifetime measures of behaviour and current sexual preference.

Behavioural sexuality: frequency of unprotected sex with men

Table 48 and Table 49 summarise the prospective same sex sexual risk behaviour of HIV negative study participants by prospective (Table 48) and lifetime (Table 49) reports of heterosexual activity. Overall, behaviourally bisexual men tended to report lower rates of unprotected AI with men than behaviourally homosexual men: participants who had sex with women during the study reported approximately half the rate of AI than participants who only had sex with men (Table 48.i.), whilst participants who reported lifetime sex with women reported one third the prospective rate of AI than men who had never had sex with women (Table 49.i.).

Table 48: Prospective heterosexual contact and prospective HIV negative participant behaviour

i. Response measure: Unprotected sex frequency

			Any female partner (prospective)		IRR[b]	aIRR[c]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Homosexual AI	uAI	*Count* Rate†	162 2.5	116 4.6	0.54 (0.29 – 1.01) 0.055	0.47 (0.19 – 1.15) 0.097
Homosexual AI role	uRAI	*Count* Rate†	21 0.3	56 2.2	**0.15 (0.07 – 0.34) <0.001**	**0.10 (0.03 – 0.32) <0.001**
	uIAI	*Count* Rate†	145 2.3	63 2.5	0.89 (0.29 – 2.71) 0.839	1.18 (0.48 – 2.95) 0.715
	p value[a]		*<0.001*	*0.905*		

ii. Response measure: Sex frequency

			Any female partner (prospective)		IRR[b]	aIRR [c]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Homosexual AI	AI	*Count* Rate†	537 8.4	303 12.0	0.71 (0.48 – 1.05) 0.083	0.72 (0.51 – 1.02) 0.065
Homosexual AI role	RAI	*Count* Rate†	147 2.3	197 7.8	**0.31 (0.16 – 0.58) <0.001**	**0.38 (0.24 – 0.61) <0.001**
	IAI	*Count* Rate†	452 7.0	131 5.2	1.37 (0.97 – 1.93) 0.078	**1.33 (1.11 – 1.60) 0.002**
	p value[a]		*<0.001*	*0.463*		

iii. Response measure: Proportion of condom-unprotected events

			Any female partner (prospective)		OR[d]	aOR[e]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Homosexual AI	AI	*n/N* %	162/537 30.2	116/303 38.3	0.46 (0.09 – 2.25) 0.336	0.50 (0.09 – 2.73) 0.420
Homosexual AI role	RAI	*n/N* %	21/147 14.3	56/197 28.4	0.41 (0.05 – 3.33) 0.405	0.49 (0.06 – 3.77) 0.490
	IAI	*n/N* %	145/452 32.1	63/131 48.1	0.28 (0.04 – 1.97) 0.203	0.43 (0.06 – 3.05) 0.396

†: Events per 4 weeks [a]. Within group comparison (Wilcoxon matched-pairs signed-ranks test) [b]. crude incidence rate ratio: negative binomial regression, no adjustment c. adjusted incidence rate ratio: negative binomial regression adjusted for age, earnings, religion, alcohol consumption, injecting drug use and sex outside study area [d]. adjusted OR: random coefficient logistic regression, adjusted for repeat observations among study participant only [e]. adjusted OR: random coefficient logistic regression, adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area sexuality and repeat observations among study participants

Table 49: Lifetime heterosexual contact and prospective HIV negative participant behaviour

i. Response measure: Unprotected sex frequency

			Any female partner (lifetime)		IRR[b]	aIRR[c]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Homosexual AI	uAI	*Count* Rate†	208 2.6	70 7.8	**0.33 (0.31 – 0.34) <0.001**	**0.25 (0.08 – 0.72) 0.010**
Homosexual AI role	uRAI	*Count* Rate†	27 0.3	50 5.6	**0.06 (0.02 – 0.16) <0.001**	**0.04 (0.01 – 0.30) 0.002**
	uIAI	*Count* Rate†	188 2.3	20 2.2	1.03 (0.39 – 2.69) 0.952	1.14 (0.15 – 8.88) 0.904
	p value[a]		*<0.001*	*0.249*		

ii. Response measure: Sex frequency

			Any female partner (lifetime)		IRR[b]	aIRR[c]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Homosexual AI	AI	*Count* Rate†	696 8.6	144 16.0	**0.54 (0.36 – 0.82) 0.004**	0.80 (0.47 – 1.35) 0.401
Homosexual AI role	RAI	*Count* Rate†	229 2.8	115 12.8	**0.23 (0.12 – 0.41) <0.001**	**0.39 (0.20 – 0.75) 0.005**
	IAI	*Count* Rate†	551 6.8	32 3.6	1.92 (0.71 – 5.20) 0.196	**3.18 (1.28 – 7.92) 0.013**
	p value[a]		*0.001*	*0.173*		

iii. Response measure: Proportion of condom-unprotected events

			Any female partner (lifetime)		OR[d]	aOR[e]
			Yes	No	(95% CI) *p* value	(95% CI) *p* value
Homosexual AI	uAI	*n/N* %	208/696 29.9	70/144 48.6	0.18 (0.02 – 1.65) 0.130	0.18 (0.01 – 2.79) 0.220
Homosexual AI role	uRAI	*n/N* %	27/229 11.8	50/115 43.5	**0.11 (0.01 – 0.98) 0.047**	**0.06 (0.01 – 0.47) 0.007**
	uIAI	*n/N* %	188/551 34.1	20/32 62.5	0.06 (0.03 – 1.41) 0.081	0.19 (0.01 – 5.76) 0.343

†: Events per 4 weeks [a]. Within group comparison (Wilcoxon matched-pairs signed-ranks test) [b]. crude incidence rate ratio: negative binomial regression, no adjustment c. adjusted incidence rate ratio: negative binomial regression adjusted for age, earnings, religion, alcohol consumption, injecting drug use and sex outside study area [d]. adjusted OR: random coefficient logistic regression, adjusted for repeat observations among study participant only [e]. adjusted OR: random coefficient logistic regression, adjusted for age, earnings, religion, alcohol consumption, injecting drug use, sex outside study area sexuality and repeat observations among study participants

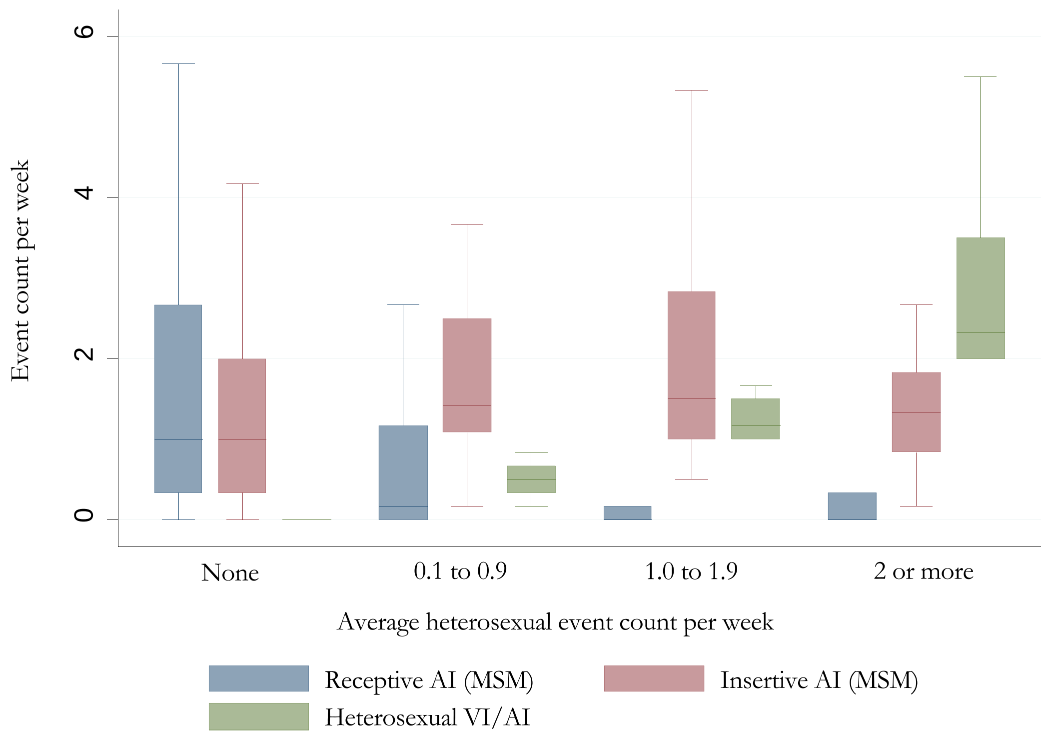
Overall associations between behavioural bisexual activity and uAI with men obscured the marked differences in AI role. Participants who were heterosexually active during follow up reported a markedly lower rate of uRAI (aIRR 0.10 (0.03 – 0.32) $p<0.001$) but very similar uIAI rate compared to participants who were only sexually active with other men. Consistent but even stronger patterns were observed comparing participants who reported lifetime heterosexual activity with participants who had only ever had male sexual partners (Table 49.i.). As previously noted, HIV negative participants who reported lifetime male partners only were all under the age of 25 years.

Behavioural sexuality: MSM behaviour frequency and condom use

The observed lower frequency of uAI and uRAI among both prospective bisexual and lifetime bisexual participants had origins in the heterogeneity in both total frequency of behaviours by behaviour sexuality, and in the probability of condom use for same sex behaviours by behavioural sexuality. Prospectively bisexual participants reported a significantly lower frequency of RAI than did MSM exclusive participants (Table 48.ii.), yet the rate ratio of RAI frequency was more modest than the rate ratio of uRAI by sexuality. The optimal fit of the relationship between prospective bisexual behaviour and RAI was achieved through specifying a zero-inflated negative binomial regression model with prospective bisexual behaviour as the inflation term. The zero-inflated negative binomial regression model estimated that prospective bisexual behaviour was significantly associated *both* with zero RAI frequency (aOR 3.74 (1.15-12.17) $p=0.028$)) *and* reduced frequency of RAI where any such events occurred (aIRR 0.68 (0.50-0.91) $p<0.001$). Changes in AI, RAI and IAI frequency by increments of heterosexual sex frequency in HIV negative MSM are shown in Figure 53, and were consistent with those described for the entire population (Figure 45).

These observations were consistent when comparing participants reporting lifetime bisexual with other participants (Table 49.ii). Whereas no association was apparent between behavioural sexuality and uIAI, both prospective and lifetime behaviourally bisexual participants reported significantly higher frequencies of IAI (after confounder adjustment: Table 48.ii & Table 49.ii). In addition, there was evidence of a fairly consistent reduction in the probability that homosexual events were condom-unprotected among participants reporting prospective heterosexual activity (Table 48.iii). Prospectively bisexual participants were more than twice as likely to report condom use for anal sex with men as homosexually exclusive participants, although this result was not statistical significant result. Comparing participants with lifetime bisexual behaviour to those reporting only male partners, these differences in condom use were consistent but more pronounced - RAI episodes were significantly more likely to have been condom-protected among lifetime bisexual participants (aIRR 0.06 (0.01 – 0.47) *p*= 0.007, Table 49.iii).

Figure 53: Box plot of IAI, RAI and heterosexual sex frequency among HIV negative MSM, sorted by increasing frequency of heterosexual sex



†: Bars represent median, boxes represent 25th & 75th centiles; Whiskers represent next adjacent value

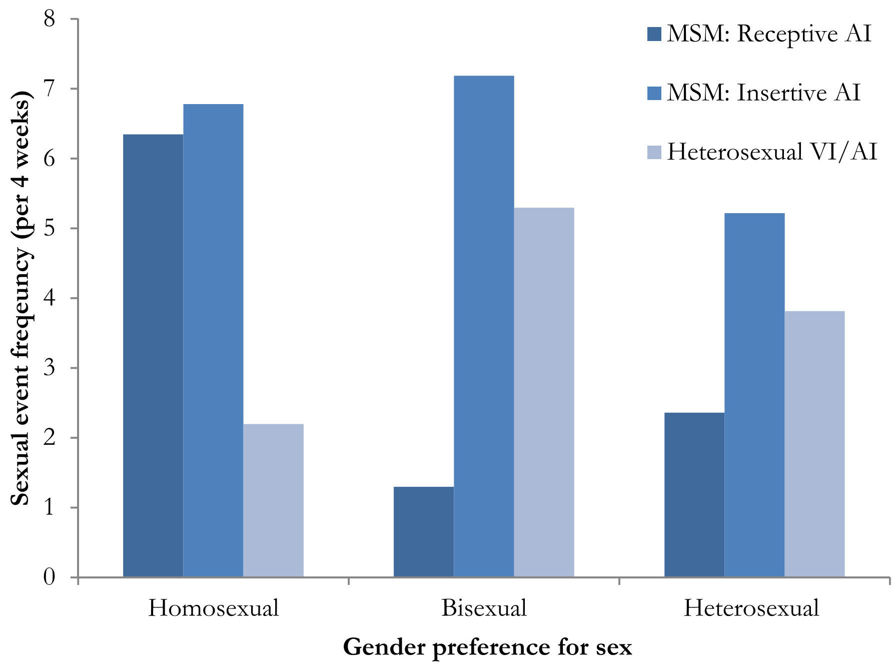
Expressed sexuality

Self-identified sexuality, as assessed by expressed gender preference for sex, yielded more nuanced insights than objective measures of actual sexual behaviour alone. 45.9% (28/61) of participants described being primarily sexually attracted to other men (homosexual attraction), 24.6% (15/61) primarily to women (heterosexual attraction) and 29.5% (18/61) equally to both men and women (bisexual attraction). Both heterosexually and bisexually attracted MSM reported lower total frequencies of homosexual AI compared to homosexually attracted MSM (heterosexual: IRR 0.59 (0.41-0.84) *p*=0.004; bisexual: IRR 0.63 (0.45-0.88) *p*=0.007 vs. homosexual attraction). Bisexually attracted MSM reported higher frequencies of IAI with men (7.2 per 4 weeks) than either homosexually or heterosexually attracted men (6.8 and 5.1 per 4 weeks respectively, not statistically significant, Figure 54), and higher frequencies of heterosexual sex than heterosexually attracted MSM (5.3 vs. 3.8 per week, IRR 1.39 (0.5-3.9) p=0.527). Yet bisexually attracted men reported by far the lowest frequencies of RAI or uRAI with men. Compared to homosexually attracted MSM, bisexually attracted MSM reported significantly lower frequencies of RAI (1.3 vs. 6.3 per 4 weeks, IRR 0.20 (0.13-0.33) p<0.001) and uRAI (0.1 vs. 1.5 per 4 weeks, IRR 0.08 (0.02-0.37) p=0.001). Similarly, compared to heterosexually attracted MSM, bisexually attracted MSM reported lower frequencies of RAI (1.3 vs. 2.4 per 4 weeks, IRR 0.55 (0.38-0.79) p=0.001) and lower frequencies of uRAI (0.1 vs. 0.7 per 4 weeks, IRR 0.17 (0.01-1.95) p=0.154).

In summary, behavioural and expressed sexuality had pronounced associations with MSM risk behaviour frequency and condom tendency among HIV negative participants, as with the MSM sample as a whole. Heterosexually active and bisexually attracted participants reported markedly lower frequencies behaviours with high HIV acquisition risks, but higher frequencies of lower risk MSM behaviours. Prospectively heterosexually active participants reported lower homosexual AI frequencies overall, constituting markedly lower frequencies of RAI and uRAI, and a non-significant reduction in the proportion of RAI that was condom unprotected. Heterosexually active participants reported higher frequencies of IAI, however uIAI frequencies were similar to homosexually exclusive men due seemingly to a markedly lower (but not statistically significant) probability that IAI events were unprotected.

These observations were apparent for both lifetime measures of behavioural sexuality, and for bisexually/heterosexually attracted MSM, however within the latter group there was some evidence for higher frequencies of RAI among heterosexually attracted men perhaps suggesting a predominant economic rather than emotional or erotic motivation for homosexual behaviours. The consistency of these behavioural trends across lifetime and contemporary measures, the high levels of condom unprotected heterosexual sex, and close consistency with participants age imply behavioural origins other than reactivity to recent research engagement.

Figure 54: Homosexual and heterosexual behaviour frequencies by expressed sexual attraction of HIV negative study participants



Sexual behaviours of sex clients

This chapter to this point has reported detailed behavioural data on participants in the prospective diary study. As discussed in Chapter 5, the study design aimed to recruit partners of diary study participants for self-reported sociodemographic, behavioural and HIV risk assessment, in addition to the subjective profile of partners described by diary keepers themselves. In practice, a very small proportion of clients given a Hotline card by study participants (34 men and 3 women) did contact the Mtwapa telephone hotline (37) and only 4 subsequently completed the CAPI survey.

The profile of male telephone respondents is shown in Table 50. Compared to the 82 diary study participants who reported selling sex, clients calling the Hotline had a significantly higher level of education, were more likely to be in formal employment and more likely to be married despite being of similar age.

Behaviourally, there were stark differences with study participants. With respect to homosexual sex, slightly fewer clients reported RAI (53% vs. 66% of study participants), but of those who did 66.7% reported the last episode having been unprotected. Condom use for last IAI was similarly low, and notably 50% of clients claimed to be unaware of potential HIV transmission risks from anal sex. Finally, in this small client sample, male client were more likely to self-report being currently married to a female spouse, to report heterosexual behaviours than participants selling sex, and to report significantly lower condom use at last vaginal or anal sex with female partners.

In summary, whilst this small fraction of the total client population cannot be considered an unbiased sample of the wider MSM client population, and the telephone survey was not designed to elicit detailed behavioural measures, these findings, if representative, indicate significant risk taking among clients, suggest significant overlaps with heterosexual networks and indicate prevalent misconceptions about the safety of anal sex. Further, the small fraction of men who acted upon the offer of counselling and research participation on a personal recommendation from a sexual partner indicates the potential difficulty in further studying or intervening with this group.

Table 50: Self-reported characteristics of male Hotline callers

		Prospective (card issuers)		Telephone (card responders)		Fisher's exact *p* value
	Total	82		37		
		N	%	N	%	
Sociodemographic						
Age	18-29	60	73.2	30	82.4	0.580
	30-39	18	22.9	5	14.7	
	40+	4	4.9	1	2.9	
Employment	Full time	11	13.4	10	29.4	0.082
	Casual / self	33	40.2	14	40.2	
	Unemployed	38	46.4	10	29.4	
Education	Primary	44	53.7	12	35.3	0.043
	Secondary	30	36.6	21	61.8	
	Higher	8	9.8	1	2.9	
Marital status	Married	8	9.8	8	23.5	0.048
	Not married	74	90.2	26	76.5	
Ethnicity	Black African	80	97.6	32	94.1	0.587
	Arabic	2	2.4	2	5.9	
	Other	0		0		
Sex with male partners						
Behavioural sexuality	Men only	29	34.9	6	17.7	0.077
	Both	54	65.1	28	82.4	
Anal sex role with men	RAI only	5	6.1	7	20.6	0.008
	IAI only	28	34.2	16	47.1	
	Versatile	49	59.8	11	32.4	
Last RAI	Condom used	43	79.6	6	33.3	<0.001
	Condom not used	11	20.4	12	66.7	
Last IAI	Condom used	59	76.6	12	44.4	0.004
	Condom not used	18	23.4	15	55.6	
Sex with female partners						
Anal sex with women	Yes	38	79.2	10	35.7	<0.001
	No	10	20.8	18	64.3	
Last vaginal sex	Condom used	31	66.0	10	35.7	0.016
	Condom not used	16	34.0	18	64.3	
Last anal sex	Condom used	24	63.2	0	0	<0.001
	Condom not used	14	36.8	10	100	
Disclosure of MSM behaviour						
Female spouse (if married)	Disclosed	1	12.5	1	12.5	1.00
	Not disclosed	7	87.5	7	87.5	
Family members	Disclosed	17	20.7	3	8.8	0.177
	Not disclosed	65	79.3	31	91.2	
HIV knowledge						
HIV risk from AI	Yes	79	96.3	17	50.0	<0.001
	No	3	3.7	17	50.0	

Chapter 8

DISCUSSION

This thesis has presented three linked projects representing data collection that occurred between 2005-2010 profiling MSM populations and their HIV risks in African HIV epidemics, and specifically within the Kenyan HIV epidemic. As apparent from the breadth of subsequent literature reported in Chapter 4, initial studies in Kenya (Chapter 3) were at the forefront of a new and sustained research focus on MSM populations in African settings, and which helped prompt a new and sustained international and national policy focus. Consequently, this period of work also bridges a time of considerable change in both general awareness of MSM populations in Africa and specifically within the HIV/AIDS response community. It is humbling now to reflect that, had my first encounter with MSM in Mtwapa been reported today, it should no longer have been with professional surprise. Yet recognition of the problem is but the first step on the path to effective delivery of equitable and accessible HIV/AIDS prevention, treatment and care for MSM.

This final chapter draws together the findings from these three research projects with reference to international comparators, offers concluding insights about HIV risk among MSM, and the significance of MSM within the wider epidemics in Kenya. In doing so, the chapter also reflects upon the methodological strengths and limitations of the research and lessons learned through this research training. Finally, the chapter considers the options for the future.

The burden of HIV among African MSM

As shown in Chapters 3-4, HIV burden among MSM research populations was considerably higher than that among other adult men in virtually all sub-Saharan contexts, including Kenya. Only in the hyper-endemic HIV epidemic contexts of Southern Africa was HIV prevalence similar between heterosexual and homosexual men, whilst at the lower end of the generalised epidemic spectrum, MSM often had over twenty-times the odds of HIV infection compared to their heterosexual country-men. Overall, there was no evidence for any dependence of MSM HIV prevalence upon the severity of the concurrent heterosexual epidemic, despite a few studies indicating comparable HIV subtype distributions circulating among MSM and heterosexual populations[220 221].

On the basis of UNGASS reports to 2008 (Chapter 1), this burden was seemingly unknown to National AIDS Control Programmes in most African states. Since then, of the 23 sub-Saharan African countries submitting UNGASS reports in 2008 and 2010 (indicators 14 and 19, see Figure 2), nine (39%) improved their reporting on MSM indicators [222], and over the course of these studies, research-based estimates of HIV prevalence among MSM increased from just two countries in 2007 to 17 today[223].

Strengths and weaknesses of behaviour measurement methods

This research employed a range of approaches to assess sexual risk of HIV, including direct assessment of risk of HIV prevalence (Chapter 3) and risk of sexual behavioural determinants of HIV transmission (Chapters 6-7). Prospective daily diaries are widely suggested as the best alternative for gathering highly reliable data on sexual activities[178 213 224], most frequently encountered as the reference measure in the evaluation of other behavioural measurement methods[113 225-231] and increasingly in the evaluation of HIV interventions[201]. This work adds to a more limited literature employing event-based diaries to describe sexual behaviours, and explore determinants of sexual behavioural risk[7 232 233].

The novel approach developed to measure prospective sexual behaviour and do so safely, accurately and with minimal literacy requirements, suitable for use in a highly marginalised population (described in Chapter 5), has since attracted attention from methodologists [188]. Personal experience of the considerable speed and ease with which members of the study population gained competence in self-recording during training were backed up with promising preliminary evidence of user acceptability, convergence with other measures, and improved prediction of longer-term HIV incidence (Chapter 5). These attributes have led to a local initiative to convert the tool as an aide to risk counselling. Further, the method adds to the small literature demonstrating that such research methods are possible in African sexual behaviour research (e.g. Figure 55)[234-236]

Figure 55: Pictographic coital diary from Tanzania

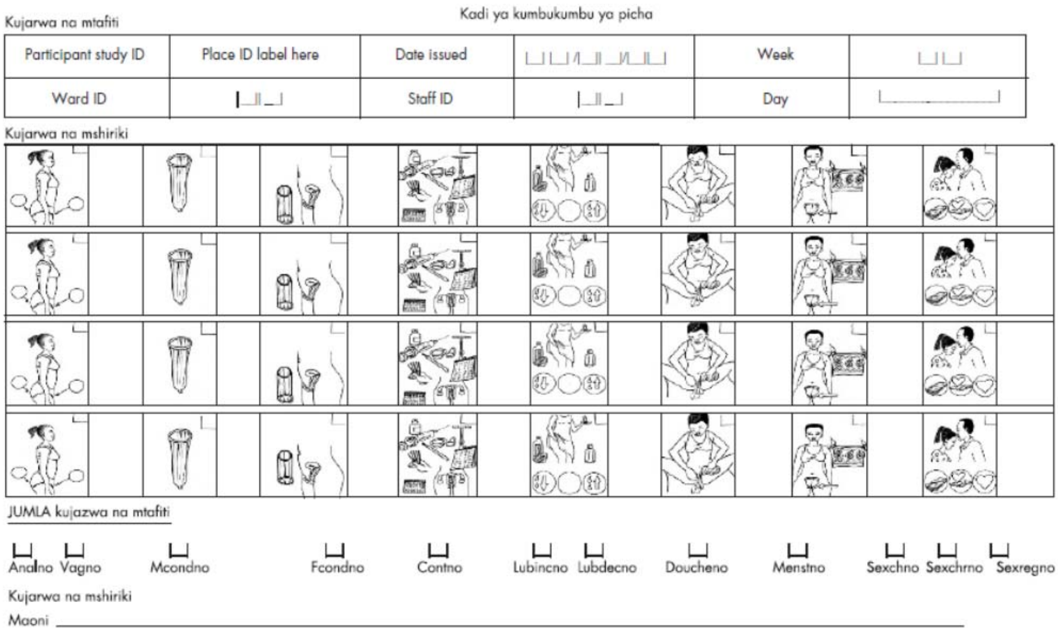


Figure 1 Coital diary collection entry page. Notes: Pictures show, from left to right: 1. Sex act (anal, vaginal). 2. Male condom. 3. Female condom. 4. Contraception. 5. Decrease and increase in lubrication. 6. Vaginal cleaning. 7. Menstruation. 8. Sex partner type (sex for money or gifts, irregular, regular).

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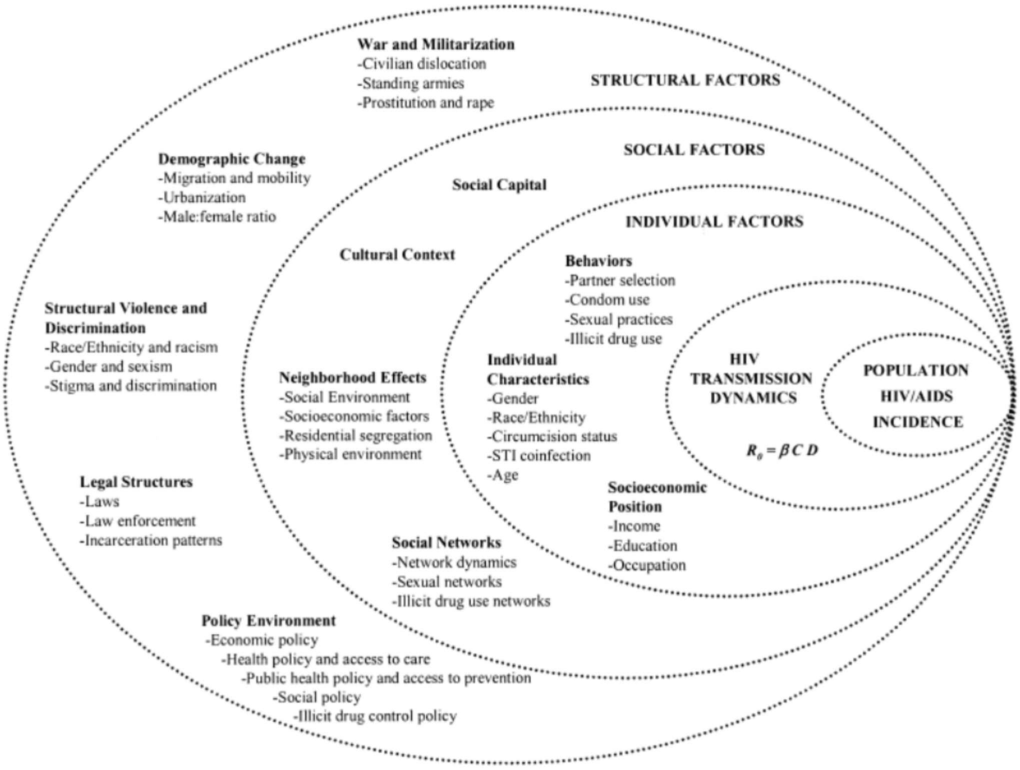
Aside the known methodological advantages of self-completed event measurement in minimising cognitive demand[229 237 238] and social desirability bias (both highly pertinent to highly sexually active groups[235 238 239] and groups reporting stigmatised or illegal behaviours [177 178 240-242]), the distinct advantage of event-based measures arose from the resolution, and range of behaviour measures that the method elicited. In the absence of behavioural biomarkers for MSM intercourse [243-245], self-reported frequencies of unprotected sexual behaviours for individual participants represent the best achievable behavioural measures of personal HIV acquisition risk [211-213 230]. Event-based measurement also permitted measurement of the components of behaviour that constitute this risk – individual behaviour frequency and individual tendency to use condoms for these behaviours, and assessment of potential determinants at the individual (study participant), the dyad (partnerships between participants and their partners), and the event level directly.

The choice of methods did come with limitations. The resolution of sexual behaviour measures could not reasonably be replicated in profiling potential determinants of sexual behaviour. Alcohol use[246 247], illicit drug use[247 248], beliefs about personal responsibility[233], depression[249] and sensation seeking [248] are but some factors found to exhibit differing effects upon sexual behaviour *between* and *within* individuals. All these factors and indeed others suggested by local anecdote (e.g. interpersonal violence or intimidation, size of cash transaction, internalised stigma) may feature in determining sexual risk for Coastal Kenyan MSM, however these could not be addressed in a diary study intended to be simple and safe to complete. Further, individual risks have been contextualised within social and structural models of HIV risk[250], many aspects of which have particular resonance to the population under study (e.g. (referring to Figure 56) structural violence and discrimination, punitive legal structures, lack of targeted health policy or access to prevention/care), but which lack the variability to explore in a localised population. Elements of the structured questionnaire could have been used to greater effect to derive more robust individual measures of alcohol or substance use/dependency[175], general wellbeing (e.g. SF36[251 252]) mental health (e.g. GHQ28[253]) or stigma[254], had the practical constraints of intensive supervision not been so prominent. Finally, although in practice enrolment to the diary study was limited by other factors, the intensive nature of paper-based diary supervision and monitoring was considerably more time and resource intensive than conventional approaches to behaviour measurement, making large scale diary studies relatively difficult to justify for routine use.

Efforts to gather self-reported measures from MSM outside the engaged research population were less successful, and limited potential insights into the wider MSM network and other information of relevance to dyadic behaviour. With this hindsight, the partnership questionnaire was underutilised to elicit more detail about sex partners from participants (e.g. HIV status / status disclosure, community engagement, awareness of HIV risk etc.).

Figure 56: Heuristic framework for the social epidemiology of HIV/AIDS



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The richness and resolution of data generated by these study methods presented analytic challenges due to the small population size, over-dispersed behavioural frequency distributions and the need to accommodate for non-independence between the large number of event-level observations reported by relatively few individuals. Whilst there is a clear consensus among researchers of the need to select methods to account for these challenges, the optimal strategy is not yet apparent from the numerous available methodological approaches [201]. Conservatively specified negative/zero-inflated regression and multilevel random effects logistic regression modelling were selected as reasonable methods accommodating both hierarchical and distributional realities in deriving accurate inference based on example[233] and advice (personal communication: Dr Fiona Steele). Naturally, such adjustment tended to be at the expense of the *apparent* precision of simpler approaches. In practice, data were fully modelled with other methods (logistic regression, generalised estimating equations) and model optimisation strategies which yielded very similar results. However, compared to other analyses, the power of methods to explore associations between individual characteristics and the proportion of individual condom-unprotected events was implicitly limited, as apparent from low precision of effect estimates and a tendency for covariate sets derived from frequency models to over-specify models estimating the level-1 coefficient intercept.

HIV acquisition risk among MSM

Biological sexual risks for HIV acquisition to individual MSM have been well documented, and centre upon the high transmission efficiency of HIV through unprotected anal sex, particularly from insertive to receptive partner. A recent meta-analysis of HIV transmission probabilities in anal sex reported a 1.4% (0.2-2.5) per-act probability for uRAI and a 0.06% (0.02-0.19) per-act probability for uIAI[108], the former being approximately 18-times greater than estimates for vaginal intercourse 0.08% (0.06-0.11)[191]. This same review estimated per-uRAI *partner* probability of HIV acquisition at 40.4% (6.0-74.9) compared to 21.7% (0.2-43.4) per-uIAI *partner*[108]. Aside the host, viral and other biological factors implicated in the probability of HIV transmission during a sex act, the cumulative sexual HIV acquisition risk to an individual is thus predominantly governed by the frequency of uRAI with partners of unknown HIV status.

HIV negative study participants in this study reported higher frequencies of uIAI than uRAI (2.3 vs. 0.9 per 4 weeks), higher frequencies of IAI than RAI (6.5 vs. 3.8 per 4 weeks) and RAI episodes were somewhat more likely to be condom protected than IAI episodes (77.6% vs. 64.3%, Chapter 7 & Table 39). Prospective measures of uRAI frequency corresponded with HIV incidence measures over the following 12 months, whilst uIAI frequency did not (Chapter 5 & Table 22). Among men at risk of HIV acquisition, the crude frequency of uRAI was significantly higher among younger MSM and among MSM who only reported sex with other men (lifetime or prospectively), or who expressed sexual attraction mostly to men, in each case reflecting differences in the frequency of RAI. Associations between uRAI frequency and lower age disappeared after adjustment for behavioural sexuality, but associations between RAI frequency and lower age persisted. Although uIAI frequency was also highest in younger MSM, this was due to a higher probability of condom unprotected IAI in young MSM rather than differences in IAI frequency between age groups. Unlike uRAI, frequency of uIAI was unrelated to measures of prospective or lifetime sexuality. These patterns persisted with adjustment for other variables. Differences were also apparent in uRAI and uIAI frequency by religious affiliation, Roman Catholic participants reporting significantly lower frequencies of uRAI than other religious groups (0.1 versus 1.3 (Protestant/Muslim/Other) per 4 weeks, $p<0.001$), but significantly higher frequencies of uIAI (4.4 vs. 1.2 per 4 weeks respectively, $p<0.001$) both attributable to differences in behavioural frequency between religious groups rather than differences in the probability of condom use for those behaviours.

Low income (cash income <2000 KSH in the previous month) and weekly use of alcohol were associated with the overall crude frequency of uAI in MSM at risk of HIV acquisition, but not uRAI or uIAI specifically. After confounder adjustment however, associations were apparent respectively between low income and specifically the proportion of condom unprotected RAI, weekly alcohol use and the overall frequency of uRAI and proportion of condom unprotected RAI. Although neither factor was prominent as a determinant of crude unprotected behaviour frequency, these findings are consistent with observations elsewhere.

Associations with recent cash income hint at an economic component of risk in a relatively deprived population: 53.3% of all uRAI events with HIV negative participants were accounted for among the 22.9% of participants reporting lowest cash incomes (Table 42 & Table 43), 95.1% which involved payment to the participant. Declining incomes were associated with a lower probability of condom use for RAI (Table 43). In a group who largely reported sound knowledge of HIV transmission risk and with ready access to prevention materials, these findings resound with reports from focus groups of the higher financial return from selling unprotected receptive anal sex, and Kibicho's observation that most coastal male sex work adheres to a 'poverty sex trade' model[90]. Whilst the literature concerning financial drivers of HIV acquisition risk in male sex workers is generally lacking[255], insights from female sex worker populations in low and middle-income settings suggest greater self-efficacy in condom negotiation among sex workers with higher or more dependable income sources[256 257].

Reviews of the HIV epidemiology literature have highlighted the role of alcohol as a specific co-factor in HIV transmission in sub-Saharan Africa [258-260], and among African MSM populations specifically[138 151 152 154]. Alcohol use in the region has been linked to high-risk sexual behaviours[261-263], STI incidence[261 264], and HIV prevalence[265]. The potential associations between alcohol and HIV risk may be various, particularly for stigmatised populations. Alcohol-serving establishments are often the places where people meet sex partners or engage in commercial sex activity[259 266]. Indeed in this study, 28.5% of new sexual partnerships were established in bars and nightclubs, and 71.1% of contacts occurred during the evening or night. Narrative interviews conducted in one of my further studies implicates both social functions of intoxication (e.g. facilitation of social engagement and sex partner identification), as well as alcohol intoxication accompanying low self-esteem and social isolation. A more recent study in Mombasa categorised 1 in seven male sex workers as alcohol dependent based on AUDIT measures, and reported that unprotected anal sex was associated with both alcohol dependence and frequency of use [267]

In keeping with the cross-sectional study reported in Chapter 3, recent or lifetime injecting drug use was rarely reported as a potential independent biological risk of HIV acquisition, countering local characterisation of a link between MSM behaviour and drug dependence. Further, there was no evidence of higher sexual risk behaviour in the small number of men who did report lifetime injecting or non-injecting drug use compared to those who did not (indeed, there was a tendency to lower frequencies of unprotected anal sex), despite such interactions being reported in other contexts[268 269].

Population HIV risks among MSM

Representativeness of the research population

The limited direct engagement of clients with the research program, through either telephone interviews or personal attendance was not altogether unexpected. Study of male clients involved in the more socially sanctioned activity of female sex trade are themselves acknowledged to be hard to engage with research[270] and tend to require imaginative recruitment designs[271-275]. The additional stigma of disclosing illegal and culturally spurned homosexual practices could only make male clients of MSM sex workers more cautious of the intentions of researchers[275], and have generally only been successfully engaged in more liberal settings[276 277]. The very low client uptake of anonymous and personal recommendation was a disappointment to study participants and research team alike.

The consequent reliance upon objective measures of partner characteristics, as made by study participants, meant that characterisation of the proximate sexual network was limited to simple, observable and non-incriminating measures, given the need for participants' safety in interpersonal contacts and maintenance of self-held materials, and the wider evidence, even in recurrent partnerships, perceptions of partner behaviours are usually inaccurate[278]. Such data offer no indication of partners' broader networks beyond contacts with study participants Nonetheless this basic information did help constitute a fairly detailed picture of the structure of study participants' sexual networks within which partners featured, clearly situating the research-engaged MSM as a young, highly sexually active core group engaged in a predominantly transactional network and likely unrepresentative of the broader MSM population.

Direct comparison between the few clients who did complete the telephone interview and study participants suggested that clients were considerably less likely to have used condoms for recent homosexual or heterosexual sex than were study participants, were more likely to be in heterosexual partnerships, and were less likely to be aware of HIV transmission risks posed by AI despite having higher education levels (Chapter 7, Table 50). Sex frequencies were not established by interview, but recapture of clients suggested that some clients were in repeated contact with different sex workers over the course of follow up. Further, objective measures from diaries suggested that client and partner populations were predominantly local, in terms of residence and ethnic origin, countering local claims that MSM sex work caters to a predominantly foreign demand for homosexual sex.

The role of transaction

In the cross-sectional study, 74% of MSM enrolled in IAVI studies reported selling sex to others in a relatively brief period of recall (Table 4), and considerably more than in other African studies between 2000-2009 (Table 12 and Figure 18). Event diaries on the same population suggested even this high proportion was an under-estimate despite measuring transaction using a narrow but unambiguous definition based on cash exchange alone, 98.8% (82/83) of MSM reported any such activity and 43.4% *only* reported transactional sex in 6 weeks of follow up. Overall, 85.6% of partners were sex clients and 83.0% of all events included cash payment to the participant. Diary study participants were more likely to report such behaviour in their diaries than in IAVI cohort assessments (Table 20 & Table 21). Under-reporting of sex work might arise either from ambiguity in the meaning of this term (suggested by formative focus groups) or from social desirability bias – sex work itself a stigmatising and illegal behaviour in Kenya, but unlike MSM behaviour, was not an inclusion criteria to enable access to IAVI cohort studies. That selling sex was not identified as a risk factor for HIV prevalence among in this population (Chapter 3), whilst elsewhere in sub-Saharan Africa it was (Chapter 4), is perhaps explained by the fact that participation in male sex work was virtually ubiquitous in this context when measured carefully.

The diary study suggested the clear influence of transactional male sex upon HIV acquisition risk in this group despite evidence for higher condom use for sex with paying clients (Table 31 and Table 32): 83.8% of all unprotected homosexual AI occurred with cash-paying sex clients, including 89.6% of uRAI and 82.2% of uIAI reported by HIV negative participants and exchange sex was *the* consistent determinant of dyadic age differentials. Participants under 25 years of age accounted for 79.2% of uRAI events with HIV negative participants of which 86.9% involved payment to the participant. And whilst dyadic age differences were associated with safer sex roles and condom use (Table 31 and Table 32), 55.7% of uRAI events were with male clients in older age groups.

The epidemiological significance of high-activity MSM core groups, such as the population described in this research, to population level MSM HIV transmission has been explored by a number of researchers. Goodreau et al, using data from the US, illustrated the differential impact of individual sexual contact frequency disparities upon the development of HIV epidemics for MSM populations[187]. Results suggest that HIV prevalence among the MSM population as a whole is highly sensitive to the partner frequencies of the proportion of men in core groups[187]. In addition to the potential epidemiological relevance of core groups to population level HIV transmission, network-level risks for HIV transmission in any sexual network are known to arise from relationship patterns [279-282] and dyadic age differences within the network[283 284]. A further network-level characteristic of influence to transmission risk within MSM sexual networks is anal sex role versatility[9 187].

Relationship patterns

New partners account for 71.1% of sexual partners, and just over half of behaviour reported by study participants. The strong association between the probability of condom-unprotected sex with increasing relationship significance and duration, however, meant that the majority of both unprotected homosexual AI events (54.7%) and unprotected heterosexual sex (62.6%) occurred within recurrent partnerships (Chapter 5, Table 28). These observations concur with studies in other

MSM[285 286] and heterosexual populations[287-289], where lower condom use is attributed to interpersonal intimacy, trust, love and HIV testing history [285 290-292] and where such bonds may prove challenging to conventional prevention messaging [293 294]. Further, 69.9% of study participants reported sex with two or more recurrent male partners, and 41% reported recurrent male and female partners.

Of particular note in this population was the overlap between the significance or duration of the relationship and transaction. Insights from female sex workers in Kenya[295 296] and from other African settings[297] characterise sexual networks consisting of casual male partners (clients) alongside non-transactional, regular partners, with differing condom use patterns between clients and non-transactional partners. The apparent relationship patterns suggest parallels to observations made by qualitative researchers in Mombasa[30 97], Malindi[98] and Nairobi [298] who indicated that enduring transactional MSM partnerships within a more conventional sex trade predominantly predicated upon random and opportunistic encounters. This prospective data adds support to this notion, and suggests that such partnership structuring has relevance for HIV risk and prevention. Indicators of relationship significance (regular rather than casual/new) and relationship duration were strongly and consistently associated with condom-unprotected sex within both MSM and heterosexual partnerships.

Age differences

Trends in the relative frequency of gender-specific and role-specific behaviours also bore a resemblance to anthropological descriptions of homosexual and heterosexual partnering among Kenyan MSM[30 95 97 299]. As discussed in chapter 2, prior anthropological studies in the Mombasa MSM community have characterised local MSM partnering along status, age and gender lines, coupled with an aspiration to change role in line with status. In diaries, HIV negative participants reported peak frequencies of RAI among young MSM, of IAI in slightly older MSM, and a predominance of heterosexual sex in MSM over 35 years of age (Figure 50 & Figure 51). A relationship between increasing age and declining RAI practice was also observed among partners, albeit only based on behaviours with study participants (Figure 40). The relative frequency of homosexual and heterosexual sex reversed across age groups: men under 25 years reported over four times the frequency of sex with men than women, between the ages of 25-34 years this difference was marginal, whilst men over 35 reported heterosexual activity rates over twice that of unprotected same sex episodes. It is plausible, as suggested by Shepperd[30], that these trends do represent cohort trends for young MSM i.e. to start out as the receptive partner, and as status and age increase to adopt insertive or heterosexual roles, in which case such patterns have significant implications for HIV transmission dynamics. This issue should prompt further study, since it is equally plausible that this pattern could reflect period or sampling effects.

Aside from individual behavioural trajectories with age, whilst the study found significant evidence for age disparities between MSM in homosexual dyads that were not apparent for heterosexual dyads, and that may infer MSM mixing of age groups with different HIV prevalent risks, it found no concordance between role and age, as are proposed by Shepperd[30]. Instead, age differences in this network appeared to be driven solely by the direction of transaction, and irrespective of sex role. Overall, dyadic age disparities in both casual and regular partnerships were more profound than in studies of populations with less transactional sex[300-305].

Versatility

The network-level consequences of versatile practices among MSM have been shown to be highly influential upon HIV epidemic trajectory and equilibrium prevalence in mathematical models[187], and are cited as one of the main reasons that HIV transmission is so resilient to intervention among MSM populations[9]. The distinction between heterosexual networks (in which biological transmission risks are gender segregated) is that versatile MSM share the highest HIV acquisition risk behaviour (RAI) with the highest onward transmission risk (IAI). As noted in Chapter 4, versatility among African MSM populations has yet to be studied in earnest. Data from other low and middle income countries has suggested less role versatility and more role segregation within socially heteronormative cultures (India 14%[305]; Peru 50%[304], compared to countries with sexually liberal cultures (USA 73%[301]; composite from Project T, STEP, HPTN039, EXPLORE). Diary data indicate a high proportion of versatile MSM (59%) among a population predominantly operating in a highly heteronormative context (Chapter 7 & Table 37).

Knowledge of HIV status

Seroadaptation, including serosorting and seropositioning, are strategies MSM have used as prevention approaches determined by knowledge of personal and partners HIV status[306]. A limitation of this study was the absence of either a self-reported measure of HIV status (due to the limited direct recruitment of clients) or a participant-reported measure of partnership HIV disclosure or perception of partner's HIV status. Yet existing IAVI cohort measures suggested that HIV status disclosure is extremely unusual even, with main partners. Diaries did suggest trends among HIV positive MSM thought more likely to represent seroadaptation than reflection of long-term risk behaviours, in particular the observation that IAI behaviours by HIV positive participants were much more likely to be condom protected than for HIV negative participants, whilst no such distinction was apparent for RAI.

Bridging transmission risk between MSM and heterosexual HIV epidemics

Beyond HIV transmission risk within MSM populations discussed above, a key consideration to further understanding the potential contribution of MSM to predominantly heterosexual African epidemics rests upon understanding the links between transmission in MSM and heterosexual populations. The theoretic risk of HIV transmission bridging high risk MSM groups to heterosexual populations, via bridging groups of bisexually active men, has been an abiding yet largely unrealised concern in the concentrated and low-level HIV epidemics in the West[307-309], Asia[308 310] and Latin America[308 311], but not as yet in sub-Saharan Africa where bridging potential between high and low risk heterosexual groups (i.e. female sex workers and their male clients) has been a focus[312 313]. Yet, the possibility that MSM populations may be driving risks among heterosexual populations has attracted media coverage and policy commentaries within the region [314-316].

Whereas the literature review in Chapter 4 found little ecological evidence that HIV prevalence among the general population has considerable influence upon the burden of HIV among MSM, the reverse scenario would not be apparent from such data since MSM represent small fractions of national populations. The review did confirm that, in most contexts, the majority of African MSM reported sexual behaviour with both men and women, and generally more so than MSM populations studied in other parts of the world. Yet the review also found that among MSM research populations, bisexually identifying or bisexually practicing men were consistently and significantly less likely to be HIV positive in virtually all contexts, including the specific context for this work, without offering insight as to why this is the case. This finding is consistent with insights from bisexual men outside Africa [186 308].

The prospective studies reported in Chapters 5-6 offer the first detailed insights into the scale of the bisexual bridge from a sub-Saharan African MSM population, and the pronounced segregation of risk behaviours among MSM which, at present, limit the HIV transmission potential across this bridge. The results of the diary study confirmed that heterosexual activity is indeed commonplace among Coastal Kenyan MSM as indicated by the cross-sectional study (Chapter 3): 59.0% of MSM within the study reported heterosexual activity during follow up (Table 34), and 41.0% reported concurrent sexual partnerships with recurrent male and female partners (page 179). 17.5% of all sexual partners of MSM were female and 19.8% of sexual events were heterosexual (Table 34). Unlike homosexual partnerships, heterosexual events nearly always involved penetrative sex (98.3%, (Table 30), over half of events included anal sex (Table 36), and penetrative sex events with different partners were over three times more likely to be condom-unprotected than were MSM events (Table 32). Further, much of this heterosexual behaviour was also transactional, documenting the existence of a previously unrecognised heterosexual sex trade, serving predominantly local female clients. Taken together, these findings strongly indicate the presence of highly active sexual connections and *potential* for HIV transmission routes between Kenyan MSM and women.

However, from a population perspective, there was also evidence to suggest that these potential HIV transmission routes are at least partially mitigated by the segregation of risk behaviour among MSM who are not heterosexually active or oriented. Firstly, HIV prevalence in both cross-sectional study and diary participants was considerably lower among MSM reporting heterosexual activity (Chapter 3), and HIV positive MSM reported markedly less unprotected heterosexual sex (Table 39). Over the diary study, HIV negative heterosexually active MSM were more likely to have been insertive role segregated in their MSM behaviours during follow up (Table 37 & text), thus at considerably lower risk of homosexual HIV acquisition than MSM reporting RAI. Across the distribution of behaviours among HIV negative MSM population, there was pronounced segregation of potential personal risks of HIV acquisition and onward heterosexual transmission risk. MSM who reported the highest rates of RAI and uRAI also reported the lowest rates of heterosexual sex, and vice versa (Figure 53). HIV negative MSM reporting any individual heterosexual behaviour or expression of orientation, compared to exclusively homosexual practicing or oriented MSM, reported significantly lower frequencies of uRAI, representing both a significantly lower frequency of RAI, as well as a marked, but not statistically significant, increase in condom-use for RAI.

Behavioural studies distinguishing bisexual risks among MSM populations against which to compare these finding have yet to emerge from sub-Saharan Africa, although Lane et al also notes a negative association between self-identified bisexual orientation and RAI practice[152]. Further afield, past studies in the USA and UK also suggest that bisexual men have similar rates of IAI, but are less likely to have had protected or unprotected RAI, and have fewer male sexual partners than exclusively homosexual men[180 317-320], however recent research is lacking perhaps due to the tendency in industrialised countries to conflate 'gay and bisexual' populations in HIV surveillance and research. However, studies also suggest that bisexual men are more likely to have unprotected sex with female partners, AI with female partners and lifetime reporting of injecting drug use than heterosexual or homosexual men[180 318 321 322].

Together, these findings suggest that a potential transmission bridge does exist between MSM and heterosexual populations through the population identified, but that behaviourally bisexual MSM who might act as this bridge presently have a much lower HIV risk profile than other MSM. Extrapolation of this finding to any other population or setting must, however, be very cautious, given indications that the research engaged population probably was not representative of the much larger, objectively characterised immediate sexual network, among whom little is known (but much speculated) about the need for covert MSM to maintain heterosexual relationships for appearance sake. Anecdotal characterisation, and the responses of the likely highly selected and small number of clients completing the telephone interview, would imply the wider MSM population are more likely to be in marital partnerships, more likely to be heterosexually active, and are less knowledgeable of the transmission risks posed by homosexual intercourse. Understanding the dynamic relationship between MSM and heterosexual epidemics in Kenya will depend on engaging with and understanding sexual knowledge, attitudes and behaviours of this wider population, although the experiences described in this thesis demonstrate that this will be hard to achieve.

Prospects for HIV/AIDS control among African MSM populations and beyond

Relevance of HIV/AIDS control in core groups to generalised HIV/AIDS control

Marie-Claude Boily et al studied the effect of core group interventions (female sex workers and their clients) upon the trajectory, peak and decline of the HIV epidemics under a range of scenarios[323]. Although not concerning MSM, her projections made the important point that core group interventions were highly effective contributions to HIV epidemic control in all epidemic scenarios (low-level, concentrated *and* generalised), and at both the early and late stages of epidemics. Whilst non-core, population-based interventions were needed in mature epidemics, models suggested that core interventions were necessary to achieving rapid reductions in incidence, and in providing long-term declines or elimination of epidemics[323].

Comparable experiments exploring the dynamics of MSM HIV transmission or impact of MSM or male sex work interventions upon wider epidemics in Africa are as yet absent from the literature, but it is difficult to counter the notion that unchecked HIV transmission among MSM generally, and specifically core groups among MSM populations must damage longer term wider prospects of HIV/AIDS control and elimination. Taken together, these models imply that where core groups exist, targeted intervention is both effective and necessary for long term HIV/AIDS control, and that unchecked HIV epidemics among MSM groups will harm prospects for elimination where HIV is in initial decline in lower risk groups. The epidemic scenario in Kenya, in the author's opinion, calls for greater diversification in the national public health response, and the research to inform this response.

The international response to sub-Saharan MSM since 2007

From a starting point described in Chapter 1, the trickle of epidemiological data indicating the plight of MSM in sub-Saharan African countries and their specific burden within HIV epidemics, has been followed by a flood. Further studies have been added to the literature since the review to 2010 (Chapter 4), documenting new MSM populations and new HIV needs in some African states, and the requirement upon African countries to find out about MSM populations is firmly established in the UNGASS process.

These efforts owe a great deal to a strong commitment by both international agencies eager to correct the historic neglect of this population, and to seek to improve their public health and human rights circumstances. Since publishing Chapters 3 and 4, the author served as a technical consultant in the first WHO Technical Consultation of HIV among MSM and Transgender people, and the content of Chapter 4 featured in a dedicated section of the 2009 Global Epidemic Report from UNAIDS[324]. The UN has been equally vocal in advocating for measures to limit the stigmatisation and discrimination of MSM particularly in sub-Saharan Africa, and is presently challenging the criminalisation of minority sexuality under human rights law and as a barrier to effective public health. Further, the stated expectations of global HIV/AIDS funding agencies, including PEPFAR[325] and the Global Fund[326], of applicant countries have strengthened their requirement of applicant countries for evidence of strategies toward HIV-related vulnerabilities of people who are marginalized due to sexual orientation, gender identity, or consensual sexual behaviours.

Potential impact and barriers to prevention among Kenyan MSM populations

Since the diary study, the author has collaborated in reviewing the prevention effectiveness of known HIV prevention interventions among MSM, and projecting the potential impacts of such interventions onto four populations, including Kenya[327]. The Kenyan component of stochastic simulation models (implemented by Steven Goodreau, University of Washington) was parameterised with data from Chapters 3, 6 and 7 of oral pre-exposure prophylaxis (40% coverage), early anti-retroviral (40%) and condom promotion (20% replacement of condom unprotected AI for condom protected AI), and projected between 15-20% aversion of 10-year HIV incidence amongst Kenyan MSM[327].

However, such projections make no account for the hard cultural realities with which MSM in sub-Saharan Africa contend from day to day. Chapter 4 highlighted some of the structural and community factors limiting access to public HIV services reported by MSM in research studies, and including stigma, discrimination and service denial. Despite increasing attention to MSM among those involved in HIV/AIDS policy in sub-Saharan African countries over the period of these studies, homophobic discrimination in all aspects of civil society continues unabated. Indeed hostile incidents toward gay African men reported in the media increased through 2009 and 2010[328 329]. Physical attacks[59], blackmail[330], arrest[331], murder[332] and desecration after death[329] have all been reported during the period of this research. Locally, on 13th February 2010, an anti-gay mob incited by local religious leaders targeted the Mtwapa clinic, resulting in staff and research participants being dragged out of clinic rooms and beaten[59]. In neighbouring Malindi, the offices of a local MSM NGO were forced to close after public demonstrations[333].

MSM opting to disclose their sexuality remain subject to intense harassment from other members of the population or authorities [330 334 335], associated with negative mental health impacts[336] and higher sexual risk behaviour[337]. And there is mounting evidence that antipathy extends deep into healthcare systems and services tasked with the response to HIV/AIDS[335 338]. A typical quote from an MSM in one of the author's current projects illustrates a frequently rehearsed dilemma in electing to seek health care:

> *"There was this day I was very sick and needed medical attention. I had a STI, which made me not to walk well so I came here at this hospital. The nurses looked at me and asked me what was wrong with me. I told them I was sick. Then one asked 'Are you a woman or a man? Why do you look like those other people who take people's husbands?' You see she was shouting it at the top of her voice just there at the waiting bay. I was embarrassed but I said to myself since I didn't have money to go to a private clinic I would shut my mind and stand the humiliation just to get treatment."* MSM interviewee, Malindi 2011

Worryingly, recent research suggests a lack of willingness among many African countries to tackle the root problems of homophobic discrimination and criminalization. In 2011, Persson et al[339] identified inconsistencies between political endorsement of universal access for MSM (by 2010!) and actual programmatic response, finding the lack of the latter often justified in terms of limited resources, lack of infrastructure, lack of data, the legal status of MSM and generic difficulties working with minorities, whilst sidestepping mention of the adverse legal, societal, religious or political barriers responsible for these constraints[339].

Whilst much of this work was exploratory in nature and aimed to describe an emergent dimension to African HIV/AIDS epidemiology and control, it draws attention to a visible MSM population with a high HIV burden and risk behaviours for whom well-developed population HIV/AIDS testing and care services may be humiliating to access or simply irrelevant to the health and welfare issues MSM and male sex workers face. The most effective, acceptable and accessible models for prevention, treatment and care services for African MSM are yet unknown, but need to be identified urgently. Interventions targeted at high-risk groups, and that characterise the HIV/AIDS response in most global settings, have as yet to be accepted in most African countries and despite the wider potential benefits of aggressive HIV prevention in such groups. Yet this work also hints at the larger groups of men and women interacting with this high risk group, including both male and female clients, who remain largely out of reach of targeted research and prevention efforts. The genuine promise of biomedical HIV prevention as oral prophylaxis[340] and in early HIV treatment[341] to mitigate or even reverse the course of generalised HIV epidemics[342] will depend upon wide scale collective programs of risk counselling, HIV testing, treatment initiation and retention that are accessible to everyone [343 344].

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APPENDICES

LIST OF APPENDICES

APPENDIX 1.1

Review of ascertainment of MSM risk factors in observational risk factor studies of HIV among adult men in Sub Saharan African to 2007

Methods

The author conducted a computerized search of PubMED using MESH headings to search for all published studies of HIV risk factors in men in sub-Saharan Africa. The following search condition was used: Africa, South of the Sahara [MeSH] AND Male [MeSH] AND HIV-infections [MeSH] AND (Risk Factors[MeSH] OR Sexual Behaviour[MeSH] OR Sexual Partners[MeSH]). Studies were limited to those articles published up to December 2007, in the English language. No attempt was made to include unpublished studies or conference abstracts, given the need for full reporting of epidemiological variables.

1623 references and abstracts were retrieved by the initial search, and included in the initial review conducted by myself. Retrieved abstracts were subject to review of the contents of title, abstract and keywords to apply the following inclusion criteria.

1. Study reports measures of risk behaviours specific to men

2. Study reports individual measures of risk behaviour (rather than ecologic or population averaged measures)

3. Study conforms to an analytic epidemiological study design (cross-sectional, case-control (and variants), cohort or controlled trials)

4. Study outcomes included HIV prevalence or incidence measured during the study.

The following exclusion criteria were applied:

1. Study reports gender-aggregated measures of risk factors only

2. Study reports ecological or population aggregated measures of risk behaviour and/or HIV prevalence/incidence only.

3. Study conforms to a descriptive epidemiological study design, case series, or case report.

4. Study outcomes limited to self-reported HIV status or testing

Articles without published abstracts, and articles with insufficient information on the electronic abstract to apply both inclusion and exclusion criteria, were retrieved as complete journal articles for more detailed review.

156 articles that were not excluded from the abstract review were retrieved in full text. One article proved impossible to retrieve in full text form despite multiple efforts to contact the publisher and author [1]. A further 41 articles were excluded on detailed review of the full text, due to lack of gender disaggregated data, inappropriate study design or duplication of data with another article. In total 114 articles were considered to have satisfied inclusion criteria, and were retained for data extraction [2-115]

Data extraction

Details of each study were double-entered into Microsoft Access (version 10, Microsoft Corporation) database and subsequently transferred into a customised Endnote (version X4, Thomson Reuters) database. For each article, each socio-demographic, sexual behavioural, non-sexual behavioural and clinical variable collected from study participants was extracted, and collated on a standard data collection form (figure 1). For each study, the tables and text were explored for reports of whether or not specific socio-demographic, behavioural or clinical variable had been collected from participants in the conduct of each study. For variables that had been collected and reported, the exact nature of the measurement(s) was recorded, as well as multiple measurements relating to the same variable (for example, counts of sexual partners over different periods (lifetime, last month, last week). Finally, the adjusted and unadjusted measures of association between reported variables and HIV outcomes were documented.

Search sensitivity

The sensitivity of the completed search strategy and inclusion criteria were compared against two contemporary systematic reviews of HIV risk factors[116 117].

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Figure 1: Standard data extraction form: Risk factors for HIV-1 in Sub-Saharan Africa

Author Year [ ]

Journal, Volume, Issue, Page [ ] [ ][ ] [ ]

Study cohort cross-sect case-control other [ ]

Participants [male #] Country [ ]

Population characteristics Study year [ ]

Exposure measurement

Outcome measurement

Measure of association rate ratio risk ratio hazard ratio inc odds ratio prev odds ratio

SOCIO DEMOGRAPHIC		
Age	Gender	
Occupation	Employment	Income
Dwelling quality	Dwelling ownership	
Community type	Duration in area	Work away
Visit towns	Visit bars	
Ethnicity / tribe	Religion	
Education	Literacy	
Marital status (pres)	Marital age	Married #

PARTNERS			
All partners	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
Regular partners	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
Casual partners	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
New partners	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
Sex with women	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
Sex with men	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
	Durations	Crude RR	Adj RR
Concurrency			
Age of partner			
Living with partner			
Partner's partners			

ACTS				
First sex act		Age	Age diff	Gender
Total	Durations		Crude RR	Adj RR
Binary [durations]				
Count [durations]				
Condom measure				
Condom use freq				
Fem – vaginal	Durations		Crude RR	Adj RR
Binary [durations]				
Count [durations]				
Condom measure				
Condom use freq				
Fem – anal	Durations		Crude RR	Adj RR
Binary [durations]				
Count [durations]				

Condom measure			
Condom use freq			
Male – ianal	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
Male - ranal	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
Use of sex workers	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
Selling sex	Durations	Crude RR	Adj RR
Binary [durations]			
Count [durations]			
Condom measure			
Condom use freq			
Alcohol use with sex	Durations	Crude RR	Adj RR
Binary			
Count			
Forced sex	Durations	Crude RR	Adj RR
Binary			
Count			
OTHER RB			
Transfusion	Durations	Crude RR	Adj RR
Binary			
Count			
Medical injections	Durations	Crude RR	Adj RR
Binary			
Count			
Surgery	Durations	Crude RR	Adj RR
Binary			
Count			
Dentistry	Durations	Crude RR	Adj RR
Binary			
Count			

Illicit drugs	Durations	Crude RR	Adj RR
Binary			
Count			
Scarification / tattoo	Durations	Crude RR	Adj RR
Binary			
Count			
TM (cutting)	Durations	Crude RR	Adj RR
Binary			
Count			
TM (monkey meat)	Durations	Crude RR	Adj RR
Binary			
Count			
Hunt / eat monkey	Durations	Crude RR	Adj RR
Binary			
Count			
Pet monkey	Durations	Crude RR	Adj RR
Binary			
Count			
CLINICAL			
STD diagnosis	Durations	Crude RR	Adj RR
Reported			
Clinical			
Clinical Genital Ulcer	Durations	Crude RR	Adj RR
Reported			
Clinical			
HSV-2 ulcer	Durations	Crude RR	Adj RR
Clinical			
HSV-2 serology	Durations	Crude RR	Adj RR
Lab			
Chancroid	Durations	Crude RR	Adj RR
Clinical			
Syphilis	Durations	Crude RR	Adj RR
Clinical			
Lab			
Clinical urethritis	Durations	Crude RR	Adj RR
Reported			
Clinical			
Chlamydia	Durations	Crude RR	Adj RR
Lab			
GC urethritis	Durations	Crude RR	Adj RR
Lab			
Circumcision status	Durations	Crude RR	Adj RR
Reported			
Clinical			
Other factors			

IAVI cohort risk assessment fields **APPENDIX 3.1**

	Unless otherwise specified, 0=no, 1=yes; fill visit number (1, 2, etc)	VISIT __	VISIT __	VISIT __	VISIT __	VISIT _	VISIT _	VISIT _
	Date (day/month/year)	__/__/__	__/__/__	__/__/__	__/__/__	__/__/__	__/__/__	__/__/__
	Time start interview	_______	_______	_______	_______	_______	_______	_______
	BIRTH CONTROL							
2.	***What method of birth control are you using?***							
	Condoms	__	__	__	__	__	__	__
	Vasectomy	__	__	__	__	__	__	__
	None	__	__	__	__	__	__	__
	HYGIENE AND HEALTH (H&H)							
6.	**How many times in the past week did you wash your genitals with?** (Fill out #; 0=method not applied)							
	Water alone	_____	_____	_____	_____	_____	_____	_____
	Antiseptic (e.g., Dettol)	_____	_____	_____	_____	_____	_____	_____
	Soap and water	_____	_____	_____	_____	_____	_____	_____
	Detergent	_____	_____	_____	_____	_____	_____	_____
	Lemon	_____	_____	_____	_____	_____	_____	_____
	didn’t wash (1 = didn’t wash)	__	__	__	__	__	__	__
6a.	**How many times in past week did you bathe?** (Fill #)	_____	_____	_____	_____	_____	_____	_____
	H&H IN THE LAST THREE MONTHS							
8.	**Last 3 months: have you had excessive or foul smelling penile discharge?**	__	__	__	__	__	__	__
9.	**Last 3 months: have you had a genital sore?**	__	__	__	__	__	__	__
	SEXUAL PRACTICES IN PAST WEEK							
9a.	**HAVE YOU HAD SEX IN PAST WEEK?** (no=0, if no skip to qes 22)	__	__	__	__	__	__	__
10.	**With how many different people, including your spouse (s) have you had sex?** (fill #; 99 = >30 partners)	__	__	__	__	__	__	__
11.	**How many regular sex partners, including spouse(s) have you had?** (fill #, if no regular partners, skip to 16)	__	__	__	__	__	__	__
12.	**How many times did you have sex with your regular partner(s)?**	__	__	__	__	__	__	__
13.	**How many times did you have sex using a condom with your**							

	regular partner(s)?	__	__	__	__	__	__	__
14.	**If you had sex with a regular partner, do you know his / her HIV status?** (if no, skip to 16)	__	__	__	__	__	__	__
15.	**If yes, is he / she HIV positive?**	__	__	__	__	__	__	__
	Unless otherwise specified, 0=no, 1=yes; fill visit number (1, 2, ..)	VISIT _	VISIT __	VISIT __	VISIT __	VISIT _	VISIT _	VISIT _
16.	**How many casual sex partner(s) have you had?** (fill #; if no casual partner(s), skip to 22)	__	__	__	__	__	__	__
17.	**How many times did you have sex with casual partner(s)?**	__	__	__	__	__	__	__
18.	**How many times did you have sex using a condom with your casual partner(s)?**	__	__	__	__	__	__	__
19.	**How many new sex partners have you had?** (fill #, if no new sex partner (s), skip to 22)	__	__	__	__	__	__	__
20.	**How many times did you have sex with new sexual partners?**	__	__	__	__	__	__	__
21.	**How many times did you have sex using a condom with new sexual partners?**	__	__	__	__	__	__	__
	SEXUAL PRACTICES IN PAST MONTH							
22.	**With how many different people, including your spouse (s) have you had sex?** (fill #;, 99=>30 partners, 0=no sex in past month skip to 23)	__	__	__	__	__	__	__
WHEN SEXUAL ACTIVITY REPORTED IN PAST WEEK, ONLY ASK QES 11A; 16A; AND 19A								
	SEXUAL PRACTICES IN PAST MONTH							
11a.	**In the last month, how many regular sex partners, including spouse(s) have you had?** (fill #; if no regular partner skip to 16a; 99=>30 partners)	__	__	__	__	__	__	__
12a.	**How many times did you have sex with your regular partner(s)?**	__	__	__	__	__	__	__
13a.	**How many times did you have sex using a condom with your regular partner(s)?**	__	__	__	__	__	__	__
14a.	**If you had sex with a regular partner, do you know his / her HIV status?** (if no, skip to 16a)	__	__	__	__	__	__	__
15a.	**If yes, is he / she HIV positive?**	__	__	__	__	__	__	__

16a.	**In the last month, how many casual sex partner(s) have you had?** (fill #; if no casual partner skip to 23; 99=>30 partners)	__	__	__	__	__	__	__
17a.	**How many times did you have sex with casual partner(s)?**	__	__	__	__	__	__	__
18a.	**How many times did you have sex using a condom with your casual partner(s)?**	__	__	__	__	__	__	__
19a.	**In the last month, how many new sex partners have you had?** (fill #; if no new sex partner (s) skip to 23; 99=>30 partners)	__	__	__	__	__	__	__
20a.	**How many times did you have sex with new sexual partners?**	__	__	__	__	__	__	__
21a.	**How many times did you have sex using a condom with new sexual partners?**	__	__	__	__	__	__	__
	Unless otherwise specified, 0=no, 1=yes; fill visit number (1, 2,..)	VISIT __	VISIT __	VISIT __	VISIT __	VISIT _	VISIT _	VISIT_
	OTHER SEXUAL PRACTICES							
23.	**In the past three months, have you had sex during menses?** 9=Don't kn.	__	__	__	__	__	__	__
24.	**In the past three months, have you had anal sex (with anal sex we mean the penis inserts the anus)** (if no skip to qes 25a)	__	__	__	__	__	__	__
24b.	**How do you practice anal sex** (1=insertive; 2=receptive; 3=both)	__	__	__	__	__	__	__
25.	**When you practice anal sex how often do you use condoms?** (0=never; 1= sometimes; 2=frequently; 3= always; 9= Don't know)	__	__	__	__	__	__	__
25a.	**Do you have sex with:** 1 = Women only; 2 = Men only; 3 = Both	__	__	__	__	__	__	__
25b.	**In past 3 months: have you participated in group-sex?** (yes/no)	__	__	__	__	__	__	__
	TRANSACTIONAL SEX							
26.	**In the last three months, have you been paid for sex with cash, living expenses, or goods?** (if no, skip to 29)	__	__	__	__	__	__	__
27.	**By how many clients were you paid for sex in the past one week?** Fill # If 0 skip to 29	__	__	__	__	__	__	__
28.	**How much did you receive on average per client in the last week?** (0 if no cash received)	______	______	______	______	______	______	______
29	**In the last three months, have you paid for sex with cash, living expenses, or goods?** (if no, skip to 32)	__	__	__	__	__	__	__
30	**How many sexual partners did you pay in the last week?** (Fill #)	__	__	__	__	__	__	__

	SUBSTANCE ABUSE AND OTHER PRACTICES							
32.	**In past 3 months: have you used intravenous drugs?** (if no skip to q34)	__	__	__	__	__	__	__
33.	**If yes: Do you share needles?**	__	__	__	__	__	__	__
34.	**In the past month have you used the following:** (0=none; 1=daily; 2=weekly; 3=1-3 times / month)	__	__	__	__	__	__	__
	Cigarettes	__	__	__	__	__	__	__
	Marijuana	__	__	__	__	__	__	__
	Miraa	__	__	__	__	__	__	__
	Other drug, specify _____________	__	__	__	__	__	__	__
35	**In the last month, how often have you had a drink containing alcohol?** (0=none; 1=daily; 2=weekly; 3=1-3 times / month) – if none skip to qes 41)	__	__	__	__	__	__	__
36.	**In the last month, how often did you get drunk?** (0=never, 1=daily; 2=weekly; 3=1-3 times / month)	__	__	__	__	__	__	__
	Unless otherwise specified, 0=no, 1=yes; fill visit number (1, 2, .)	VISIT __	VISIT __	VISIT __	VISIT __	VISIT _	VISIT _	VISIT _
37.	**How often do you have sex after alcohol? (**0=never; 1=sometimes; 2=frequently; 3=always)	__	__	__	__	__	__	__
38.	**In the last month, have you experienced any of the following after drinking alcohol?** (no / yes)							
	Gotten into a fight	__	__	__	__	__	__	__
	Had accident / Injured yourself	__	__	__	__	__	__	__
	Been arrested	__	__	__	__	__	__	__
	Been raped	__	__	__	__	__	__	__
	Sexually assaulted someone	__	__	__	__	__	__	__
41.	**During the last three months, have you been raped?** (if no, skip qes 43)	__	__	__	__	__	__	__
42.	**If yes, who was he /were they?** (1=sex partner (spouse/boyfriend); 2= relative; 3= Acquaint.; 4=stranger; 5= > one man; 6=didn't see him/them)	__	__	__	__	__	__	__
43.	**Finish time interview**	_____	_____	_____	_____	_____	_____	_____
	Initials of person completing questionnaire	___	___	___	___	___	___	___

Detailed literature search procedures

Peer reviewed journal articles

The following medical subject headings (keywords) were used to search PubMED: (Homosexual [MESH] OR "homosexual*" OR Bisexual [MESH] OR "bisexual*") AND Africa, south of the Sahara [MESH] ("Africa South of the Sahara"[Mesh]), in combination with either Sexual Behaviour [MESH] or "HIV" OR Human Immunodefiency Virus [MESH]. Similar keyword terms were used to search EMBASE ('Homosexuality' AND 'Africa, South of the Sahara' AND 'Human Immunodeficiency Virus' OR 'Sexual Behaviour'). After removal of duplicate returns, this strategy yielded 176 abstracts: 151 abstracts were rejected on the basis of title and abstract review and a further 9 were rejected on review of full article (4 genotypes studies and 4 wholly qualitative studies of MSM). The sensitivity of the search strategy was checked by performing the search in SCOPUS. This yielded 47 abstracts, all of which had been detected. In total, the search of PubMED/EMBASE retrieved 16 original articles meeting the inclusion criteria which provided information on 17 unique surveys [1-16]. One article reported on three separate surveys in Namibia, Malawi and Botswana[2], and two separate journal articles analyse data from the same Ugandan study [5 8].

Peer reviewed international conference abstracts

The online catalogues of the International AIDS conference[17], IAS Conference on HIV Pathogenesis and Treatment[17] and the Conference on Retroviruses and Opportunistic Infections[18] which do not offer thesauri of key terms or advanced Boolean search architecture, were searched with a combination of the following search terms: 'MSM', 'Men who have sex with men', 'Homosexual', 'Homosexuality', 'Bisexual', 'Bisexuality', 'Africa', 'Sub-Saharan Africa'. The two databases identified 156 abstracts, 19 of which met the inclusion criteria. Further comparison with search results from the peer-reviewed literature identified that 5 of the retained conference abstracts had been superseded by journal publication[19-22], and that two abstracts reported on the same South African data, leaving a total of 14 original conference abstracts relating to 13 original studies[23-35].

Governmental and non-governmental reports.

The following keywords were used to search POPLINE: MEN HAVING SEX WITH MEN OR homosex* and AFRICA SUB SAHARAN. Google Scholar was searches with similar Boolean search terms as PubMED/EMBASE searches. In combination, this search yielded 42 results, 27 rejected (7 qualitative) and 10 duplicates. 5 new non-governmental reports were identified[36-41], and one further report that reported on a survey since published as a journal article[42].

Catalogues of behavioural and HIV seroprevalence surveys were searched on the HIV/AIDS Survey Indicators Database, the register of standardised indicators of HIV/AIDS prevention and treatment submitted through mandatory national monitoring and evaluation reports to UNGASS and PEPFAR up to 2007, and through hand-searching the UNGASS and Behavioural Surveillance Survey reports submitted by individual countries in 2008 . National indicators of HIV prevalence and risk behaviours are themselves generated from national Demographic and Health Surveys, AIDS Indicator Surveys, and Behavioural Surveillance Surveys. The following country indicators were searched for sub-Saharan Africa: Indicator 8: Percentage of MSM who have received an HIV test in the last 12 months, Indicator 14: Percentage of MSM who correctly identify ways of preventing the sexual transmission of HIV, Indicator 19: Percentage of MSM who report the use of a condom the last time they had anal sex with a man, Indicator 23: Percentage of MSM who are HIV infected. This search identified twelve government reports since, of which five reported data sources not identified elsewhere[43-48].

The US Bureau of Census HIV/AIDS Surveillance Data Base (a register of published and unpublished HIV seroprevalence surveys) were identified by imposing the following database limits: 'Homosexuals' + 'Male', and to exclude 'Data of Unknown Quality'. The data outcome was limited to HIV Prevalence. The search was performed for each individual country in sub-Saharan Africa, including Sudan. This search yielded record of 29 surveys providing data on HIV prevalence amongst homosexual men, most of which were duplicates or disaggregated data from surveys already included in the search. Further details on one Madagascar study could not be further traced [49], however it is briefly described as a general population survey thus is likely not to have met inclusion criteria. In total, no new studies were identified from this search.

Reference lists

Two studies from Ghana[50] [51] were widely referenced by other studies, but had not been published in formal governmental or non-governmental reports from the country. The AED/SHARP prevalence study had temporarily been openly available online, but the entire website has since been removed[50]. Attipoe et al remains accessible as an online report on servers outside Ghana [51].

Contact with authors

The study methods of individual reports were scrutinized and compared to identify duplication of data sources. Authors were contacted where it was unclear if separate reports referred to the same data source (personal communication – Earl Burrell, Stefan Baral, Sylvia Adebajo, Laetitia Rispel, Phoebe Kajubi, Scott Geibel, Eduard Sanders, Chris Beyrer, James Robertson, Andrea Kim). Two of articles reported results from more than one sampling population[2 25]; where this occurred, the surveys were interpreted as discrete findings. Where relevant, authors were asked to clarify uncertainties in the presentation of data. Finally, authors were asked to suggest unpublished or ongoing research. No additional studies satisfying the inclusion criteria were identified in this way, however contacts signalled new and ongoing MSM HIV prevalence surveys in Uganda, Togo, Benin, Ghana, Cote D'Ivoire and Ethiopia.

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STUDY DESIGN AND REPORTING QUALITY APPRAISAL STUDY NUMBER _ _ _ _ _ _

1. Publication type
    a. Abstract or full report / article
2. Study design [**all cross-sectional**]
    a. Cross sectional descriptive or cross sectional analytic (risk factor)
3. Study setting:
    a. Locations [stated-unambiguous, stated-ambiguous, unstated]
    b. Relevant dates including periods of recruitment, exposure, follow up and data collection [stated-unambiguous, stated-ambiguous, unstated]
4. Participants:
    a. Eligibility criteria
        i. Definition of MSM **[yes/no]**
        ii. Inclusion criteria stated **[yes/no]**
    b. Stated sampling method **[yes/no]**
        i. Sampling method **[RDS/Venue Based/Snowball/Other convenience/unstated]**
    c. Achieved sample size stated **[yes/no]**
    d. Reporting of refusal to participate **[yes/no]**
5. Outcome variable: HIV
    a. Was current HIV status confirmed during the study **[yes/no]**
    b. If no:
        i. How was HIV status established **[medical notes/research records/self-reported]**
        ii. Was interval between diagnosis and study reported **[yes/no]**
    c. If yes: How was HIV status measured **[self-report / medical notes / oral test / rapid test / antibody test / Western Blot]**
6. Exposure variables
    a. Reports which potential risk factors and confounders were measured [yes/no]
    b. Reports source of exposure information collected **[yes/no]**
        i. Self-reported **[FTFI/ SAQ/ CAPI/ ACASI/other]**
        ii. Abstraction **[medical notes/record linkage/other]**
    c. Reports quantitative exposure measurement **[yes/no]**
    d. Reports reference period of quantitative exposure measurement **[yes/no]**
7. Bias: Effect of reverse causation
    a. Was information on prior individual knowledge of HIV status collected **[yes/no]**
8. Statistical methods:
    a. Description of statistical methods **[yes/no]**
    b. Reported control of confounding **[yes/no]**
        i. Method reported **[stratification/restriction/ analytic]**
        ii. Missing HIV prevalence confounders (e.g. injecting drug use) **[yes/no]**
    c. Explanation for missing data **[yes/no]**
    d. Analytic methods taking account of sampling strategy **[yes/no]**
9. Main results:
    a. Report HIV prevalence estimate and precision **[yes/no]**
    b. Report unadjusted risk factor associations with HIV prevalence and precision **[yes/no]**
    c. Report confounder adjusted risk factor associations with HIV prevalence and precision **[yes/no]**
        i. States which confounders were adjusted for **[yes/no]**
        ii. States why confounders were included **[yes/no]**
    d. Reported risk factor associations adjusted for prior knowledge of HIV status **[yes/no]**
        i. Type of adjustment **[stratification/restriction/analytic]**
10. **Comment**

MSM networks in and around Mombasa

Assessing sexual networks of men who have sex with men in and around Mombasa, and validating risk behaviour data in preparation for an HIV-1 vaccine efficacy trial (OXTREC 001-07)

Participant Consent Form

INTRODUCTION

Investigator's statement: I am (--------------------Name of Researcher) from KEMRI. I would like to tell you about a study being conducted by researchers from KEMRI in Kilifi. I would like to find out if you would be willing to participate.

PURPOSE OF THE STUDY

Over the last twenty years, a new infectious disease called AIDS which is caused by the human immunodeficiency virus type 1 (HIV-1) has appeared in countries throughout the world, including Kenya. This disease is sometimes spread between adults during sex, including when a man has sex with another man. In the research study that I will tell you about, we want to learn more about sex between men in Mombasa. We also want to learn more about the best ways that researchers can ask people about their sexual activities.

Why do we want to learn more about sex between men? We know that in Mombasa, men who have sex with men have a high risk of developing HIV infection. If we understand more about the sex happening between men, we can understand more about why these men are in danger of getting HIV and other sexual infections. The study will help us find ways to reach out to men having sex with men, and help them reducing the chance of getting HIV and transmitting HIV to their sex partners.

PROCEDURES

Enrollment

You can only be involved in this study if you:

a) are also part of one of the cohort studies of KEMRI in Mtwapa, and
b) can read and write in the diary (in KiSwahili or English), and
c) have had sex with more that one person in the last month, and
d) agree to participate in the activities described in this consent form.

Training

Before the beginning of the study you will attend training about the study in a group of about 20 other MSM cohort members. You will be free to ask any questions about this consent form and about participation in the study at that time, or at any other time at the Mtwapa Clinic.

Contact diary

If you choose to participate, you will be provided with a printed sexual contact diary. In this diary you will write down something each time you have sex with anyone over the study period. After each time you had sex, you will write down a few pieces of information in the diary about what took place during sex. Some of the information will be about what type of sex you had and where it took place.

Some of the information will be about the person you had sex with. Most of the information you will write down about the person you had sex with will be from your own observations, for example are they young, middle-aged or old. It will take between 1 and 2 minutes to write down the information for each sex act.

You will not need to write in the diary whilst your sexual partner is still there. However, you will offer a Hotline Card to any partner who has agreed to pay you for the sex, in money or other goods. You will only offer cards to sexual partners who have agreed to pay you for sex, and not to your other sexual partners who do not pay you. When you offer a card, you will need to ask if they have been offered one before. You should not need to ask clients about anything else.

Some of the information in the diary will be coded, for your privacy should you lose the diary. You will not write your name, or the name of any of your partners, in the diary you keep. You will receive training in how to complete and look after the diary.

During the study period, you will meet with a member of the study team every week. At these meetings you will go over your completed diary entries and discuss anything you are uncertain about. You will be provided with free condoms and lubricants at these meetings, or at any other time at the Mtwapa Clinic.

Hotline Cards

The Hotline Cards have a printed toll-free telephone number which your client can telephone to get private and anonymous advice about safe sex and sexually-transmitted diseases. Clients do not have to use the Hotline if they do not want to, and they do not have to accept the card if they do not want to. If your clients do telephone the hotline, they will not be asked to identify themselves unless they chose to offer that information. If your client does telephone the hotline, your details will never be disclosed. The telephone operator will not have access to your personal details at Mtwapa Clinic, nor information you might have provided in your diary.

These cards should be offered to every client after every sex act, unless you think it might not be safe to do so. You will record if they accepted the card, refused to accept the card or if you chose not to offer a card. You will also ask clients if they have received a card previously, and if so which colour it was, and you will record this in your diary. No further details on how the client received the card will be requested.

BENEFITS

Through the hotline system, clients who pay for sex with men will be offered sexual health counselling and services. In this way we want to give safe sex advice to the clients of sex workers, and hope that this will make sex safer for sex workers too.

We also want to use this investigation to see how well we are doing when we ask about sexual activity in the other study you participate in. Better understanding of the information we collect may improve care in the clinic.

You will have free access to condoms and lubricants throughout the study.

Each week, upon presenting a completed diary to the study supervisor you will receive Ksh. 500.

It is important that you know the following: your participation is voluntary, and you have every right to choose to take part in this study or not. Your future medical care will not be affected by your decision to choose or not choose to participate and you may decide to stop being part of the study at any time.

RISKS, STRESS, AND DISCOMFORT

MSM networks in and around Mombasa

Assessing sexual networks of men who have sex with men in and around Mombasa, and validating risk behaviour data in preparation for an HIV-1 vaccine efficacy trial (OXTREC 001-07)

A major risk to participating in this study is that both sex work and sex between men are illegal in Kenya, hence might expose you to the law authorities. During the study, you will be carrying a letter explaining that you collaborate with KEMRI and that offering an HIV risk reduction intervention (i.e. a hotline card) is supported by Provincial Medical Office. Under no circumstances will people running this study, or the organizations they work for, hand over information about individuals in the study to the police or other authorities.

The written materials will not have your name on them, and much of what you record will be in code. This is because there is a possibility you may lose diaries or hotline cards, or that they are forcibly taken from you by other individuals. This may result in information about your sexual behaviour being seen by other people, including possibly the police. This might lead to your being victimized by violent or discriminatory acts, and written materials might be used as evidence of illegal behaviour by the authorities.

It is already known that sex without a condom, and selling sex, may put you at higher risk of receiving or passing on HIV or other sexually transmitted infections. We therefore prefer that you do not engage in unprotected sex or selling sex, and you will not be judged or penalized for not selling sex and having few or no entries in your diary.

It is not possible to predict how clients will react when offered a hotline card. If you come to think that trying to collect information from or offering a card to a particular client may put you in danger, or will put you or your client under stress, then you should not try to do so.

PRIVACY

Your identity and information you provide to the study team on your sexual activities will remain confidential, known only to the investigators. Information on your identity or sexual health will not be available to counsellors talking to clients on the hotline, and will not be revealed to clients at any stage.

Information you provide in this study will be compared against information you have provided in the cohort study. Information will be kept for an indefinite period of time, and will be stored in a secure way.

PARTICIPATION

Participation in the study is entirely voluntary. Your care at this clinic and your involvement in other studies will not be affected by your decision whether or not to participate in this study.

If you decide to participate, you are free to refuse to participate and to withdraw from this study at any later time without penalty or loss of benefits to which you are otherwise entitled. You can withdraw from the study without giving a reason.

We will attempt to contact you if you do not show up for a scheduled meeting with the study team.

You may be removed from the study at any time for the following reasons:

- If you do not keep a follow up meeting
- If the study is stopped or cancelled
- If you are no longer willing to come for counselling and testing
- Other administrative reasons

MSM networks in and around Mombasa

Assessing sexual networks of men who have sex with men in and around Mombasa, and validating risk behaviour data in preparation for an HIV-1 vaccine efficacy trial (OXTREC 001-07)

You are also free to ask questions of the investigator both before consenting to participate and at any time thereafter. Members of the research team are available to answer questions here in the clinic anytime during working hours.

All materials & travel expenses expressly for the purpose of this study will be provided at no cost to you.

Do you have any questions? Do you agree to participate?

Subject's Statement

This study has been explained to me, and I voluntarily consent to participate. I have understood that I commit to recording sexual activities for the period of 4 weeks, during which time I will attend training and weekly meetings.

I have had an opportunity to ask questions. I understand that future questions I may have about the research will be answered by one of the investigators. I will receive a copy of this consent form.

Who should I contact with any questions about the study?

The coordinator is Dr. Eduard Sanders. If you have any questions you can reach him at KEMRI (telephone: 041-522133).
If you have a medical problem related to your participation, please contact Dr. Norbert Peshu, Director KEMRI (telephone: 041-522535).
If you have a question about the ethics of this investigation you can contact Dr. Dorcas Kamuya, (041-522535) at KEMRI, or The Chairman, Mr. Ambrose Rachier, KEMRI/National Ethical Review Committee, P. O. BOX 54840-00200, Nairobi, Mobile phone: 0722205901 or 0733400003.

Name of subject __________________________

Signature of Subject ____ Date _______

Name and Signature of Person obtaining consent

Name ____________________________ Signature ____________________ Date _______

Copies to: investigator, subject

MSM networks in and around Mombasa

Assessing sexual networks of men who have sex with men in and around Mombasa, and validating risk behaviour data in preparation for an HIV-1 vaccine efficacy trial (SCC 1193)

Client Informed Consent Form

INTRODUCTION

My name is ______________________. I am a counsellor from KEMRI-UW Drop-in Centre at Mtwapa. Currently we are conducting research amongst men who have sex with men, male sex workers and their clients. I would like to find out if you would be willing to participate.

PURPOSE OF THIS STUDY

Over the last twenty years, a new infectious disease called AIDS which is caused by the human immunodeficiency virus type 1 (HIV-1) has appeared in countries throughout the world, including Kenya. This disease is often spread between adults during sex, including when a man has sex with another man. In the research study that I will tell you about, we want to learn more about sex between men in Mombasa. We also want to learn more about the best ways that researchers can ask people about their sexual activities.

Why do we want to learn more about sex between men? We know that in Mombasa, men who have sex with men have a high risk of developing HIV infection. If we understand more about the sex happening between men, we can understand more about why these men are in danger of HIV and other sexual infections. This study will help us find ways to reach out to men having sex with men, and help them reducing the chance of getting HIV and transmitting HIV to their sex partners.

PROCEDURES

If you would like to participate, you'll be asked to schedule an interview time. Each interview will take up to two hours. The interview will cover topics such as your life style, your sexual relationships, your knowledge about HIV, safer sex and the kind of problems you may experience. You may also be asked about issues such as rape, violence and sexual abuse. We will ask these questions as a way to begin to understand the issues faced by men who have sex with men in this community. This will help us develop appropriate ways of helping this particular community.

Information from each interview will be entered into computer or recorded in writing. Your name will not appear on any of these typed pages.

You may refuse to answer any question. If you decide at any time that you no longer want to participate in the interview, you may stop.

BENEFITS

You will get 200 Kenyan shillings for participating in the interview to pay for your travel costs

RISKS, STRESSES AND DISCOMFORT

There is a possibility that some of these questions may make you uncomfortable or distressed: if so, please let me know. You don't have to answer those questions if you don't want to. You also need to understand that all information that I receive from you, including your name and any other identifying information, will be strictly confidential and will be kept under lock and key.

MSM networks in and around Mombasa

Assessing sexual networks of men who have sex with men in and around Mombasa, and validating risk behaviour data in preparation for an HIV-1 vaccine efficacy trial (SCC 1193)

PRIVACY

The information you provide as part of the interview will remain confidential. Study data will be labelled only with your study identification number and the code linking this number to your name will be kept in a computer with restricted access.

You are free to refuse to participate, and to withdraw at any time. Participation in this study is entirely voluntary.

Who should I contact with any questions about the study?

The coordinator is Dr. Eduard Sanders. If you have any questions you can reach him at KEMRI (telephone: 041-522133).

If you have a medical problem related to your participation, please contact Dr. Norbert Peshu, Director KEMRI (telephone: 041-522535).

If you have a question about the ethics of this investigation you can contact Dr. Dorcas Kamuya, (041-522535) at KEMRI, or The Chairman, Mr. Ambrose Rachier, KEMRI/National Ethical Review Committee, P. O. BOX 54840-00200, Nairobi, Mobile phone: 0722205901 or 0733400003.

Do you have any questions? Do you agree to participate?

Subject's statement

This study has been explained to me, and I voluntarily consent to participate. I have had an opportunity to ask questions. I understand that future questions I may have about the research will be answered by one of the investigators listed below. If I have questions about my rights as a research subject, I may call Mr. Ambrose Rachier. I will receive a copy of this consent form.

____________________	____________________	__________
Name of Subject	Signature subject	Date

Name, signature of person obtaining consent

____________________	____________________	__________
Name	Signature	Date

Diary Study CAPI Questionnaire (English Back Translation)

Q1. Recruitment source
1 Diary study participant
2 Partner of diary study participant

If Q0 is equal to 2, then skip to Q1b

Q1a. Volunteer Study I D ____________________

Skip to Q2

Q1b. Telephone Study I D ____________________

Q2. Site ID ____________________

Q3. Initials of supervisor __ __

Module 1: Sociodemographics

Q1. In which year were you born? __ __ __ __
yyyy

Q2. Are you a man or a woman? (Choose one)
1 Man
2 Woman

Q3. In which country were you born? (Choose one)
1 Kenya
2 Tanzania / Zanzibar
3 Uganda
4 Somalia
5 Other (specify)

If Q3 is not equal to 5, then skip to instruction before Q4.

Q3a. Specify country of birth: ____________________

If Q3 is greater than 1, then skip to Q5.

Q4. In what province were you born in Kenya? (Choose one)
1 Coast
2 Eastern
3 Central
4 Nairobi
5 Rift Valley
6 Western
7 Nyanza
8 North Eastern

Q5. Do you usually live in or around Mombasa?
1 Yes
2 No

If Q5 is equal to 1, then skip to Q8.

Q6. In what country do you live for most of the time? (Choose one)

1 Kenya
2 Tanzania / Zanzibar
3 Uganda
4 Somalia
5 Other (specify)

If Q6 is not equal to 5, then skip to instruction before Q7.

Q6a. Specify other country you live most of the time:

— —

If Q6 is greater than 1, then skip to Q8.

Q7. In what province do you live for most of the time? (Choose one)

1 Coast
2 Eastern
3 Central
4 Nairobi
5 Rift Valley
6 Western
7 Nyanza
8 North Eastern

Q8. What is your religion? (Choose one)

1 Muslim
2 Catholic
3 Protestant
4 Hindu
5 Other Christian
6 No religion
7 Other (specify)

If Q8 is not equal to 7, then skip to Q9.

Q8a. Specify other religion you belong to:

— —

Q9. Have you ever been married, by law? (Choose one)

0 Never ***Skip to Q11***
1 Yes, I am presently married and we are together now
2 Yes, now divorced / separated

Q10. Do you have children with your wife / husband?

1 Yes
2 No

Q11. Do you live in a dwelling with a roof?

1 Yes
2 No

If Q11 is equal to 2, then skip to Q13.

Q12. Who do you live with? (Check all that apply)

__ Spouse(s)
__ Boyfriend/girlfriend(s)
__ Parent(s)
__ Sibling(s)
__ Child(ren)
__ Other family members
__ Other persons
__ None - I live alone

If (Q12A is equal to 1 or Q12B is equal to 1 or Q12C is equal to 1 or Q12D is equal to 1 or Q12E is equal to 1 or Q12F is equal to 1 or Q12G is equal to 1) and Q12H is equal to 1 then Invalid Choice made, your choice of H conflicts with the other choices made. PLEASE REVIEW and skip to Q12.

Module 2: Retrospective risk assessment

Q13. How old were you when you first had sex? __ __

99 Don't Know

Q14. When you first had sex, was this with a man or woman? (Choose one)

1 Man

2 Woman

Q15. When you first had sex, how old was your partner **(guess if you do not know for sure)**?

__ __

99 Don't Know

Q16. When you first had sex, was it voluntary for you? (Choose one)

1 Yes, I chose to have sex with that person

2 No, I did not want sex with that person but had no choice

3 None of these options

Q17. Since then, have you ever been forced to have sex against your will?

1 Yes

2 No

Q18. How many different people have you ever had sex with over your whole lifetime? (Choose one)

1 Less than 5 partners

2 5 to 29 partners

3 30 to 99 partners

4 100 to 499 partners

5 500 to 999 partners

6 1000 or more partners

Q19. Have your partners been men or women? (Choose one)

1 All men

2 Mostly men

3 Equal men and women

4 Mostly women

5 All women

Q20. Have you ever received money for sex?

1 Yes

2 No

If Q20 is equal to 2, then skip to Q24.

Q21. Who has given you money for sex? (Choose one)

1 Only men

2 Only women

3 Both men and women

Q22. How old were you when you first received money for sex? __ __

99 Don't Know

If Q22 is less than Q13 then You were &[OLD_SEX] years when you first had sex. You now say you were &[age_cash] years when first received money for sex. Please review and skip to Q22.

Q23. When you have sex for pleasure, do you prefer sex with men or women? (Choose one)

1 Prefer sex with men

2 Prefer sex with women

3 I like sex with men and women

4 I do not like to have sex with men or women

Q24. Have you ever paid someone to have sex with you?

1 Yes

2 No

If Q24 is equal to 2, then skip to Q26.

Q25. Who have you paid to have sex with you? (Choose one)

1 Only men

2 Only women

3 Both men and women

Q26. In the last month, how many men did you have sex with? __ __

If Q26 is equal to 0 or Q26 is equal to 0, then skip to Q29.

Q27. In the last month, how many men gave you money for sex? __ __

If Q27 is greater than Q26 then The number you have entered (&[MEN_CASH]) is greater than the number of male partners you recorded in the last month (&[MON_MPRT]). Please enter the information again and skip to Q26.

Q28. In the last month, how many men did you pay to have sex with you? __ __

If Q28 is greater than Q26 then The number you have entered (&[PAID_MEN]) is greater than the number of male partners you recorded in the last month (&[MON_MPRT]). Please enter the information again and skip to Q26.

Q29. In the last month, how many women did you have sex with? __ __

If Q29 is equal to 0 or Q29 is equal to 0, then skip to instruction before Q100a.

Q30. In the last month, how many women gave you money for sex? __ __

If Q30 is greater than Q29 then The number you have entered (&[WMEN_SEX]) is greater than the number of male partners you recorded in the last month (&[SEX_WMEN]). Please enter the information again and skip to Q29.

Q31. In the last month, how many women did you pay to have sex with you? __ __

If Q31 is greater than Q29 then The number you have entered (&[PAY_WMEN]) is greater than the number of male partners you recorded in the last month (&[SEX_WMEN]). Please enter the information again and skip to Q29.

Q32. Have you ever used any of the following drugs? **(check any that apply, if none press Next Question)** (Check all that apply)

__ Heroin

__ Crack (Brown sugar)

__ Cocaine (Unga)

__ Amphetamines

__ Valium/Temazepam

__ None of the above

If Q32F is equal to 1, then skip to instruction before Q36.

Q33. Have you ever injected yourself with any of the following drugs? **(check any that apply, if none press Next Question)** (Check all that apply)

__ Heroin

__ Crack (brown sugar)

__ Cocaine (Unga)

__ Amphetamines

__ Valium / Temazepam

__ None of the above

If Q32A is equal to 2 and Q33A is equal to 1 then Your selection of injected drugs conflicts with your list of drugs used. Please review and skip to Q32.

Q34. In the last month, how often have you had a drink containing alcohol? (Choose one)

1 Never

2 1 to 3 times

3 Every week

4 Every day

If Q34 is equal to 1, then skip to Q36.

Q35. In the last month, how often did you get drunk using alcohol? (Choose one)

1 Never

2 1 to 3 times

3 Every week

4 Every day

Module 3: Knowledge and attitudes toward sexual health

We will now ask you some questions about your knowledge and attitudes about sexual health, including HIV/ AIDS.
These questions are not connected to the information you have given about your own behaviour, or that of your partners.

If Q19 is equal to 5 or Q2 is equal to 2, then skip to Q40.

If Q9 is equal to 0, then skip to Q37.

Q36. Have you told your wife that you have sex with men?

1 Yes

2 No

Q37. Which members of your family have you told that you have sex with men? (Check all that apply)

__ Parent(s)

__ Brother(s) or sister(s)

__ Other family member

If Q37C is not equal to 1, then skip to Q39.

Q38. Specify who this other person(s) whom you told that you have sex with men?

____

Q39. Have you ever disclosed to staff at health clinics (other than KEMRI) that that you have sex with men?

1 Yes

2 No

Q40. Where do you get useful information about sexual health? (Check all that apply)

__ Newspaper
__ Radio
__ Television
__ Public meetings
__ Public posters
__ Your family
__ Your friends
__ Government clinic / hospital
__ Private Clinic / hospital
__ KEMRI
__ I know no sources of information relevant to me

If (Q40A is equal to 1 or Q40B is equal to 1 or Q40C is equal to 1 or Q40D is equal to 1 or Q40E is equal to 1 or Q40F is equal to 1 or Q40G is equal to 1 or Q40H is equal to 1 or Q40I is equal to 1 or Q40J is equal to 1) and Q40K is equal to 1 then Invalid Choice made, your choice of K conflicts with the other choices made. PLEASE REVIEW and skip to Q40.

Q41. Which sources do you trust to give you accurate information about your sexual health? (Check all that apply)

__ Newspapers
__ Radio
__ Television
__ Public meetings
__ Public posters
__ Your family
__ Your friends
__ Government clinic / hospital
__ Private clinic / hospital
__ KEMRI
__ No known information source

If (Q41A is equal to 1 or Q41B is equal to 1 or Q41C is equal to 1 or Q41D is equal to 1 or Q41E is equal to 1 or Q41F is equal to 1 or Q40G is equal to 1 or Q41H is equal to 1 or Q41I is equal to 1 or Q41J is equal to 1) and Q41K is equal to 1 then Invalid Choice made, your choice of K conflicts with the other choices made. PLEASE REVIEW and skip to Q41.

Now there are questions about what you have been told about sexual health and HIV

Q41a. Can a man catch HIV from unprotected vaginal sex with woman?

1 Yes
2 No

Q41b. Can a man catch HIV from unprotected anal sex with a woman?

1 Yes
2 No

Q41c. Can a man catch HIV from unprotected insertive anal sex (going top) with another man?

1 Yes
2 No

Q41d. Can a man catch HIV from unprotected receptive anal sex (going bottom) with another man?

1 Yes

2 No

Q41e. Can a man catch HIV from unprotected oral sex with a man or woman?

1 Yes

2 No

Q42. For a man, which of these actions carries the highest risk of HIV infection if his partner is HIV positive? (Choose one)

1 Unprotected sex with a woman

2 Unprotected sex with a man

7 Don't Know

Q43. For a man, which of these actions carries the highest risk of HIV infection if his partner is HIV positive? (Choose one)

1 Unprotected insertive anal sex with a man (top)

2 Unprotected receptive anal sex with a man (bottom)

3 Unprotected oral sex with a man

7 Don't Know

Q44. For a man, which of these actions carries the highest risk of HIV infection if his partner is HIV positive? (Choose one)

1 Unprotected vaginal sex with a woman

2 Unprotected anal sex with a woman

7 Don't Know

Q45a. Can a woman catch HIV from unprotected vaginal sex with a man?

1 Yes

2 No

Q45b. Can a woman catch HIV from unprotected anal sex with a man?

1 Yes

2 No

Q45c. Can a woman catch HIV from unprotected oral sex with a partner?

1 Yes

2 No

Q46. For a woman, which of these actions carries the highest risk of HIV infection if her partner is HIV positive? (Choose one)

1 Vaginal sex with a man

2 Anal sex with a man

3 Oral sex

Now there are some questions about what you do to reduce the risk of catching HIV from your partners or passing on HIV to your partners.

Q46b. Do you limit the number of different sex partners you have?

1 Yes

2 No

9 Not Applicable

Q46c. Do you just have sex with people whom you know to have the same HIV status as yourself? (Choose one)

1 Always

2 Sometimes

3 Never

4 Not relevant to me

If Q2 is equal to 2, then skip to Q47d.

Q46d. Do you wear a condom as a precaution? (Choose one)

1 Always

2 Sometimes

3 Never

4 Not relevant to me

Q47d. Do you insist that your partners use condoms? (Choose one)

1 Always
2 Sometimes
3 Never
4 Not relevant to me

If Q20 is equal to 2, then skip to Q48f.

Q48d. Do you insist that your clients use condoms? (Choose one)

1 Always
2 Sometimes
3 Never
4 Not relevant to me

Q48f. Do you avoid sex when you have a genital sore or discharge? (Choose one)

1 Always
2 Sometimes
3 Never
4 Not relevant to me

Q48g. Do you refuse to have sex with partners if they have a genital sore or discharges? (Choose one)

1 Always
2 Sometimes
3 Never
4 Not relevant to me

Q48h. Do you have oral sex instead of penetrative sex? (Choose one)

1 Always
2 Sometimes
3 Never
4 Not relevant to me

If Q1 is equal to 1, then skip to end of questionnaire.

Q49. Have you ever had a test for HIV? (Choose one)

1 Yes, I have done a test
2 No, I have not done a test
3 I do not wish to answer
99 DK

If Q49 is not equal to 1, then skip to end of questionnaire.

Q50. How long ago was your last HIV test for which you received the result? (Choose one)

_ _ _ _ _ YEARS
_ _ _ _ _ MONTHS
_ _ _ _ _ DAYS

Q51: What was the result of the last HIV test for which you received the result? (Choose one)

1 HIV Positive
2 HIV Negatve
99 DK

Module 4: Recent partnerships

MOST RECENT PARTNER

Now there are some questions about your three most recent sexual partners, starting with the most recent.

These first questions are about your relationship with the person you had sex with most recently

Q100a. Enter the initials or nickname of this person as you know them. Enter XX if you do not remember their initials. This will help remind you who the following questions refer to. It will not be possible for anyone to identify your partner from these initials.

— — — — — —

Q101a. Is this [Response to Q100a] a man or a woman? (Choose one)
1 Man
2 Woman

If Q2 is equal to Q101a, then skip to Q103a.

Q102a. Are you married to [Response to Q100a]?
1 Yes
2 No

Q103a. How old was [Response to Q100a] at the time you last had sex? **(guess if you do not know for sure)**

— —

99 Don't Know

Q104a. Have you ever given [Response to Q100a] money to have sex with you?
1 Yes
2 No

Q105a. Has [Response to Q100a] ever given you money for sex?
1 Yes
2 No

Q106a. When did you last have sex with [Response to Q100a]?
— — — — — YEARS
— — — — — MONTHS
— — — — — DAYS

Q107a. Where did this take place? (Choose one)
1 In or around Mombasa (in the study area)
2 Other location (specify town or district)

If Q107a is not equal to 2, then skip to Q108a.

Q107a.i. Specify the town or district where you last had sex with [Response to Q100a]

— — — — — — — — — — — — — — — — — — — —

Q108a. Was this the only time you have had sex with [Response to Q100a]?
1 Yes
2 No

If Q108a is equal to 1, then skip to instruction before Q115a.

Q109a. When was the first time you had sex with [Response to Q100a]?
— — — — — YEARS
— — — — — MONTHS
— — — — — DAYS

Q110a. Has this relationship come to an end?
1 Yes
2 No

If Q110a is equal to 1, then skip to Q113a.

Q111a. About often do you have sex with [Response to Q100a]? (Choose one)
1 Daily
2 Weekly
3 Monthly
4 Yearly
5 Less than once a year

Q112a. How would you describe your relationship with [Response to Q100a]? (Choose one)

1 Husband and wife
2 Steady partners, living as married
3 Steady partners, not living as married
4 Steady partners, meeting from time to time
5 Not regular partner

If Q112a is greater than 0, then skip to instruction before Q115a.

Q113a. How frequently did you used to have sex with [Response to Q100a], when you were in a sexual relationship? (Choose one)

1 Daily
2 Weekly
3 Monthly
4 Yearly
5 Less than once a year

Q114a. How would you have described [Response to Q100a], when you were in a sexual relationship? (Choose one)

1 Husband and wife
2 Steady partners, living as married
3 Steady partners, not living as married
4 Steady partners, meeting from time to time
5 Not regular partner

If Q2 is equal to 1 and Q101a is equal to 1, then skip to instruction before Q115a.

If Q2 is equal to 1 and Q101a is equal to 2, then skip to instruction before Q121a.

If Q2 is equal to 2 and Q101a is equal to 1, then skip to instruction before Q126a.

If Q2 is equal to 2 and Q101a is equal to 2, then skip to instruction before Q131.

Q115a. Have you ever practiced insertive anal sex with [Response to Q100a]? In other words, have you gone top with him?

1 Yes
2 No

If Q115a is equal to 2, then skip to Q117a.

Q116a. When having insertive anal sex with [Response to Q100a], how often was a condom used? (Choose one)

1 Always
2 Sometimes
3 Never

Q117a. Have you ever practiced receptive anal sex with [Response to Q100a]? In other words, have you gone bottom with him?

1 Yes
2 No

If Q117a is equal to 2, then skip to Q119a.

Q118a. When having receptive anal sex with [Response to Q100a], did he use a condom? (Choose one)

1 Always
2 Sometimes
3 Never

Q119a. Have you ever had oral sex with [Response to Q100a]?

1 Yes
2 No

If Q119a is equal to 2, then skip to instruction before Q121a.

Q120a. When having oral sex with [Response to Q100a], how often did either of you use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Skip to instruction before Q131a.

Q121a. Have you ever practiced vaginal sex with [Response to Q100a]?

1 Yes

2 No

If Q121a is equal to 2, then skip to Q123a.

Q122a. When having vaginal sex with [Response to Q100a], how often did you use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Q123a. Have you ever practiced anal sex with [Response to Q100a]?

1 Yes

2 No

If Q123a is equal to 2, then skip to Q125a.

Q124a. When having anal sex with [Response to Q100a], how often did you use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Q125a. Have you ever practiced oral sex with [Response to Q100a]?

1 Yes

2 No

Skip to instruction before Q131a.

Q126a. Have you ever practiced vaginal sex with [Response to Q100a]?

1 Yes

2 No

If Q126a is equal to 2, then skip to Q128a.

Q127a. When having vaginal sex with [Response to Q100a], how often was a condom used? (Choose one)

1 Always

2 Sometimes

3 Never

Q128a. Have you ever practice anal sex with [Response to Q100a]?

1 Yes

2 No

If Q128a is equal to 2, then skip to Q130a.

Q129a. When having anal sex with [Response to Q100a], how often was a condom used? (Choose one)

1 Always

2 Sometimes

3 Never

Q130a. Have you ever practiced oral sex with [Response to Q100a]?

1 Yes

2 No

That is the end of the questions about your relationship with [Response to Q100a]. Now remember the person you most recently had sex with who was not [Response to Q100a]

Q131a Have you had sex with anyone else other than [Response to Q100a]?

1 Yes

2 No

If Q131a is equal to 2, then skip to instruction before END

SECOND SEXUAL PARTNER

Q100b. Enter the initials or nickname of this person as you know them. Enter YY if you do not remember their initials. This will help remind you who the following questions refer to. It will not be possible for anyone to identify your partner from these initials.

— — — — — —

Q101b. Is this [Response to Q100b] a man or a woman? (Choose one)

1 Man

2 Woman

If Q2 is equal to Q101b, then skip to Q103b.

Q102b. Are you married to [Response to Q100b]?

1 Yes

2 No

Q103b. How old was [Response to Q100b] at the time you last had sex? **(guess if you do not know for sure)**

— —

99 Don't Know

Q104b. Have you ever given [Response to Q100b] money to have sex with you?

1 Yes

2 No

Q105b. Has [Response to Q100b] ever given you money for sex?

1 Yes

2 No

Q106b. When did you last have sex with [Response to Q100b]?

_ _ _ _ _ YEARS

_ _ _ _ _ MONTHS

_ _ _ _ _ DAYS

Q107b. Where did this take place? (Choose one)

1 In or around Mombasa (in the study area)

2 Other location (specify town or district)

If Q107b is not equal to 2, then skip to Q108b.

Q107b.i. Specify the town or district where you last had sex with [Response to Q100b]

— — — — — — — — — — — — — — — — — — — —

Q108b. Was this the only time you have had sex with [Response to Q100b]?

1 Yes

2 No

If Q108b is equal to 1, then skip to instruction before Q115b.

Q109b. When was the first time you had sex with [Response to Q100b]?

_ _ _ _ _ YEARS

_ _ _ _ _ MONTHS

_ _ _ _ _ DAYS

Q110b. Has this relationship come to an end?

1 Yes

2 No

If Q110b is equal to 1, then skip to Q113b.

Q111b. About often do you have sex with [Response to Q100b]? (Choose one)

1 Daily

2 Weekly

3 Monthly

4 Yearly

5 Less than once a year

Q112b. How would you describe your relationship with [Response to Q100b]? (Choose one)

1 Husband and wife

2 Steady partners, living as married

3 Steady partners, not living as married

4 Steady partners, meeting from time to time

5 Not regular partner

If Q112b is greater than 0, then skip to instruction before Q115b.

Q113b. How frequently did you used to have sex with [Response to Q100b], when you were in a sexual relationship? (Choose one)

1 Daily

2 Weekly

3 Monthly

4 Yearly

5 Less than once a year

Q114b. How would you have described [Response to Q100b], when you were in a sexual relationship? (Choose one)

1 Husband and wife

2 Steady partners, living as married

3 Steady partners, not living as married

4 Steady partners, meeting from time to time

5 Not regular partner

If Q2 is equal to 1 and Q101b is equal to 1, then skip to instruction before Q115b.

If Q2 is equal to 1 and Q101b is equal to 2, then skip to instruction before Q121b.

If Q2 is equal to 2 and Q101b is equal to 1, then skip to instruction before Q126b.

If Q2 is equal to 2 and Q101b is equal to 2, then skip to instruction before Q131.

Q115b. Have you ever practiced insertive anal sex with [Response to Q100b]? In other words, have you gone top with him?

1 Yes

2 No

If Q115b is equal to 2, then skip to Q117b.

Q116b. When having insertive anal sex with [Response to Q100b], how often was a condom used? (Choose one)

1 Always

2 Sometimes

3 Never

Q117b. Have you ever practiced receptive anal sex with [Response to Q100b]? In other words, have you gone bottom with him?

1 Yes

2 No

If Q117b is equal to 2, then skip to Q119b.

Q118b. When having receptive anal sex with [Response to Q100b], did he use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Q119b. Have you ever had oral sex with [Response to Q100b]?

1 Yes

2 No

If Q119b is equal to 2, then skip to instruction before Q121b.

Q120b. When having oral sex with [Response to Q100b], how often did either of you use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Skip to instruction before Q131b.

Q121b. Have you ever practiced vaginal sex with [Response to Q100b]?

1 Yes

2 No

If Q121b is equal to 2, then skip to Q123b.

Q122b. When having vaginal sex with [Response to Q100b], how often did you use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Q123b. Have you ever practiced anal sex with [Response to Q100b]?

1 Yes

2 No

If Q123b is equal to 2, then skip to Q125b.

Q124b. When having anal sex with [Response to Q100b], how often did you use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Q125b. Have you ever practiced oral sex with [Response to Q100b]?

1 Yes

2 No

Skip to instruction before Q131b.

Q126b. Have you ever practiced vaginal sex with [Response to Q100b]?

1 Yes

2 No

If Q126b is equal to 2, then skip to Q128b.

Q127b. When having vaginal sex with [Response to Q100b], how often was a condom used? (Choose one)

1 Always

2 Sometimes

3 Never

Q128b. Have you ever practice anal sex with [Response to Q100b]?

1 Yes

2 No

If Q128b is equal to 2, then skip to Q130b.

Q129b. When having anal sex with [Response to Q100b], how often was a condom used? (Choose one)

1 Always

2 Sometimes

3 Never

Q130b. Have you ever practiced oral sex with [Response to Q100b]?

1 Yes

2 No

That is the end of the questions about your relationship with [Response to Q100b]. Now remember the person you most recently had sex with who was not [Response to Q100a] or [Response to Q100b]

Q131b. Have you had sex with anyone else other than [Response to Q100b] and [Response to Q100a]?

1 Yes

2 No

If Q131b is equal to 2, then skip to instruction before END

THIRD SEXUAL PARTNER

Q100c. Enter the initial or nickname of this person as you know them. Enter ZZ if you do not remember their initials. This will help remind you who the following questions refer to. It will not be possible for anyone to identify your partner from these initials.

— — — — — —

Q101c. Is this [Response to Q100c] a man or a woman? (Choose one)
1 Man
2 Woman

If Q2 is equal to Q101c, then skip to Q103c.

Q102c. Are you married to [Response to Q100c]?
1 Yes
2 No

Q103c. How old was [Response to Q100c] at the time you last had sex? **(guess if you do not know for sure)**

— —

99 Don't Know

Q104c. Have you ever given [Response to Q100c] money to have sex with you?
1 Yes
2 No

Q105c. Has [Response to Q100c] ever given you money for sex?
1 Yes
2 No

Q106c. When did you last have sex with [Response to Q100c]?
— — — — — YEARS
— — — — — MONTHS
— — — — — DAYS

Q107c. Where did this take place? (Choose one)
1 In or around Mombasa
2 Other location (specify town or district)

If Q107c is not equal to 2, then skip to Q108c.

Q107c.i. Specify the town or district where you last had sex with [Response to Q100c]

— — — — — — — — — — — — — — — — — — — —

Q108c. Was this the only time you have had sex with [Response to Q100c]?
1 Yes
2 No

If Q108c is equal to 1, then skip to instruction before Q115c.

Q109c. When was the first time you had sex with [Response to Q100c]?
— — — — — YEARS
— — — — — MONTHS
— — — — — DAYS

Q110c. Has this relationship come to an end?
1 Yes
2 No

If Q110c is equal to 1, then skip to Q113c.

Q111c. About often do you have sex with [Response to Q100c]? (Choose one)
1 Daily
2 Weekly
3 Monthly
4 Yearly
5 Less than once a year

Q112c. How would you describe your relationship with [Response to Q100c]? (Choose one)

1 Husband and wife
2 Steady partners, living as married
3 Steady partners, not living as married
4 Steady partners, meeting from time to time
5 Not regular partner

If Q112c is greater than 0, then skip to instruction before Q115c.

Q113c. How frequently did you used to have sex with [Response to Q100c], when you were in a sexual relationship? (Choose one)

1 Daily
2 Weekly
3 Monthly
4 Yearly
5 Less than once a year

Q114c. How would you have described [Response to Q100c], when you were in a sexual relationship? (Choose one)

1 Husband and wife
2 Steady partners, living as married
3 Steady partners, not living as married
4 Steady partners, meeting from time to time
5 Not regular partner

If Q2 is equal to 1 and Q101c is equal to 1, then skip to instruction before Q115c.

If Q2 is equal to 1 and Q101c is equal to 2, then skip to instruction before Q121c.

If Q2 is equal to 2 and Q101c is equal to 1, then skip to instruction before Q126c.

If Q2 is equal to 2 and Q101c is equal to 2, then skip to Q131.

Q115c. Have you ever practiced insertive anal sex with [Response to Q100c]? In other words, have you gone top with him?

1 Yes
2 No

If Q115c is equal to 2, then skip to Q117c.

Q116c. When having insertive anal sex with [Response to Q100c], how often was a condom used? (Choose one)

1 Always
2 Sometimes
3 Never

Q117c. Have you ever practiced receptive anal sex with [Response to Q100c]? In other words, have you gone bottom with him?

1 Yes
2 No

If Q117c is equal to 2, then skip to Q119c.

Q118c. When having receptive anal sex with [Response to Q100c], did he use a condom? (Choose one)

1 Always
2 Sometimes
3 Never

Q119c. Have you ever had oral sex with [Response to Q100c]?

1 Yes
2 No

If Q119c is equal to 2, then skip to instruction before Q121c.

Q120c. When having oral sex with [Response to Q100c], how often did either of you use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Skip to Q131.

Q121c. Have you ever practiced vaginal sex with [Response to Q100c]?

1 Yes

2 No

If Q121c is equal to 2, then skip to Q123c.

Q122c. When having vaginal sex with [Response to Q100c], how often did you use a condom? (Choose one)

1 Always

2 Sometimes

3 Never

Q123c. Have you ever practiced anal sex with [Response to Q100c]?

1 Yes

2 No

If Q123c is equal to 2, then skip to Q125c.

Q124c. When having anal sex with [Response to Q100c], how often was a condom used? (Choose one)

1 Always

2 Sometimes

3 Never

Q125c. Have you ever practiced oral sex with [Response to Q100c]?

1 Yes

2 No

Skip to Q131.

Q126c. Have you ever practiced vaginal sex with [Response to Q100c]?

1 Yes

2 No

If Q126c is equal to 2, then skip to Q128c.

Q127c. When having vaginal sex with [Response to Q100c], how often was a condom used? (Choose one)

1 Always

2 Sometimes

3 Never

Q128c. Have you ever practiced anal sex with [Response to Q100c]?

1 Yes

2 No

If Q128c is equal to 2, then skip to Q130c.

Q129c. When having anal sex with [Response to Q100c], how often was a condom used? (Choose one)

1 Always

2 Sometimes

3 Never

Q130c. Have you ever practiced oral sex with [Response to Q100c]?

1 Yes

2 No

That is the end of the questions about your relationship with the [Response to Q100c]

Q131. Have you ever had sex with any other partners, before the three partners you have mentioned ([Response to Q100a], [Response to Q100b] or [Response to Q100c])

1 Yes

2 No

If Q131 is equal to 2, then skip to instruction before END.

Q132. When did you last have sex with someone **other** than [Response to Q100a], [Response to Q100b] and [Response to Q100c]

__ __ __ __ __	YEARS
__ __ __ __ __	MONTHS
__ __ __ __ __	DAYS

Thank you for participating in this interview. If you would like to discuss any issues that these questions have made you think about, please remember to discuss these with your counsellor.

END

Telephone Questionnaire Study number __ __ __ __

Date and time of SMS received: _______ (Date) _________ (Time) Before making a return call, pls record **First attempt: Date and time of call**: _______ (Date) __________ Time) **Second attempt: Date and time of call**: _______ (Date) __________ Time) **Third attempt: Date and time of call**: _______ (Date) __________ Time) Stop calling after 3 attempts.				
S1	***My name is ________________ [first name only]. I am calling from KEMRI's helpline at Mtwapa. I am responding to your SMS***	***Jina langu ni ________________________________ _ Ninapiga kutoka KEMRI Mtwapa nikijibu ujumbe mfupi uliotuma (yaani SMS)***		
Q1	Are you the sender of the SMS?	Je, ni wewe uliyetuma ujumbe huu (SMS)?		1. Yes 0. No **STOP**
Q2	How can I help you? What is your reason for calling?	Nikusaidieje? Sababu yako ya kupiga ni ipi?	**TXT**	capture reason as text in box below
Q3	Have you called in before?	Umewahi kupiga simu wakati mwingine?	**BIN**	1. Yes 0. No
S2	***We are currently doing a study to learn about sexual health from people who call our helpline, who are 18 years or older, and who have received a coloured helpline card***	***Sasa tunafanya uchunguzi wa afya ya ngono (kufanya mapenzi) ambapo tunawahoji watu ambao hawajitambulishi kupitia kwa simu watu ambao wana umri wa miaka 18 au zaidi, na ambao wamepokea kadi ya manjano "kadi ya simu ya usaidizi" ("helpline card")***		
Q4	What year were you born?	Ulizaliwa mwaka gani?	**NUM**	_ _ _ _ **SKIP TO S3>1988**
Q5	Where did you get our SMS number?	Ulipata wapi nambari yetu ya ujumbe mfupi wa sms?	**TXT+**	1. card 3. other (specify) **STOP S3**
Q6	What colour is the card you were given?	Umepewa kadi ya rangi gani?	**TXT+**	1. blue 2. yellow. 3. other **STOP S3**
Q7	**BLUE CARDS ONLY:** Did you read the leaflet on anal sex and rectal health?	Uliwahi kusoma kijitabu kuhusu ngono mkundu na afya ya mkundu?	**BIN**	1. Yes 0. No
Q8	If you still have the card, what is the number on the back?	Tafadhali nisomee nambari iliyoko nyuma ya kadi?	**NUM**	__ __ __ __ Enter 9999 = no card
Q9	Can I tell you more about the sexual health study?	Je ninaweza kukuambia zaidi kuhusu utafiti wa afya ya ngono?	**BIN**	1. Yes 0. No
S3	***If No: Thank you for your time. You can always call again or come to our Drop-in Centre***	***Asante kwa wakati wako.Unaweza kupiga simu tena au uje katika kituo chetu (yaani Drop-in Centre)***		**STOP END HERE**
S4	***Obtaining verbal consent:Uchukuaji wa idhini kwa mazungumzo*** ***0. Check age>=18*** *1. The interview will take approximately 10 to 15 minutes.*	***Obtaining verbal consent:Uchukuaji wa idhini kwa mazungumzo*** ***0. Check age>=18*** *1. Mahojiano yatachukua karibu dakika 10 hadi 15.* *2. Nitakuuliza maswali*		**READ OUT and CHECK** **0.** □ **1.** □

Telephone Questionnaire   Study number __ __ __ __

Date and time of SMS received: _______ (Date) _________ (Time)

Before making a return call, pls record
First attempt: Date and time of call: _______ (Date) __________ Time)
Second attempt: Date and time of call: _______ (Date) __________ Time)
Third attempt: Date and time of call: _______ (Date) __________ Time)
Stop calling after 3 attempts.

S1	***My name is ________________ [first name only]. I am calling from KEMRI's helpline at Mtwapa. I am responding to your SMS***	***Jina langu ni ________________________________ _ Ninapiga kutoka KEMRI Mtwapa nikijibu ujumbe mfupi uliotuma (yaani SMS)***		
Q1	Are you the sender of the SMS?	Je, ni wewe uliyetuma ujumbe huu (SMS)?		1. Yes 0. No **STOP**
Q2	How can I help you? What is your reason for calling?	Nikusaidieje? Sababu yako ya kupiga ni ipi?	**TXT**	capture reason as text in box below
Q3	Have you called in before?	Umewahi kupiga simu wakati mwingine?	**BIN**	1. Yes 0. No
S2	***We are currently doing a study to learn about sexual health from people who call our helpline, who are 18 years or older, and who have received a coloured helpline card***	***Sasa tunafanya uchunguzi wa afya ya ngono (kufanya mapenzi) ambapo tunawahoji watu ambao hawajitambulishi kupitia kwa simu watu ambao wana umri wa miaka 18 au zaidi, na ambao wamepokea kadi ya manjano "kadi ya simu ya usaidizi" ("helpline card")***		
Q4	What year were you born?	Ulizaliwa mwaka gani?	**NUM**	_ _ _ _ **SKIP TO S3>1988**
Q5	Where did you get our SMS number?	Ulipata wapi nambari yetu ya ujumbe mfupi wa sms?	**TXT+**	1. card 3. other (specify) **STOP S3**
Q6	What colour is the card you were given?	Umepewa kadi ya rangi gani?	**TXT+**	1. blue 2. yellow. 3. other **STOP S3**
Q7	**BLUE CARDS ONLY:** Did you read the leaflet on anal sex and rectal health?	Uliwahi kusoma kijitabu kuhusu ngono mkundu na afya ya mkundu?	**BIN**	1. Yes 0. No
Q8	If you still have the card, what is the number on the back?	Tafadhali nisomee nambari iliyoko nyuma ya kadi?	**NUM**	__ __ __ __ Enter 9999 = no card
Q9	Can I tell you more about the sexual health study?	Je ninaweza kukuambia zaidi kuhusu utafiti wa afya ya ngono?	**BIN**	1. Yes 0. No
S3	***If No: Thank you for your time. You can always call again or come to our Drop-in Centre***	***Asante kwa wakati wako.Unaweza kupiga simu tena au uje katika kituo chetu (yaani Drop-in Centre)***		**STOP END HERE**
S4	***Obtaining verbal consent:Uchukuaji wa idhini kwa mazungumzo*** ***0. Check age>=18*** *1. The interview will take approximately 10 to 15 minutes.*	***Obtaining verbal consent:Uchukuaji wa idhini kwa mazungumzo*** ***0. Check age>=18*** *1. Mahojiano yatachukua karibu dakika 10 hadi 15.* *2. Nitakuuliza maswali*		**READ OUT and CHECK** **0.** □ **1.** □

Telephone Questionnaire Study number __ __ __ __

	2. *I'll ask you a number of questions. Please understand that all information that I receive from you will be strictly confidential. There will be no name documented.* 3. *All questions I'll ask are personal, and some questions may make you uncomfortable.* 4. *If you want to come and talk to a counsellor in our Drop-in after the interview, you are very welcome.* 5. *That's all I have to tell you about the interview. Would you like to ask me any questions?*	*kadha. Tafadhali ningependa ujue kwamba habari zozote ninazozipokea kutoka kwako ni siri. Hatutaweka jina lolote.* 3. *Maswali yote nitakayouliza ni ya binafsi na maswali mengine huenda yakakufanya usikie vibaya.* 4. *Kama unataka uje na uzungumze na mshauri katika kituo chetu (Drop-in Centre) baada ya makojiano, unakaribishwa.* 5. *Ni hayo tu nilihitaji kukuambia kuhusu mahojiano. Je, ungependa kuniuliza maswali yoyote?*		**2.** □ **3.** □ **4.** □ **5.** □
Q10	Do you want to participate in the interview?	Ungependa kushiriki katika mahojiano?		1. Yes 0. No **STOP: END**
S5	**VERBAL CONSENT?**	**VERBAL CONSENT?**	**Sign**	__________
Q11	Were you given the card by someone whom you paid for sex	Ulipewa kadi na mtu ulie mlipa kwa ngono?		1. Yes 0. No
Q12	Were you born a man or a woman	Ninahitaji kujua kama wewe ni mwanaume ama mwanamke?	**BIN**	1. Male 2. Female
Q13	Are you married (by law)	Umeoa au umeolewa?	**TXT**	1. Yes 0. No
Q14	Where do you normally live (town, country)	Unaishi wapi?	**TXT**	__________ __________
Q15	How long have you lived there	Umeishi hapo kwa mda gani?	**NUM**	_ _ Years
Q16	What type of employment are you in?	Umeajiriwa vipi?	**CAT**	1. Full time 2. Kazi ya mda mfupi 3. Nime jiajiri mwenyewe 4. Sina kazi 5. Kibarua
Q17	What type of work do you do?	Unafanya kazi gani?	**TXT**	________________ (probe profession)
Q18	What is your highest level of education reached?	Umefikia wapi kitika masomo yako?	**NUM**	1. Primary 2. Secondary 3. Tertiary 4. No education
Q19	Would you describe yourself as African, Indian, Arab, White or other	Wewe ni kabila gani (Yaani kabila lako ni gani? / Yaani asili yako ni ipi?	**CAT**	1. African 2. White 3. Indian 4. Arab 5. Other (specify) ________________

Telephone Questionnaire Study number __ __ __ __

S6	***Now I would like to ask you some questions about your knowledge of sexual health, and your sexual activities***	***Sasa ningependa kukuuliza maswali kuhusu afya ya ngono na shughuli zako za kufanya mapenzi***		
Q20	Do you have sex with men, women, or both?	Je wewe hufanya ngono na manaume, au wanawake, au wote?	**CAT**	1. Men 2. Women **SKIP TO Q21** 3. Both
	CALLER IS A MAN			
M1	**Only If Married:** Have you told your wife that you have sex with men?	**Only if Married:** Umewahi kumwambia mke wako kua unafanya mapenzi na wanaume		1. Yes 0. No
M2	**Not married:** Have you told any member of your family that you have sex with men?	Umewahi kumwambia mtu yote katika familia yako kua unafanya mapenzi na wanaume	**BIN**	1. Yes 0. No
	BOTH MEN AND WOMEN			
Q21	Have you learned something new about sexual health & HIV in the last three months?	Katika miezi mitatu ilyopita mejifunza jambo lolote kuhusu afya ya ngono na virusi vya ukimwi?	**BIN**	1. Yes (specify 21a) 0. No
21a	What was it that you learned?	Ulijifunza nini?	**TXT**	______________ (specify)
Q22	From where or whom did you get this new information?	Ilipata habari hizi kutoka kwa nani au wapi?	**TXT**	______________ (specify)
Q23	Has this information made you change, or plan to change, what you yourself do?	Habari hizi zimekufanya ugeuke au umepanga kugeuza kile unachokifanya?	**BIN**	1. Yes (specify 23a) 0. No
23a	**IF YES:** What do you, or do you plan to do, differently?	**Kama ndio:** unapanga kufanya kitugani kilicho tofauti?	**TXT**	______________ (specify):
Q24	As far as you know, can you catch a sexually transmitted disease, or HIV, from having anal sex?	Mbali na unacho kijua unaweza kutapa magonjwa ya zina au virusi kwa kufanya ngono ya mkundu	**BIN**	1. Yes 0.No **SKIP NEXT**
Q25	As far as you know, do condoms help protect you against HIV and STIs from anal sex?	Mbali na unacho kijua, mipira ina kinga inakukinga kutokana na magonjwa ya zina na virusi ukifanya ngono ya mkundu	**BIN**	1. Yes 0. No
	CALLER HAS SEX WITH MEN			
M3	When you have sex with a man: do you go top, bottom, or both?	Wakati ukifanya ngono na manaume, wewe hufanya, au kufanywa, au zote	**CAT**	1. Top 2. Bottom **SKIP TO M6** 3. Both
M4	TOP: The last time you went top, did you use a condom?	Mara ya mwisho, ulipofanya ulitumia mpira?	**BIN**	1. Yes 0. No
M5	BOTTOM: The last time you went bottom, did your partner use a condom?	Mara ya mwisho, ulipofanywa mpenzi wako alitumia mpira?	**BIN**	1. Yes 0. No 9. Don't know
	SEX WITH WOMEN			
M6	Do you have anal sex with women?	Je wewe, hufanya ngono ya mkundu na wanawake?	**BIN**	1. Yes 0. No
M7	The last time you had anal sex	Mara ya mwisho, ulipofanya	**BIN**	1. Yes

	with a woman, did you use a condom?	ngono ya mkundu na mwanamke ulitumia mpira?		0. No
M8	The last time you had vaginal sex with a woman, did you use a condom?	Mara ya mwisho, ulipofanya mapenzi ya kuma na mwanamke ulitumia mpira?	**BIN**	1. Yes 0. No
	IF CALLER IS A WOMAN			
F1	Do you have sex with men, women or both?	Je wewe hufanya ngono na wanaume, au wanawake, au wote?	**CAT**	1. Men only 2. Women only 3. Both **SKIP Q29 IF == 2**
F2	Do you have anal sex with men?	Je wewe hufanya ngono na wanaume?	**BIN**	1. Yes 0. No
F3	The last time you had anal sex with a man, did he use a condom?	Mara ya misho ulipokua ukifanya mapenzi na mwanaume, ulitumia mpira?	**BIN**	1. Yes 0. No 9. Don't know
F4	The last time you he vaginal sex with a man, did he use a condom?	Mara ya misho ulipokua ukifanya mapenzi ya kuma na mwanaume, uletumia mpira?	**BIN**	1. Yes 0. No
	ALL CALLERS		**BIN**	
Q29	Do you sometimes sell sex yourself?	Je wewe mwenyewe huuza ngono?	**BIN**	1. Yes 0. No
Q30	If a friend told you that he had a rectal discharge after anal sex, where would you suggest they go for medical care?	Je rafiki yako akikuelezea kua anatokwa na majimaji katika mkundu,niwapi ungependekeza aende kwa matibabu?	**TXT**	____________________ _
Q32	Do you have concerns about your sexual health?	Una wasiwasi kuhusu afya yako ya ngono?		
Q33	If yes: please tell me your main concern?	Kama ndio.tafadhali nielezee wasiwasi wako.		
Q34	We would be very interested to talk more to you. Would you be happy to participate in a longer interview at a later date? (talking about topics such as life style, safer sex etc)	Tungependa kuongea zaidi na wewe. Ungependa kushiriki katika mahojiano marefu katika siku za usoni? (mazungumzo kuhusu maswala ya kimaisha, ngono iliyo salama na kadhalika)		**FILL OUT INTERVIEW APPOINTMENT SHEET** **If client is interested to come forward**

Exit questionnaire: Questions read out by supervisor

Do you agree or disagree with this statement?

1. I understood how to fill in the diary properly
2. I think I may have made some mistakes that the supervisor did not notice
3. Going over my diaries with a supervisor was embarrassing
4. I used condoms more often than normal, because I knew the supervisor would be checking
5. I had more sex that normal during the study
6. I liked to compare my diary with someone else's diary
7. It was dangerous to keep information about my lifestyle in the diaries
8. Some of the things I wrote in my diary did not really happen
9. There were things that I did not want supervisors to know about, and that I did not put in the diary
10. I often remembered that I had forgotten to write something down after I handed in the diary
11. I never showed a card to someone who was not going to pay me for sex
12. Although I might have made mistakes, I was always honest when writing my diaries
13. A stranger who looked at my diary would not understand what it meant
14. I should have been able to give cards to anyone I liked
15. It was best to fill in the week's diary just before going to see the supervisor
16. Overall, cohort visits are less embarrassing than discussing diaries with a supervisor.
17. Overall, the information in my diaries is more accurate than information I can remember when I come for my cohort visits
18. Overall, I was able to be more honest about my sex life using the diaries than when I come for my cohort visits

Exit questionnaire : Anonymous participant form

Do not write your name or study number on this paper

	Agree	50:50	Disagree	Don't know/ didn't apply to me
1	✓	-	×	?
2	✓	-	×	?
3	✓	-	×	?
4	✓	-	×	?
5	✓	-	×	?
6	✓	-	×	?
7	✓	-	×	?
8	✓	-	×	?
9	✓	-	×	?
10	✓	-	×	?
11	✓	-	×	?
12	✓	-	×	?
13	✓	-	×	?
14	✓	-	×	?
15	✓	-	×	?
16	✓	-	×	?
17	✓	-	×	?
18	✓	-	×	?

Please put this in the collections box. Asante

Oxford Tropical Research Ethics Committee
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5th March, 2007.

Dr. Eduard Sanders,
Kenya Medical Research Institute,
P.O.Box 230,
KILIFI 80108,
KENYA.

Dear Dr. Sanders,

Re:- 001-07: Assessing sexual networks of men who have sex with men in and around Mombasa, and validating risk behaviour data in preparation for an HIV-1 vaccine efficacy trial.

Thank you very much for submitting this application, which the Committee considered on the 22nd February, 2007. This was perceived as being an interesting and potentially important study although quite difficult to conduct. It appears that you have taken the practical and ethical problems into careful consideration.

The only things that we would like to raise would be that the running title should be in bold on the information sheet and consent forms, with the full title in smaller case. In addition the OXTREC number should appear on both the information sheet and consent forms.

We are happy to give approval for this study to go forward. Approval is given in the first instance for three years subject to an annual review form being submitted by the investigators to our committee.

Yours sincerely,

Dr. Chris Conlon.
Chairman.

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KEMRI/RES/7/3/1 **February 21, 2007**

Dr. Eduard Sanders,
CGMR-C,
KILIFI

Dear Sir,

RE: SSC No. 1193 – Assessing sexual networks of men who have sex with men in and around Mombasa, and validating risk behaviour data in preparation for an HIV-1 vaccine efficacy trial **PI: E. Sanders (CGMR-C)**

This is to inform you that during the 141st meeting of KEMRI/National Ethical Review Committee held on 20th February 2007, the above mentioned proposal was discussed.

Thank you for a well written, informative and timely proposal that primarily aims to assess risk behavior of MSM through the keeping of diaries and to compare the diary data with the data from standardized questionnaires collected in cohort studies. Secondly, you intend to extend, through the MSMs, a toll-free hotline to paying partners with the view to facilitating anonymous telephone-based risk reduction counseling. Finally you intend to enumerate the number of clients of MSM who sell sex using a capture-recapture methodology.

Due consideration has been given to ethical issues and the study is granted approval. You may proceed with the study.

You are responsible for reporting to the Ethical Review Committee any changes to the protocol or in the Informed Consent Document. This includes changes to research design or procedures that could introduce new or more than minimum risk to human subjects.

Yours faithfully,

RCKithinji

R. C. Kithinji,
For: Secretary,
KEMRI/NATIONAL ETHICAL REVIEW COMMITTEE