Developing a psychological understanding of violence by men with psychosis: laying the foundations for treatment development



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Abstract

Background

Approximately one in ten men with psychosis are convicted of a violent offence. Offences can range from assault and grievous bodily harm to murder. Needless to say, violence has a devastating effect on the lives of victims, perpetrators, and their families and carries a substantial financial cost. For example, it is estimated that 19% of the mental health budget is spent on forensic services. Despite this, there are few evidence-based psychological interventions for reducing violent behaviour. New effective interventions are needed. One way forward may be via identification of the psychological processes underpinning violence that can then serve as targets for treatment. This thesis aims to develop a testable psychological framework for understanding violence by men with psychosis to directly inform future intervention development.

Method

In Chapter 2, in-depth interviews were conducted with twenty male patients with psychosis receiving forensic psychiatric services across three regions in England. Reflexive thematic analysis informed the development of a psychological framework for understanding violence. In Chapter 3, a comprehensive item pool of violence-related cognitions — derived from the qualitative data—was completed by a large sample of men with psychosis (N = 860; over 40% with a previous conviction for a violent offence). Exploratory and confirmatory factor analyses were conducted to develop two psychometrically robust measures of violence-related cognitions. Chapter 4 used structural equation modelling and network analysis to examine the associations between violence-related cognitions and other putative proximal and distal risk factors, and recent violent behaviour, within the same sample (N = 860). Finally in Chapter 5, a mixed design experimental study was conducted to test whether a

mildly intimidating VR social environment activated hostile appraisals and raised anger in men with anger difficulties.

Results

The psychological framework, derived from patient accounts, identified a number of psychological processes underpinning violent behaviour (Chapter 2). Violence was often a habitual response used to manage interpersonal sensitivities (physical threat, disrespect, and injustice), and regulate intense emotions or overwhelming psychotic experiences. Cognitions were a common endpoint for the influence of these processes. As such Chapter 3 presents two psychometrically robust measures of violence-related cognitions: The Oxford Violence-Activating Cognitions Scale and The Oxford Violence-Inhibiting Cognitions Scale. Both measures had an excellent model fit, good internal reliability, and excellent test-retest reliability. Chapter 4 showed violence-activating cognitions partly explained the occurrence of violent behaviours alongside other disinhibiting factors such as anger, substance use, psychotic symptoms, and younger age. Finally, Chapter 5 demonstrated the efficacy of virtual reality (VR) to elicit anger—an established driver of violence in psychosis. Anger was associated with greater endorsement of hostile appraisals of the virtual characters.

Conclusions

This thesis offers a theoretical framework grounded in patients' lived experience, identifies modifiable targets for treatment development, provides robust assessments of novel factors, and demonstrates the potential of virtual reality for treatment development and delivery. Whilst there are a number of limitations, which mean the findings must be interpreted with caution, this work provides a clear path to developing a targeted intervention to reduce violent behaviour.

Declaration

The work described in this thesis was carried out between September 2021 and June 2025 under the supervision of Professor Daniel Freeman and Professor Seena Fazel. The qualitative analysis was supervised by Dr Kate Cooper (Chapter 2) and Dr Aiden Loe closely supervised the structural equation modelling (Chapter 4).The work in this thesis is the candidate's own, with the exceptions listed below:

- Data collection for Chapter 3 & 4 was supported by the NIHR Clinical Research Network and Felicity Hudson, Research Assistant. Data entry was supported by research assistant Izara Alexandia.

- Research assistants (Felicity Hudson, Memoona Ahmed, and Ghizlane Slaoui) supported data collection for study 5.

- The lift scenario used in Chapter 5 was programmed by Dr Aitor Rovira, André Migel, and Matt Bousfeild.

I declare that the work presented in this thesis has not been submitted for any other degree, in this or any other university or institute of learning.

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Introduction:

Although most people with psychosis are never violent, for a significant minority reducing violent behaviour is a pressing clinical challenge. There has been extensive research identifying those patients with psychosis at high risk of violent behaviour, however the causal mechanisms are largely unknown. Many of the risk factors identified are either static or too broad to guide intervention development. Furthermore, there are few theoretical models of violence by people with psychosis and limited effective psychological interventions available. This thesis aims to develop a psychological understanding of violence in psychosis to guide future treatment development. This will be achieved by firstly talking with patients about their experiences with violence; secondly by empirically testing psychological factors putatively associated with violence; and finally, by using an experimental test to evaluate virtual reality as a tool for treatment development and delivery.

This introductory chapter reviews the background literature, highlighting the need for advancements in both theory and intervention. It begins with a definition of physical violence and an overview of its impact. The prevalence of violence in individuals with psychosis is then discussed, followed by a review of established risk factors. Existing models for understanding violence—both in the general population and in the context of psychosis—are examined, along with the efficacy of current treatment approaches. Finally, the Oxford approach to

intervention development is outlined, which has informed the present programme of research.

Defining violence and its impact

The World Health Organisation (WHO) has described violence as one of the leading public health issues of our time (WHO, 2014). Violence is defined as "*the intentional use of physical force or power, threatened or actual that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation*" (WHO, 2002, p.3). Their typology distinguishes four modes in which violence may be inflicted: physical, sexual, psychological, and deprivation. It further divides the general definition of violence into three sub-types according to the victim-perpetrator relationship: 1. Self-directed violence refers to violence in which the perpetrator and the victim are the same individual (i.e. self-harm). 2. Interpersonal violence refers to violence between individuals. 3. Collective violence refers to violence committed by larger groups of individuals e.g. political violence.

It is estimated that in 2019 interpersonal physical violence directly accounted for four hundred and seventy-five thousand deaths worldwide (WHO, 2022). Across all ages, violence victimisation increases the risk of psychiatric diagnoses, suicidal behaviour, and further violence. In addition to the personal cost, violence incurs significant financial cost to healthcare, justice, and social services (Bellis et al., 2012; McCollister et al., 2010; Wilson et al., 2011). The economic burden of interpersonal violence is considerable with an estimated cost of 11% of the worldwide gross domestic product (Iqbal et al., 2021). The WHO has called for a much wider and more comprehensive role for public health in the response to violence advocating for better monitoring of violence, identification of the causes, and formulating and testing interventions to reduce violence (WHO, 2014).

The focus of this thesis is identification of the psychological drivers of interpersonal physical violence by men with psychosis. This was because male patients constitute the majority of the forensic mental health population, and the significant differences in offence rates, recidivism patterns, and offending profiles between genders suggests separate investigations may be needed (de Vogel et al., 2016; Klier et al., 2013; Koons-Witt & Schram, 2003).

Violence by people with psychosis

Psychosis encompasses a number of symptoms associated with significant changes in a person's perception, thinking, mood, and behaviour. Individuals experience a combination of positive symptoms, which may include delusions (fixed falsely held beliefs), hallucinations (perceptions in the absence of stimulus), and/or disorganised speech, behaviour, or thinking, and negative symptoms such as lack of motivation or avolition (American Psychiatric Association, 2022). Psychosis is associated with a range of adverse outcomes including suicide (Hor & Taylor, 2010), greater pre-morbid mortality (Fazel et al., 2014), violent victimisation (Sariaslan et al., 2021), and violence perpetration (Fazel et al., 2014).

Although psychosis is associated with an elevated risk of violence, most patients with psychosis are never violent. The relationship between psychosis and violence is often overstated, particularly in the media reporting of violent crimes (Maletta & Vass, 2023). This linking of psychosis to violence has led to increased stigma and a public perception that those with psychosis are dangerous (Chan et al., 2019; Maletta & Vass, 2023; Ross et al., 2019). It is necessary, therefore, to be thoughtful in our approach to this topic. Research on the link between violence and psychosis may serve to increase or reinforce stigmatised views of patients. However, for an important minority of patients reducing violent behaviour is a pressing clinical challenge that warrants investigation.

Estimates of the prevalence of violence in psychosis vary. A total population cohort study in Sweden (N=24,297) found 10% of men and 3% of women with psychosis were convicted of a violent offence over the five years from diagnosis (Fazel et al., 2014). They also matched those with psychosis to people in the general population based on age and gender and also compared them to unaffected siblings. They found that people with psychosis had seven times the adjusted odds of being convicted for a violent offence compared to the general population and five times the adjusted odds of a violent conviction compared to unaffected siblings. A systematic review of register-based studies examining the rate of violence in psychosis (N= 50,250) found an absolute risk of violence of less than one in four for men (range reported across studies 2.3-24.7%) and less than one in twenty for women over a 35-year follow up period (Whiting et al., 2022). A recent UK study, which examined individuals consecutively assessed by two Early Intervention Teams over 12-months, found that 26% had perpetrated physical violence and one in seven were arrested or charged with a violent offence (Whiting et al., 2020). These figures illustrate that for a sizable minority of those with psychosis, reducing violent behaviour is a key treatment target.

Risk factors for violence by people with psychosis

There has been extensive research identifying those patients with psychosis at high risk of committing violence. High quality meta-analyses have helped distil the available data[1] (Lagerberg et al., 2025; Witt et al., 2013). Static risk factors such as previous criminal convictions, young age, male gender, and a history of substance misuse have the largest associations with future violence (Fazel et al., 2009; Witt et al., 2013). Dynamic risk factors such as hostile behaviour, poor impulse control,

[1] I am a co-author on a systematic review and meta-analysis published in 2025 that examined the risk factors that predict future violence in psychosis (Lagerberg et al., 2025, See Appendix A). The findings of this review have been referenced in this chapter and have informed the thesis

non-adherence with psychological therapies or medication, recent substance or alcohol misuse also predict violence (Witt et al., 2013). The relationship between positive symptoms and violence has been significant but relatively modest (Odds Ratio (OR)=1.12) (Lagerberg et al., 2025). Fewer studies have measured paranoia, however two independent studies found paranoia predicted future violence with a large effect size (OR=3.07) (Lagerberg et al., 2025). Premorbid factors associated with an increased risk of violence include recent violent victimisation (OR=5.81), previous violent history (OR=3.5), history of self-harm (OR=1.74) and a history of parental violent crime (OR=1.37) (Lagerberg et al., 2025; Witt et al., 2013). There is clear progress in understanding risk factors for violence. However, many of the risk factors identified are static whilst dynamic factors (e.g. adherence to treatment and hostile behaviour) are too broad to guide targeted treatment development, highlighting the need for mechanistic models that can inform intervention.

There are several methodological challenges in identifying the key factors associated with violence in psychosis. Many epidemiological studies have used large datasets drawn from health and social care records (e.g. Fazel et al., 2014). These datasets are more likely to capture static factors such as demographic characteristics, diagnoses, and previous violent offending, whereas dynamic psychological factors such as violent attitudes, the nature and subjective experience of hallucinations and delusions, and emotional states are less likely to be included. Thus, many of the risk prediction models derived from these datasets predominantly include static factors (e.g. Fazel et al., 2017). A further challenge is that many psychological factors (e.g., anger, paranoia) fluctuate over time, and their exact intensity during a violent incident is difficult to determine. Other important factors influencing the occurrence of violence may be situational and can only be assessed retrospectively following a violent incident. As such, they are likely to be affected by poor insight, recall bias, or social desirability. Finally, establishing causality between risk factors and violent behaviour remains

particularly challenging. Many studies use retrospective designs, which increase temporal ambiguity (i.e. uncertain whether the risk factor predate the violent incident), risk of biased sampling, and observer bias (e.g. the researcher interpretation of assessments might be impacted by knowing the participant has been violent previously). However, prospective studies require large samples as the rate of violence in psychosis is low reducing feasibility.

General models for understanding violence

Understanding the mechanisms underlying violent behaviour has been a central concern in forensic and criminal psychology for decades. This pursuit has resulted in several influential theoretical frameworks that attempt to explain how violence develops and is maintained across different populations and contexts. The three most widely used models of aggression are social learning theory (SLT) (Bandura, 1978), social information processing theory (SIP) (Crick & Dodge, 1996), and the general aggression model (GAM) (Allen et al., 2018; Anderson & Bushman, 2002). Each offers a distinct perspective on the pathways to violent behaviour, yet all share the fundamental assumption that aggression is not simply an automatic response to environmental triggers, but rather emerges from complex interactions between individual characteristics, social experiences, and situational factors.

Social learning theory of aggression (Bandura, 1978) posits that aggression develops through social processes. Bandura illustrated through a series of experiments with children that aggression is a behaviour learnt through observation, imitation, and modelling. Aggressive behaviour is shaped by differential reinforcement, defined as the balance of rewards and punishments (anticipated or actual) that follow a behaviour, either directly or vicariously through observations of the consequences aggressive behaviour has for others.

Social information processing model (Crick & Dodge, 1996) describes the individual, social, and situational processes that lead to aggressive behaviour. These include encoding of social cues, attribution of meaning, goal clarification, consideration of the response options, response decision, and finally behaviour enactment.

General aggression model (Allen et al., 2018; Anderson & Bushman, 2002) is an overarching framework that describes how biological, cognitive, and social factors can lead to aggression. It combines features of the previous two models making a distinction between distal factors and proximal factors. Distal factors such as biological modifiers (e.g. ADHD, hormone imbalances) and persistent environmental factors (e.g. cultural norms, antisocial peer group) over time influence personality. Personality then influences proximate processes that explain an individual episode of aggression. These proximal factors include person-related factors and situation-related factors. *Person factors* are any individual differences that may influence how a person responds to a situation (e.g. self-esteem, positive attitudes about violence). Whilst *situation factors* are aspects of the situation that may influence whether aggression occurs (e.g. social rejection, goal frustration). These interact to influence an individual's internal state, their appraisal of the situation, and decision process. Then the final stage is that the person decides how to respond.

The GAM is a very broad and inclusive model and although it may be helpful in organising information, it does not highlight key factors sufficiently to allow empirical testing of the model or direct treatment development. In contrast both SLT and SIP have been criticised for being oversimplistic. SLT highlights the importance of the social context but perhaps neglects individual and situational factors, whilst SIP implies the individual is systematically working through cognitive steps and neglects to incorporate other factors such as emotions, habitual responses, or systemic factors. In addition, while these general models have advanced our understanding of violence, their applicability to specific clinical

groups remains questionable. When considering violence in the context of psychosis, unique phenomenological features—such as altered reality testing, command hallucinations, and delusional beliefs—may create pathways to violence that are not adequately captured by these models. Some efforts have been made to specify testable theories of violence in psychosis. A review of these will be outlined below.

Psychological models for understanding violence in psychosis

A systematic review was conducted to identify existing psychological models of violence in psychosis (see Table 1.1). A small number of psychological models were identified that have been proposed to explain violence by patients with psychosis. On the basis of a narrative review, Lamsma & Harte (2015) and Volavka et al., (2011) propose different causal pathways between predisposing risk factors (including social factors such as family history of criminality or neighbourhood with social problems), psychiatric disorder (e.g. schizophrenia, comorbid antisocial personality, substance misuse), psychiatric symptoms (e.g. hostility, positive symptoms, agitation), and precipitating factors (e.g. stress, treatment non-adherence) and violence.

Table 1.1: Systematic review to identify existing psychological models of violence by patients with psychosis.

On January 9th 2023 PubMed, PsychInfo, Web of Science, and Embase were searched - with no date or language restrictions - using the following search terms: (Psychosis OR Schizophrenia OR Forensic) AND (Anger OR Violence OR Aggression) AND (Model OR Theor*). 5476 papers were identified. Five proposed theories of violence were identified based on narrative reviews of the literature. There were no psychological models of

violence explicitly grounded in research on patients' subjective experiences.

Other models have focused on a single driving factor for violence. Adams and Yanos (2020) proposed that violence in psychosis is primarily driven by anger, exacerbated by substance misuse and impulsivity. Anger is hypothesised to arise from a number of factors, including victimisation, social stressors, anxious arousal, and hostile attribution bias. In support of this theory, Coid et al (2013) found the relationship between delusions and serious violence was mediated by anger due to delusional beliefs. However, anger has not been examined in a sufficient number of studies to be included in meta-analyses (Lagerberg et al., 2025; Witt et al., 2013). Two theories suggest that specific psychosis symptoms lead to violence (Link & Stueve, 1994; McNiel et al., 2000). The control-threat override theory posits that violence occurs when delusions cause a person to feel personally threatened or involve the intrusion of thoughts that override self-control (Link & Stueve, 1994): though this has not been consistently replicated (Appelbaum et al., 2000). Command hallucinations, when the person believes the voices they hear are omnipotent and powerful, can contribute to the occurrence of violence. (McNiel et al., 2000). Shawyer et al. (2003) reported a median prevalence rate of 53% for command hallucination in a sample of adult psychiatric patients; of these, 48% commanded harmful or dangerous actions. Prevalence was significantly higher in the forensic population with 83% of voice hearers experiencing command hallucinations with harmful content (Beck-Sander et al. 1997). However, in the Macarthur study of risk factors for violence (Appelbaum et al., 2000), there was no association between the presence of command hallucinations and violence.

Current treatments to reduce violence by those with psychosis.

Forensic mental health services

Forensic services provide mental health treatment to patients with a history of violence who pose a risk to the public (Davoren et al., 2015). Typical offences include violent offences (e.g. assault, grievous bodily harm), attempted murder, or manslaughter (Kasmi et al., 2020). There are 7,700 forensic secure beds in England and Wales. Approximately 70% of patients in secure services have a primary diagnosis of psychosis (Coid et al., 2007). Forensic services have the dual aim of improving mental health and reducing risk to others (Dickins et al., 2015). Costs per patient are substantially more than psychiatric inpatient hospitals with an estimated annual budget of over £1 billion (Wilson et al., 2011), equivalent to 19% of England's mental health budget (Fazel et al., 2016). Despite being a costly, lengthy, and restrictive intervention, rates of recidivism remain high after discharge. A Swedish study found, 40% of forensic psychiatric patients violently offend after their first discharge over a mean follow-up of 9.4 years (Fazel, Wolf, Fimińska, & Larsson, 2016). UK based studies have reported that 18% are convicted of a violent offence following discharge from a forensic service and 12% are convicted of grave offences (e.g. homicide) over a mean follow-up period of 6.2 years.

Psychological therapy.

The available evidence on psychological interventions for psychosis and aggressive behaviour is limited. A national survey of UK forensic services found that the majority of offence specific group treatment programmes used were developed 'in-house' and had not been subjected to even a local service evaluation of effectiveness (Mallion et al., 2020). Few randomised controlled trials (RCT) have been conducted of psychological interventions targeting the reduction of violence by forensic patients with psychosis. The key treatment targets of interventions have included reducing anger, self-reported aggression, and incidents of violence. Most interventions have been adapted versions of those used in prison (e.g.

Reasoning and Rehabilitation, R&R) or with general psychiatric populations (e.g. dialectical behaviour therapy (DBT), cognitive behaviour therapy (CBT)). However there are two randomised controlled trials, which tested interventions specifically developed for people with psychosis (Birchwood et al., 2018; Haddock et al., 2009).

Haddock and colleagues conducted a RCT of CBT for psychosis with anger management (Haddock et al., 2009), compared to an active control arm, social activity training (SAT). They found no effect on anger and no difference between groups in the overall incidents of aggression or verbal aggression during treatment or follow up. However, they did find a significant difference in incidents of physical aggression during follow up period. Birchwood and colleagues developed an intervention specifically targeting harmful compliance with command hallucinations (Birchwood et al., 2018). Harmful compliance included harm to self and harm to others. Participants were randomised to either CBT for command hallucinations or treatment as usual. The treatment targeted beliefs about voices as being omnipotent and powerful. They found a significant effect of treatment on harmful compliance and this was maintained at 18-month follow-up. However, they did not measure violent incidents or aggression and did not provide a breakdown of the types of harmful compliance, thus it is hard to draw conclusions on the impact on aggressive behaviour.

A recent meta-analysis evaluated the effect of psychological interventions used in forensic services on anger, self-reported aggression, and incidents of aggression (McIntosh et al., 2021). Interventions included R&R (k=5), aggression replacement training (k=2), DBT (k=1), and forgiveness skills (k=1). The meta-analysis (k=9) found no effect on anger or self-reported aggression. The effect of treatment (k=3) on incidents of aggression was also not effective. In addition to the poor treatment outcomes, other challenges for the field have been identified. Studies have reported very high levels of attrition (Cullen et al., 2012; Young, 2010; Young et al., 2010). Most studies have

small sample sizes and are thus likely underpowered to detect treatment differences (Appelbaum et al., 2000). Few interventions have been developed specifically for people with psychosis and a history of violent behaviour. Developing interventions specifically matched to the needs of this population, and ideally designed with a co-design or person-centred design approach, may help improve engagement, treatment completion, and clinical outcomes.

Virtual reality psychological therapy for anger and aggression.

Virtual reality (VR) social simulations may be a safe way for people with difficulties with anger or aggression to practise overcoming unhelpful reactions. VR uses three-dimensional simulations of environments that can be navigated around and interacted with in a real way. It provides a safe, controlled space for patients to learn at their own pace. Environments can be designed to match the situations patients find most challenging. Clinically relevant features such as types of people, facial expressions, and noises can be embedded to increase the potency of the experience. Tasks can be repeated and the level of difficulty graded. Studies have shown that patients are more willing to enter challenging VR situations and experiment with alternative ways of responding because they know it is not real (Bond et al., 2023). Crucially, the learning made in VR translates into the real world (Freeman et al., 2022). Randomised controlled trials have demonstrated the effectiveness of VR psychological therapy in treating anxiety-related difficulties such as phobias (Freeman et al., 2018; Parsons & Rizzo, 2008), posttraumatic stress disorder (W. Deng et al., 2019), psychosis and agoraphobic avoidance (Freeman et al., 2022), and persecutory delusions (Freeman et al., 2016; Pot-Kolder et., 2018). VR has great potential for the treatment of anger and violence, particularly for populations with restricted opportunities to practice new skills, (e.g. forensic inpatients or prison

populations) or those who, due to the risk of harm to others, cannot participate in behaviour therapy in real world settings.

More recently, researchers have begun to use VR in the treatment of difficulties with anger and aggressive behaviour (Smeijers et al., 2021; Tuente et al., 2018, 2020). Tuente and colleagues (2020) conducted a multisite RCT to test the effectiveness of VR Aggression Prevention Training (VR-APT) with forensic inpatients. The therapy was designed based on the social information processing model of aggression. Forensic patients were randomised to either receive 16-sessions of VR-APT or a waiting list control group. There was no significant difference in aggressive behaviour (measured through staff-observation or self-report). There was a temporary improvement in anger control skills, impulsivity, and hostility but these were not maintained at 3-month follow-up. Smeijers and colleagues (2021) developed a VR aggression impulse management game which involved promoting an avoidance response to aggressive social stimuli. Participants were randomised to receive the VR therapy or a control game. They found no effect of intervention on anger or aggressive behaviour.

There are a number of requirements necessary for the development of effective VR interventions (1) the virtual environments need to be able to activate the emotional and cognitive processes that underpin the presenting problem, (2) the treatment techniques applied need to be effectively targeting the right mechanism and (3) the treatment needs to reflect the goals and needs of the patient group that it was designed for. It could be argued that the preliminary work to achieve these have not been adequately addressed to date in the development of VR interventions for aggression and this may have contributed to the poor outcomes by the aforementioned studies.

There is little research demonstrating that VR can be used to activate anger and, if so, what features of VR successfully elicit anger. Two studies have illustrated the potential of VR to activate anger. Miyahira et al. (2010) randomised-sixty healthy soldiers and military

retirees to view anger provoking vignettes as a VR 360 video or on a flat screen. They demonstrated significant anger arousal in response to VR 360 video vignettes when compared to those viewed on a flat screen. Unlike immersive VR, 360 videos do not allow the user to actively participate in the scenario and instead the user is solely a spectator. Immersive VR may have greater applicability for skills development as it allows the user to actively participate in the scenario. One study did record anger levels during an immersive VR experience (Jo et al., 2022). Sixty-male participants, divided into high and low aggression groups, completed scenarios where they had an argument with a virtual character. During these scenarios, participants were instructed to first express their anger (argument condition) and then to attempt to resolve the conflict (resolution condition). Users reported higher levels of anger in the argument condition compared to the resolution condition. There was no difference between the high and low aggression groups. To the best of our knowledge, no other studies have tested the use of immersive VR in activating anger. The first step in developing VR treatments for anger and aggression will be to test whether anger can be caused by simulations of everyday stressful social situations.

The current research

As evidenced in this chapter, reducing violent behaviour is a clinical priority for a significant minority of men with psychosis. Despite the far-reaching consequences, our understanding of the psychological drivers of violence in psychosis remains limited. This is reflected in a lack of evidence-based interventions to prevent or reduce violent behaviour. This represents a critical gap in mental health provision that requires focused research attention. The overarching aim of this thesis is therefore to develop a testable psychological framework for understanding violence by men with psychosis that can directly inform future intervention development. This work will draw on the Oxford Approach to the development of evidence based cognitive therapies (Clark, 2004).

Spearheaded by Clark and Ehlers, the Oxford Approach has led to the development of several NICE recommended psychological therapies for anxiety disorders (Clark, 1988; Ehlers & and Clark, 2008; National Collaborating Centre for Mental Health (UK), 2006) and has more recently been successfully applied to persecutory delusions (Freeman, Emsley, et al., 2021). This approach advocates for the specification of a testable theoretical account of the core processes associated with the presenting problem, developed through patient interviews and an examination of the available literature. The proposed mechanisms can then be tested through observational studies and experimental manipulations. Treatment techniques can then be developed to target the processes shown to drive and maintain the presenting problem. Treatment techniques are extensively tested through experiments, case series and randomised controlled trials. This programme of research will conduct the early stages of this approach – laying the foundations for treatment development and testing.

Aims and objectives

The aims of this programme of research are:

1. To develop a testable psychological framework explaining violence in psychosis grounded in patient experience (Chapter 2).
2. To develop psychometrically robust measures of new cognitive factors identified by the framework (Chapter 3).
3. To identify the cognitive processes and other factors most closely associated with physical violence and which may serve as targets for future treatment development (Chapter 4)
4. To evaluate the use of VR as a tool for treatment delivery by testing whether a VR simulation of a mildly intimidating social situation can trigger anger and test if the effects are greater in those who have anger difficulties. (Chapter 5).

2

A psychological framework for understanding violence by people with psychosis.

This chapter is adapted from the following published paper, shown in Appendix B: Lambe, S., Cooper, K., Fazel, S., & Freeman, D. (2024). Psychological framework to understand interpersonal violence by forensic patients with psychosis. *The British Journal of Psychiatry*, *224*(2), 47–54. https://doi.org/10.1192/bjp.2023.132

Abstract

Background

Forensic patients with psychosis often engage in violent behaviour. There has been significant progress in understanding risk factors for violence, but identification of causal mechanisms of violence is limited.

Aim

To develop a testable psychological framework explaining violence in psychosis - grounded in patient experience - to guide targeted treatment development.

Methods

In-depth interviews were conducted with twenty patients with psychosis using forensic psychiatric services across three regions in England. Interviews were analysed using reflexive thematic analysis. People with lived experience contributed to the analysis.

Findings

Analysis of interviews identified several psychological processes involved in the occurrence of violence. Violence was the participants' dominant response mode to difficulties that was both habitual and underpinned by rules that engaged and justified an attack. Violence was triggered by a trio of sensitivities to other people: sensitivity to physical threat from which violence protected, sensitivity to social disrespect by which violence increased status, and sensitivity to unfairness by which violence delivered revenge. Violence was an attempt to regulate difficult internal states: intense emotions were released through aggression and violence was an attempt to escape being overwhelmed by voices, visions, or paranoia. There were different patterns of emphasis across these processes when explaining an individual participant's offending behaviour.

Interpretation

A seven-factor model of violence is presented derived from our analysis of patient accounts. It highlights multiple modifiable psychological processes that can plausibly lead to violence. The model can guide the research and development of targeted treatments to reduce violence by patients with psychosis.

Introduction

As outlined in Chapter 1, there is clear progress in understanding risk factors for violence, however many of these factors are static and provide little guidance for treatment development (Fazel et al., 2009; Lagerberg et al., 2025; Witt et al., 2013). Modifiable causal mechanisms driving violent behaviour are still largely unknown (Fazel et al., 2016; Witt et al., 2013). The development of effective psychological therapy requires a theoretically-driven approach. Treatment techniques need to target key mechanisms that contribute to the occurrence of aggression (Barnao et al., 2010; Skivington et al., 2021). Our understanding of these mechanisms could be advanced by speaking with the patients themselves. Acceptability of a treatment approach is likely to be enhanced if models are aligned with patient experience.

A systematic review was conducted on Dec 15, 2022 to identify any existing qualitative papers examining psychological processes underpinning violence in psychosis. Databases PubMed, PsychInfo, Web of Science, and Embase were searched with no date or language restrictions using the following search terms: (psychosis OR schizophrenia OR forensic) AND (anger OR violence OR aggression) AND (qualitative). 926 papers were identified. Six qualitative studies have examined anger or violence in patients with psychosis in either forensic or community mental health services. These varied in focus, such as managing risk of violent behaviour (Haggard-Grann & Gumpert, n.d.; Levin et al., 2022), the role of mental illness in violence (Radovic & Höglund, 2014), identifying types of violent acts (Yosep et al., 2022), the occurrence of violence in parent-child dyads (Hsu & Tu, 2014), and experiences of violence on inpatient wards (Olsson et al., 2015). No studies focused on the psychological factors leading to violence in forensic patients with psychosis.

The present study aimed to understand, from forensic patients with psychosis, the key psychological processes that may drive violent behaviour. Studies have found that the risk factors for minor and more

severe forms of interpersonal violence are similar (Witt et al., 2013), thus participants were interviewed about a range of violent incidents including their index offences.

Method

Study design

Reflexive thematic analysis (TA)(Braun & Clarke, 2006; Clarke & Braun, 2021) was used to investigate the psychological processes involved in violence by forensic patients with psychosis. Reflexive thematic analysis is a qualitative research method for analysing and interpreting patterns across a dataset of interviews. It requires researchers to critically interrogate their own experiences, preconceptions, and biases and consider how these may affect the analytic process. The study received approval from an NHS Research Ethics Committee (London - Riverside Research Ethics Committee; ref 21/LO/0892).

Participants

Purposive sampling was used to ensure representation across stages of recovery and severity and form of violent behaviour. A sample of twenty participants allowed for in-depth interviewing and analysis while also ensuring a sufficient breath of viewpoints. Participants were recruited from three NHS Trusts: Oxford Health NHS Foundation Trust (Oxford, UK), West London NHS Trust (London, UK), and Devon Partnership NHS Trust (Devon, UK). Participants were included in the study if they were aged 18 yearsor older, identified as male, had a primary diagnosis of schizophrenia spectrum disorder, and a history of interpersonal violence. Participants were excluded if their offending was primarily sexual violence, if they had a learning disability, or if their verbal English was insufficient to take part in the interview.

Positionality

A critical realist approach underpinned the analysis. Critical realism theory posits that there exists an objectively knowable reality, but acknowledges that perception and cognition influence how that reality is

observed. In other words, there is a singular true reality but it cannot be accessed directly, rather the beliefs and experiences of the researcher influences how that reality is perceived, interpreted and represented. It is therefore necessary for the researchers to critically interrogate their own experiences, preconceptions, and biases and consider how these may affect the analytic process. This aligns with reflexive thematic analysis, the approach taken in this study, which emphasises the importance of reflexivity throughout the analytic process.

Reflexivity

The positionality of the researcher (SL) and academic supervisors will be described with consideration of how this contributed to reflexive research practice. The researcher is a female clinical psychologist, who works in the National Health Service (NHS) as well as conducting research at the University of Oxford. Her clinical work focuses on cognitive behaviour approaches to treating psychosis and she has worked in general adult mental health services and forensic mental health services. Her supervisory team specialises in cognitive approaches to psychosis (DF), forensic psychiatry (SF), and qualitative research methods (KC). The research was also supported by a lived experience advisory panel (LEAP) who had difficulties with interpersonal violence and had been admitted to a medium secure forensic unit. At the onset of the study, SL had discussions with each member of the research team about their perspectives on the nature of violence in psychosis.

As a clinical psychologist with an interest in cognitive behaviour therapy, the researcher was aware that she would be drawn to developmental and psychological factors that lead to violence. The researcher was therefore careful to listen attentively to accounts of other factors, for example related to biological factors or psychopathology. The researcher checked out her interpretations with the LEAP and supervision team – supervision with a forensic psychiatrist was particularly helpful for interrogating her interpretation.

The researcher had no direct exposure to violence though she had worked with many perpetrators and victims of violence in her work as a clinical psychologist. Listening to accounts from participants was often like entering a different world. She therefore tried to explore events and topics raised in a very open and neutral way. She tried to not make any assumptions about what these experiences would be like (instead asking follow up questions and checking her understanding) as she was aware that her response in those situations (e.g. scared) might be very different from that of the interviewee (e.g. excited). Many participants were inpatients and clinical staff did not sit in on interviews. This was to help ease any anxiety of participants that discussing details of their past violence might influence decisions about their progress and leave. Though it was made clear the limitations of confidentiality, participants were reassured that their interviews would not be shared with their clinical team. The impact of differences in gender, socio-economic status, and race were explicitly considered in discussions in supervision and with the LEAP throughout the interviews and analytic process.

Procedure

Participants were initially told about the research by their clinical team and only if they expressed an interest were they approached by the research team. Limitations of confidentiality were clearly explained. Participants provided written informed consent to take part and for quotes to be used under a pseudonym in later publications. Participants were given a two-week cooling off period, where they could contact the researcher to withdraw and have their interview deleted.

All interviews were conducted by a clinical psychologist (SL) trained in reflexive thematic analysis. Interviews were audio recorded and later transcribed verbatim by a professional transcription service. Interviews were semi-structured to facilitate a more open and flexible discussion and to allow the exploration of unanticipated themes. The interview guide (Appendix C) was developed based on input from a lived

experience advisory panel (comprising of four people who had had psychosis and used forensic psychiatric services), discussions with clinicians working in forensic services, and a review of literature on risk factors for violence by forensic patients with psychosis. Three pilot interviews were conducted with people with lived experience to ensure the questions and interview style promoted openness and elicited the depth of description needed to achieve the study aim. These data were not included in the analysis.

Interviews started with an initial open question about the patient's experience with violence. Subsequent questions focussed on the initial emergence of violent behaviour, an in-depth description of significant incidents of committing violence, including the build-up to the incidents and the thoughts and emotions before, during, and after. Questions also explored 'near misses' when there was an urge to be violent that was not acted on, which aimed to identify inhibiting factors for violence and understand how patients experienced the consequences of not being violent when feeling provoked. It was emphasized that the information given by the participant in the interview would only be shared with care teams if a disclosure significantly altered their current risk assessment. Follow-up questions and probes were used as appropriate.

Analysis

The analysis followed the guidance provided by Braun and Clarke(Braun & Clarke, 2006; Clarke & Braun, 2021) for reflexive TA. Audio recordings were listened to and transcriptions read and re-read to ensure familiarity. All transcripts were coded paying attention to both descriptive and conceptual elements within the data. Text could be coded to several initial codes at once. Codes were considered against the whole dataset and similar codes with similar meaning were combined. Thematic maps were used to aid the development of themes and consider the links and relationships between themes. Themes were considered in relation to the research aim and any themes that fell outside the study

remit or did not have sufficient data to support them were discarded. Quotes were selected if they provided a good summary of the core of a theme and represented views across the range of participants. Codes and themes were reviewed in supervision and by members of the lived experience advisory panel to ensure a rigorous credibility analysis was conducted (Elliott et al., 1999).

Results

Recruitment took place from February 23rd 2022 to May 24th 2022. Of 22 patients approached, 20 consented to take part in the interview. Participants' mean age was 36.4 (sd=11.0: range 20-56) and ethnicity was reported as White British (n=10; 50%), White Other (n=3), Black British (n=2), White and Black Caribbean (n=2), Black African (n=1); White and Black African (n=1) and Mixed White and Asian (n=1). Participant index offences included violent offences such as assault, battery, grievous bodily harm, affray, or use of an offensive weapon (n=15), attempted murder (n=2), manslaughter (n=2), and murder (n= 1). Clinical and crime-related information is shown in Table 2.1.

The analysis identified three themes: (1) Violence as a dominant response mode; (2) Violence protects against a tripartite of sensitivity to other people; and (3) Violence relieves negative internal states. There were seven subthemes across these three themes, each representing a different psychological factor contributing to violence (See Table 2.2 & 2.3).

Theme 1: Violence as the dominant response mode

In this theme, violence had become a dominant response to difficulties. It has become an established behaviour through social learning [subtheme

1A: Violence is all I know]. Participants had a rigid set of rules, which guide their behaviour during a confrontation [subtheme 1B: Rules for engagement]. These rules provided a way for participants to justify their behaviour.

Table 2.1: Participants' clinical and offending information.

	n (%)
Primary diagnosis	
Schizophrenia	17 (85)
Schizoaffective disorder	3 (15)
Secondary diagnoses	
None	11 (55)
Personality disorder (antisocial, borderline)	4 (20)
Substance misuse	4 (20)
Generalised anxiety disorder	1 (5)
ADHD	1 (5)
Forensic service	
Medium secure acute ward	3 (15)
Medium secure rehab ward	14 (70)
Low secure ward	2 (10)
Community forensic service	1 (5)
Previously admission to high secure forensic unit	1 (5)
Previously admission to medium secure forensic unit	9 (45)
Previous convictions	13 (65)
Previous violent conviction	11 (55)
	m(sd)
Length of forensic admission (months)	33.8 (28.2)

Subtheme 1A: Violence is all I know

Violence was a habitual response to interpersonal difficulties and happened without significant conscious thought.

Just brush past me or stand next to me. I just turn around and smack them. **Kyle**

Family members and peers modelled and normalised using violence. Participants were exposed to violence, criminality, and drugs as they grew up. Local criminal gangs often displayed wealth and this lifestyle was further promoted in favoured music and film. In this context violence achieved results, was reinforced by peers, and formed part of a positive social identity.

It becomes so normal to you that you don't even see it as aggressive behaviour. **Amadi**

> *My older brother, he's six years older than me, he was a football hooligan, and he liked fighting, and he was an influence on me. He was always wrestling me, telling me he was going to toughen me up, and I should fight at school and be the hardest, and, constantly telling me that. I grew up thinking that. I grew up thinking I had to be big and hard and fight people*. **Dean**

> *I could have started saying look I'm a bad man, I'm a gangster, who the fuck are you fuck… do you know who you're messing with? Who do you think you're talking to?* **Juan**

A limited behavioural repertoire for managing interpersonal difficulties meant that even when motivated, participants struggled to conceive how situations could be handled without violence, beyond the complete avoidance of triggers.

I don’t have a choice, some people would say there’s always a choice but, I don’t think I’ll ever be normal again, like I’d love to be. I’d feel uncomfortable going out on dates with girls because of things that could arise. Like going out with a girl, going to a bar, there’s a situation when I’m drunk, someone is trying to chat to my girl. So I’m saying that, that’s my girl don’t chat to her, and then if he gets lairy, I’ll end up bottling the guy. **Jamar**

Subtheme 1B: Rules of engagement

Rules guided behaviour during a violent confrontation with the aim of increasing the chance of winning the fight, maintaining a reputation, and providing justification. Key rules included: if you believe someone is going to harm you, it is best to hit them first, hit them until they can’t get up, and scare them enough that they won’t retaliate in future.

Because I don’t want to get attacked first, I don’t want to get hit first, so I always attack first. **Jamar**

But say if they see me that’s when I pull out my weapon, I will try and chase them or try stabbing them or something. Because I want to scare them. Or else I’ll probably get stabbed or something, yes or it will happen to me. **Adam**

Some rules reflected the views of wider social networks on how to behave during a confrontation. For example, if a friend is in a fight then you must step in too; If someone brings trouble to you, you must deal with it rather than involving the police. These rules led to more reactive and extreme violence and perpetuated cycles of violence.

If you see your friend get scared well now you've got to step up because he's part of your group of people, so now you've got to let the people know they can't mess with your mate like that because he's got back up. **Dan**

I didn't press charges against the guy that stabbed me. **Juan**

The threshold by which violence was considered a justified response was low, whilst the degree of force deemed appropriate was severe. It was often black and white – if someone was considered to have 'crossed a line' then any level of violence was justified. These justifications allowed absolution of guilt or remorse.

And I walked up to him and I was like…like 'you say that again to my face'. And he said it again to my face. I grabbed him. I punched him until he was a puddle. I punched him really really hard on the face over and over again **Lewis**

I wouldn't feel anything. I wouldn't feel remorse. I just carry on what I'm doing. I won't give a shit. They tried something with me and I put them in their place and that's the way it was. That's the way me and my mates score up. **Kyle**

Theme 2 –Violence protects against a tripartite of sensitivities

In this theme, violence was a response to the behaviour of others. Participants were highly sensitive to disrespect [sub-theme 2A], threats of physical harm [sub-theme 2B], or unfair treatment [sub-theme 2C], whether real or imagined. They held positive beliefs about violence as a method for increasing social status, protecting oneself, and getting justice.

Sub-theme 2A: Sensitivity to disrespect

Subtle behaviours, such as body language or tone of voice, were interpreted as disrespectful. Violence was used to re-establish social status. Delusional content (e.g. that others are laughing or mocking you) amplified this process.

'Look. Like, if you talk to me in a certain way and I don't like it, I'm gonna fight you.' **Amadi**

My index offence is somebody that was in supported lodging that I believed was reading my mind and yeah I stabbed him with a knife. Yeah, mocking me, laughing at me. Knew exactly what I was thinking. **Dean**

Participants described feeling 'worthless' and 'unloved' from growing up in poverty and being criticised, bullied or abused. Violence became an effective way for of proving oneself and gaining respect.

My other brother who was six years older, always bullied me and tried to humiliate me and mock me in front of people. **Dean**

Because your life is worthless, you don't mind if you hurt somebody else's life, so that aggressiveness can come out of you from time to time. **Amadi**

I had my first fight when I was about eight, nine years old. And then I found out what it was like for people to be frightened of me and respect me. And then things just escalated from there. **Juan**

Table 2.2: Three themes and seven subthemes illustrated by quotes.

Theme 1: Violence is a dominant response mode.
Sub theme 1A: Violence is all I know.
I grew up with violence, I grew up with gangs. Violence is all I know **Garry**
If you think like people are lying to you then that [violence] is the only way deal with it **Sorin**
Sub theme 1B: Rules of engagement
You know someone's saying something bad and talking shit about you, you go and deal with it. I lived by these rules for a long time. **Kyle**
Something could happen to me, so I don't stop until I know they're out. **Jamar**
I mean once I've beaten them up and they're lying on the floor and they're bleeding or they're unconscious I will stop; I won't kill them. **Pasquale**
Sometimes like my friend will get in trouble and I have to fight because he's in trouble. **Adam**
Theme 2: Violence protects against a tripartite of sensitivities.
Sub theme 2A: Sensitivity to disrespect
I was not respected at home. I was not loved you know and I was abused. So I felt better when I was in the gang, I thought well I am somebody now, do you know what I'm saying, even though I'm a criminal. **Pasquale**
All I want to do is fight. I always have to prove myself or if I think someone's better than me or something being violent is the way forward. **Kyle**
When I see someone back down from something, I think oh he's now accepted a lower rank in the hierarchy than another person who's now taking his place in the ranking of the hierarchy. There

are some people who stay completely out of it, and I struggle to understand how they do it. **Mark**

I was travelling on the bus, I thought people had taken the mick out of me, so I had a bit of a go at them. They were just sat really close to me and just laughing all the time. Thought they're probably making fun of me. **Scott**

Sub theme2B: Sensitivity to physical harm

Punches. Crutches hit across my head, iron bars hit across my head. You know I got stabbed when I was 17. I was in a coma. **Juan**

I became a scary person in like year seven like no one would like fuck with me anymore because I'd like asserted my myself with violence. **Lewis**

You didn't punch them back, but in my mind I'm thinking yes maybe I did the right thing but it's still making me feel scared, I still feel scared and anxious now, they'll continue to do that until I punch them **Pasquale**

When I got stabbed, I kept calling the police, said I wanted police protection. I didn't press charges against the guy that stabbed me. But I kept thinking he was going to come back and finish me off. But that's the time when my schizophrenia started **Juan**.

I used to fight the wardens a lot in prison and I used to think it was them putting things in my food to make me hear the voices. **Pasquale**

Sub theme2C: Sensitivity to unfairness

They do want to frustrate me, yeah obviously they, they know it frustrates me, makes me angry, I but I don't know why they want to do that. **Dean**

Even if I killed him. Even if it takes like ten years, I have to get him back. Like I've got a couple of people like that like if I see him yes, I have to get him back, I have to get him back. I don't know why. Every time I think about it, it gets… every time I think

about this it gets me really angry. Like I get really agitated and stuff. **Adam**

And I was watching a YouTube video, I remember with Dan Bilzerian has more than me and he had a lot of things and I couldn't even get 20 quid on my credit card. So, I start thinking what use is my life right here. He's got everything and I got nothing, too different, too different. It killed me inside. I wanted to take his life. **Reece**

Theme 3: Violence relieves negative internal states
Sub theme 3A:Physiological drive
It’s like a, like a pressure but when you kick off it releases, relieves stress, so when you kick off you feel much better. **Sorin**
Anger can be released in a wrong way, you can see anger as a ticking bomb, as a ticking bomb inside of me. It can detonate. It can explode in the violence and aggression. well it happened to me on five occasions where I hit someone in the face because of my anger **Tomasz**
Sub theme 3B: Factor 7: Escape from psychotic experiences
I thought that a crisis team were taking my kids away to mutilate them and bring them back with all their guts hanging out and everything to show my wife and my dad and that’s why I attacked my wife and my dad so that’s it. Where’s that come from I’ve got no idea, how that fed into violence I mean it’s just ridiculous, it doesn’t make any sense I can’t put my finger on it, I just got no idea I just didn’t want them to see my kid mangled, but it doesn’t make any sense. But that was it but what turned it into violence, is I just didn’t want my wife or dad to see my mutilated kids. **Jack**

In contrast walking away from a fight reduced patients' sense of social status and often triggered angry rumination.

> *In the past I wouldn't [walk away from a fight] because they'd just take you for an idiot. Other people would be saying oh he's an idiot*. **Sorin**

Sub-theme 2B: Sensitivity to physical harm

Participants were vigilant for signs of threat and would respond with force.

> *I'm always on guard, I'm always thinking, threat, threat, threat, all the time. […]Shoulders, arms, body language, how they're moving and like how they're talking, tone of voice. You know something is about to kick off.* **Jamar**

> *Anyone acknowledges that if they feel threatened, then they will get violent. It's like when people are paranoid, and they perceive people as a threat, they will act on it, and do something. Fight or flight mode, or they'll run away or they'll attack someone*. **Dean**

Participants had been victims of extreme violence in the past and believed using violence was essential for protecting oneself. The patients often had examples of when using violence protected them or a member of their family. In contrast being non-violent left them feeling more vulnerable to attack.

> *I've been attacked badly in the past, nearly killed. Jumped by eight people and they nearly kicked me to death. When I did nothing wrong.* **Scott**

It was only till I was older and I started fighting back that he stop beating her [my mum] **Garry**

You get beaten up, get really hurt. If you don't fight back then people just walk all over you. **Kyle**

Psychosis triggered or amplified the sense of threat leading to the use of violence. For example, participants described voices that were threatening or would warn of imminent threats from others. A number of participants' attempts to explain the onset of psychosis led them to believe they were being poisoned. The use of violence was driven by the belief that violence was the best means of protecting oneself and others.

I was smoking weed and I started hearing things. For example, saying, Tommy is gonna kill ya, you'll have to get him. I'll go and get him, I'll go the second I can, I thought they were coming for me so I went for them. **Garry**

I heard it with my ears. It said, your neighbour's raping his girlfriend. I heard it a few times and about a week before it happened. So, I went over with a hammer and I got in through his window. **Sam**

Subtheme 2C: Sensitivity to unfairness

Participants had rigid ideas of how they should be treated and were sensitive to unfair treatment. The frustrations they faced were often interpreted as intentional attempts to upset them.

When I feel like other people are violating the terms of what they're supposed to do. I used to get angry quite a lot, especially with staff.

Because I used to feel like they weren't treating me the way they were supposed to be treating me. **Amadi**

Participants described ruminating about reasons that they had been treated unfairly or injustices that they had suffered in the past. There was a strong desire to restore equilibrium through violence.

I really want to go and get revenge. I always be thinking about it and it got to a point where my girlfriend was like 'you got to stop talking about it; it was like a year ago and still going on about it'. **Kyle**

If somebody accidentally hit me in the face with a piece of wood, I'd want to slap them back, even if, even if it was an accident. I don't think it would be completely out of order. They caused me pain then, I think I would give them some pain back. **Mateo**

This sense of unfairness was generalised by the patients to society as a whole. For example, two unprovoked attacks on strangers in the street by patients came from the belief that others had been given a better hand in life. Jealousy and resentment led to the use of violence.

Something that happened that day, I spotted, maybe spotted some loving couple holding their hands together getting inside of a rich car, Mercedes let's say….fancy car, and I thought they looked happy and I thought …and in comparison …I instantly compared myself to them where I thought that they were happy and I wasn't happy so it built up my anger. **Tomasz**

Theme 3: Violence relieves negative internal states

In this theme, violence was a response to internal states. Violence had an emotion regulation function and was triggered by psychological arousal and strong emotions [subtheme 3A: physiological drive]. Violence could also be a desperate attempt to escape or stop voices, visions, and paranoia [subtheme 3B: escape from psychotic experiences].

Subtheme 3A: Physiological drive

Violence was a response to intense feelings of anger or anxiety and provided an effective way for the patient to regulate difficult emotions.

> *Sometimes there's a pressure on the lungs. Your chest feels tight, your legs feel like jelly. Yeah it's like you know when you get, what do they call it, your stomach churns. And you get pains in your arm, and then you let go you kick off and it goes away. Anxiety that's what they call it. That's it yeah, feels like I'm having a heart attack. And once you, lash out with anger, it's released that anxiety, the pressure*. **Sorin**

> *I used to punch walls a lot, and my hands felt bad because my knuckles were all pushed in because I'd hit walls when I'm angry. I hit people. It was just a release and it hurts afterwards and it feel good like it takes it away.* **Kyle**

In these cases, the victim often had done nothing to trigger the perpetrator or had done something minor that had triggered a disproportionate response.

> *Just to hit somebody, random people were just being hit because I wanted to let the anger out and I didn't decide to punch a tree, I*

didn't decide to punch a stop sign on the way. I decided to punch somebody. **Tomasz**

Participants described being very reactive to even minor triggers such as repetitive noises. Poor inhibitory control when angry or anxious often led to violence.

I still get angry very, very… bad anger. It comes up quickly you know so it's hard to manage. **Pasquale**

There'd be no thoughts, I'd kick the shit out of them and they would take me to seclusion. **Garry**

There was a lack of knowledge of how to manage frustrations or difficult emotions without violence. There were also limited opportunities for practising alternative ways of dealing with anger.

I'll say, "Right next time I'll try again next time" and it's an ongoing thing, you can't practise all these skills until you're angry and it's hard to… to do everything right when you're angry. **Pasquale**

Subtheme 3B: Escape from psychotic experiences

Violence was sometimes an act of desperation. Participants described terrifying experiences during an acute psychotic phase. They were overwhelmed by voices, visual hallucinations, or perceptual distortions. Sometimes voices encouraged violence as a way to make these

experiences stop. Violence was seen as a last resort to escape these experiences or to prevent family members from witnessing it.

> *I was freaking out. I was seeing people change into reptilian, shapeshifting, aliens. I used to have conspiracy theories about it and it just got to my head. I started seeing people change in front of my eyes. I was a hundred percent sure it was real. I was too scared to talk about it. I was terrified … I thought if I did what I did, it would all stop. That's what the devil chant and voices were telling me to do this it will stop. The moment I done it [stabbed someone] it just went quiet. Everything just went really quiet. The sun went in and I was like this isn't going to stop and I just walked out.* **KYLE**

Discussion

In this study qualitative methods were used to understand key psychological processes that may drive violent behaviour by patients with psychosis. In-depth interviews were conducted with twenty patients with psychosis recruited from forensic psychiatric services in three regions in England. The rich descriptions shared by participants provided an insight into how they think about violence, the functions it serves, and the perceived barriers to using alternative non-violent behaviours. Such insights can help orientate clinicians to the patient perspective, allowing better calibration of clinical discussions around violence. Our analysis identified seven key psychological factors that contribute to the use of violence (Table 2.3): Violence is a learnt behaviour, which can be both habitual (Factor 1) and underpinned by rules that engaged and justified an attack (Factor 2). Violence is often a protective strategy against a tripartite of sensitivities to other people: sensitivity to physical threat from which violence protects (Factor 3); sensitivity to social disrespect whereby violence increased status (Factor 4); and sensitivity to unfairness whereby violence delivers revenge (Factor 5). Violence can have an emotional regulation function where-by intense emotions are released (Factor 6) and violence can be an attempt to escape or gain control when overwhelmed by voices, visions, and paranoia (Factor 7). The pattern of emphasis across these processes differs when explaining an individual patient's offending behaviour. This seven-factor framework is consistent with, and expands on, existing literature on violence in psychosis and provides multiple testable hypothesis about the underlying causal mechanisms. The multifactorial nature of the model reflects the complex nature of violence by patients with psychosis. It can be used to distinguish between different patterns of violence allowing for more individualised approaches to understanding and treating violence. Furthermore, it identifies potentially modifiable factors (habitual behaviour patterns, pro-violence beliefs and attitudes, low tolerance to signs of threat, social disrespect and injustice, poor emotion regulation, and positive psychotic symptoms) and can be used to guide the

development of new targeted interventions to reduce violence – an area that needs renewed attention.

Through social learning processes violence can become an established part of one's behavioural repertoire (Bandura, 1978). Factors such as parental involvement in crime, early experiences of physical violence, and violent victimisation are known risk factors (Witt et al., 2013). Many participants were exposed to crime and violence from a young age, with violence being normalised or even glorified. At times this violence was extreme in nature (e.g. chased with knives, stabbings). It could be argued that such environments, not only teach but, at times, necessitate violence. In this context pro-criminal beliefs and maladaptive rules and assumptions

Table 2.3: Seven factor model of violence in psychosis.

Violence as a dominant response mode
Factor 1: Violence is all I know • Violence modelled, normalised and reinforced by social network. • Reinforced by proceeds or crime and drug dealing. • Practice has ingrained behaviour. • Forms part of positive social identity. • Deficit in pro-social problem-solving skills.
Factor 2: Rules for engagement • If there is going to be a fight, make sure you throw the first punch. • Hurt them enough that they won't retaliate. • If your friend is in a fight, you have to get involved. • You deal with problems yourself; you don't involve the police. • If they cross a line, any level of violence is justified. (Black and white thinking)

Violence protects against a trio of sensitivity.
Factor 3: Sensitivity to threat of physical harm • Experience as victim of extreme violence • Hypervigilance for signs of threat. • Misinterpretation others behaviour (e.g. eye contact) as threatening. • Triggered or reinforced by paranoia and voices. Memories of violence protecting self and others from harm. • Belief that violence is protective and not using violence (i.e. pro-social response) is dangerous.
Factor 4: Sensitivity to social disrespect • Experiences of neglect, bullying, emotional abuse. • Low self-worth. • Hypervigilance for signs of disrespect. • Misinterpretation of others behaviour as disrespectful or belittling. • Violence provides sense of self-esteem and status. • Others being fearful is interpreted as respect. • Belief that walking away from a fight is degrading.
Factor 5: Sensitivity to unfairness • Frustrations interpreted as intentional injustices by others. • Rumination about being treated unjustly • Build-up of resentment towards others. • Revenge drive.
Violence relieves difficult internal states

Factor 6: Physiological drive • Heightened anxiety and/or anger. • Emotionally reactive. • Poor emotional regulation skills. • Violence relieves intense feeling of anger or anxiety.
Factor 7: Escape from psychosis experiences • Intense experiences of voices, visual hallucinations, and perceptual distortions. • High levels of belief and absorption in positive symptoms. • High levels of distress. • Delusional experiences support use of violence (e.g. voices encouraging). • Violence seen as a last option to stop or escape experiences.

about violence develop. Such beliefs have been implicated in violence in the general population (Gannon et al., 2009) but have not been explored as a mediator of violence in psychosis. Violent behaviour becomes habitual through use, with past violent behaviour being one of the strongest predictors of future violence (Witt et al., 2013). Any future treatment should have a strong behavioural component (e.g. role plays, behaviour experiments) to establish and strengthen competing pro-social behaviour responses to difficult situations.

Violence was often a response to other people's behaviour - triggered by the perception that others were being threatening, disrespectful, or unfair. Similar to previous studies (Witt et al., 2013), experiences of violent victimisation, bullying, neglect, abuse, and social injustice were common. These increased hypervigilance for threat and hostile attribution biases which were further amplified by psychosis

symptoms (e.g. voices or paranoia). Hypervigilance and persecutory beliefs are common in psychosis and in most cases do not lead to violence. However, it was the combination of perceived threat and the belief that violence was an effective method of protecting oneself, gaining respect or justice that led to violent behaviour. The use of violence also prevented opportunities for the correction of misinterpretations (e.g. they are staring at me because they are going to attack) and positive beliefs about violence (e.g. violence keeps me safe). Violence elicited aggression from others, reinforcing the view that others are threatening. The non-occurrence of an attack was misattributed to having acted aggressively and thus successfully scaring the person off. As such the belief that violence is necessary persisted. Treatments should incorporate techniques to test out and correct these misinterpretations, build a tolerance for the behaviour of others, and help patients develop pro-social ways of achieving safety, social respect, and justice to reduce their reliance on violence.

Studies have shown anger to be an important driver of violence in psychosis.(Adams & Yanos, 2020; Coid et al., 2013) However, the influence of emotion regulation has not been explored; though there is some evidence it night play a role in violence in the general population. (Roberton et al., 2014) Violence did appear to have an emotion regulation function. Participants described high emotional reactivity and poor ability to regulate their response. Violence was effective for the patient in releasing intense feelings of anger or anxiety. The descriptions provided of violence releasing or taking away difficult feelings are reminiscent of self-harm literature in which some acts are performed without suicidal intent but in order to regulate intense emotional states (Stänicke et al., 2018). Self-harm and violence frequently co-occur and the presence of one has shown to increase the risk of the other (Fazel et al., 2014). Difficulties in emotional regulation, which has been implicated in self-harm (Brereton & McGlinchey, 2020), may also play a role in violence. Future treatments could benefit from incorporating the development emotional regulation skills.

For most participants positive psychotic symptoms, particularly paranoia and voices, contributed to violence by amplifying the aforementioned processes (sensitivity to others and emotional dysregulation). This is consistent with empirical findings that positive symptoms alone are a weak predictor of future violence (Lagerberg et al., 2025; Witt et al., 2013). However, although less common in the study's participant group, violence was sometimes a direct response to being overwhelmed by delusions, voices, and perceptual distortions, and was a desperate attempt to escape these experiences or make them stop. In two accounts, violence occurred during their first episode of psychosis, was ego dystonic, and had occurred within 24 hours of contact with mental health services.

Finally it is important to comment on the role of substance misuse as this is one of the strongest predictors of violence in psychosis (Fazel et al., 2009, 2014). Surprisingly, no participants described substances as being a direct single cause of their violence, but rather substance use contributed across a number of the different factors. Involvement in taking drugs or drug dealing was an initial route into crime for several patients and led to some of the more extreme experiences of violence (e.g. between drug gangs). Alcohol and drug use increased anger and impulsivity. For some patients, substances were used to relax and manage difficult feelings (emotion regulation) and agitation increased when going through withdrawals. Drug use also triggered or amplified psychosis symptoms e.g. voices and paranoia. Management of substance misuse difficulties should be included in any future treatment.

Strengths and limitations

To our knowledge, this is the first qualitative study to explore the psychological processes of violence in psychosis. However, there are a number of study limitations. The nature of qualitative research means the sample is small and not representative. As such, it is exploratory and the findings need to be tested in larger, more varied samples. In addition, it

may be that those willing to participate in the current study differ from the general forensic population, for example, in their ability to reflect on their violence. However, there was a high uptake with only two people approached about the study declining to take part. This work focussed on violence by people with psychosis, which suggests that violence by patients with psychosis differs in nature to that of violence by the general population. However, some elements of this model may have wider applicability. The study is reliant on retrospective account, which may not always be accurate. In addition, violence is a stigmatised issue and, although efforts were taken to manage this, participants may not have been completely open. However, the detailed descriptions of violence provided some assurances that this was not a significant issue. People with lived experience were involved in the study design and analysis; however, more participatory methods (e.g. interviews conducted by peer researchers) could have been used to enrich the analytic process and should be considered in future research. The next steps for this work is to develop methods for measuring some of the processes identified in this framework (Chapter 3) and then quantitatively assessing this framework in a larger sample of men with psychosis (Chapter 4).

3

The development of the Oxford Violence-Activating Cognition Scale and the Oxford Violence-Inhibiting Cognitions Scale.

Abstract

Background

As outlined in Chapter 2, violence by men with psychosis often functions as a habitual response used to manage interpersonal sensitivities (physical threat, disrespect, and injustice) and regulate difficult internal states such as intense emotions or overwhelming psychotic experiences. Cognitions may be a common endpoint for the influence of these processes. Testing the relationship between violence-related cognitions and violent behaviour in psychosis requires a psychometrically robust measure. The aim of this chapter is to develop two measures of violence-related cognitions: The Oxford Violence-Activating Cognitions Scale (OVAC) and The Oxford Violence-Inhibiting Cognitions Scale (OVIC).

Method

Men aged 16 years or older with a diagnosis of affective or non-affective psychosis were recruited from secondary care mental health services in forty-two NHS Trusts in England and Wales. Participants completed two comprehensive item pools: one assessing violence-activating cognitions and one assessing violence-inhibiting cognitions. The participant sample was split into a derivation sample and validation sample. Exploratory factor analysis with the derivation sample was used to develop the questionnaires and confirmatory factor analysis with the validation sample was used to confirm the model fit. Inter-rater reliability and internal consistency were assessed.

Results

Exploratory factor analysis identified six-types of violence-activating cognitions: violence to survive the social environment; attribution of negative intent from others; violence as a justified response; violence giving feelings of power; negative consequences of not being violent; and violence regulating negative emotions. Confirmatory factor analysis showed an excellent model fit (χ^2 = 443.903, df = 335, p < .001; CFI = 0.963, TLI = 0.956, RMSEA = 0.041, SRMR = 0.056). The OVAC scale demonstrated excellent internal reliability (α = 0.95) and test-retest reliability was excellent (ICC = 0.84, 95% CI [0.77, 0.89], p < .001).

Two types of violence-inhibiting cognitions were identified: negative personal consequences and negative external consequences of violence. The model fit was also excellent (χ^2 = 422.26, df = 21, p < .001, CFI = 0.985, TLI = 0.976, RMSEA = 0.044; SRMR = 0.034). The O-VIC demonstrated good internal reliability (α = 0.813) and test-retest reliability was excellent (ICC = 0.81, 95% CI [0.73, 0.87], p < .001).

Conclusions

The Oxford Violence-Activating Cognitions Scale and The Oxford Violence-Inhibiting Cognitions Scale are psychometrically robust scales that can be used to examine the role of cognitions in violence by men with psychosis.

Introduction

Based on our interviews with patients in Chapter 2, violence by men with psychosis can be conceptualised as a habitual response guided and justified by rules about engagement. Violence is used to manage interpersonal sensitivities (physical threat, disrespect, and injustice), and regulate intense emotions or overwhelming psychotic experiences. Cognitions may be a common endpoint for the influence of these processes. For example, a person may think 'Where I am from you have to be violent to survive' or 'If someone puts me down, I will make them regret it' leading them to favour a violent response during an interpersonal conflict. Cognitions may also serve as a key modifiable mechanism through which other more established factors (e.g. childhood adverse experiences, psychotic experiences, anger) lead to violence. For example, if a patient believes that 'It feels like justice to hurt someone who has hurt you', then a perception that someone is trying to harm them (paranoia) may lead them to attack that individual. However, there has been very limited study of the cognitions that lead to violent behaviour in psychosis.

A systematic review was conducted to identify any previous research examining violence-related cognitions in psychosis. PubMed was searched on the 13th Feb 2025 using the search terms (schizophren* OR psychosis OR psychotic OR "severe mental illness*") AND (violen* OR aggress*) AND (cognition* OR belief OR attitude* OR thought* OR think* OR delusion* OR meaning* OR interpretation OR misinterpretation OR perception OR bias). 2084 papers were retrieved. No empirical studies to date have directly examined cognitions about violence in those with schizophrenia nor their relationship with other established risk factors. There have been studies that link violence to specific delusional beliefs (e.g. delusions of misidentification (Silva et al., 1995; Spencer, 2017), threat-control override (Link & Stueve, 1994), or persecution (Coid et al., 2013, 2016)) and beliefs about psychotic experiences (e.g. the power and omnipotence of command hallucinations (Berman et al., 2010; Salim et

al., 2021)). Several studies have examined impairments in social cognition, for example impaired facial emotion recognition (Bulgari et al., 2020; Kuharic et al., 2019), theory of mind (Engelstad et al., 2019; Vaskinn et al., 2021), and a hostile attribution bias (Harris et al., 2014). Three studies have demonstrated a link between moral cognition – reasoning and decision-making about right and wrong – and violence by people with psychosis (O'Reilly et al., 2018, 2019; Peng et al., 2024).

Testing the association of violence-related cognitions in psychosis requires a psychometrically robust measure. There are a number of measures of attitudes to violence which have been developed for the general population. These include measures of the acceptability of violence (Funk et al., 1999; Straus et al., 1996), moral disengagement (Bandura, 1999), hostile attribution bias (Coccaro et al., 2009), aggressive masculine pride or 'machismo' (Walker, 2005), and pro-criminality beliefs (Knight et al., 2006; Tangney et al., 2012; Walters, 2002). However, these measures do not capture the violence-related cognitions identified by the framework (e.g. the use of violence for emotional regulation or violence to ensure safety). The aim of this chapter is to develop two psychometrically robust measures of violence-related cognitions derived from qualitative data in Chapter 2: The Oxford Violence-Activating Cognitions Scale and The Oxford Violence-Inhibiting Cognitions Scale.

Method

Design and participants

A cross-sectional design was used, with test-retest reliability assessed for the new questionnaires. Participants were recruited from forty-two NHS trusts in England and Wales. Participants were included in the study if they: were male; aged 16 years or older; had affective or non-affective psychosis; and were attending secondary care mental health services in

England and Wales. Exclusion criteria were a primary diagnosis of alcohol or drug disorder, personality disorder, or organic syndrome, or a history of predominantly sexual offending. Participants were purposefully sample to ensure a range of difficulties with anger and aggression. Participants completed the assessments with support from a NIHR Clinical Research Network research officer. A subgroup of participants completed the violence-related cognitions assessment again after one week to assess test-retest reliability. In addition to the self-report measure described below, research officers extracted demographic, clinical, and forensic information from participants' clinical records. The study was approved by NHS Research Ethics Committee (North West - Preston Research Ethics Committee 23/NW/0012).

Item pool for the Oxford Violent-Cognitions Scales.

The 162-item pool assessing violence cognitions was developed from multiple sources (see Appendix D for item pool). Items were primarily derived from the framework of violence in psychosis presented in Chapter 2 and the qualitative interviews upon which it was based. Additional items were generated through a literature review, examination of existing violence attitude measures, consultation with a Lived Experience Advisory Panel (LEAP), and input from experts in cognitive therapy and psychosis. The LEAP reviewed all items for relevance, readability, and comprehensiveness. Each item was rated on a 5-point scale from 0 (Do not believe at all) to 4 (Believe it totally). The items were divided into two distinct pools: Violence-activating cognitions (145 items), reflecting positive views about violence where higher scores indicate stronger pro-violence beliefs; and violence-inhibiting cognitions (17 items), addressing the negative consequences of violence where higher scores indicate stronger anti-violence beliefs.

Analysis

All analyses were conducted in R, version 4.2.0 (R Core Team, 2023) using packages psych (Revelle, 2024), lavaan (Rosseel, 2012), and regsem (Jacobucci, 2023). This analysis was underpinned by Classical Test Theory (CTT) (J. D. Brown, 2012), which provides the foundational framework for understanding measurement reliability and validity when developing psychological measures. In CTT, any observed score consists of a true score plus measurement error (X = T + E). The primary goal is to maximize the true score variance while minimizing error variance. True score variance is maximized through the selection and retention of items that demonstrate strong psychometric properties.

Factor analysis is a multivariate statistical technique used to identify latent variables (factors) that explain the correlations among observed variables (items). FA is a key methodological tool for achieving CTT's objectives by providing empirical evidence for item quality and the construct structure. It operates on the principle that if items measure the same underlying construct, they should correlate with each other due to their shared relationship with that latent factor. FA also shows the dimensional structure of the construct being measured, and whether that structure is unidimensional or multidimensional. FA directly supports CTT by identifying items that load strongly (typically ≥.30) on factors while revealing items that contribute primarily to error variance (i.e. those with low communalities or problematic cross-loadings). Poor performing items can then be removed to improve the psychometric properties of the measure.

Factor analysis encompasses two complementary approaches used sequentially in scale development. Exploratory Factor Analysis (EFA) is conducted first to identify the underlying dimensional structure of the construct without imposing a priori assumptions about the number or nature of factors. Following EFA, Confirmatory Factor Analysis (CFA) tests the hypothesized factor structure derived from the EFA. CFA evaluates model fit through fir indices (described below). Ideally, CFA is conducted in a sample independent of the sample in which the factor structure was initially derived**, thus providing a test of the measure's

structural validity and replicability. This is the approach taken in this chapter.

Data preparation and appropriateness of factor analysis

Only cases with complete data were included in the factor analysis. The samples for each scale were randomly split into derivation (60%) and validation (40%) subsets. Two methods were used to evaluate whether the data was appropriate for factor analysis in the derivation sample: Bartlett's test of Sphericity and the Kaiser-Meyer-Olkin (KMO) tests. The determinant test was also calculated, which examines potential multicollinearity. Bartlett's test assesses whether the matrix of item correlations is significantly different from an identity matrix, where items are completely unrelated. A significant result indicates that items have enough shared variance to perform factor analysis (Field, 2012) The KMO is a measure of sampling adequacy and is calculated both for individual items and the whole scale. KMO index values of above 0.7 is recommended and above 0.9 are excellent (Hutcheson & Sofroniou, 1999). The determinant test with values above 0.00001 indicates acceptable levels of item distinctiveness.

For the OVAC item pool, factor analysis was deemed appropriate with the derivation sample (n=439) as Bartlett’s test of Sphericity was significant (Bartlett's test: χ^2= 67265.19, df=10440, p<0.001) and the Kaiser–Meyer–Olkin (KMO) test of sampling adequacy was excellent (KMO=0.97, individual values ranging from 0.88-0.98). The low determinant value (1.335832e-67) indicated item redundancy, which is acceptable at this development stage.

For the OVIC item pool, factor analysis was deemed appropriate in the derivation sample (n=487). The Bartlett’s test of Sphericity was significant (Bartlett's test: χ^2=2868.52, df=136, p<0.001) and the Kaiser–Meyer–Olkin (KMO) test of sampling adequacy was excellent (KMO=0.93, individual values ranging from 0.90-0.96) The determinant of 0.002522was above the threshold.

Deriving the OVAC and OVIC

To derive the OVAC and OVIC from the item pool, exploratory factor analysis (EFA) was conducted with the derivation samples. Prior to factor analysis, items that were highly correlated with another item (>0.8) were deleted prior to the EFA to avoid issues of multicollinearity. Items were extracted using principal axis factoring with oblimin rotation. Factor retention was guided by parallel analysis and scree plot inspection. Items with loadings <.30 or cross-loadings >.30 were removed. The OVAC was further refined into a shorter form to enhance parsimony and clinical utility, with items eliminated based on high modification indices (>20) and conceptual redundancy.

Evaluation of the model fit

Final factor structures for both the OVAC and OVIC were validated via confirmatory factor analysis using their respective validation samples. Model fit was assessed using the chi squared, comparative fit index (CFI), the Tucker-Lewis index (TLI) the robust root mean square residual (SRMR) and the root mean square error of approximation (RMSEA). Thresholds for acceptable fit were - CFI and TLI >0.9 (Klein, 2005) and SRMR and RMSEA 0.08 (Hu & Bentler, 1999; MacCallum et al., 1996) and for an excellent fit were - CFI and TLI >0.95, SRMR<0.08 and RMSEA <0.06 (Hu & Bentler, 1999).

Reliability

To examine test–retest reliability in participants with repeat data, a two-way, mixed effects, absolute agreement intraclass correlation coefficient (ICC) was conducted. Internal consistency of the scale was evaluated using Cronbach’s alpha, with values above 0.70 considered indicative of acceptable reliability.

Criterion validity

To assess whether these beliefs are in fact related to violence, the association between scores on these measures and violent behaviour must be assessed. However, this will be conducted in Chapter 5.

Endorsement rates

The endorsement rate for each item in the final questionnaires was calculated. Strong endorsement was operationalised as a score or 3 or 4 on an item. Any endorsement was a score >0.

Results

Recruitment took place between 19th February 2023 and 31st May 2024. Eight-hundred and sixty men with psychosis participated in the study. The average age of participants was 41.0 (SD=12.6). Three hundred and forty-eight participants (41.5%) had a previous conviction for a violent offence. Demographic, clinical, and forensic information are summarised in Table 3.1.

Table 3.1. Forensic, clinical, and demographic characteristics of male secondary care patients that participated in the study.

	Frequency N=860	**Percentage %**
Previous conviction or arrest for a violent offence	348	41.5
Ethnicity		
White English/Welsh/Scottish/Northern Irish/British	558	64.9
White Gypsy/Traveller or Irish Traveller	2	0.2
White Irish	10	1.2
Any other white background	37	4.3
Black African	37	4.3
Black British	48	5.6

Black Caribbean	22	2.6
Any other Black/African/Caribbean Background	6	0.7
Bangladeshi	9	1.0
Chinese	2	0.2
Indian	16	1.9
Pakistani	17	2.0
Any other Asian Background	13	1.5
White and Asian	15	1.7
White and Black African	4	0.5
White and Black Caribbean	27	3.1
Any other Mixed/Multiple Ethnic Background	20	2.3
Arab	4	0.5
Any other Ethnic Group	7	0.8
Missing	6	0.7
Marital status		
Cohabiting	30	3.5
Married or civil partnership	58	6.7
Separated or divorced	56	6.5
Single	704	81.9
Widowed	9	1.0
Missing	3	0.3
Employment status		
Employed (full time)	56	6.5
Employed (part time)	44	5.1
Homemaker	4	0.5
Retired	29	3.4
Self-employed	30	3.5
Student	27	3.1
Unemployed	603	70.1
Voluntary work	62	7.2
Missing	5	0.6
Living situation		
Inpatient/hospital unit	278	32.3
Live alone	288	33.5
Live with children	11	1.3
Live with friends or housemates	21	2.4
Live with parents and/or siblings	120	14.0
Live with partner / spouse	62	7.2
Supported living /accommodation	72	8.4
Other	5	0.6
Missing	3	0.3
Diagnosis		

Bipolar affective disorder with psychotic features	76	8.8
Brief psychotic disorder	10	1.2
Delusional disorder	17	2.0
Depression with psychotic features	2	0.2
First episode psychosis	93	10.8
Paranoid schizophrenia	374	43.5
Psychotic disorder not otherwise specified	56	6.5
Schizoaffective disorder	87	10.1
Schizophrenia	144	16.7
Missing	1	0.1
Service		
An adult psychiatric inpatient ward	236	38.0
A day hospital	1	0.1
A forensic adult mental health (community) team	30	3.5
A high secure forensic hospital	3	0.3
A low secure forensic hospital	74	8.6
A medium secure forensic hospital	92	10.7
An adult mental health (community) team	318	37.0
An early intervention for psychosis service	104	12.1
Missing	2	0.2
Seen or heard things others couldn’t		
No	420	48.8
Yes	414	48.1
Missing	26	3.0
Heard voices		
No	450	52.3
Yes	381	44.3
Missing	29	3.4
Past alcohol use		
No	50	5.8
Yes	788	91.6
Missing	22	2.6
Current alcohol use		
No	418	48.6
Yes	420	48.8
Missing	22	2.6
Past illegal drug use		
No	190	22.1
Yes	649	75.5
Missing	21	2.4
Current illegal drug use		
No	654	76.0

Yes	183	21.3
Missing	23	2.7

Factor analysis

Oxford Violence-Activating Cognitions Scale

For the OVAC item pool, 724 participants had complete data. In the derivation sample (n=439), exploratory factor analysis using principal axis factoring with oblimin rotation yielded a six-factor solution. The six factors explained 59% of the total variance and contained 44 items. The confirmatory factor analysis of the six-factor model with the validation sample (n=285) showed a good fit (χ^2 = 1102.945, df = 764, p < .001, CFI = 0.931, TLI = 0.926, RMSEA = 0.048, SRMR = 0.060). Inter-factor correlations were moderate to strong (r = 0.53 to 0.89). Items and factor loadings are displayed in the Table 3.2.

Table 3.2: Items and factor loadings for the Oxford-Violence Activating Cognitions Scale – Long form.

Factor	Item Content	EFA Loading	CFA Loading
Violence to Survive the Social Environment			
	1. Where I am from you have to be violent to survive.	0.74	0.83
	2. Violence is respected where I was brought up.	0.68	0.84
	3. The people I respect are impressed by violence.	0.57	0.77
	4. The people I am close to are often violent.	0.52	0.73
	5. I'd probably be dead now if I didn't use violence.	0.46	0.65
Attribution of negative intent from others			
	6. Other people always try to put me down.	0.84	0.78
	7. Other people enjoy upsetting me.	0.79	0.88
	8. Other people intentionally try to upset me.	0.77	0.83
	9. If given the chance people will try and take advantage of me.	0.49	0.67
	10. I watch other people's body language for signs of aggression.	0.38	0.37

Factor	Item Content	EFA Loading	CFA Loading
Violence as justified response			
	11. It feels good to hurt someone who has hurt you.	0.70	0.73
	12. If someone puts me down I will make them regret it.	0.64	0.84
	13. I get a thrill from violence.	0.60	0.71
	14. It's like justice to hurt someone who has hurt you.	0.57	0.76
	15. I won't tolerate any sign of disrespect.	0.50	0.62
	16. Getting aggressive makes me feel like I am taking action.	0.50	0.82
	17. I won't tolerate people taking the piss out of me.	0.43	0.62
	18. If someone does something to provoke me then it's their fault if I hurt them.	0.39	0.73
Violence giving feelings of power			
	19. Getting into fights proves I'm a man.	0.73	0.74
	20. Violence makes me feel in control.	0.70	0.83
	21. Being violent makes me feel strong.	0.62	0.79
	22. Violence makes me feel powerful.	0.61	0.81
	23. Being violent makes me feel safe.	0.53	0.79
	24. Being aggressive is the only way to get what I want.	0.52	0.71
	25. Violence gives me control over other people.	0.44	0.73
Negative consequences of not being violent			
	26. Walking away from a fight makes me feel worse.	0.65	0.80
	27. Walking away from a fight leaves me feeling pathetic.	0.64	0.72
	28. Walking away from a fight makes me look like an idiot.	0.60	0.79
	29. If I walk away from a fight, I'll be in a bad mood for days.	0.58	0.75
	30. Walking away from a fight means I'll never feel safe.	0.51	0.75
	31. Walking away from a fight means I won't be able to stop thinking about it.	0.50	0.72
	32. Walking away from a fight means I will be more of a target next time.	0.40	0.70
Violence regulating negative emotions			
	33. When I'm angry, I lose control.	0.65	0.63
	34. Sometimes I lash out when I'm feeling stressed.	0.65	0.70
	35. I get aggressive to let people know I'm stressed.	0.62	0.78
	36. When something upsets me, I can't control my actions.	0.58	0.71
	37. Sometimes I only feel better after punching	0.55	0.77

Factor	Item Content	EFA Loading	CFA Loading
	something.		
38.	Getting aggressive is how I let people know I need space.	0.53	0.79
39.	Kicking off relieves stress.	0.52	0.78
40.	I get aggressive when I have run out of other options.	0.52	0.68
41.	People don't realise I'm struggling unless I lash out.	0.50	0.67
42.	If I am anxious it makes me feel better to hit out.	0.50	0.70
43.	When I'm angry I don't think, I just react.	0.48	0.70
44.	When I feel desperate, violence is a way out.	0.42	0.72

To produce a more parsimonious model with an improved model fit and greater clinical utility, a shorter version was created. An additional sixteen items were removed based on consideration of both the modification indices (>20) and the content (for example if items had similar meaning “I won't tolerate any sign of disrespect” and “I won’t tolerate people taking the piss out of me”). The shorter version had 28 items over six factors and explained 60% of the total variance.

Confirmatory factor analysis of the short form, six-factor model with the validation sample (n=285) showed an excellent model fit (χ^2 = 443.903, df = 335, p < .001, CFI = 0.963, TLI = 0.956, RMSEA = 0.041, SRMR = 0.056). Items and factor loadings are displayed in Table 3.3. Inter-factor correlations were moderate to strong (r = 0.57 to 0.84). Rates of endorsement by the whole sample are also displayed in Table 3.3

O-VAC reliability

One hundred and one participants had repeated the item pool a week later. Test-retest reliability OVAC short version was excellent (ICC = 0.84, 95% CI [0.77, 0.89], p < .001). The O-VAC also demonstrated excellent internal reliability (α = 0.95).

Table 3.3. The six types of violence-activating cognitions, item factor loadings, and endorsement rates for the short version

Item content	EFA Loading	CFA Loading	Any endorsement count (%)	Strong endorsement count (%)
	n=439	n=285	N=860	N=860
			n (%)	n (%)
Violence to survive the social environment				
Where I am from you have to be violent to survive.	0.80	0.86	297 (35.7)	129 (15.5)
Violence is respected where I was brought up.	0.70	0.84	361 (43.5)	175 (21.1)
The people I respect are impressed by violence.	0.59	0.74	204 (24.5)	78 (9.4)
I'd probably be dead now if I didn't use violence.	0.42	0.65	231 (27.5)	109 (13.0)
Attribution of negative intent from others				
Other people always try to put me down.	0.86	0.78	439 (52.8)	175 (21.0)
Other people enjoy upsetting me.	0.69	0.82	444 (53.2)	165 (19.8)
If given the chance people will try and take advantage of me.	0.50	0.71	577 (69.3)	297 (35.7)
I watch other people's body language for signs of aggression.	0.32	0.42	625 (73.6)	306 (36.0)
Violence as a justified response				
If someone puts me down, I will make them regret it.	0.80	0.87	344 (40.6)	105 (12.4)
I won't tolerate any sign of disrespect.	0.67	0.66	424 (50.0)	162 (19.1)
If someone does something to provoke me then it's their fault if I	0.44	0.76	546 (63.8)	209 (24.4)

Item content	EFA Loading	CFA Loading	Any endorsement count (%)	Strong endorsement count (%)
	n=439	n=285	N=860	N=860
hurt them.				
It's like justice to hurt someone who has hurt you.	0.35	0.75	367 (43.5)	143 (16.9)
Violence giving feelings of power				
Being violent makes me feel strong.	0.57	0.81	219 (26.3)	67 (8.0)
Violence makes me feel in control.	0.57	0.82	210 (25.0)	67 (8.0)
Violence makes me feel powerful.	0.57	0.82	232 (30.0)	85 (9.9)
Being aggressive is the only way to get what I want.	0.45	0.6	186 (22.0)	37 (4.4)
Negative consequences of not being violent				
Walking away from a fight leaves me feeling pathetic.	0.77	0.71	400 (48.0)	157 (18.8)
Walking away from a fight makes me feel worse.	0.72	0.80	395 (46.0)	109 (12.7)
Walking away from a fight means I won't be able to stop thinking about it.	0.64	0.73	293 (34.8)	79 (9.4)
Walking away from a fight means I will be more of a target next time.	0.52	0.69	348 (41.0)	119 (14.0)
Violence regulating negative emotions				
I lash out when I'm feeling stressed.	0.68	0.69	321 (38.0)	110 (13.0)
I get aggressive to let people know I'm stressed.	0.66	0.77	206 (24.4)	55 (6.5)
When I'm angry, I lose control.	0.65	0.60	277 (32.6)	99 (11.6)
Getting aggressive is how I let people know I need space.	0.62	0.80	400 (48.0)	157 (18.8)
I get aggressive when I have run out of other options.	0.60	0.69	395 (46.0)	109 (12.7)
People don't realise I'm struggling unless I lash out.	0.57	0.69	293 (34.8)	79 (9.4)

Item content	EFA Loading	CFA Loading	Any endorsement count (%)	Strong endorsement count (%)
	n=439	n=285	N=860	N=860
If I am anxious, it makes me feel better to hit out.	0.51	0.69	348 (41.0)	119 (14.0)
When I feel desperate, violence is a way out.	0.50	0.74	397 (46.8)	133 (15.7)

Oxford Violence-Inhibiting Cognitions Scale

For the OVIC item pool, 801 participants had complete data. In the derivation sample (n=487), exploratory factor analysis found two types of violence inhibiting cognitions: negative personal consequences of violence and negative external consequences of violence. The two factors explained 47% of the total variance and contained seven items (See Table 3.4). Confirmatory factor analysis (validation sample n=337) of the two-factor structure showed excellent fit ($\chi^2 = 422.26$, df = 21, $p < .001$, CFI = 0.985, TLI = 0.976, RMSEA = 0.044; SRMR = 0.034). The correlation between factors was high (r = 0.84), suggesting a higher order factor.

OVIC reliability

One hundred and one participants had repeated the item pool a week later. Test-retest reliability was excellent (ICC = 0.81, 95% CI [0.73, 0.87], $p < .001$). The O-VIC demonstrated also good internal reliability ($\alpha = 0.813$).

Table 3.4. Two types of violence-inhibiting cognitions, item factor loading, and endorsement rates.

Item	**EFA Loading**	**CFA Loading**	**Any endorsement count (%)**	**Strong endorsement count (%)**
	n=487	n=337	N=860	N=860
Factor 1: Negative personal consequences of violence				
If I lose my temper, I always regret it.	0.63	0.74	656 (77.8)	381 (45.2)
Getting aggressive always makes me feel worse.	0.88	0.71	615 (72.9)	351 (41.6)
Being aggressive makes me feel bad about myself.	0.41	0.62	604 (71.2)	374 (44.1)
Factor 2: Negative external consequences of violence				
Being aggressive means you are more likely to get hurt.	0.53	0.59	692 (82.1)	456 (54.1)
Violence is seen negatively by most people.	0.61	0.61	746 (87.7)	535 (62.9)
People don't like aggressive people.	0.71	0.65	725 (85.2)	490 (57.6)
Being aggressive makes life more difficult.	0.57	0.64	709 (83)	468 (54.8)

Discussion

In a large sample of men diagnosed with psychosis, two new measures of violence-related cognitions were developed: the Oxford Violence-Activating Cognitions Scale (See Appendix I) and the Oxford Violence-Inhibiting Cognitions Scale (See Appendix J). Factor analysis identified six types of violence-activating cognitions. Cognitions reflected past learning, ways of managing interpersonal difficulties, providing a sense of power, a means of managing difficult emotions or psychotic experiences, and the psychological and social cost of non-violence. Cognitions were strongly endorsed by approximately a fifth of participants, with higher strong endorsement rates for *attribution of negative intent from others* (36%) and lower strong endorsement rates for *violence gives feelings of power* (10%). Two types of violence-inhibiting cognitions were identified: negative personal consequences of violence (e.g. *Being aggressive makes me feel bad about myself*) and negative external consequences of violence (e.g. *People don't like aggressive people*). The majority of participants (70-80%) endorsed these violence-inhibiting cognitions. Both measures showed an excellent model fit, excellent test re-test reliability, and good internal reliability. These strong psychometric properties support the use of these measures to investigate the association between violence-related cognitions and violent behaviour in psychosis. This will be investigated in Chapter 5.

The factor structure broadly aligns with the results of the qualitative study (Chapter 2). Social influences—normalising and necessitating violence—were reflected in the *violence to survive social environment* factor. Sensitivity to others (physical and social threats) was reflected in the *attribution of negative intent from others* factor. The use of violence as a means of managing mistreatment from others and increasing your status or self-esteem were reflected in *violence as a justified response* factor) and *violence giving feelings of power*. The *violence for emotional regulation* factor reflected beliefs in violence as an emotional release, communication method, and a last resort. No items in the item pool

asked specifically about being overwhelmed by psychotic experiences. Such items were difficult to word without specific knowledge of individual psychosis symptoms, whilst general terms such as 'psychosis' could not be used as not all participants would view their experiences as psychosis. Instead, items attempted to indirectly assess this dimension of the framework by using words like "struggling" and "desperation" (e.g., *When I feel desperate, violence is a way out*). These items loaded onto the *violence for emotional regulation* factor. The *negative consequences of non-violence* factor reflected the psychological costs of abstaining from violence.

Limitations

This study has several limitations. Firstly, although the factor structure broadly aligns with the framework, this may just reflect that the framework was used to inform the item pool. Also, the extent to which these cognitions relate to violence is unknown. This will be investigated in Chapter 5 and provide a more robust test of the framework. This study purposefully sampled those with difficulties with aggression and therefore no conclusions about the prevalence of violence convictions in psychosis can be made based on this sample. Those who agreed to take part in the research may not have been representative of those with psychosis. Endorsement of cognitions was assessed via self-report and may be subject to social desirability bias. In addition, it is unlikely that all cognitions relevant for understanding violence by men with psychosis were assessed in this study. This study only included men and thus the relevance of the results to women with psychosis is unknown.

These measures may provide a useful tool for both research and clinical practice in assessing and understanding the cognitions that may support or inhibit violence. However, their validity as violence-activating or violence-inhibiting cognitions depends on their relationship to actual violent behaviour. The next step is therefore to examine the association between these violence-related cognitions and violent behaviour in

individuals with psychosis, alongside other putative risk factors. This is the focus of Chapter 4.

4

Understanding violence in psychosis: Identifying key factors to target in treatment.

Abstract

Background

As specified in Chapter 2, violence by men with psychosis often functions as a habitual response used to manage interpersonal sensitivities (physical threat, disrespect, and injustice) and regulate difficult internal states such as intense emotions or overwhelming psychotic experiences. Cognitions about violence are an understudied but likely proximal contributor to violence. They may prove most problematic when they occur alongside other established proximal factors (e.g. substance use, anger, voice hearing, and paranoia) and distal risk factors (e.g. childhood adverse experiences and previous violent offences).

The aim of this study was to identify key psychological processes and other risk factors for violence in men with psychosis that can guide future treatment development.

Methods

Men aged 16 years or older with a diagnosis of affective or non-affective psychosis were recruited from secondary care mental health services in England and Wales. Participants completed assessments of violence-related cognitions, paranoia, voices, emotion dysregulation, anger, childhood adverse experiences, and substance use. The primary outcome was physical violence within the previous six months, assessed through clinical records and self-report. A violence severity score was also calculated for each participant. Structural equation modelling and network analysis were used to explore relationships between violence-related cognitions, other proximal and distal factors, and recent violent behaviour.

Findings

Between 19th February 2023 and 30th May 2024, 860 male participants, with a mean age of 41.0 years (SD 12.6), were recruited. 70.6% were White, 13.5% were Black, 7.5% were Asian, 7.6% had mixed ethnicity. 348 (41.5%) individuals had a previous conviction for a violent offence and 211 (24.7%) had been physically violent in the previous six months. 31% of the variance in recent violent incidents was explained by five variables: violence-activating cognitions (OR = 1.92), anger (OR= 1.60), current substance misuse (binary variable; OR = 2.47), distress from voice hearing (OR = 1.13), and age (OR = 0.98). Network analysis indicated that violence severity had direct highly stable positive associations with current drug use (edge weight = 0.291), anger (edge weight = 0.191), and violence-activating cognitions (0.168), and a negative association with age (edge weight = 0.104). Strength indices identified violence-activating cognitions, current drug use, and emotional dysregulation as the most influential nodes in the network.

Interpretation

Violent behaviour may be most likely to occur when there are a range of violence-activating cognitions that are not inhibited due to factors such

as anger, psychotic experiences, and substance misuse. This understanding provides a number of proximal modifiable causes of violence behaviour in patients with a diagnosis of psychosis. The key limitation of the current work is the cross-sectional design that prevents causal conclusions. Targeting in intervention the different types of cognitions identified provides a test of the potential causal connection with violence and new treatment routes.

Introduction

As discussed in Chapter 1, new intervention approaches to reducing violence by men with psychosis are needed. A route to better treatment may be the identification of modifiable proximal factors that drive violence. Epidemiological studies have identified static risk factors for violence in people with psychosis such as being male, younger age, recent victimisation, and a history of substance misuse, violent offending, or self-harm (Fazel et al., 2014; Witt et al., 2013). Dynamic factors such as current substance misuse, adherence to psychological treatment, and adherence to medication have also been found to predict violence (Lagerberg et al., 2025; Whiting et al., 2022; Witt et al., 2013). However, these factors offer limited guidance for novel treatment development. To discover possible important modifiable drivers of violence, in-depth interviews were conducted with men with psychosis and a history of violence (Chapter 2). Several psychological processes underpinning violence in psychosis were identified. Violence may be a learnt response, reinforced through peer and family interactions, and guided by distorted rules for engagement. Violence is frequently triggered by sensitivities to other people: sensitivity to physical threat, from which violence serves as a defence; sensitivity to social disrespect, from which violence serves to increase status; and sensitivity to unfairness, from which violence delivers revenge. Violence can be used as a method for regulating difficult internal states: a release for intense emotions or method to escape overwhelming psychotic experiences such as paranoia and voices.

This framework integrates and extends previous empirical findings. The social learning component has been highlighted in general models of violence (Bandura, 1978) and is consistent with research showing that early exposure to violence, particularly parental violence, predicts later violent behaviour in people with psychosis (Lagerberg et al., 2025; Witt et al., 2013). Sensitivity to threats of harm from others (e.g. paranoia) has been shown to be associated with both frequency and severity of violence (Coid et al., 2016) and such sensitivities may amplify momentary

hostile attribution biases when individuals are faced with ambiguous social information. Such hostile attribution biases have been associated with violence in the general population (Tuente et al., 2019). In addition delusional beliefs about threat from others (i.e. paranoia) have also been found to predict violent behaviour (Coid et al., 2013; Lagerberg et al., 2025). Experiences that may serve to increase sensitivity to others such as recent experiences of victimisation have been strongly associated with violent behaviour (Witt et al., 2013). To date there have been no studies specifically examining the beliefs held by individuals with psychosis about the utility of violence for achieving safety, enhancing social status, or seeking retribution.

The use of violence as a means of regulating difficult internal states (such as intense emotions or overwhelming psychotic experiences) has not been directly investigated in psychosis. However, an association between emotional dysregulation and violence has been reported in the general population (Garofalo & Velotti, 2017; Maloney et al., 2023) and there is emerging support for this process in psychosis. For example, strong emotional states — particularly anger — have been identified as important drivers of violence in individuals with psychosis (Adams & Yanos, 2020; Coid et al., 2018). Furthermore, the well-documented association between self-harm and interpersonal violence in psychosis may reflect broader difficulties in emotional regulation, suggesting that violence could function as an externalised method of regulating intense internal distress (Fazel et al., 2014; Lagerberg et al., 2025).

In Chapter 3, factor analysis identified six types of violence-activating cognitions and two types of violence-inhibiting cognitions. The aim of this chapter is to test the association of such cognitions with recent physical violence. In addition, as violence likely results from a complex interplay of factors with multiple causal pathways, this study examined the contribution of cognitions alongside other proximal (substance use, anger, emotional dysregulation, paranoia, distress from voices) and established risk factors (childhood adverse events, previous violent

offence, age) to identify the best potential routes for new treatment development (see Figure 4.1).

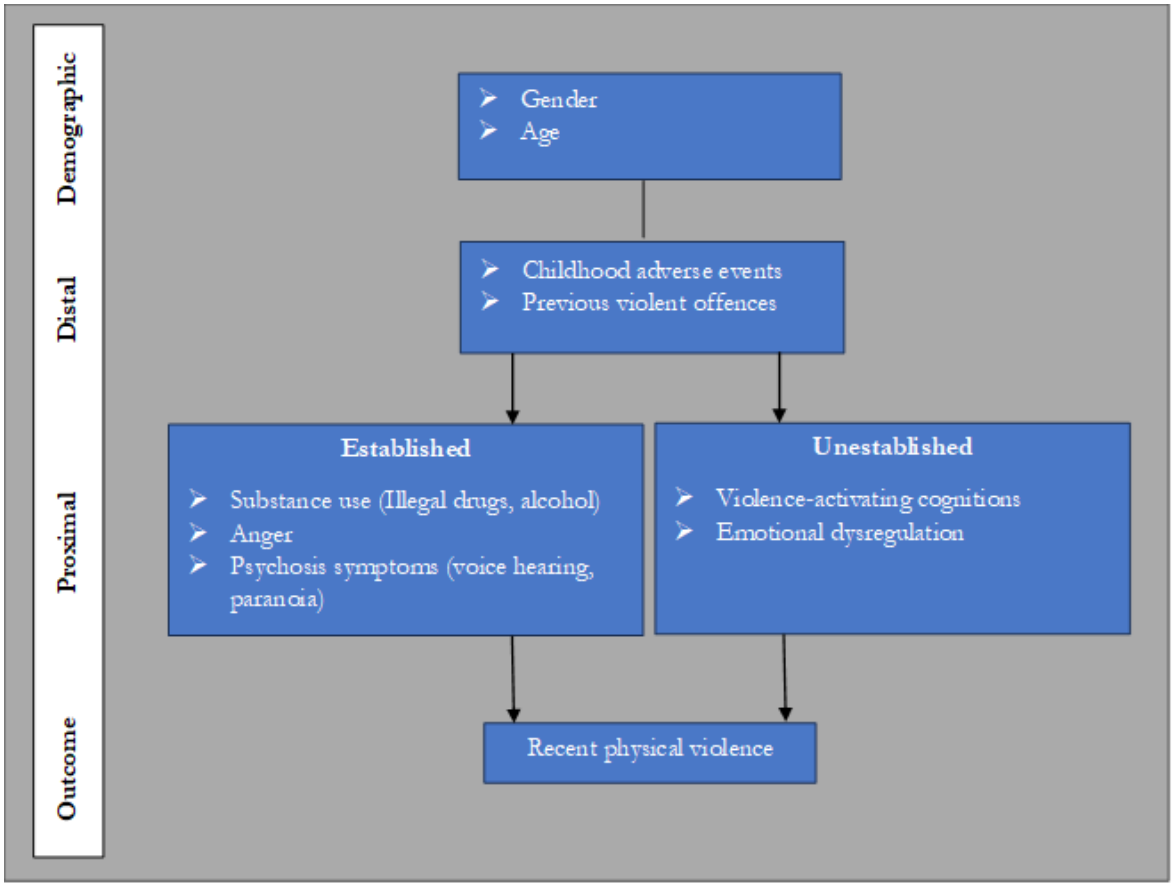


Figure 4.1: A summary of established and unestablished proximal factors and more distal risk factors under investigation for their association with recent physical violence

Method

Design and participants

The participants and procedure are the same as described in Chapter 3. Additional questionnaires were collected for this chapter. In addition to the self-report measure described below, research officers extracted demographic, clinical, and forensic information from participants' clinical records and services' incident reporting systems. All participants provided informed consent. The study was approved by NHS Research Ethics Committee (North West - Preston Research Ethics Committee 23/NW/0012).

Assessments

All questionnaire scales underwent a confirmatory factor analysis to confirm the model fit was adequate for inclusion in the structured equation modelling as this analysis method takes into account measurement error. Assessments with a poor model fit underwent exploratory and confirmatory factor analysis.

Violence and aggression severity: The clinical notes of each participant and the clinical services' incident reporting systems were reviewed for the past six months. Any incidents of verbal aggression, destruction of property, physical violence, or use of a weapon on another person were recorded. Participants also completed a self-report measure which asked about the occurrence of ten aggressive behaviours in the last six months and covered verbal aggression, destruction of property, physical assault, and use of a weapon (Steadman et al., 1998). The primary outcome was physical violence in the past six months (Yes or No). A person was recorded as being physically violent if, in the clinical notes or self-reported, there was an incident of a physical assault or use of a weapon. An aggression severity score was also calculated, ranging from 0 to 4 (0 = no form of aggression, 1 = verbal aggression, 2 = destruction of

property, 3 = physical violence, 4 = use of a weapon)(Steadman et al., 1998; Ullrich et al., 2014).

Oxford Violent-Activating Cognitions Scale (OVAC) contains 28 items reflecting different violence-activating cognitions. Each item is rated on a 5-point scale from 0 (Do not believe at all) to 4 (Believe it totally). Higher scores indicate stronger violence-supporting beliefs. Confirmatory factor analysis showed an excellent model fit (χ^2 = 443.903, df = 335, p < .001, CFI = 0.963, TLI = 0.956, RMSEA = 0.041, SRMR = 0.056). Cronbach's alpha in this sample was 0.95)

Oxford Violence-Inhibiting Cognitions Scale (OVIC) is a seven-item scale addressing the negative consequences of violence. Each item is rated on a 5-point scale from 0 (Do not believe at all) to 4 (Believe it totally). Higher scores indicate stronger negative beliefs about violence and its consequences. The confirmatory factor analysis showed an excellent fit (χ^2 = 422.26, df = 21, p < .001, CFI = 0.985, TLI = 0.976, RMSEA = 0.044; SRMR = 0.034). Cronbach's alpha in this sample was 0.813.

Revised Difficulties in Emotion Regulation Scale (RDERS) (Kaufman et al., 2016) The original scale contained 18 items, each rated on a 5-point Likert scale and was proposed to have a six-factor structure: Awareness, Clarity, Goals, Impulse, Nonacceptance, and Strategies. A CFA in the current sample, showed a poor model fit (scaled χ^2 = 816.583, df = 120, p < .001; CFI = .878, TLI = .844; RMSEA = .098). Thus an EFA and CFA was conducted (see Appendix E). A four-factor structure was identified with 13 items (non-acceptance of emotional responses, difficulties in impulse control, lack of emotional clarity, and difficulty engaging in goal directed behaviour) and a good model fit (scaled χ^2 = 182.24, df = 120, p < .001; CFI = 0.94., TLI = 0.93; RMSEA = .061, SRMR=0.056). Cronbach's alpha in this sample (n= 830) was 0.91.

Dimensions of Anger Reactions-5 Scale(DAR-5) (Forbes, Alkemade, Hopcraft, et al., 2014) is a five-item measure of anger, with each item rated on a scale of 0 (none of the time) to 4 (all of the time). Items assess anger frequency, intensity, duration, aggressive urge, and interference

with social relationships over the past four weeks. Total scores can range from 0 to 20, with higher scores indicating greater levels of anger. A CFA with this study sample showed an excellent model fit (scaled $\chi^2 = 7.99$, df = 5, $p > .05$; CFI = 0.99, TLI = 0.99; RMSEA = .026, SRMR = 0.015). Cronbach's alpha in this sample (n=855) was 0.86

Revised Green et al Paranoid Thoughts Scale Part B *(RGPTS)* (Freeman, Loe, et al., 2021) is a ten-item self-report measure of persecutory ideation over the past month. Items are rated on a 5-point scale from 0 (not at all) to 4 (totally) with higher scores indicating greater paranoia. A CFA with the study sample found an excellent model fit (scaled $\chi^2 = 3126.07$, df = 45, $p < .001$; CFI = 0.96, TLI = 0.95; RMSEA = .062, SRMR = 0.030). Cronbach's alpha in this sample (n=836) was 0.95

Psychosis Screening Questionnaire (PSQ) (Bebbington & Nayani, 1995). The presence of hallucinations in the past 12 months was assessed using two items from the PSQ: 'Have there been times when you saw/heard things that other people couldn't?' (Yes/No). 'Did you at any time hear voices saying quite a few words or sentences when there was no one around that might account for it?' (Yes/No). If a participant selected Yes, they were asked to rate their distress in response to the experience on a scale from 0 (no distress) to 10 (extremely distressing).

The Adverse Childhood Experiences (ACE)(Felitti et al., 1998) is ten-item self-report questionnaire assessing exposure to abuse (emotional, physical, and sexual), neglect (emotional and physical), and household dysfunction (e.g. parental substance abuse, parental mental illness, incarceration of a household member) during the first 18 years of life. Items are scored as either 0 (No, did not experience) or 1 (Yes, did experience), with total scores ranging from 0 to 10. Higher scores indicate a greater number of adverse childhood experiences.

Substance Use. Participants were asked if they were currently using illegal substances (Yes/No), drinking alcohol (Yes/No) or had ever used illegal substances (Yes/No) or drank alcohol (Yes/No).

Statistical analysis

All analyses were conducted in R, version 4.2.0 (R Core Team, 2023) using packages psych (Revelle, 2024), GPArotation (Bernaards & Jennrich, 2005), dplyr (Wickham et al., 2023), lavaan (Rosseel, 2012), regsem(Jacobucci, 2023), mice (Buuren & Groothuis-Oudshoorn, 2011), qgraph (Epskamp et al., 2012), mgm (Haslbeck & Waldorp, 2020), bootnet (Epskamp et al., 2018).

Data preparation

Only complete data were used for factor analysis. However, prior to structural equation modelling and network analysis, missing data were handled using imputation. Only cases with less than 30% missing data per scale were retained for imputation. Multiple imputation was performed using the mice package (van Buuren & Groothuis-Oudshoorn, 2011). This approach was applied consistently across all scales in the study.

Group comparisons

To examine differences between groups, participants with recent physical violence and those without recent violence will be compared on all the measures using a t-test (continuous variables) or chi squared (categorical variables).

Structural Equation Modelling

Structural equation modelling (SEM) comprises of a confirmatory measurement model, (also known as the confirmation factor analysis, CFA), which estimates the relations among latent constructs and their observed indicators, and a structural model, which estimates the

relationship between constructs (Kline, 2015). SEM is particularly valuable for investigating complex relationships among variables and dealing with issues of multicollinearity.

SEM was conducted on the whole sample to test an explanatory model for the recent occurrence of violence. Separate SEMs were performed, regressing recent physical violence onto each explanatory factor. These factors were then integrated into a unified SEM to account for the correlation between the predictors. SEMs were estimated using the weighted least squares means and variance adjusted (WLSMV) estimator, which is appropriate for models containing categorical variables, including the binary outcome variable (recent physical violence), and does not assume multivariate normality of the observed variables (T. A. Brown, 2015). Missing data were removed pairwise. In assessing the relations among constructs in the structural model, a backward elimination procedure was employed, setting non-significant variables to zero one at a time (Grewal et al., 2004; Hocking, 1976).

The odds ratios were calculated using a conversion approach from probit coefficients to logistic coefficients. First, the probit coefficients from the SEM model predicting the binary outcome variable ‘recent physical violence’ were extracted. These coefficients were then multiplied by 1.6 (a standard approximation factor) to convert them from the probit to logit scale. The odds ratios were subsequently obtained by exponentiating these converted logit coefficients (OR = exp(logit_coef)). Confidence intervals for the odds ratios were similarly calculated by first converting the probit confidence bounds using the same 1.6 factor and then exponentiating them, providing a meaningful interpretation of effect sizes in terms of the relative odds of experiencing a violent incident associated with each predictor.

Network analysis

A network approach entails conceptualising a domain as a network, that is, as a set of components and the relationship among those components. Central to this approach is ‘systems thinking’ which conceptualises phenomena (in this case violence) as an emergent property generated by the components of the network interacting with each other (Isvoranu et al., 2022). This theoretical foundation draws from general systems theory, which posits that the whole is greater than the sum of its parts, and that system properties emerge from the dynamic interactions between components rather than being reducible to any single element. Unlike models that assume a linear, predictable, proportional responses to intervention, systems thinking acknowledges that changes in one part of a network can cascade through interconnected pathways, potentially producing effects elsewhere in the system.

In this study network analysis was used to explore and visualise the conditional relationships between variables including severity of violence in the last six months, violence-activating cognitions, anger, emotional dysregulation, psychosis symptoms, substance use, childhood adverse events, and age. Violence severity was used for the network analysis as it is a continuous variable and thus more suited to network visualisation.

Cases with missing data were excluded using listwise deletion, leaving 780 participants with complete data. Correlations between variables were examined and one variable in each high correlation pair (>0.70) was removed as high multicollinearity reduces stability of the edges.

A regularised Mixed Graphical Model (MGM) was estimated to identify conditional relationships between variables. The network represents variables as nodes, and a pair of nodes can be connected by an edge representing a conditional association that exists once all other variables in the network have been conditioned upon. MGM accommodates both continuous and binary variables in a single network (Haslbeck & Waldorp, 2020). All variables were scaled prior to estimation.

To prevent overfitting and the estimation of spurious edges, a regularisation technique with the Least Absolute Shrinkage and Selection

Operator (LASSO (Tibshirani, 1996)) was used. LASSO regularisation employs a penalty by limiting the sum of the partial correlation coefficients, leading to a shrinking of estimates with some becoming exactly zero and dropping out of the model (Epskamp and Fried, 2018). The degree of regularization is controlled by the tuning parameter λ, selected using the Extended Bayesian Information Criterion (EBIC) grid search method. This approach identifies optimal penalty parameters to balance model fit and sparsity. As LASSO regularisation estimates edges that are not needed as zero, observing an edge indicates it is sufficiently strong to be included in the model. Edge weights were calculated, which indicate the strength of the relationship between two variables. Larger weights suggest stronger relationships. Once estimated, the relations among the variables were visualised using the package 'qgraph'. Edge thickness and colour saturation corresponds to the strength of the conditional association, with thicker edges denoting stronger relationships. Green edges represent positive associations while red edges represent negative associations. Conversely the absence of an edge indicates no significant relationship between those variables when controlling for the other variables in the network. Node predictability - the extent to which each node is predicted by its neighbouring nodes – was estimated using variance explained (R^2) for continuous variables and the proportion of correct classification (CC_{total}) for binary variables.

The network visualisation provides an intuitive overview of how variables (nodes) relate to one another. Centrality indices (strength, closeness, and betweenness) were also calculated to identify influential nodes within the network. *Strength* centrality indicates the sum of absolute weights of all direct connections for each node, quantifying how strongly a variable is connected within the network. *Closeness* centrality represents how well a node is indirectly connected to other nodes. *Betweenness* centrality measures how important a node is in the average path between two other nodes.

As network models can be susceptible to sampling variation, two complementary bootstrap approaches were used to assess edge weight accuracy and to produce a highly stable network of edges (retained in 95% of bootstrapped samples).

First, using the bootnet package (Epskamp et al., 2018), edge weight accuracy was evaluated through 500 bootstrapped samples to measure (a) the accuracy of estimated edge weights by calculating confidence intervals, with narrower intervals indicating more precise estimation of connection strengths; (b) edge differences, which examines whether edges significantly differ from each other in strength, preventing over-interpretation of small differences between connections and identifying which relationships are reliably stronger than others; (c) stability of centrality measures which uses case-dropping procedures to determine whether the relative importance of nodes remains consistent despite sampling variations. The correlation stability coefficient (CSC) was calculated at a threshold of cor=0.7 (Epskamp et al., 2018), representing the maximum proportion of cases that can be dropped while maintaining, with 95% probability, a correlation above 0.70 between original and subset centrality indices (Epskamp et al., 2018). A CSC should not be below 0.25 and preferably be above 0.5 for reliable interpretation of centrality measures.

While the first bootnet analysis evaluates general network stability and centrality robustness, a second procedure using the mgm package's resampling function (Haslbeck & Waldorp, 2020) focuses on conservative edge selection through a separate bootstrapped network (n = 500) with a stability threshold of 0.95, retaining only edges present in 95% of bootstrap samples. This highly conservative threshold (0.95) was chosen to ensure only the most robust connections are retained, minimizing false positive edges in the final network. This approach, specifically designed for MGMs, generates distributions of edge parameters with 5th and 95th percentile confidence intervals, which will be visualized alongside the

network to demonstrate estimation uncertainty and support interpretation of edge reliability.

Results

The sample for this study is the same as that described in Chapter 3. See Table 3.1 for demographic, clinical, and forensic information. As already outlined, eight-hundred and sixty men with psychosis took part (average age=41.0 years; SD=12.6). Three hundred and forty-eight participants (41.5%) had a previous conviction for a violent offence. Two hundred and eleven (24.7%) participants had been physically violent in the past six months. Table 4.1 provides a summary of violent incidents over the previous six months. The means and standard deviations (or frequencies) for all measures administered, both for the whole sample and by recent physical violence status are displayed in Table 4.2, alongside group comparisons.

Table 4.1: Violent incidents over the previous six months, recorded from clinical notes and self-reports, alongside violence severity scores for the study sample.

	Frequency N=860	**Percentage** %
Physical violence in the past 6 months - objective or self-report	211	24.5
Incidents recorded in patient clinical notes (past 6-months)		
Verbal aggression	259	30.1
Destruction of property	124	14.4
Physical assault	93	10.8
Use of a weapon	26	3.0
Self-reported incidents (past 6-months)		
Verbal aggression	302	35.1
Destruction of property	181	21
Physical assault	150	17.4

	Use of a weapon	31	3.6
Violence severity score			
0	No aggression	0	47.3
1	Verbal aggression	154	17.9
2	Destruction of property	88	10.2
3	Physical assault	157	18.3
4	Use of weapons	54	6.3

Structural equation modelling

Individual SEMs for each variable are displayed in Table 4.3. It can be seen that the variables that had the strongest associations with recent physical violence were violence-activating cognitions (higher order factor) – violence regulated emotions was the subscale most strongly related to violence – anger, current drug use, and paranoia. Violence-inhibiting cognitions and previous violent offences did not significantly predict violence.

Unified SEM model

Fourteen variables were included in a unified SEM. Two of these variables were identified as possible suppressors: emotional dysregulation and hearing voices (yes/no). Details of the assessment of these variables, their impact on the model, and the rationale for their exclusion from the model are outlined in Appendix F. The unified SEM combining the remaining 12 predictor variables had an excellent model fit (scaled): χ^2 (2174) = 5075.88, $p < .001$; CFI = 0.944; TLI = 0.953; RMSEA = 0.040; SRMR = 0.063. The backward elimination procedure reduced the number of predictors from 12 to 5 with an R squared of 30.9. Violence-activating cognitions showed the strongest association with recent physical violence (OR = 1.92, 95% CI [1.38, 2.67]) followed by anger (OR = 1.60, 95% CI [1.20, 2.15]) and current drug use (binary variable) (OR = 2.47, 95% CI [1.68, 3.62]). Voice-related distress had a

smaller but still significant effect (OR = 1.13, 95% CI [1.02, 1.25]). Younger age was associated with increased risk of physical violence (OR = 0.98, 95% CI [0.97, 0.99]). Paranoia was approaching significance but was removed from the model without reducing the variance explained. See Table 4.4 and Figure 4.2 for the unified SEM results.

Table 4.2: Means and standard deviations for the whole sample and by recent physical violence grouping and group comparisons.

Variable	Whole Sample			Non-Violent Group			Violent Group			Group Comparison	
Continuous Variables	n	mean	sd	n	mean	sd	n	mean	sd	t	p
Anger (DAR-5)	855	9.21	4.53	645	8.44	4.05	210	11.58	5.08	-8.14	<0.001
Paranoia (RGPTS)	836	12.49	12.90	633	10.46	11.80	203	18.83	14.12	-7.64	<0.001
Revised Emotional regulation											
Non-acceptance of emotions	830	7.02	3.55	630	6.79	3.46	200	7.76	3.75	-3.23	0.001
Difficulties in impulse control	830	7.85	4.26	630	7.28	3.83	200	9.67	4.98	-6.21	<0.001
Difficulty with goal directed behaviour	830	8.88	3.84	630	8.65	3.84	200	9.62	3.78	-3.13	0.002
Lack of emotional clarity	831	6.51	3.16	630	6.31	3.02	201	7.15	3.50	-3.10	0.002
Total	830	30.27	12.26	630	29.03	11.60	200	34.19	13.46	-4.87	<0.001
Number of Childhood Adverse Events	772	3.03	2.73	589	2.73	2.54	183	3.98	3.08	-4.97	<0.001
Violence-Activating Cognitions											
Violence for emotional regulation	845	6.51	7.39	641	5.13	6.17	204	10.84	9.08	-8.39	<0.001
Violence gives power and control	836	2.04	3.47	634	1.50	2.88	202	3.71	4.48	-6.59	<0.001
Violence as justified	849	4.35	4.36	641	3.67	3.87	208	6.43	5.06	-7.22	<0.001

Variable	Whole Sample			Non-Violent Group			Violent Group			Group Comparison	
Negative consequences of non-violence	832	3.72	4.30	630	3.21	3.96	202	5.29	4.92	-5.46	<0.001
Sensitivity to others	835	6.05	4.58	633	5.41	4.26	202	8.05	4.97	-6.79	<0.001
Violence needed for survive	832	3.18	4.32	630	2.52	3.72	202	5.22	5.33	-6.69	<0.001
Violence-Inhibiting Cognitions											
Violence negatively impacts self	844	6.13	3.79	639	6.05	3.78	205	6.39	3.82	-1.12	0.262
Violence negatively impacts others	843	10.08	4.22	638	10.01	4.26	205	10.29	4.07	-0.86	0.392
Categorical Variables	**n**	**Count**	**%**	**n**	**Count**	**%**	**n**	**Count**	**%**	**p**	**sig**
Past alcohol use	838	788	94.03	649	602	92.8	211	186	88.2	0.392	
Current alcohol use	838	420	50.12	649	323	49.8	211	97	46.0	0.546	
Past illegal drug use	839	649	77.35	649	492	75.8	211	157	74.4	0.844	
Current illegal drug use	837	183	21.86	649	112	17.3	211	71	33.6	<0.001	***
Saw or heard things other could not.	834	414	49.64	649	312	48.1	211	102	48.3	0.780	
Heard voices that other could not.	831	381	45.85	649	283	43.6	211	98	46.4	0.345	
Previous violent offence	857	348	40.61	649	258	39.8	211	90	42.7	0.453	
Childhood adverse events											

Variable	Whole Sample			Non-Violent Group			Violent Group			Group Comparison
Physical abuse	798	379	47.49	649	272	41.9	211	107	50.7	<0.005 **
Emotional abuse	798	325	40.73	649	237	36.5	211	88	41.7	0.063
Sexual abuse	790	126	15.95	649	80	12.3	211	46	21.8	<0.001 ***
Physical neglect	797	300	37.64	649	211	32.5	211	89	42.2	0.003 **
Emotional neglect	800	176	22.00	649	114	17.6	211	62	29.4	<0.001 ***
Household substance abuse	796	312	39.20	649	225	34.7	211	87	41.2	0.034 *
Household mental illness	794	176	22.17	649	119	18.3	211	57	27.0	0.004 **
Parental separation/divorce	797	252	31.62	649	169	26.0	211	83	39.3	<0.001 ***
Household member incarceration	797	281	35.26	649	191	29.4	211	90	42.7	<0.001 ***
Witnessing domestic violence	798	112	14.04	649	67	10.3	211	45	21.3	<0.001 ***

Note: *** p < 0.001, ** p < 0.01, * p < 0.05

Table 4.3: Individual SEM models predicting recent physical violence

Variable	Standardized Estimate	R Squared	Odds Ratio	OR Lower 95% CI	OR Upper 95% CI	p-value
Childhood Adverse Events (ACE)	0.276	0.076	1.62	1.35	1.95	<0.001
Anger (DAR-5)	0.440	0.193	2.30	1.95	2.72	<0.001
Paranoia (R-GPTS)	0.383	0.147	2.00	1.71	2.34	<0.001
Violence-activating cognitions (OVAC) (Higher Order)	0.439	0.193	2.81	2.30	3.42	<0.001
Violence to survive the social environment	0.375	0.141	1.93	1.63	2.28	<0.001
Attribution of negative intent from others	0.350	0.123	1.88	1.59	2.21	<0.001
Violence as a justified response	0.389	0.152	2.27	1.86	2.76	<0.001
Violence giving feelings of power	0.404	0.163	2.06	1.73	2.45	<0.001
Negative consequences of not being violent	0.291	0.085	1.69	1.42	2.01	<0.001
Violence regulating negative emotions	0.453	0.205	2.63	2.20	3.23	<0.001
Violence-inhibiting cognitions total (OVIC) (Higher Order)	0.069	0.005	1.14	0.90	1.45	0.264
Negative personal consequences of violence	0.058	0.003	1.08	0.94	1.25	0.261
Negative external consequences of violence	0.056	0.003	1.15	0.89	1.50	0.283
Revised Emotional dysregulation scale total (R-SDRS) (Higher Order)	0.253	0.064	1.83	1.45	2.31	<0.001
Non-acceptance of emotions	0.165	0.027	1.41	1.14	1.74	0.001
Difficulties in impulse control	0.338	0.114	1.79	1.52	2.10	<0.001
Difficulty with goal directed behaviour	0.159	0.025	1.32	1.11	1.57	0.001
Lack of emotional clarity	0.155	0.024	1.45	1.14	1.85	0.003
Age	-0.203	0.041	0.97	0.96	0.99	<0.001
Previous violent offence	0.039	-	1.13	0.84	1.53	0.407

Variable	Standardized Estimate	R Squared	Odds Ratio	OR Lower 95% CI	OR Upper 95% CI	p-value
Current drug use	0.224	-	2.43	1.73	3.43	<0.001
Past drug use	0.014	-	1.05	0.74	1.51	0.769
Current alcohol use	-0.032	-	0.90	0.67	1.21	0.494
Past alcohol use	-0.046	-	0.73	0.40	1.34	0.313
Presence of voices (PSQ)	0.049	-	1.17	0.87	1.58	0.305
Distress from voice hearing	0.132	0.017	1.15	1.05	1.26	0.003
Saw or heard things (PSQ)	0.017	-	1.06	0.78	1.42	0.719
Saw or heard things distress	0.090	0.008	1.10	1.00	1.21	0.040

Table 4.4: SEM unified model regression results.

Variable	Standardized Estimate	Probit Coeff	Approx. Logit Coeff	Odds Ratio	OR Lower 95% CI	OR Upper 95% CI	p-value
Current drug use	0.220	0.564	0.902	2.47	1.68	3.62	<0.001
Violence-activating cognitions	0.259	0.407	0.651	1.92	1.38	2.67	<0.001
Anger	0.227	0.295	0.472	1.60	1.20	2.15	0.002
Voice distress	0.108	0.076	0.122	1.13	1.02	1.25	0.015
Age	-0.179	-0.015	-0.024	0.98	0.97	0.99	<0.001
Paranoia	0.000	-	-	-	-	-	-
Childhood Adverse Events	0.000	-	-	-	-	-	-
Current alcohol use	0.000	-	-	-	-	-	-
Violence-inhibiting cognitions	0.000	-	-	-	-	-	-
Past alcohol use	0.000	-	-	-	-	-	-
Past drugs use	0.000	-	-	-	-	-	-

Variable	Standardized Estimate	Probit Coeff	Approx. Logit Coeff	Odds Ratio	OR Lower 95% CI	OR Upper 95% CI	p-value
Previous violent offence	0.000	-	-	-	-	-	-

Note: Variables in bold have significant direct paths ($p < 0.05$). Variables with standardized estimates of 0.000 had paths fixed to zero in the model.

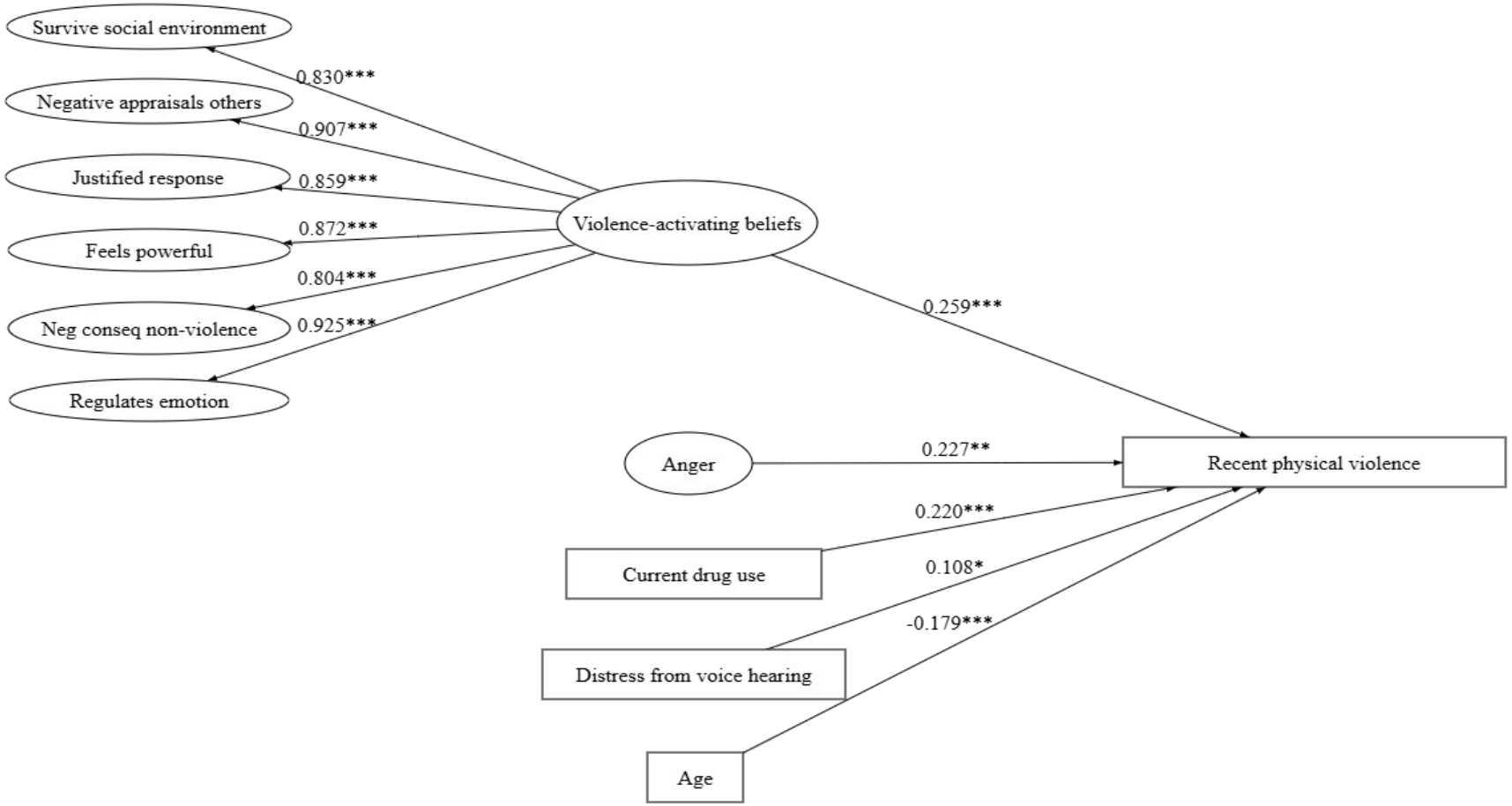


Figure 4.2: Unified structural equation model. ***Note:*** ***p* < 0.05, ****p* < 0.01, *****p* < 0.001.

Further investigation of impact of previous violent conviction on violent behaviour.

As it was an unexpected finding that previous violent conviction did not significantly predict recent violent behaviour. The association between violent offences and both self-reported violence and objective violent incidents was tested separately to assess if this finding was the result of differences in the measurement of violence. No significant differences emerged in physical violence between participants without versus with previous violent offenses, measured by either self-report (without violent conviction 103/509 [20.24%] vs. with a violent conviction 76/348 [21.84%]; χ^2=0.232, p=0.630) or by incident reports (without violent conviction 60/509 [11.79%] vs. without violent conviction 41/348 [11.78%]; $\chi^2 \approx 0$, p=1.000)

Network analysis

The fully estimated regularised network of violence severity is shown in Figure 4.3. Violence severity had a direct positive association with current drug use (edge weight = 0.291; 95% CI = [0.15, 0.41]), anger (edge weight = 0.191 95% CI =[0.12, 0.26]), violence-activating cognitions (edge weight = 0.168; 95% CI =[0.09, 0.24]), paranoia (0.085; 95% CI =[0.00, 0.15]), childhood adversity (edge weight = 0.058; 95% CI =[0.00, 0.13]), and a direct negative association with age (edge weight = -0.104; 95% CI =[-0.18, 0.00]), and alcohol use (edge weight = -0.058; 95% CI =[-0.16, 0.00]) (See Table 4.5 for all edge weights). A total of 27% of the variance in violence severity was explained by the direct edges with these six variables. Among the network nodes, violence-activating cognitions showed the highest predictability (R^2 = 0.56), followed by paranoia (R^2 = 0.51) and drug use (CC = 0.79).

Analysis of network stability revealed 20 of the 52 edges remained consistently non-zero across 95% of bootstrap samples (See Figure 4.4 for edge-weights and bootstrapped confidence intervals). Direct

relationships between violence severity and substance use, anger, violence-activating cognition, and age were shown to be highly stable across bootstrap iterations. Figure 4.5 presents a network including only highly stable edges, indicating consistent and robust associations between nodes.

Strength indices identified violence-activating cognitions (strength = 1.26), emotional dysregulation (strength = 1.20), and current drug use (strength = 1.18) as the most influential nodes in the network and the centrality stability coefficient (CSC) for strength was 0.75 demonstrating excellent stability of this finding. Centrality indices, closeness (CSC=0.00) and betweenness (CSC=0.21) were below the acceptable range to allow for interpretation (See Appendix G for centrality indices for all variables and centrality stability).

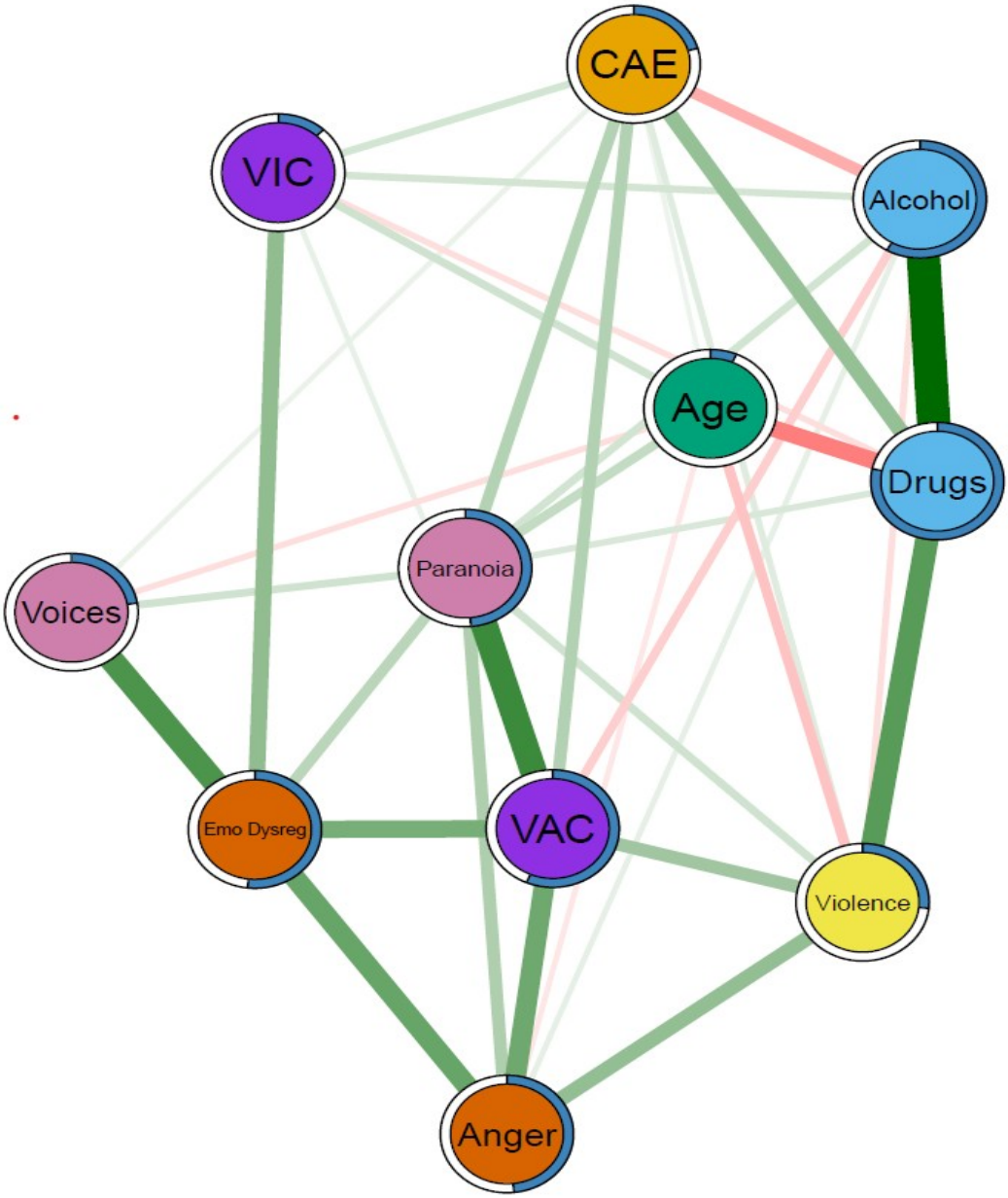


Figure 4.3: Regularised mixed graphical model network with the shaded area of the pie chart around the nodes indicating the predictability measure. VAC – Violence-activating cognitions; VIC – Violence-inhibiting cognitions; CAE – Childhood adverse events. Emo Dysreg – Emotional Dysregulation.

Table 4.5: Edge weights for all variables.

	Childhood Adversity	Anger	Emotional dysregulation	VAC	VIC	Voices distress	Paranoia	Age	Violence Severity	Current drug use	Current alcohol use
Childhood Adversity	0.000000	0.000000	0.000000	0.136730	0.079363	0.038185	0.134046	0.032325	0.057288	0.187288	0.146432
Anger	0.000000	0.000000	0.266530	0.254187	0.000000	0.000000	0.142308	0.044281	0.191249	0.000000	0.044583
Emotional dysregulation	0.000000	0.266530	0.000000	0.239056	0.195776	0.313728	0.121784	0.000000	0.000000	0.000000	0.000000
VAC	0.136730	0.254187	0.239056	0.000000	0.040916	0.000000	0.342692	0.000000	0.168155	0.000000	0.089120
VIC	0.079363	0.000000	0.195776	0.040916	0.000000	0.000000	0.000000	0.084561	0.000000	0.059331	0.078153
Voices distress	0.038185	0.000000	0.313728	0.000000	0.000000	0.000000	0.084470	0.059082	0.000000	0.000000	0.000000
Paranoia	0.134046	0.142308	0.121784	0.342692	0.000000	0.084470	0.000000	0.105379	0.085227	0.066185	0.081637
Age	0.032325	0.044281	0.000000	0.000000	0.084561	0.059082	0.105379	0.000000	0.109549	0.228883	0.000000

	Childhood Adversity	Anger	Emotional dysregulation	VAC	VIC	Voices distress	Paranoia	Age	Violence Severity	Current drug use	Current alcohol use
		81		00	61	82	79	00	10	20	00
Violence Severity	0.057288	0.191249	0.000000	0.168155	0.000000	0.000000	0.085227	0.109510	0.000000	0.291855	0.058860
Current drug use	0.187288	0.000000	0.000000	0.000000	0.059331	0.000000	0.066185	0.228820	0.291855	0.000000	0.433783
Current alcohol use	0.146432	0.044583	0.000000	0.089120	0.078153	0.000000	0.081637	0.000000	0.058860	0.433783	0.000000

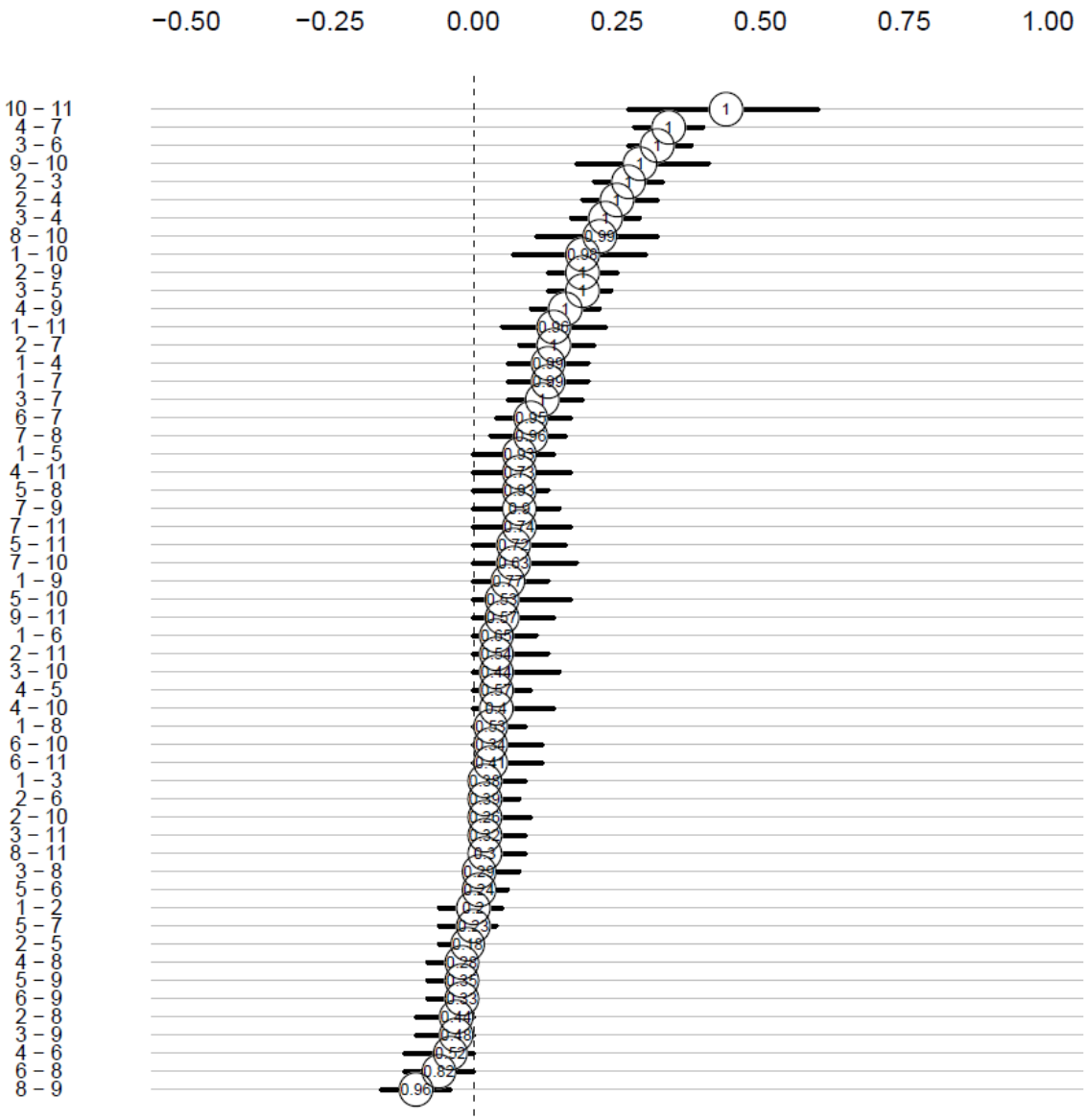


Figure 4.4: Showing sample edge-weights and bootstrapped confidence intervals of edge-weights obtained via non-parametric bootstrapping (500 bootstraps) for all edges in the network. Numbers represent variables. 1=Childhood Adversity, 2=Anger, 3=Emotional dysregulation, 4=VAC, 5=VIC, 6=Voices distress, 7=Paranoia, 8=Age, 9=Violence Severity, 10=Current drug use, 11=Current alcohol use

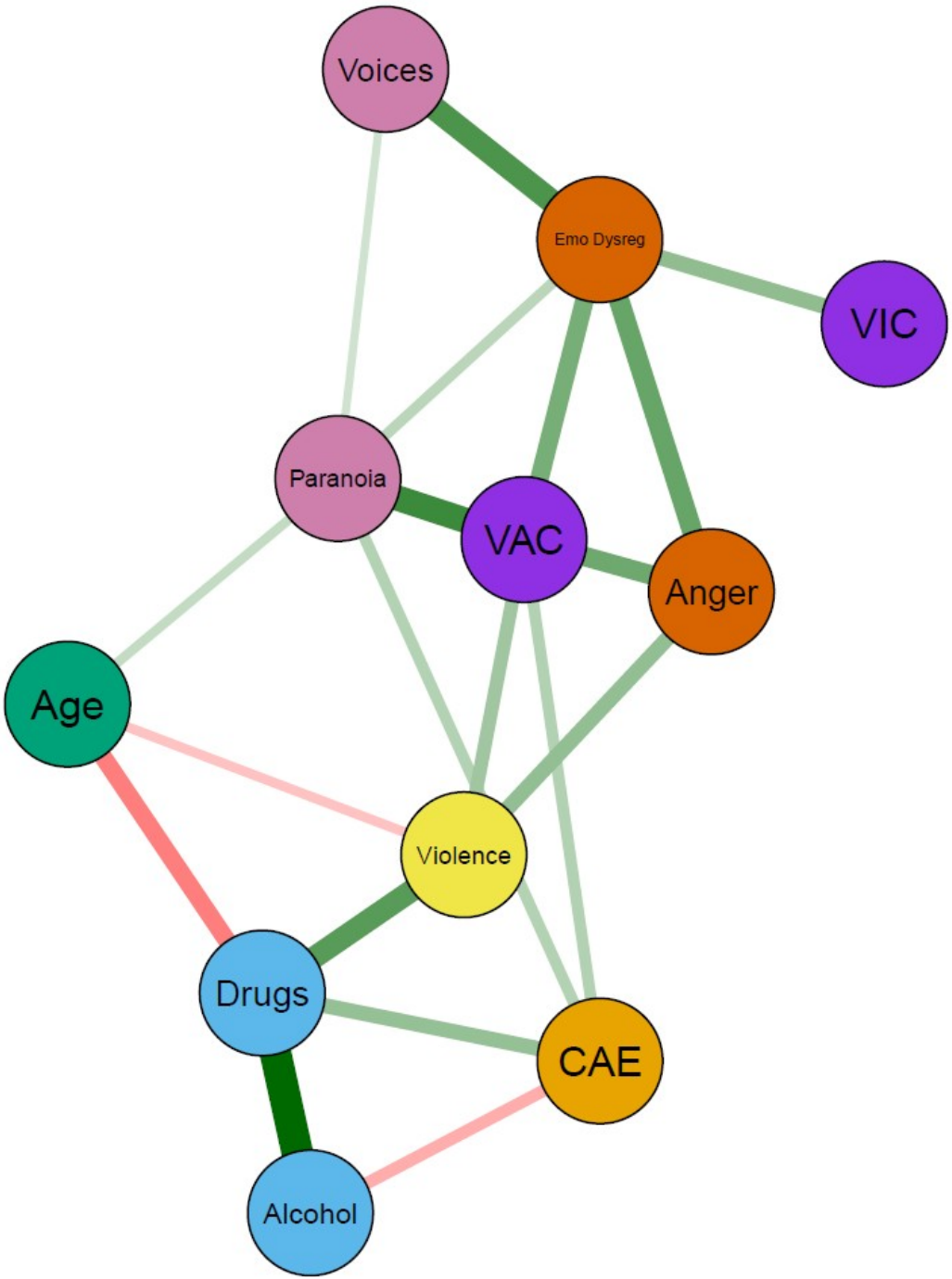

Voices
Emo Dysreg
VIC
Paranoia
VAC
Anger
Age
Violence
Drugs
CAE
Alcohol

Figure 4.5: Mixed graphical model network with highly stable edges retained in 95% of bootstrap samples. VAC – Violence-activating cognitions; VIC – Violence-inhibiting cognitions; CAE – Childhood adverse events. Emo Dysreg – Emotional Dysregulation.

Discussion

A better understanding of the proximal causes of violence can be a route to the development of better interventions. In a large sample of men diagnosed with psychosis, cognitions were examined as a proximal contributor to violence, alongside other more established proximal factors (anger, substance use, voice hearing, and paranoia), and distal risk factors (childhood adverse experiences and previous violent offences). The broad array of violence-activating cognitions identified in Chapter 3 were significantly associated with recent physical violence - with the strongest associations for *violence for regulating emotions* and *violence as a justified response* - alongside other proximal factors such as anger, current drug use, and distress from voice hearing. Violence was negatively associated with age. Targeting in intervention both the different types of violence-activating cognitions and the factors that may disinhibit acting on the thoughts (e.g. substance use, anger, and voice-related distress) may provide new treatment routes.

Chapter 3 also identified two types of violence-inhibiting cognitions: negative personal consequences of violence (e.g. Being aggressive makes me feel bad about myself.) and negative external consequences of violence (e.g. People don't like aggressive people.). Endorsement of these beliefs showed no association with recent violent behaviour. This suggests that an appreciation of the negative consequences of violence is not sufficient to inhibit violent behaviour. It also highlights the secondary negative effects of violence on an individual's self-perception and perceived place in society. The diminishing effect of violence on one’s

sense of self and belonging may leave them more vulnerable to future triggers of violence. For example, there is a well-established association between low or fragile self-esteem and violence (Lambe et al., 2018). Clinically, it suggests targeting the perceived benefits of violence may be more effective than emphasising its costs, though an awareness of the negative consequences of violence could be leveraged to increase motivation for intervention.

The study findings are consistent with known risk factors for violence. Substance misuse is a well-established risk factor for violence in both psychiatric and general populations. Proposed mechanisms include reduced impulse control, emotional dysregulation, worsening psychosis, and increased exposure to antisocial peers or contexts (Lagerberg et al., 2025). In our network analysis, current drug use was not directly associated with emotional dysregulation or anger, but showed a small positive link with paranoia. Current drug use also had a highly stable direct association with childhood adversity, possibly reflecting early exposure to substances (e.g., parental substance use, poor supervision) or self-medication. Alcohol use did not directly predict violence but was strongly associated with drug use, suggesting an indirect pathway to violence. Unfortunately, evidence of effective interventions for substance misuse in people diagnosed with psychosis is lacking. A recent meta-analysis of 35 randomised controlled trials of psychosocial interventions for comorbid psychosis and substance use found no significant effect on substance use (Siddiqui et al., 2024). Given the robust link between substance use and violence, novel interventions for reducing substance use in psychosis should be a research priority.

Surprisingly, previous violent offending was not associated with violence in this sample. Forty-one percent of those who had engaged in recent physical violence had a previous violent conviction, compared to a similar 39% among those who had not been violent. This pattern held true across both objectively recorded incidents and self-reported measures of violence. The reason for this finding is unclear but may relate to

sampling from high-risk services or the proximity of the previous offences.

This study has several limitations. This study purposefully sampled those with difficulties with aggression and therefore no conclusions about the prevalence of violence can be made. The cross-sectional design precludes most causal inference. Violence was assessed retrospectively, which limits the ability to establish predictive associations between these factors and violence. Key predictors (e.g. anger, paranoia, and voice-related distress) are dynamic and their levels at the time of measurement may differ from the time of the violent incident. Thus, observed associations likely reflect signals rather than precise estimates of effect sizes. Although the violence outcome combined objective and self-report measures, violent incident may still have been missed, meaning that a number of individuals may have been misclassified as having not been violent. Many predictors were assessed via self-report and may be subject to social desirability bias. However, participants reported more aggressive incidents than documented in clinical records, suggesting some openness in disclosing problematic behaviour. In addition, not all likely factors relevant for understanding violence by men with psychosis were assessed in this study, for example command hallucinations (Birchwood et al., 2018), current medications (Lagerberg et al., 2025), or systemic factors (e.g. environmental triggers)(Ezell, 2021). This study only included men and thus the relevance of the results to women with psychosis is unknown. It is also plausible that many of the factors identified are relevant to understanding violence by men who do not have psychosis. Overall, the study highlights how a broad array of violence-activating cognitions, alongside several modifiable disinhibiting factors, may lead to violence. The findings offer a potential foundation for the development of much-needed new targeted interventions to reduce violence by men with psychosis.

5

Using a virtual reality social scene to trigger anger: a proof-of-concept experimental study

Abstract

Background

Virtual reality (VR) social simulations may be a safe way for people with high levels of anger to practise overcoming unhelpful reactions. The first step in such treatment development is to test whether anger can be caused by simulations of everyday stressful social situations.

Aim

The aim was to test whether a mildly intimidating VR social environment raises anger in men and whether the effect is more pronounced in men with problematic anger.

Method

A mixed design experimental study was conducted. Two-hundred and sixty-five people were screened. 20 people were allocated to a high anger

group based on the clinical cut-off on the Dimensions of Anger Reactions-5 (DAR-5) and 22 were allocated to a low anger group based on having a low score on the DAR-5 (<8). Levels of anger were assessed pre and post experiencing a mildly intimidating virtual lift scenario with seven virtual characters. Appraisals (hostile, neutral, friendly, judgemental) of the virtual characters were also assessed. Regression analysis was used to test the effect of group on anger in response to the VR. A further regression tested the impact of appraisals of virtual characters on levels of anger in response to the VR.

Results

Across participants anger significantly increased from pre to post VR ($t(41)=3.63$, $p<0.001$, $d = 0.56$). There was a significant effect of group on the extent anger was triggered by the VR ($\beta = .277$, $t(df) = 2.443$, $p = .019$, $SE = 2.098$) with the high anger group showing a greater anger response. Hostile attributions toward virtual characters ($\beta = .416$, $t(df) = 3.285$, $p = .002$, $SE = 0.038$) was associated with a greater anger response, whilst controlling for group and baseline anger.

Conclusions

The reactions to the virtual reality simulation mirrored what may be expected in the real world. A mildly intimating VR social situation raised anger in all but this was more pronounced in men who have difficulties with anger. VR has the potential to be used in the development and delivery of treatments for anger.

Introduction

Virtual reality provides new opportunities for the delivery of psychological therapy. As discussed in Chapter 1, it can provide a safe and controlled environment for patients to make new learning and offers several unique advantages for treatment delivery. VR simulations can activate the same cognitive and emotional responses as the real world (Martens et al., 2019). However, patients are more willing to enter a simulation and experiment with new ways of behaving because they know it is not real (Bond et al., 2023). Importantly, the learning made in VR translates into the real world (Freeman et al., 2016). Simulations can be tailored to the patient's difficulty and features can be added to increase engagement, for example, through gamification. The effectiveness of VR in the treatment of anxiety disorders is well established (W. Deng et al., 2019; Freeman et al., 2018; Parsons & Rizzo, 2008), and there is increasing support for its use in psychosis (Freeman et al., 2016, 2022). More recently, VR has been considered for the treatment of difficulties with anger and aggressive behaviour (Alsem et al., 2021; Jo et al., 2022; Tuente et al., 2020). The success of VR for treating anger will depend on the effective activation of anger and the associated cognitions by simulations of everyday anger-inducing environments. The aim of this study was to show that a VR simulation of a mildly intimidating social situation can trigger anger and that the effects are greater in those who have problematic anger.

Anger is a normal human emotion, but is considered problematic when it is frequent, intense, and lasting, negatively affects social functioning, and is accompanied by a strong desire to harm the offending party (Novaco, 2018). Problematic anger is associated with relationship problems (Renshaw et al., 2010). Anger can be a common feature for a proportion of patients with post-traumatic stress disorder (Adler et al., 2020; Taft et al., 2012), borderline personality disorder (Fernandez & Johnson, 2016), depression (Judd et al., 2013), panic (Gould et al., 1996), psychosis (Coid et al., 2007), eating disorders (Waller et al., 2003) and substance misuse

difficulties (Laitano et al., 2022) and is associated more severe symptoms and poorer treatment outcomes (Adler et al., 2017; Fraguas et al., 2006; Novaco & Chemtob, 2002; Orth & Wieland, 2006; Pickles et al., 2010; Witkiewitz & Villarroel, 2009). Anger has also been shown to increase risk of violent behaviour (Norlander & Eckhardt, 2005). Accounts of violence in Chapter 2 highlighted the role of anger and it was the second greatest predictor of recent violence behaviour in Chapter 4. Thus, it represents a key potential treatment target in reducing the risk of violence.

Cognitive behaviour treatments are most commonly used in the treatment of problematic anger and aggressive behaviour. Treatments for reducing anger have moderate effects in both non-clinical and psychiatric populations (DiGiuseppe & Tafrate, 2003; Lee & DiGiuseppe, 2018), whilst reports of the effectiveness of interventions for reducing aggressive behaviours have been inconsistent (Beaudry et al., 2021; Henwood et al., 2015; Lee & DiGiuseppe, 2018). There is some evidence that interventions that include behaviour rehearsal have better outcomes (Lee & DiGiuseppe, 2018). One key advantage of virtual reality is that it can provide a low-risk environment to practise responding to the triggers of anger and aggression. This may be particularly useful for populations with restricted opportunities to practise new skills (e.g. forensic inpatients or prison populations) or those who, due to the risk of harm to others, cannot participate in behaviour therapy in real world settings.

To the best of our knowledge only two studies have demonstrated that VR can be used to activate anger. As detailed in Chapter 1, Miyahira et al. (2010) demonstrated significant anger arousal in military personnel in response to VR 360 video vignettes when compared to those viewed on a flat screen. In contrast, Jo et al., (2022) used immersive VR environments and found that a greater anger response was elicited when participants argued with a virtual character compared to when they attempted to resolve the conflict. Neither study looked at the impact of cognitions on the anger response.

This study investigated the ability of an immersive VR simulation of a common social scenario to activate anger in individuals with anger difficulties. A virtual lift environment was designed to represent a mildly intimidating everyday social situation that could potentially trigger anger responses. Consistent with the previous studies, this focused exclusively on men given the potential gender differences in the triggers of anger. For example, a man staring might be perceived as confrontational by a man and elicit feelings of anger; whilst it may be viewed as more intimidating and threatening for a woman and elicit feelings of fear. Three hypotheses were tested: 1. The VR exposure would significantly increase self-reported anger. 2.Anger would be exacerbated to a greater degree for those with problematic anger compared to low anger controls. 3. Greater endorsement of the virtual characters as being hostile or judgemental would be associated with greater anger in response to VR

Method

Participants

This study employed a mixed design to test the effect of exposure to a VR social environment on self-reported anger (within-subjects factor) and whether the effect of exposure differs for people with high versus low anger (between-subjects factor). Participants were recruited through advertisements on social media and local radio stations. Those interested in taking part completed the study screening questionnaire which included the Dimensions of Anger – 5 (DAR-5) (Forbes, Alkemade, Hopcraft, et al., 2014). Inclusion criteria were being male and aged 18 or

older. Participants were allocated to the high anger group if they scored above the clinical cut off (>12) for problematic anger on the DAR-5. For the low anger group, participants who scored below this threshold were ranked by their DAR-5 scores, and those with the lowest scores were prioritized for invitation to participate to ensure maximal group differentiation.

Procedure

Upon arrival, participants met individually with a research assistant and were informed that the study examined subjective experiences in virtual environments. To maintain experimental blinding, participants were not informed of the specific focus on anger responses. Participants first completed baseline questionnaires assessing anger. They also completed questions about anxiety, happiness, calmness, and sadness, to disguise the primary outcome measure. Additionally, participants completed a measure of paranoid ideation. Following questionnaire completion, the research assistant provided technical support for VR headset setup and ensured participant comfort with the virtual environment. Participants then completed the experimental virtual reality scenario. Immediately post-VR exposure, participants completed outcome measures assessing their subjective experience during the virtual scenario, including emotional responses and cognitive appraisals of virtual characters encountered within the environment. Following the assessment, participants were fully debriefed on the purpose of the study.Ethical approval was granted by the University of Oxford, Central University Research Ethics Committee (reference R81586/RE001). All participants gave partially informed consent.

Assessments

The Dimensions of Anger Reactions (DAR-5) is a five-item measure of anger assessing frequency, intensity, duration, aggression, and impact on social functioning (Forbes, Alkemade, Mitchell, et al., 2014). Items are rated on five-point scales from none or almost none of the time (1) to all or almost all of the time (5). Higher scores indicate greater problematic anger. The DAR-5 has demonstrated good internal consistency, convergent, concurrent and discriminant validity (Forbes, Alkemade, Hopcraft, et al., 2014; Forbes, Alkemade, Mitchell, et al., 2014). A score of 12 or above on the DAR-5 indicates the presence of problematic anger that may benefit from clinical attention (Forbes, Alkemade, Hopcraft, et al., 2014; Forbes, Alkemade, Mitchell, et al., 2014). The Cronbach's alpha in the study sample (N=42) was 0.89.

Revised Green et al Paranoid Thoughts Scale (RGPTS) Part B (Freeman, Loe, et al., 2021) is a 10-item self-report measure of persecutory ideation over the past month. Items are rated on a 5-point scale from 0 (not at all) to 4 (totally) with high scores indicating greater paranoia. The Cronbach's alpha in the study sample (N=42) was 0.87.

Subjective Feelings of Anger Scale (SFAS) was created for this study and has three-items assessing current feelings of anger. Each item is rated on an 11-point scale ranging from 0 (Not at all) to 10 (Extremely). Higher scores indicate greater feelings of anger. The Cronbach's alpha in the study sample (N=42) was 0.90.

Appraisals of Virtual Characters Scale (AVCS) was created for this study and includes 25 potential appraisal statements of virtual characters. Items were rated on a scale of 0 (did not believe) to 10 (completely believe). The measure has four subscales covering appraisals of characters as friendly (e.g. Everyone was pleasant), judgemental (e.g. They thought they were better than me), hostile (e.g. Someone was trying to intimidate me), and neutral (e.g. No-one had any particular feelings about me). Cronbach's alpha in the study sample (N=42) for each subscale was: friendly=0.79, judgemental= 0.80, hostile=0.96, and neutral=0.77.

VR scenarios

The VR experience was run with a Windows 10 computer (Intel, Nvidia GeForce GTX 1080Ti, 32 GB RAM) and rendered on a *Meta Quest Pro* (Meta, 2022) via Meta Air Link. Participants began in a foyer, waiting for a lift to arrive. The lift door opened automatically and the participant was teleported inside. The lift travelled to the top floor of a (very tall) building, which took approximately three minutes. The lift was dimly lit with seven characters inside (five male and two female). To create a mildly intimidating atmosphere three male characters were set to be taller than the user, eye contact was frequent, and the user was placed in a central position facing the characters (See Figure 5.1). Facial expressions of the characters were set to be subtle and involved different combinations of happy, sad, impressed, and unimpressed (See Figure 5.2).



Figure 5.1: The lift scenario from the user perspective. Top left - View when the lift door opens. Top right – user view to their right in the lift. Bottom left – users view to their left. Bottom right- user view straight in front.



Figure 5.2: Examples of character facial expressions.

Statistical analysis

Analyses were conducted in SPSS (IBM Corp., 2023). There was no missing data. Before the main analysis a number of assumptions were assessed: linearity and homoscedasticity were examined via residual plots. Independence was evaluated using a Durbin-Watson test, with values near 2 indicating no autocorrelation. Normality was tested with Shapiro-Wilk ($\alpha=0.05$). Multicollinearity was assessed using VIF values (threshold <5) and a correlation matrix. Influential observations were identified with Cook's distance, using $4/(n-k)$ as the critical threshold.

To assess the effectiveness of VR in triggering an anger response, a repeated measures t-test was used to compare anger at baseline to anger after VR for the whole sample (hypothesis 1).

A linear regression analysis examined the effect of group (low anger vs. high anger) on anger post VR whilst controlling for baseline anger (hypothesis 2).

Finally, a linear regression analysis was then used to examine the effect of appraisals on anger in response to VR (hypothesis 3). Group (low anger/high anger), appraisals of virtual characters and baseline anger were regressed upon anger during VR. Backwards elimination was used to remove non-significant appraisals from the regression model.

Results

Two-hundred and sixty-five people were screened. Forty-two male participants completed the study (mean age in years=43.0; SD=15.6; range: 19-73). Twenty-two participants were in the low anger group (mean DAR-5 =5.36 SD=0.72; range: 5-7) and twenty participants were in the high anger group (mean DAR-5=15.10 SD=1.41; range: 12-17). The two groups differed significantly on baseline feelings of anger as assessed by the *Subjective Feelings of Anger Scale* (t(19.98) = -3.058, p = .006) with a mean difference of -3.63 (95% CI: -6.10 to -1.15) indicating that the high anger group reported greater baseline feelings of anger compared to the low anger group. See Table 2.1 for the participant characteristics and Table 2.2 for scores on all measures by group.

Table 2.1: Participant characteristics by group

	Low Anger (n = 22)	**High Anger (n = 20)**
Age (years) Mean (SD)	44.64 (16.07)	41.25 (15.59)

	Low Anger (n = 22)	High Anger (n = 20)
Highest Education (n, %)		
GCSEs	1 (4.5)	1 (5.0)
AS Levels	0 (0.0)	1 (5.0)
A Levels	5 (22.7)	6 (30.0)
Bachelor's degree	10 (45.5)	5 (25.0)
Postgraduate	6 (27.3)	7 (35.0)
Employment Status (n, %))		
Unemployed	2 (9.1)	4 (20.0)
Employed (full time)	7 (31.8)	13 (65.0)
Employed (part time)	3 (13.6)	1 (5.0)
Self-employed	4 (18.2)	2 (10.0)
Retired	4 (18.2)	0 (0.0)
Voluntary	1 (4.5)	0 (0.0)
Disabled/sick leave	1 (4.5)	0 (0.0)
Marital Status		
Single	7 (31.8)	7 (35.0)
Married/civil partner	13 (59.1)	8 (40.0)
Cohabiting	1 (4.5)	3 (15.0)
Separated	0 (0.0)	2 (10.0)
Prefer not to say	1 (4.5)	0 (0.0)
Ethnicity		
White British	12 (54.5)	10 (50.0)
Other White background	7 (31.8)	5 (25.0)
Mixed background	0 (0.0)	1 (5.0)
Asian - Indian	1 (4.5)	2 (10.0)
Asian - Chinese	0 (0.0)	1 (5.0)
Black - African	2 (9.1)	0 (0.0)
Other	0 (0.0)	1 (5.0)

Residuals showed normal distribution (Shapiro-Wilk p=0.156), observations were independent (Durbin-Watson p=0.082), and no severely influential outliers were detected. There was moderate multicollinearity (highest VIF=4.43) for hostile appraisals, however this was within the acceptable threshold.

Hypothesis 1: A repeated measures t-test comparing anger at baseline (N=42, M=2.03, SD=4.06) with anger post VR (N=42, M=5.58, SD=7.32) showed a significant increase $t(41) = 3.63$, $p < .001$, $d = 0.56$. This represents a medium effect size.

Hypothesis 2: A regression tested the effect of group (low anger vs. high anger) on anger post VR whilst controlling for baseline anger. It showed a significant effect of group on anger post VR ($\beta = .277$, $t(df) = 2.443$, $p = .019$, $SE = 2.098$), with high anger group showing greater increases in anger compared to the low anger group (See Figure 5.3 and Table 5.2).

Hypothesis 3: Using backwards elimination, a regression model reduced the predictors of anger during VR from six variables to three: group allocation (high anger vs. low anger), hostile appraisals of the virtual characters, and baseline anger. The model was statistically significant ($F = 12.29$, $df = 3, 38$, $p < 0.001$), explaining 49.2% of the variance in anger post VR. Endorsing hostile appraisals of the virtual characters was significantly associated with anger post VR ($\beta = .416$, $t(df) = 3.285$, $p = .002$, $SE = 0.038$). There was a significant effect of group allocation on anger post VR ($\beta = .277$, $t(df) = 2.103$, $p = .042$, $SE = 1.907$), whilst baseline anger showed a positive but non-significant relationship with anger post VR ($\beta = .217$, $t(df) = 1.611$, $p = .116$, $SE = 0.243$) but was retained in the model to control for baseline anger. Neutral, friendly, or judgemental appraisals were not significant and removed from the model. See Table 5.2.

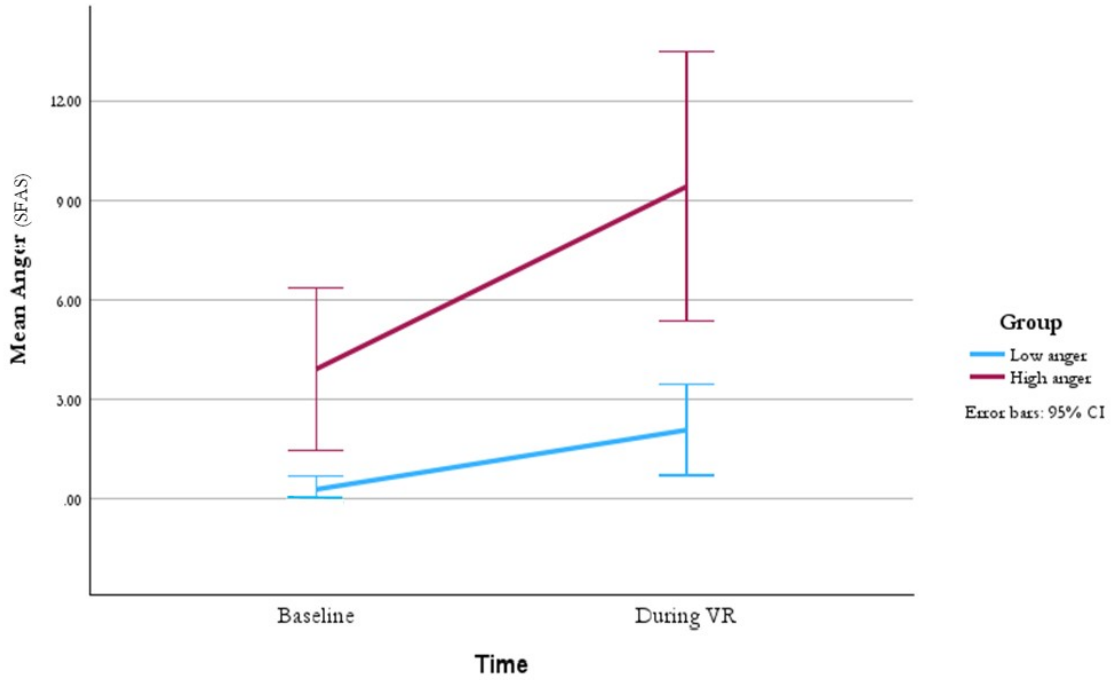


Figure 5.3: Mean anger scores as measured by the SFAS by group across time points.

Table 5.2: Outcome measures by group.

Variable	Low Anger M (SD)	High Anger M (SD)	*t*	*p*	Cohens D
Baseline					
Problematic anger (DAR-5)	5.36 (0.73)	15.10 (1.41)	27.71*	<.001	8.64
Anger (SFAS)	0.30 (0.88)	3.93 (5.24)	3.06*	.006	0.97
Paranoia (RGPTS)	5.55 (7.37)	17.40 (12.03)	3.89	<.001	1.18
Post VR					
Anger (SFAS)	2.09 (3.09)	9.43 (8.68)	3.58*	.002	1.13
Friendly appraisal (AVCS)	18.18 (10.35)	13.67 (9.46)	-1.47	.150	-0.45
Neutral appraisal (AVCS)	15.39 (9.72)	13.68 (11.40)	-0.52	.603	-0.16
Judgmental appraisal (AVCS)	14.78 (9.72)	17.13 (10.65)	0.75	.461	0.23

Variable	Low Anger M (SD)	High Anger M (SD)	*t*	*p*	Cohens D
Hostile appraisal (AVCS)	27.19 (22.47)	42.54 (24.60)	2.11	.041	0.65

Discussion

This study examined the effectiveness of a virtual reality (VR) environment in eliciting anger and tested whether this effect was more pronounced among individuals who experience problems with anger. The VR environment was designed to be intimidating through subtle non-verbal social cues such as prolonged eye contact, facial expressions, and close proximity in an enclosed space. The findings indicated that this VR environment could significantly increase anger, though the intensity of the anger response was modest. As hypothesised, individuals high in problematic anger showed a stronger effect, even after controlling for baseline anger levels. Hostile appraisals of virtual characters were associated with heightened feelings of anger during the VR experience.

These findings are consistent with research showing that individuals with high levels of problematic anger often exhibit heightened emotional reactivity (Alcázar et al., 2011; Deffenbacher et al., 1996). The association between hostile appraisals and anger is an established finding in the literature (Tuente et al., 2019) but this is, to the best of our knowledge, the first study to replicate this finding in VR. The effect of group allocation remained significant even after controlling for hostile appraisals, indicating that the greater anger responses in the high-anger group was not fully explained by differences in threat perception. This may suggest the involvement of additional mechanisms—such as poor emotion regulation, increased autonomic reactivity, or maladaptive responses to provocation (Alcázar et al., 2011; Robinson et al., 2012).

The high anger group showed significant variability in anger intensity during VR. This highlights that the triggers of anger are likely heterogeneous and may encompass a range of factors including hostile

attribution bias, goal frustration, in-group outgroup dynamics (e.g. supporters of rival football teams), sensory overload (e.g. crowds, noise), and overt mistreatment by others (e.g. unjust, disrespectful, or threatening behaviour). The identification of key triggers of anger and the specific VR features or scenarios that most reliably elicit anger will be essential for future VR treatment development. Our findings validate the use of VR to test theoretical models of anger and the techniques for its manipulation allowing causal inferences to be made and the identification of effective therapeutic approaches.

The current study has a number of limitations. It included only male participants. This was a deliberate methodological choice based on well-established gender differences in threat perception and emotional responses (Brody et al., 1995; Y. Deng et al., 2016). Thus, the study needs to be replicated with female participants to examine whether similar mechanisms and responses are observed across genders. The study used self-report measures of anger which may be influenced by social desirability. Future studies would benefit from including physiological measures, which would provide objective assessments of arousal.

This study demonstrates the capacity to elicit an anger response, yet more research is needed to identify the key conditions for provoking anger and its underlying mechanisms. VR offers novel opportunities for advancing our theoretical understanding of anger and violence and developing innovative targeted interventions.

6

Discussion

Violence by men with psychosis is a pressing clinical challenge. Despite the scale and impact of the problem, this has been a largely neglected area of research. Our understanding of the psychological drivers of violence remains limited and this is reflected in a lack of evidence-based interventions to prevent or reduce violent behaviour in psychosis. The aim of this thesis was to develop a testable psychological framework for understanding violence by men with psychosis to directly inform future intervention development. To ensure understanding was grounded in patient experience, qualitative interviews informed the development of a framework for understanding violence in psychosis (Chapter 2). Violence-related cognitions played a key role in a number of the processes identified by the framework. Testing the importance of these cognitions in driving violence required precise measurement and consequently, two psychometrically robust assessments of violence-related cognitions were developed (Chapter 3). These cognitions, along with other risk factors identified by the framework or wider literature, were tested in a large sample to establish the factors most closely associated with violence (Chapter 4). Finally, the potential of virtual reality for treatment delivery was assessed using an experimental paradigm (Chapter 5). This final chapter presents a summary of the findings and considers the clinical implications. This is followed by a discussion of the limitations and future directions for this research.

Psychological framework for understanding violence by men with psychosis.

In the qualitative study (Chapter 2) participants spoke in detail about their experiences with violence. They provided a rich description of their relationship with violence and the functions it serves. The resulting framework identified seven key psychological factors that contributed to the use of violence: Violence was a learnt behaviour, which could be both habitual (Factor 1) and underpinned by rules that engaged and justified an attack (Factor 2). Violence was often a protective strategy against a tripartite of sensitivities to other people: sensitivity to physical threat from which violence protects (Factor 3); sensitivity to social disrespect whereby violence increases status (Factor 4); and sensitivity to unfairness whereby violence delivers revenge (Factor 5). Violence had an emotional regulation function whereby intense emotions were released (Factor 6) and violence was sometimes an attempt to escape or gain control when overwhelmed by voices, visions, and paranoia (Factor 7). Having established this framework, the next step was to operationalise and quantitatively test the key components.

Cognitions and other key risk factors associated with recent physical violence

Violence-related cognitions played a key role in the factors identified by the framework. For example, a person may believe that ‘Violence makes me feel powerful’ leading them to favour a violent response in situations where they perceive a challenge to their sense of status or autonomy. Cognitions may also serve as a key modifiable mechanism through which other more established factors (e.g. childhood adverse experiences, psychotic experiences, anger) lead to violence. This was illustrated by one participant in the qualitative interviews whose father was violent to him and his mother. This violence only stopped after he beat up his father. This experience led to the formation of strong beliefs that violence

is necessary for survival. As such, when he felt under threat (e.g. due to paranoid thoughts) he would become violent.

To measure and test the potential role of these cognitions, two measures of violence-related cognitions were developed in a large sample of men with psychosis (N=860; 40% with a history of violence) – The Oxford Violence-Activating Cognitions Scale and The Oxford Violence-Inhibiting Cognitions Scale (Chapter 3). Factor analysis identified six types of violence-activating cognitions: violence to survive the social environment (e.g. I'd probably be dead now if I didn't use violence.); attribution of negative intent from others (e.g. Other people enjoy upsetting me); violence as a justified response (e.g. If someone does something to provoke me then it's their fault if I hurt them); violence giving feelings of power (e.g. Violence makes me feel powerful); negative consequences of not being violent (e.g. Walking away from a fight leaves me feeling pathetic); and violence regulating negative emotions (e.g. If I am anxious it makes me feel better to hit out). Factor analysis also identified two types of violence-inhibiting cognitions: negative personal consequences of violence (e.g. Getting aggressive always makes me feel worse) and negative external consequences of violence (e.g. Being aggressive makes life more difficult).

These cognitions were tested in a large cross-sectional study with men with psychosis (N=860), alongside a range of proximal factors for violence including anger, substance use, paranoia, voice hearing, and emotional dysregulation as well as distal risk factors for violence such as childhood adverse events, previous violent offending, and age (Chapter 4). Violence-activating cognitions were significantly associated with the recent occurrence of violent behaviour. However, violence-inhibiting cognitions were not - being strongly endorsed by both the violent and non-violent groups. Structural equation modelling and network analysis indicated that violence-related cognitions may act alongside other disinhibiting factors including the emotion of anger, substance use, psychotic symptoms, and younger age.

The use of virtual reality to elicit anger and hostile appraisals.

Behavioural techniques (e.g. behaviour experiments) are arguably the most powerful component of cognitive behaviour approaches. Evidence in the treatment of anger and aggression suggests that interventions with experiential learning (e.g. role plays) have better outcomes. However, their application in the treatment of violence is often limited due to restricted access to public spaces (e.g. forensic units) and concerns about the risk to others. In Chapter 5, virtual reality was investigated as a safer method to activate feelings of anger and appraisals of hostile intent from others – two factors associated with violence in Chapter 4. The results indicated that a mildly intimating VR social situation raised anger in the study sample, with a more pronounced effect in people who had difficulties with anger. Anger intensity was associated with greater appraisals of hostile intent from the virtual characters. This demonstrates the potential for VR to be used in the treatment of anger.

This thesis represents the foundational work for the development of a targeted treatment to reduce violence by men with psychosis. It provides a theoretical framework for understanding violence, identifies a number of modifiable treatment targets, provides validated measures to assess these, and provides support for a novel method of treatment delivery: virtual reality. The findings have implications for understanding violence by men with psychosis and point to promising avenues for treatment development. However, as an early-stage investigation, this work must be interpreted with appropriate caution. The possible clinical implications of this work will be discussed followed by careful consideration of the limitations and directions for future research.

Clinical implications

Understanding violence: For most people, violence is rarely experienced firsthand and remains a disturbing, often incomprehensible phenomenon. This distance can foster oversimplified understandings, particularly in the context of psychosis, where violence is frequently portrayed in the media as either the product of uncontrollable 'madness' or of inherent moral failing. This 'mad or bad' dichotomy, commonly referenced in forensic psychiatry (Vossier et al., 2017), reflects longstanding legal and societal narratives that seek to categorise violent individuals as either mentally ill or fully culpable (Lilienthal & Ahmad, 2017). While there is growing recognition that violence is a complex behaviour shaped by multiple interacting factors, reductive views continue to influence public attitudes and clinical practice (Vossier et al., 2017). In contrast, models grounded in patients' lived experiences can offer a more nuanced understanding. The framework developed in Chapter 2 can be used by clinicians to inform assessment and formulation of aggressive behaviour, particularly helping clinicians explore how individuals understand and use violence, the functions it serves, and the perceived obstacles to using pro-social alternatives. Such insights may help clinicians better engage with patients' perspectives, fostering more informed and empathetic discussions around violence. The Oxford Violence-Activating Cognitions Scale and the Oxford Violence-Inhibiting Cognitions Scale can further support assessment and formulation, and help monitor the impact of interventions targeting violence supporting patterns of thinking. Printable versions of these measures will be made available through our team website and in the published paper appendices.

The role of psychosis in violence. Psychosis symptoms played a role in the occurrence of violence. In the qualitative study (Chapter 2), two of the twenty participants, described how acute hallucinations and delusions during a first episode led to the use of violence, something that was ego dystonic. In both these cases there were systemic failures in getting adequate support in a timely manner. For other participants, psychosis symptoms were often a trigger of violence because it made them feel under threat and they saw violence as an effective method for

managing this, or their symptoms triggered intense emotional distress, from which violence was a release. In keeping with this, the large quantitative study (Chapter 4) demonstrated that distress from voices (in the structural equation model) and paranoia (in the network analysis) showed only a small positive association with violence with greater contributions from other factors. Psychosis symptoms might be best conceptualised as an INUS condition for violence – insufficient but necessary cause, of an unnecessary but sufficient condition. That is, psychosis alone is *insufficient* to cause violence, as evidenced by the majority of people with psychosis who are never violent, but may be a *necessary* component within a constellation of factors that together create *sufficient* conditions for violence. Importantly, this same violent outcome could arise through entirely different pathways that do not involve psychosis at all – hence psychosis forms part of a sufficient but *unnecessary* causal complex. This conceptualization helps explain the heterogeneity observed in violence among people with psychosis and underscores why interventions must target multiple components rather than focusing solely on symptom management.

Potential targets for future treatment development. Violence-related cognitions had not been previously investigated as a factor in violence in psychosis. A range of cognitions were found to contribute to violence (Chapter 4). These cognitions likely prove most problematic in the presence of factors which disinhibit behaviour such as substance misuse, anger, psychotic symptoms, and younger age. Hence treatment may need to target both the cognitions that support violence and factors that disinhibit behaviour. Different violence-activating cognitions reflect different psychological processes and will require specific intervention.

I was not respected at home. I was not loved you know and I was abused. So I felt

better when I was in the gang, I thought well I am somebody now, do you know what

I'm saying, even though I'm a criminal.

Approximately 15% strongly believed that violence was necessary to survive their social environment – be that to protect against physical danger or do maintain the respect of peers. Future interventions need to take into account the social context that participants find themselves in. Many patients face genuine threats of harm in their social environment and the use of violence (e.g. carrying a weapon) offers protection, at least in the short term. Some patients may remain closely affiliated with anti-social groups and identities in the absence of other support networks. Reintegration into mainstream society can be challenging, particularly given the pervasive stigma associated with criminal records. For individuals with psychosis, this challenge is compounded by the stigma of mental illness, creating a "double stigma" that further impedes their ability to build or access prosocial networks. Studies have also shown that minoritized groups with criminal records face even greater obstacles (Decker et al., 2015; Keene et al., 2018). One initiative that has sought to address this challenge is the Twinning Project, which operates within prisons by partnering them with local football clubs (Newson et al., 2024). Through this collaboration, prisoners receive training in coaching skills, creating opportunities to develop prosocial identities and forge social bonds with members of law-abiding communities. The project has demonstrated significant improvements in the behaviour of prisoners and also increased community support for reintegration (Newson et al., 2024). Such approaches may have value for forensic patients.

I'm always on guard, I'm always thinking, threat, threat, threat, all the time. […]

Shoulders, arms, body language, how they're moving and like how they're talking, tone of voice.

Even when the environment doesn't present a real danger, sensitisation to the signs of physical or social threat may lead to the misinterpretation of social cues and the use of violence. Cognitions which attribute negative intent to others combined with the belief that violence is a justified response to mistreatment may lead to violent behaviour. Attribution of negative intent to others is a common feature in psychosis and overlaps conceptually with paranoia. Exposure, behaviour experiments, and cognitive restructuring have been shown to be successful in reducing paranoid beliefs (Freeman, Emsley, et al., 2021; Freeman et al., 2016, 2022) and may be helpful in addressing hostile appraisals. Chapter 5 demonstrated that virtual reality (VR) can successfully activate hostile appraisals, complementing existing evidence that VR reliably elicits paranoid thoughts. Beyond its assessment potential, VR has also been shown to reduce conviction in paranoid beliefs, indicating its promise as a tool for both developing and delivering therapeutic interventions. However, reducing hostile appraisals alone is unlikely to be sufficient. Patients must also be supported in developing a repertoire of prosocial strategies for responding to perceived physical or social threats. If violence remains the only available means of achieving safety or respect, it is likely to persist despite cognitive change.

It's like a, like a pressure but when you kick off it releases, relieves stress,

so when you kick off you feel much better.

The cognition most strongly associated with violence as a way of regulating difficult emotions. Cognitions in this factor related to the use of violence to communicate distress to others, to release difficult emotions, and as a way out when desperate. Anger was also the second strongest predictor of violence after violence-activating cognitions

further supporting the role of strong emotions in violence (Chapter 4). Unfortunately, this research did not examine other emotions (e.g. anxiety or low mood) and their relationship with recent physical violence. Interventions have been developed previously to target difficulties with anger (e.g. anger management (Novaco, 2013)) and emotional dysregulation (e.g. dialectical behaviour therapy (Lynch et al., 2007)). Anger management includes strategies such as psychoeducation, self-monitoring, cognitive restructuring, development of coping skills and arousal reduction strategies, examination of appraisals and meaning of anger, role-play and imaginal exposure (Novaco, 2013). Dialectical Behaviour Therapy (DBT), originally developed for individuals with borderline personality disorder, is a structured, skills-based intervention that combines cognitive-behavioural techniques with principles of mindfulness. It aims to enhance emotional regulation, distress tolerance, interpersonal effectiveness, and reduce impulsive or reactive behaviour (Lynch et al., 2007). As discussed in Chapter 1, anger management was used alongside CBT psychosis and found a positive effects on incidents of physical aggression following the therapy (Haddock et al., 2009). Future interventions might draw on these approaches but the best results will likely come from taking a mechanistic approach, developing an in-depth understanding of the mechanisms by which emotions lead to violence and identifying the techniques that effectively target these.

While promising, these implications should be interpreted with caution, as there are a number of limitations that warrant further investigation.

Limitations and future research

The central limitation of this work is that these studies were observational or cross-sectional in nature and thus causal claims cannot be made. In Chapter 4 violent behaviour was measured retrospectively (incidents over the past 6 months) which further limits the ability to establish predictive associations between these factors and violence. The

next step would be to establish causality through experimental manipulation. An interventionist causal approach determines whether Y causes X by examining what happens to X when you manipulate Y, whilst controlling for other confounders. Cognitive behaviour therapy has a strong tradition of using theory-driven, experimental manipulations to inform treatment development (Clark, 2004). Causality has been demonstrated through short experiments(Clark & Teasdale, 1982; Ehlers & and Clark, 2008; Salkovskis et al., 1999; Teasdale, 1983), single-session manipulations (sometimes embedded within a larger treatment protocol) (Harvey et al., 2000; McManus et al., 2009), or randomised controlled trials of sustained treatments (Ehlers et al., 2003; Freeman, Emsley, et al., 2021; Freeman et al., 2022). In addition, as many psychiatric presentations occur on a spectrum, short experiments with the general population may be helpful in understanding the phenomenology of aggression. Chapter 5 is an example of this approach using men in the general population with anger difficulties. The use of VR for such experiments may be particularly fruitful as it allows for the controlled manipulation of variables and offers some ecological validity due to its similarity with the real world. In addition to testing causality, an evaluation of the effectiveness of the techniques used to manipulate the target (for example through mediation analysis) is an essential component of building effective treatment. A failure to change an outcome may be the result of a failure of theory (Y does not cause X) or a failure of technique (Y is unchanged and thus so is X). Some of the techniques used in a future treatment for violence may be new or adapted from other therapies. Clark's (2004) paper on psychological treatment development, highlights that techniques found to be effective for one anxiety disorder were not necessarily as effective when applied to another. Clark advocates taking time to develop and test techniques, confirming large effect size changes in treatment targets ahead of progressing to a randomised controlled trial.

Another limitation concerns the representativeness of the study samples. Firstly, the study only included men with psychosis so findings

can’t be generalised to women. A further programme of research is required to examine the psychological processes for violence in women with psychosis. Secondly it is unclear how much the samples used in Chapters 2-4 reflect the broader population of men with psychosis and difficulties with violence. It may be that those who take part in research differ in some way to those who refuse. Finally, the sample was predominantly white (70%). As such, the performance of cognition measures or models of violence (SEM, network analysis) was not examined in different ethnic groups. This is problematic as there is evidence that those from minoritised backgrounds have different experiences of forensic services and may have unique pathways to violence (e.g. low trust in services, health inequalities, or cultural factors). For example approximately 16% of patients in secure hospitals are Black (Davies, 2022) despite them only making up 4% of the population (Office for National Statistics, 2022). Furthermore, Black people are 40% more likely than White people to come into contact with mental health services in crisis and through the criminal justice system, rather than through primary care services (Archie et al., 2010; Barnett et al., 2019; Bhui et al., 2003; Halvorsrud et al., 2018). Once admitted, they are more likely to be subjected to restrictive practices such as high-dose anti-psychotic medication, physical restraint, and seclusion (Archie et al., 2010; Barnett et al., 2019; Das-Munshi et al., 2018; Halvorsrud et al., 2018; Payne-Gill et al., 2021). Unsurprisingly, they are more likely to report a poor experience of mental health services and engagement in treatment tends to be poor. Future research should explore additional factors that may contribute to violence within these populations, including those that may be culturally specific or impacted by structural inequalities (Das-Munshi et al., 2018; Halvorsrud et al., 2018). In parallel, treatment development should draw on culturally adapted approaches, as seen in cognitive behavioural therapy and systemic interventions for psychosis (Edge et al., 2018; Habib et al., 2015). Furthermore, adopting an inclusive co-design methodology in treatment development can help ensure that interventions are relevant, acceptable,

and engaging for patients. This approach may also address the high attrition rates commonly observed among forensic populations generally (Cullen et al., 2012; Young et al., 2010), as well as within minoritised groups.

Another limitation is that the structural equation model only explained 31% of the variance in violent behaviour. This may be because many of the factors associated with violence (e.g. anger, paranoia, and voice-related distress) are dynamic and their levels at the time of measurement may have differed from the time of the violent incident. Furthermore, there may be other variables important for understanding violence that have not been assessed in this study, or example command hallucinations (Birchwood et al., 2018), current medications or psychological treatment (Lagerberg et al., 2025), or systemic factors (e.g. environmental triggers)(Ezell, 2021). Future research could address this by prospectively measuring factors and tracking incidents of violence over subsequent weeks. This would also provide insight into the predictive utility of these models. Even in the absence of causal inference, identifying individuals at elevated risk can direct targeted support and resource allocation.

The final limitation to consider is the focus on variable-centred statistical approaches. In other words, analyses such as SEM and network analysis look at relationships among variables in the sample as a whole. Whilst this is helpful in identifying group level associations, it may not capture individual heterogeneity that may exist in this population. This is compounded further by the use of stability analysis completed as part of the network analysis. These only highlight relationships that are present in 500 bootstrapped samples. As such it is useful in identifying the most common and stable risk factors. However, it may obscure meaningful subgroups of individuals who follow distinct pathways to violence. For example, the modest effect sizes observed for psychotic symptoms may reflect this heterogeneity - while voices and paranoia may be crucial drivers of violence for some individuals with psychosis, they

may be largely irrelevant for others whose violence stems from entirely different mechanisms such as substance use and anger. Person-centred approaches may be able to identify subgroups. For example, latent class analysis is a statistical procedure used to identify qualitatively different subgroups within populations that may share certain outward characteristics.

Conclusions

This thesis represents an important step toward understanding and reducing violence by men with psychosis. It offers a theoretical framework grounded in patients' lived experiences, identifies potentially important processes that could serve as targets for intervention, and demonstrates the potential of virtual reality as a novel tool for treatment development and delivery. Whilst there are a number of limitations which mean the findings must be interpreted with caution, this work offers a clear path forward. Rigorously testing techniques which target the putative mechanisms underpinning violence will help identify causal links and establish routes for treatment. When combined with an inclusive co-design approach – one that considers the diverse backgrounds of participants - and using new technologies to enhance delivery, there is the strong potential to develop an efficacious and engaging psychological therapy. Reducing violent behaviour in psychosis would have far-reaching benefits for patients, forensic services, and broader society.

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Appendices

Appendix A- Systematic review

factors were associated with the greatest risk of violent crime (pooled OR=3.50, 95%CI=2.37, 5.16), followed by substance misuse factors (OR=2.36, 95%CI=1.99, 2.80). Many treatment-related factors were protective (OR=0.54, 95%CI=0.34, 0.85). Effect estimates were attenuated in inpatient settings. We also identified novel risk factors, including cannabis misuse, in a secondary analysis (OR=3.34, 95%CI=2.32, 4.82).

Conclusions—Using longitudinal evidence, we have validated comorbid substance misuse and criminal history as major risk factors for violence in psychosis. Novel factors such as cannabis misuse need further replication. Several identified factors are possible intervention targets if associations are found to be causal.

Introduction

Given the high costs of violence perpetration to patients, victims, and society,[1 2] preventing violent outcomes and improving risk management is a priority for clinical services.[3] Triangulated evidence show a higher risk of violence among individuals with psychotic disorders than among those without.[4–6] Absolute risks of violence can be as high as 26% over 12 months in first episode psychosis,[7] but are more typically less than 10% within 5 years of diagnosis by clinical services.[5] Identification of risk factors – particularly modifiable ones – in people with psychotic disorders is a next step in developing targeted interventions,[8] and could help develop more precise risk assessment tools that allow for risk stratification. Such tools are common in forensic mental health and criminal justice to aid clinical decision-making, but of varying accuracy.[9] Updated evidence on risk factors is particularly relevant for treatment allocation in the context of limited resources, for example with the reduction of available psychiatric hospital beds in the UK and US that has continued in recent years.[10]

A 2013 systematic review[11] of risk factors for violence in psychosis outlined a range of replicated risk markers for criminal history, psychopathological symptoms, and treatment-related factors. However, the previous review is now more than a decade old with its search ending in 2011, and many new investigations have since been published. Furthermore, the previous review included a majority of cross-sectional studies where the temporal relationship between the studied factor and violent outcome is not clear. In this update, we have focused on longitudinal studies to improve the quality of the evidence. In addition, we have conducted separate analyses restricting studies to those using more severe violent outcomes, and those where a majority of participants were recruited from inpatient settings. The latter can inform how to prevent and manage inpatient violence, which has been reported to occur in 21-32% of hospitalized individuals with psychotic disorders.[12] We consider risk factors in a broad way to include descriptive, causal, and predictive associations.[13] We anticipated replicating the strongest risk factors in the previous review – including comorbid substance use disorders and criminal history – while drawing on a decade of new evidence on emerging risk factors for violence in psychosis, including the misuse of individual substances.

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Methods

The study was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Protocol

The review methods are based on a previous review from our group,[11] published open access in 2013. One deviation from this protocol was to limit the inclusion to longitudinal designs, which were included in the original protocol alongside cross-sectional designs. We further excluded studies in selected (e.g. solely offender) populations. There were no other material deviations from the original protocol.

Search strategy

We implemented the same search strategy as the 2013 review,[11] using the following search term to identify studies examining psychiatric disorders and various violence measures: *(schiz* AND (viol* OR aggress* OR crim* OR offend* OR danger* OR hosti*)) OR (psych* AND (viol* OR aggress* OR crim* OR offend* OR danger* OR hosti*)) OR (mental* AND (viol* OR aggress* OR crim* OR offend* OR danger* OR hosti*))* (Table S1). We conducted the search in five databases – CINAHL, Embase, Global Health, PsycINFO and PubMed – to identify papers published from 1st January 2012 until 30th June 2022. We thus complemented the search from the original review, which searched evidence until 31st December 2011. The extraction of references from the databases was carried out on 30th June 2022. We also conducted a manual search of reference lists in included or related papers. We translated non-English language publications using Google Translate and asked a native speaker for clarification where necessary. Search and eligibility assessment was carried out by the first author (TL). A second reviewer was not considered for systematic eligibility assessment, in line with the previous review.

Study eligibility

We considered studies where: (1) at least 95% of the sample were diagnosed with schizophrenia, schizoaffective disorder, delusional disorder, other schizophrenia-spectrum disorder, schizotypal disorder, bipolar disorder, or other affective psychosis, excluding drug-induced psychosis (e.g. if a study included 94% patients with schizophrenia spectrum disorder and 6% with drug-induced psychosis or a non-psychotic disorder then that study would be excluded); (2) diagnosis was made using Diagnostic and Statistical Manual of Mental Disorders (DSM) or International Classification of Diseases (ICD) criteria; (3) individuals were aged 15 years or above; and (4) the study employed a design where risk factors preceded the outcome (e.g. cohort studies, nested case-control, RCTs, and prediction studies). Further, we (5) excluded studies that only considered repeat violence as an outcome – that is, any study examining violent outcomes in a selected population with violence histories. As in the previous review, bipolar disorder was included as psychosis is a feature in most individuals with bipolar disorder,[14] and to incorporate risk factors for violence in affective psychosis. For each study considered for inclusion, we extracted information on each inclusion criterion 1-5 – the first inclusion criterion we noticed that was not fulfilled was logged as the reason for that paper's exclusion.

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Data extraction

Data from included papers was extracted by the first author (TL). A second author (SL) independently extracted a randomly selected 20% subset of included studies to assess extraction accuracy. For both risk factors and violent outcomes, we extracted information on whether the variable was categorical or continuous. Risk factor definitions across studies were standardized where possible to ensure they could be pooled. In keeping with previous work,[11] we classified risk factors into the following broad and distinctive domains: criminal history, negative symptoms, neuropsychological, positive symptoms, premorbid, psychopathological, sociodemographic, substance misuse, suicidality, and treatment related.

To ensure comparability with previous work and allow for data pooling, we converted all effect estimates to odds ratios (ORs), using methods described in previous publications.[11 15] Hazard ratios (HRs) and probit regression coefficients cannot strictly be converted to ORs. However, probit and logistic regression give very similar results, and HRs can be relatively similar to ORs if the outcome event is rare by the end of follow-up.[16] We therefore included these effect estimates in the main analysis. As a sensitivity analysis, we excluded all effect estimates measured by HRs or probit regression coefficients.

Study quality was assessed by co-author AP using an adaptation of the Newcastle-Ottawa Scale[17] where we scored quality of exposure ascertainment separately for each risk factor domain included in the study. The overall quality score was then produced by summing the quality score for each risk factor domain included with the other sub-scores (selection, comparability, and outcome). The score was expressed as a percentage of the maximum quality score available given the risk factor domains included in the study.

Statistical analyses

We assessed extraction accuracy by calculating inter-rater reliability for the extraction of the proportion of violent patients using Krippendorff's alpha.[18]

We pooled ORs using random effects models due to the heterogeneity in the design and predictors/outcomes of studies. We only considered risk factors that occurred in at least three independent samples in the main analysis, but reported results for risk factors occurring in two samples in the supplement. We chose to pool the minimally adjusted effect estimate available, as this was the most consistently reported and comparable.[11 15] Some included papers were based on the same original study. If a risk factor occurred in more than one paper that used the same study population, we included the risk factor that derived from the paper with the largest sample size to avoid double counting.[11] All analyses in the current paper were carried out at the level of independent samples rather than publications.

We additionally pooled ORs within each risk factor domain. If one paper contributed more than one risk factor per domain, we included the risk factor with the highest absolute z-score. The z-score takes into account the size of the effect estimate (strength of association) and its standard deviation (precision).[11]

We assessed heterogeneity using the I^2 statistic to quantify the proportion of the variance in the risk factor effect estimates that are due to between-study differences rather than

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random sampling error. To investigate the sources of between-study variability, we ran meta-regression models for risk factors that occurred in at least 7 samples and had an I^2 of ≥75%. We considered the following between-study factors in the meta-regressions: whether the study setting was in Europe or not (binary), whether a majority of study subjects were recruited from an inpatient setting or not (binary), percentage of men (continuous), and whether the violent outcome was based on forensic care status/criminal record or not (binary).

Sensitivity analyses

To account for different settings and violent outcome types across samples, we conducted analyses including risk factors from only: a) samples where violence was defined by conviction/arrest (violence and/or homicide) or forensic psychiatric care (which typically requires a criminal offence); or b) samples where 95% or more of the population was recruited from inpatient settings. We also conducted analyses where we excluded risk factors with effect estimates reported as HRs and probit regression coefficients. We further restricted analyses to those papers that were deemed to have a quality score of ≥75%. Finally, we conducted publication bias analyses for risk factors that occurred in at least 7 independent samples using Peters' regression test.[19]

Data management and analyses, including effect estimate conversions, were carried out in R version 4.3.0.

Results

Study characteristics

We identified 79,988 publications from the five listed databases after removal of duplicates; 288 remained after a title and abstract screening. After full-text screening, 47 studies were included in this update, representing 41 independent samples (Figure S1, Table S3). [5 20–65] Four studies stratified their findings by sex and one further study was stratified by diagnostic category (schizophrenia vs bipolar disorder), and thus each contributed two independent sets of risk factors to analyses.[5 33 50 58 59] Fourteen studies overall were overlapping, some of which incorporated aforementioned sex- or diagnosis-stratified samples.[21–23 25 33–35 51 56 58–60 62 63] Overall, 564 separate effect sizes were extracted, representing 387 unique risk factors after standardization. Of these, 30 were examined in at least three independent samples, and an additional 30 factors occurred in two. The publication years ranged from 1983 to 2022, with the majority of samples originating from Europe (k=20, 49%), followed by the USA (k=10) and the UK (k=5). Median sample size was 404 (Table 1). Ten samples (24%) recruited more than 95% of their participants from inpatient settings. The majority measured their violent outcome as a physical assault on another person (k=12, 29%) or as a conviction for a violent crime (k=12, 29%; Table 1).

We found good interrater reliability of the extraction of the proportion of violent individuals (Krippendorff's alpha=0.77).

Table 2 shows the effect estimates of risk factors that were reported in ≥3 independent samples, pooled over the individual risk factors. Figure 1 illustrates the effect estimates

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when these risk factors were pooled over risk factor domains. No risk factors in the neuropsychological domain were present in two or more samples, and hence no factors from the neuropsychological domain were included in the analyses. We allowed individual PANSS items to be included as separate risk factors.

Criminal history domain

OR estimates were similar across criminal history factors (Table 2), and were all associated with an increased risk of violence in people with psychosis. The most commonly reported criminal history risk factor was "violence history" (k=15), with an OR of 2.91 (95%CI=2.06, 4.10). After pooling across all criminal history factors, the overall domain was associated with more than a three-fold increased risk (OR=3.50, 95%CI=2.37, 5.16; Figure 1). A history of non-violent crime and a family history of offending behaviour were also risk factors and reported in two independent samples (Table S4).

Negative and positive symptom domains

Risk factors present in three or more independent samples were the negative symptom score on the Positive and Negative Syndrome Scale (PANSS) (OR=1.10, 95%CI=0.95, 1.27) and positive symptom score on the PANSS (OR=1.12, 95%CI=0.45, 2.82) (Table 2), though neither showed a clear association with violence. In the positive symptom domain, paranoia and hostility were reported in two independent samples (Table S4), with paranoia showing the greatest point estimate (OR=3.07, 95%CI=0.88, 10.69).

Premorbid domain

Two premorbid factors were associated with an increased risk of violence: recent violent victimization (OR=5.81, 95%CI=3.45, 9.78) and a history of parental violent crime (OR=1.37, 95%CI=1.15, 1.63; Table 2). Overall, the premorbid domain was associated with an increased risk of violence (OR=1.79, 95%CI=1.16, 2.77; Figure 1). In addition, parental bereavement, ever being non-violently victimized, childhood abuse, and a parental history of substance misuse were associated with violence risk, but reported in only two independent samples (Table S4).

Psychopathological domain

A diagnosis of schizophrenia was associated with an increased risk of violence compared with other psychotic disorders in a given study (OR=1.63, 95%CI=1.17, 2.28; Table 2), as was comorbid diagnosis of personality disorder (OR=2.30, 95%CI=1.71, 3.09) and number of past hospitalizations (OR=2.65, 95%CI=1.45, 4.84). There was also an association of the overall psychopathological domain (OR=1.66, 95%CI=1.05, 2.62; Figure 1). A lack of insight, comorbid diagnosis of antisocial personality disorder, a diagnosis of bipolar disorder, younger age of psychosis onset, and traumatic brain injury were associated with violence in two independent samples (Table S4).

Sociodemographic domain

No educational qualifications versus any (OR=1.46, 95%CI=1.26, 1.69), Black and minority ethnicity (OR=1.72, 95%CI=1.08, 2.74), and male gender (OR=1.67, 95%CI=1.06, 2.64)

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were associated with higher violence risk (Table 2), as was the overall sociodemographic domain (OR=1.61, 95%CI=1.07, 2.44).

Substance misuse domain

All factors in the substance misuse domain were associated with an increased risk of violence. Substance misuse, drug misuse (current or recent), alcohol misuse, and a history of alcohol misuse had similar effect sizes (ORs ranging from 1.61 to 2.41). The overall substance misuse domain was associated with an increased risk of violence (OR=2.36, 95%CI=1.99, 2.80; Figure 1). Cannabis use history and recent alcohol misuse were reported in two samples, with the highest OR estimated for a history of cannabis use (OR=3.34, 95%CI=2.32, 4.82; Table S4).

Suicidality domain

Self-harm history was associated with an elevated violence risk (OR=1.74, 95%CI=1.01, 2.98; Table 2; Figure 1). Unintentional self-harm, reported in two samples, was also associated with violence (OR=5.50, 95%CI=4.26, 7.08; Table S4).

Treatment related domain

Antipsychotic medication was associated with a reduced risk of violence (OR=0.51, 95%CI=0.27, 0.96; Table 2). Treatment adherence had a protective association, though not statistically significant. Antidepressant treatment was also associated with a protective effect (OR=0.80, 95%CI=0.66, 0.97; Table S4) though it was only reported in two samples (Table S4).

Sensitivity analyses

When restricting analyses to those samples where a majority of patients were from inpatient settings (k=10 or 24% of the overall sample), risk factors occurring in two or more of these samples all had non-significant associations apart from the number of previous hospitalizations, reported in two independent samples (OR=2.07, 95%CI=1.22, 3.53; Table 3). Overall, point estimates in inpatient settings were also reduced as compared to the main analysis. Meanwhile, only including samples from community settings did not materially change results (Table S5). When restricting analyses to samples where violence was defined by conviction or arrest for violence/homicide (k=14), there were 11 factors reported in k≥3 independent samples, and findings were similar to the main analyses (Table S6). There were no material changes when excluding risk factors where associations were reported as HRs or probit regression coefficients (Table S7). Results were also similar when restricting analyses to studies with independent samples that had quality scores ≥75% (Table S8). We found no evidence of publication bias.

Meta-regression

For the majority of included risk factors, heterogeneity as measured by the I^2 statistic was high. Meta-regression was conducted for risk factors that occurred in at least seven independent samples and that had an I^2 ≥75%. These risk factors include: unemployment, self-harm history, alcohol misuse, male gender, substance misuse, drug misuse, and violence

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history. We only found statistically significant results for male gender. In univariate meta-regression, we found that if the study reported the outcome as violent arrest or violent conviction, then being male was statistically significantly associated with a greater risk of violence compared to when the study used a less severe definition of violence. This was also the case for samples based in Europe compared with other regions. In samples where there was a higher percentage of men, being male was associated with a lower violence risk as compared to samples where there was a lower percentage of men. None of these sample characteristics retained statistical significance when simultaneously entered into a multivariable meta-regression model.

Discussion

In this updated systematic review and meta-analysis of risk factors for violence in psychosis based on longitudinal studies, we identified 41 independent samples comprising 203,297 individuals. We examined 30 individual risk factors that were reported in at least three independent samples. This synthesis identified novel risk factors and validates associations identified in previous work, providing information on several potentially modifiable risk factors. Importantly, the focus on longitudinal studies reduces the likelihood of reverse causation, meaning that findings can inform risk stratification and help identify potential treatment targets.

We found that criminal history was the risk factor domain with the strongest association with violence, followed by the substance misuse domain. In relation to criminal history, both previous violent and non-violent crime were risk factors – possibly because these measure a general propensity for criminality, or because engaging in criminality introduces individuals to social contexts and networks that increase the risk of subsequent violence. There are many explanations for the importance of comorbid substance misuse as a risk factor domain. Intoxication leads to poorer impulse control, which has been found to be a strong risk factor for violence in cross-sectional studies.[11] Individuals with schizophrenia (and other severe mental illnesses, including bipolar disorder) may also self-medicate with substances to manage symptoms,[66] possibly affecting treatment adherence and effectiveness,[67] while being an indicator of more severe symptomatology. Drug misuse may additionally be an entry route into criminality and expose individuals to violent environments.[68 69] Another important risk factor domain is suicidality. It is likely that common processes underpin violence and suicidality – for example, they may both be outward expressions to regulate intense internal states.[68] The strength of the association for these and other studied risk factor domains were broadly similar to the previous review,[11] validating the evidence using longitudinal designs.

An unexpected finding in this review was the lack of a clear association between overall positive symptom scores and violence, despite previous research finding that positive symptoms are an important risk factor for violence.[70] However, the confidence interval for our result was wide (OR=1.12, 95% CI=0.45, 2.82), and with a high I^2 statistic. We also found a modest, though statistically non-significant, association for negative symptom score (OR=1.10, 95%CI=0.95, 1.27). While this may be consistent with the null association found in the previous review (OR=1.00, 95%CI=0.90, 1.20),[11] another possibility is that negative

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symptoms are a marker of disease severity and partial response to treatment. It is also possible that other symptoms associated with violence, such as hostility, are misclassified as negative symptoms due to their overlap with blunted affect and asociality.[71]

Antipsychotic treatment was statistically significantly associated with reduced violence (OR=0.51, 95%CI=0.27, 0.96), in line with the protective effect expected from interventions that reduce psychotic symptoms. We also found that treatment with an antidepressant (reported in two independent samples) was a protective factor (0.80, 95%CI=0.66, 0.97). It is possible that the affective component of a psychosis is being treated with the antidepressant, including anger, which has been shown to be one mechanism for violence in schizophrenia.[70] Alternatively, being under medical treatment may be a marker of closer contact with clinical services. Another novel finding is that cannabis use (reported in two independent samples) was identified as a risk factor for violence in the current review with an odds ratio of 3.34 (95%CI=2.32, 4.82), while it had a null association in the previous review. This suggests that cannabis use disorder could be considered as part of an individualized violence risk assessment.[72 73] It is also possible that cannabis drives at least part of the overall association of substance misuse with violence, given that many studies did not separate out the effect of cannabis misuse from that of other substances. Previous literature has found that cannabis use is associated with earlier onset of schizophrenia and other psychotic disorders,[74–76] and that earlier onset of psychosis is associated with greater risk of violent crime.[77] We further identified traumatic brain injury as a potential risk factor, which was not reported in the previous review. While organic brain disorders have been implicated in violence,[78] further research is necessary – especially as we only identified this risk factor in two independent samples.

Clinical implications

Our results confirm the importance of previous crime and previous or current substance misuse, and also identify potential novel risk factors including cannabis misuse. These findings can inform more precise stratification of violence risk for patients with psychotic disorders. However, the clinical impact of accurate risk prediction models depends on whether effective interventions are available. Many of the identified risk factors, such as comorbid substance misuse, are potential targets for clinical intervention if found to be causal. Others may be markers of modifiable risk factors. For example, criminal history could be a marker of pro-criminal beliefs that may be reduced using cognitive or behavioural interventions.[68] Further research is recommended to test the impact of different types of interventions in individuals with psychosis.

We have included multiple study settings, and it is possible that certain risk factors vary in their association depending on the context in which the assessment is made. When we restricted our analysis to inpatient settings, risk factors were attenuated and became statistically non-significant. Patients from inpatient settings are likely to be a selected sample due to greater severity of symptoms and may have more similar risk factor profiles, leading to lower variance in violence risk. Consequently, more in-depth risk assessment may be necessary.

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Strengths and limitations

We have focused on longitudinal studies, which reduces the possibility that reverse causation explains the results. However, several limitations should be noted. First, we relied on minimally adjusted effect estimates, given that covariate adjustment varied across studies. This may help explain why the effect estimates are quite similar within certain domains (notably the criminal history domain). Different types of criminality often co-occur within individuals – the presence of a given type may therefore be a marker of another, obscuring the relationship of specific risk factors with violence. We did not have individual participant data, which may have allowed us to provide consistently adjusted effect estimates.[79] Second, causal inferences are not possible, given that we extract minimally adjusted effect estimates and include a mix of study designs with different aims (descriptive, causal, and predictive). Nonetheless, our results may offer insight into risk factors that are important to consider in predictive and causal models, and – if found to be causal – that are modifiable in the sense that they can be improved through clinical intervention. Both types of risk factors are important – causal factors would allow for interventions to mitigate risk, while predictive ones would provide better risk stratification.

Third, our decision to pool individual risk factors and risk factor domains need to be considered in the context of substantial heterogeneity, e.g. in terms of study designs and measures. However, pooling can provide a broad overview of a large body of evidence.[11] Fourth, some risk factors were only measured in a cross-sectional setting, notably those based on detailed neuropsychological or cognitive tests or biomarkers, which meant that they were not examined. Fifth, we did not use a second reviewer for screening, given the large number of references at the screening phase and because we followed a previous protocol. However, the original search and the updated one were carried out by independent reviewers. Sixth, included studies predominantly come from high-income Western countries and further research is needed to better understand risk factors in other regions.

Conclusion

In this updated systematic review and meta-analysis using longitudinal designs, we have validated the importance of comorbid substance misuse and criminal history as risk factors for violence in psychosis, while identifying potential novel risk factors such as cannabis misuse that require replication. If found to be causal, several of these factors represent modifiable intervention targets.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data Availability

Data availability is not applicable to this article as no new data were created or analysed in this study.

Analytic Code Availability

The analytic code for running the meta-analysis is available upon request.

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Risk factor domain	k	N violent	N total	Odds Ratio (95% CI)
treatment related	7	2,533	72,805	0.54 (0.34, 0.85)
negative symptoms	4	192	1,767	1.10 (0.95, 1.27)
positive symptoms	5	192	2,921	1.12 (0.45, 2.82)
sociodemographic	25	6,876	189,791	1.61 (1.07, 2.44)
psychopathological	12	760	5,757	1.66 (1.05, 2.62)
suicidality	9	3,324	155,356	1.74 (1.01, 2.98)
premorbid	6	4,655	98,999	1.79 (1.16, 2.77)
substance misuse	23	6,841	157,466	2.36 (1.99, 2.80)
criminal history	19	5,834	117,120	3.50 (2.37, 5.16)

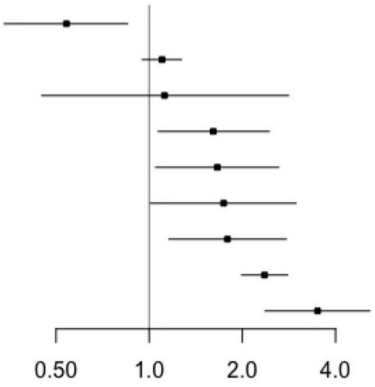


Figure 1. Pooled odds ratios for violence in psychosis by overall risk factor domain

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Table 1

Characteristics of independent samples[a]

	Original search	Updated search	Overall
	(N=21)	(N=20)	(N=41)
Publication Year			
Median [Min, Max]	2004 [1983, 2010]	2016 [2013, 2022]	2011 [1983, 2022]
Region			
Asia	1 (4.8%)	0 (0%)	1 (2.4%)
Australia	0 (0%)	1 (5.0%)	1 (2.4%)
Europe	8 (38.1%)	12 (60.0%)	20 (48.8%)
International collaboration	3 (14.3%)	1 (5.0%)	4 (9.8%)
UK	2 (9.5%)	3 (15.0%)	5 (12.2%)
USA	7 (33.3%)	3 (15.0%)	10 (24.4%)
Sample size			
Median [Min, Max]	207 [16, 4,035]	1221.5 [30, 58,771]	404 [16, 58,771]
Inpatient population			
No	12 (57.1%)	19 (95.0%)	31 (75.6%)
Yes	9 (42.9%)	1 (5.0%)	10 (24.4%)
Violence measure			
Aggression	1 (4.8%)	0 (0%)	1 (2.4%)
Attack	10 (47.6%)	2 (10.0%)	12 (29.3%)
Attack / verbal abuse	4 (19.0%)	6 (30.0%)	10 (24.4%)
Forensic care	0 (0%)	1 (5.0%)	1 (2.4%)
Homicide conviction	0 (0%)	1 (5.0%)	1 (2.4%)
PANSS[b] hostility (continuous)	0 (0%)	2 (10.0%)	2 (4.9%)
Physical assault episodes (continuous)	1 (4.8%)	0 (0%)	1 (2.4%)
Violent offence arrest	0 (0%)	1 (5.0%)	1 (2.4%)
Violent offence conviction	5 (23.8%)	7 (35.0%)	12 (29.3%)

[a]For overlapping samples, information from the sample with the greatest sample size is presented

[b]PANSS: The Positive and Negative Syndrome Scale

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Table 2
Pooled odds ratios of risk factors for violence in psychosis

Risk factor domain	Risk factor[a,b,c]	K	No. Violent	No. Total	OR (95% CI)	Z-value	I^2
Criminal history	Violence history	15	5,521	111,504	2.91 (2.06, 4.10)	6.07	96
	Criminal history: prison	3	1,756	10,140	3.04 (2.08, 4.44)	5.76	60
	Violence history: recent	3	1,564	9,272	3.40 (1.65, 7.00)	3.32	78
	Non-violent crime: history	6	2,478	30,154	4.16 (1.66, 10.38)	3.05	99
Negative symptoms	Negative: PANSS (continuous)	4	192	1,767	1.10 (0.95, 1.27)	1.23	0
Positive symptoms	Positive symptom score: PANSS (continuous)	5	192	2,921	1.12 (0.45, 2.82)	0.25	99
Premorbid	Victimization: violent, recent	5	212	67,623	5.81 (3.45, 9.78)	6.62	67
	Family history: violent crime, parent	4	4,525	97,260	1.37 (1.15, 1.63)	3.47	47
Psychopathological	Diagnosis: personality disorder	4	461	3,246	2.30 (1.71, 3.09)	5.49	23
	Hospitalization: history, number (continuous)	3	128	386	2.65 (1.45, 4.84)	3.18	27
	Diagnosis: schizophrenia	4	70	910	1.63 (1.17, 2.28)	2.87	0
	Total: PANSS (continuous)	3	181	1,655	0.67 (0.15, 2.95)	-0.53	97
Sociodemographic	Education: no qualifications vs any	3	940	7,697	1.46 (1.26, 1.69)	5.00	4
	Black and minority ethnicity	4	259	2,430	1.72 (1.08, 2.74)	2.28	68
	Gender: male	12	2,953	89,379	1.67 (1.06, 2.64)	2.19	96
	Age: younger	4	983	59,827	1.63 (0.80, 3.32)	1.35	91
	SES: low income	6	4,110	49,864	1.11 (0.84, 1.47)	0.76	93
	Living situation: homeless	3	293	1,393	1.31 (0.59, 2.92)	0.67	0
	Marital status: single	11	2,917	31,384	1.07 (0.84, 1.35)	0.53	72
	Living situation: living with others	3	202	1,883	1.10 (0.72, 1.68)	0.45	0
	Employment: unemployed	7	377	3,353	0.86 (0.39, 1.91)	-0.36	90
	Living situation: living alone	3	322	2,378	0.75 (0.57, 1.00)	-1.97	0
Substance misuse	Substance misuse	11	2,929	35,209	2.41 (1.84, 3.15)	6.42	87
	Drug misuse	11	3,935	122,048	2.20 (1.72, 2.82)	6.28	86
	Alcohol misuse: history	3	1,009	59,873	1.61 (1.31, 1.99)	4.45	19
	Drug misuse: recent	4	254	2,320	1.80 (1.35, 2.38)	4.06	0
	Alcohol misuse	7	3,630	34,453	1.92 (1.38, 2.68)	3.86	87
Suicidality	Self-harm: history	9	3,324	155,356	1.74 (1.01, 2.98)	1.99	97
Treatment related	Medication: treatment adherence	4	261	2,575	0.59 (0.33, 1.06)	-1.77	80
	Medication: antipsychotic	4	2,272	70,459	0.51 (0.27, 0.96)	-2.09	95

[a] Recent: within last year

[b] PANSS: The Positive and Negative Syndrome Scale

[c] SES: Socioeconomic status

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Table 3
Pooled odds ratios of risk factors for violence in psychosis in inpatient settings

Risk factor domain	Risk factor[a,b]	K	No. Violent	No. Total	OR (95% CI)	Z-value	I^2
Criminal history	Violence history	3	215	586	1.23 (0.35, 4.33)	0.33	83
Negative symptoms	Negative: PANSS (continuous)	2	104	220	1.42 (0.62, 3.23)	0.83	64
Positive symptoms	Paranoia: BPRS (continuous)	2	7	223	3.07 (0.88, 10.69)	1.76	52
	Positive symptom score: PANSS (continuous)	2	104	220	0.48 (0.07, 3.29)	-0.75	92
Psychopathological	Hospitalization: history, number (continuous)	2	106	201	2.07 (1.22, 3.53)	2.69	0
	Total: PANSS (continuous)	2	104	220	0.41 (0.05, 3.64)	-0.80	94
Sociodemographic	Marital status: single	3	131	1,922	1.22 (0.84, 1.77)	1.03	0
	Gender: male	3	267	3,105	1.59 (0.44, 5.81)	0.70	92
	Living situation: living with others	2	125	448	1.28 (0.46, 3.55)	0.47	0
	Living situation: homeless	2	125	448	0.54 (0.08, 3.88)	-0.61	0
	Employment: unemployed	2	69	367	0.33 (0.01, 10.01)	-0.64	94
Suicidality	Self-harm: history	2	69	367	1.64 (0.88, 3.05)	1.57	0

[a]PANSS: The Positive and Negative Syndrome Scale

[b]BPRS: Brief Psychiatric Rating Scale

Appendix B - Qualitative Paper

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Original Article

Psychological framework to understand interpersonal violence by forensic patients with psychosis

Sinéad Lambe, Kate Cooper, Seena Fazel and Daniel Freeman

Background

Forensic patients with psychosis often engage in violent behaviour. There has been significant progress in understanding risk factors for violence, but identification of causal mechanisms of violence is limited.

Aims

To develop a testable psychological framework explaining violence in psychosis – grounded in patient experience – to guide targeted treatment development.

Method

We conducted in-depth interviews with 20 patients with psychosis using forensic psychiatric services across three regions in England. Interviews were analysed using reflexive thematic analysis. People with lived experience contributed to the analysis.

Results

Analysis of interviews identified several psychological processes involved in the occurrence of violence. Violence was the dominant response mode to difficulties that was both habitual and underpinned by rules that engaged and justified an attack. Violence was triggered by a trio of sensitivities to other people: sensitivity to physical threat, from which violence protected; sensitivity to social disrespect, by which violence increased status; and sensitivity to unfairness, by which violence delivered revenge. Violence was an attempt to regulate difficult internal states: intense emotions were released through aggression and violence was an attempt to escape being overwhelmed by voices, visions or paranoia. There were different patterns of emphasis across these processes when explaining an individual participant's offending behaviour.

Conclusions

The seven-factor model of violence derived from our analysis of patient accounts highlights multiple modifiable psychological processes that can plausibly lead to violence. The model can guide the research and development of targeted treatments to reduce violence by individuals with psychosis.

Keywords:

Psychotic disorders/schizophrenia; forensic psychiatry; qualitative research; risk assessment; violence.

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Approximately 60–70% of patients in forensic secure services in the UK have a primary diagnosis of psychosis.[1] Typical offences include violent offences (e.g. assault, grievous bodily harm), attempted murder and manslaughter.[2] There has been extensive research identifying those patients with psychosis at high risk of committing violence. Static risk factors such as previous criminal convictions, young age, male gender and a history of substance misuse have the largest associations with future violence.[3,4] Dynamic risk factors such as hostile behaviour, recent drug or alcohol misuse, poor impulse control and non-adherence to psychological therapies or medication also predict violence.[4] There is clear progress in understanding risk factors for violence, but the causal mechanisms driving violence are still largely unknown.

Models of violence in psychosis

To date, a small number of psychological models have been proposed to explain violence by individuals with psychosis. On the basis of a narrative review, Lamsma & Harte[5] and Volavka & Citrome[6] propose different causal pathways between predisposing risk factors (including social factors such as family history of criminality or a neighbourhood with social problems), psychiatric disorder (e.g. schizophrenia, comorbid antisocial personality disorder, substance misuse), psychiatric symptoms (e.g. hostility, positive symptoms, agitation) and precipitating factors (e.g. stress, treatment non-adherence). Other models have focused on a single driving factor for violence. Adams & Yanos[7] proposed that violence in psychosis is primarily driven by anger, exacerbated by substance misuse and impulsivity. Anger is hypothesised to arise from a number of factors, including victimisation, social stressors, anxious arousal and hostile attribution bias. Two theories suggest that specific psychosis symptoms lead to violence.[8,9] The threat/control-override theory posits that violence occurs when delusions cause a person to feel personally threatened or involve the intrusion of thoughts that override self-control;[8] this has not been consistently replicated.[10] The second theory is that command hallucinations, when the person believes the voices are omnipotent and powerful, result in violence.[9] This has led to treatments designed to reduce compliance with command hallucinations.[11]

Treatments

Clozapine is currently the most effective pharmacological treatment for aggressive and violent behaviour in people with psychosis.[12,13] However, the effects of clozapine are unspecific and the underlying mechanism is not yet understood.[14] The available evidence on psychological interventions is more limited. Few randomised controlled trials have been conducted of psychological interventions targeting the reduction of violence by forensic patients with psychosis. Trials have tested dialectical behaviour therapy,[15] reasoning and rehabilitation,[16] cognitive remediation,[17] cognitive–behavioural therapy for psychosis with anger management,[18] and virtual reality aggression prevention therapy.[19] Findings of these have been mixed (e.g. change in one domain of violence, such as verbal aggression, but not in others)[16,18,19] or difficult to interpret

owing to small numbers[15] or high levels of attrition.[16] The development of effective psychological therapy requires a theoretically driven approach. Treatment techniques need to target key mechanisms that contribute to the occurrence of aggression.[20,21] Our understanding of these mechanisms could be advanced by speaking with the patients themselves. Acceptability of a treatment is likely to be enhanced if models are aligned with patient experience.

The present study

To date, there has been no qualitative study of psychological factors leading to violence in patients with psychosis. The present study aimed to understand, from forensic patients with psychosis, the key psychological processes that may drive violent behaviour. We are focusing on violence in people with psychosis for several reasons: (a) there is an elevated risk of violent offending, (b) there is typically contact with health services before and after the offence, providing an opportunity for both prevention and intervention, and (c) there are clinical features specific to this group (e.g. positive symptoms) that need to be accounted for in any model and subsequent treatment. For this study we defined violence and aggression as the intentional use of physical force or power, threatened or actual, against another person that either results in or has a high likelihood of resulting in injury, death or psychological harm. Studies have found that the risk factors for minor and more severe forms of interpersonal violence are similar,[4] thus participants were interviewed about a range of violent incidents, including their index offences.

Method

Study design

We used reflexive thematic analysis[22,23] to investigate the psychological processes involved in violence by forensic patients with psychosis. Reflexive thematic analysis is a qualitative research method for analysing and interpreting patterns across a data-set of interviews. It requires researchers to critically interrogate their own experiences, preconceptions and biases and consider how these may affect the analytical process. We took a critical realist approach to the analysis. Critical realism theory posits that there exists an objectively knowable reality, but acknowledges that perception and cognition influence how that reality is observed.

Participants

Purposive sampling was used to ensure representation across stages of recovery and severity and form of violent behaviour. A sample of 20 participants allowed for in-depth interviewing and analysis while also ensuring a sufficient breadth of viewpoints. Participants were recruited from three National Health Service (NHS) trusts: Oxford Health NHS Foundation Trust (Oxford, UK), West London NHS Trust (London, UK) and Devon Partnership NHS Trust (Devon, UK). Participants were included in the study if they were over 18 years old, identified as male, and had a primary diagnosis of schizophrenia spectrum disorder and a history of interpersonal violence. Participants were excluded if their offending was primarily sexual violence, if they had an intellectual disability or if their verbal English was insufficient to take part in the interview.

Procedure

Participants were initially told about the research by their clinical team and only if they expressed an interest were they approached by the research team. Limitations of confidentiality were clearly explained. Participants provided written informed consent to take part and for quotes to be used under a pseudonym in later publications. Participants were given a 2 week cooling-off period, when they could contact the researcher to withdraw and have their interview deleted.

All interviews were conducted by a clinical psychologist (S.L.) trained in reflexive thematic analysis. Interviews were audio-recorded and later transcribed verbatim by a professional transcription service. Interviews were semi-structured to facilitate a more open and flexible discussion and to allow the exploration of unanticipated themes. The interview guide (Supplementary material 1, available at https://dx.doi.org/10.1192/bjp.2023.132) was developed based on input from a lived experience advisory panel (four people who had had psychosis and used forensic psychiatric services), discussions with clinicians working in forensic services and a review of literature on risk factors for violence by forensic patients with psychosis. Three pilot interviews were conducted with people with lived experience to ensure the questions and interview style promoted openness and elicited the depth of description needed to achieve the study aim. These data were not included in the analysis.

Interviews started with an initial open question about the participant's experience with violence. Subsequent questions focused on the initial emergence of violent behaviour, an in-depth description of significant incidents of committing violence, including the build-up to the incidents, and the thoughts and emotions before, during and after. Questions also explored 'near misses', when there was an urge to be violent that was not acted on, which aimed to identify inhibiting factors for violence and understand how participants experienced the consequences of not being violent when feeling provoked. It was emphasised that the information given by the participant in the interview would be shared with care teams only if a disclosure significantly altered their current risk assessment. Follow-up questions and probes were used as appropriate. Interviews were transcribed verbatim, anonymised and checked for accuracy.

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The study received approval from an NHS research ethics committee (London – Riverside Research Ethics Committee; ref 21/LO/0892).

Analysis

The analysis followed the guidance provided by Braun & Clarke[22,23] for reflexive thematic analysis (for more details on the analytical process see Supplementary material 2). Audio recordings were listened to and transcriptions read and re-read to ensure familiarity. All transcripts were coded by S.L., paying attention to both descriptive and conceptual elements within the data. Codes were considered against the whole data-set and similar codes combined. Thematic maps were used to aid the development of themes and consider the links and relationships between themes. Themes were considered in relation to the research aim and any themes that fell outside the study remit or did not have sufficient data to support them were discarded. Quotations were selected if they provided a good summary of the core of a theme and represented views across the range of participants. Codes and themes were reviewed in supervision (D.F., S.F. and K.C.) and by members of the lived experience advisory panel to ensure that a rigorous credibility analysis was conducted.[24]

Results

Recruitment took place from 23 February 2022 to 24 May 2022. Of 22 patients approached, 20 consented to take part in the interview. Participants' mean age was 36.4 years (s.d. = 11.0: range 20–56) and

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Table 1 Participants' clinical and offending information

	n (%)
Primary diagnosis	
Schizophrenia	17 (85)
Schizoaffective disorder	3 (15)
Secondary diagnoses	
None	11 (55)
Personality disorder (antisocial, borderline)	4 (20)
Substance misuse	4 (20)
Generalised anxiety disorder	1 (5)
Attention-deficit hyperactivity disorder	1 (5)
Forensic service	
Medium secure acute ward	3 (15)
Medium secure rehab ward	14 (70)
Low secure ward	2 (10)
Community forensic service	1 (5)
Previously admission to high secure forensic unit	1 (5)
Previously admission to medium secure forensic unit	9 (45)
Previous convictions	13 (65)
Previous violent conviction	11 (55)
	Mean (s.d.)
Length of forensic admission (months)	33.8 (28.2)

ethnicity was reported as White British ($n = 10$; 50%), White Other ($n = 3$), Black British ($n = 2$), White and Black Caribbean ($n = 2$), Black African ($n = 1$), White and Black African ($n = 1$) and Mixed White and Asian ($n = 1$). Participants' index offences included violent offences such as assault, battery, grievous bodily harm, affray or use of an offensive weapon ($n = 15$), attempted murder ($n = 2$), manslaughter ($n = 2$) and murder ($n = 1$). Clinical and crime-related information is shown in Table 1.

The analysis identified three themes: (1) Violence as the dominant response mode; (2) Violence protects against a trio of sensitivities to other people; and (3) Violence relieves negative internal states. There were seven subthemes across these three themes, each representing a different psychological factor contributing to violence (Appendices 1 and 2).

Theme 1: Violence as the dominant response mode

In this theme, violence had become the dominant response to difficulties. It has become an established behaviour through social learning (subtheme 1.1: Violence is all I know). Participants had a rigid set of rules, which guided their behaviour during a confrontation (subtheme 1.2: Rules of engagement). These rules provided a way for participants to justify their behaviour.

Subtheme 1.1: Violence is all I know

Violence was a habitual response to interpersonal difficulties and happened without significant conscious thought:

> 'Just brushing past me or stand next to me. I just turn around and smack them.' (Kyle)

Family members and peers modelled and normalised the use of violence. Participants were exposed to violence, criminality and drugs as they grew up. Local criminal gangs often displayed wealth and this lifestyle was further promoted in favoured music and films. In this context violence achieved results, was reinforced by peers and formed part of a positive social identity:

> 'It becomes so normal to you that you don't even see it as aggressive behaviour.' (Amadi)

> 'My older brother, he's six years older than me, he was a football hooligan, and he liked fighting, and he was an influence on me. He was always wrestling me, telling me he was going to toughen me up, and I should fight at school and be the hardest, and, constantly telling me that. I grew up thinking that. I grew up thinking I had to be big and hard and fight people.' (Dean)

> 'I could have started saying look, I'm a bad man, I'm a gangster, who the fuck are you, fuck… do you know who you're messing with? Who do you think you're talking to?' (Juan)

A limited behavioural repertoire for managing interpersonal difficulties meant that even when motivated, participants struggled to conceive how situations could be handled without violence, beyond the complete avoidance of triggers:

> 'I don't have a choice, some people would say there's always a choice but, I don't think I'll ever be normal again, like I'd love to be. I'd feel uncomfortable going out on dates with girls because of things that could arise. Like going out with a girl, going to a bar, there's a situation when I'm drunk, someone is trying to chat to my girl. So I'm saying "That, that's my girl. Don't chat to her", and then if he gets lairy, I'll end up bottling the guy.' (Jamar)

Subtheme 1.2: Rules of engagement

Rules guided behaviour during a violent confrontation with the aim of increasing the chance of winning the fight, maintaining a reputation and providing justification. Key rules included: if you believe someone is going to harm you, it is best to hit them first, hit them until they can't get up and scare them enough that they won't retaliate in future:

> 'Because I don't want to get attacked first, I don't want to get hit first, so I always attack first.' (Jamar)

> 'But say if they see me, that's when I pull out my weapon, I will try and chase them or try stabbing them or something. Because I want to scare them. Or else I'll probably get stabbed or something, yes or it will happen to me.' (Adam)

Some rules reflected the views of wider social networks on how to behave during a confrontation. For example, if a friend is in a fight then you must step in too; if someone brings trouble to you, you must deal with it rather than involving the police. These rules led to more reactive and extreme violence and perpetuated cycles of violence:

> 'If you see your friend get scared, well, now you've got to step up because he's part of your group of people, so now you've got to let the people know they can't mess with your mate like that because he's got back up.' (Dan)

> 'I didn't press charges against the guy that stabbed me.' (Juan)

The threshold at which violence was considered a justified response was low, whereas the degree of force deemed appropriate was severe. It was often black and white – if someone was considered to have 'crossed a line' then any level of violence was justified. These justifications allowed absolution of guilt or remorse:

> 'And I walked up to him and I was like… like "You say that again to my face". And he said it again to my face. I grabbed him. I punched him until he was a puddle. I punched him really really hard on the face over and over again.' (Lewis)

> 'I wouldn't feel anything. I wouldn't feel remorse. I just carry on what I'm doing. I won't give a shit. They tried something with me and I put them in their place and that's the way it was. That's the way me and my mates score up.' (Kyle)

Theme 2: Violence protects against a trio of sensitivities

In this theme, violence was a response to the behaviour of others. Participants were highly sensitive to disrespect (subtheme 2.1), threats of physical harm (subtheme 2.2) and unfair treatment (subtheme 2.3), whether real or imagined. They held positive beliefs about violence as a way of increasing social status, protecting oneself and getting justice.

Subtheme 2.1: Sensitivity to disrespect

Subtle behaviours, such as body language or tone of voice, were interpreted as disrespectful. Violence was used to re-establish social status. Delusional content (e.g. that others were laughing at or mocking them) amplified this process:

> 'Look. Like, if you talk to me in a certain way and I don't like it, I'm gonna fight you.' (Amadi)

> 'My index offence is somebody that was in supported lodging that I believed was reading my mind and yeah I stabbed him with a knife. Yeah, mocking me, laughing at me. Knew exactly what I was thinking.' (Dean)

Participants described feeling 'worthless' and 'unloved' from growing up in poverty and being bullied or criticised. Violence became an effective way for them to prove themselves and gaining respect:

> 'My other brother, who was six years older, always bullied me and tried to humiliate me and mock me in front of people.' (Dean)

> 'Because your life is worthless, you don't mind if you hurt somebody else's life, so that aggressiveness can come out of you from time to time.' (Amadi)

> 'I had my first fight when I was about eight, nine years old. And then I found out what it was like for people to be frightened of me and respect me. And then things just escalated from there.' (Juan)

In contrast, walking away from a fight reduced participants' sense of social status and often triggered angry rumination:

> 'In the past I wouldn't [walk away from a fight] because they'd just take you for an idiot. Other people would be saying "Oh, he's an idiot".' (Sorin)

Subtheme 2.2: Sensitivity to physical harm

Participants were vigilant for signs of threat and would respond with force:

> 'I'm always on guard, I'm always thinking, threat, threat, threat, all the time. […] Shoulders, arms, body language, how they're moving and, like, how they're talking, tone of voice. You know something is about to kick off.' (Jamar)

> 'Anyone acknowledges that if they feel threatened, then they will get violent. It's like when people are paranoid, and they perceive people as a threat, they will act on it, and do something. Fight or flight mode, or they'll run away or they'll attack someone.' (Dean)

Participants had been victims of extreme violence in the past and believed using violence was essential for protecting oneself. They often had examples of when using violence protected them or a member of their family. In contrast, being non-violent left them feeling more vulnerable to attack:

> 'I've been attacked badly in the past, nearly killed. Jumped by eight people and they nearly kicked me to death. When I did nothing wrong.' (Scott)

> 'It was only till I was older and I started fighting back that he stop beating her [my mum].' (Garry)

> 'You get beaten up, get really hurt. If you don't fight back then people just walk all over you.' (Kyle)

Psychosis triggered or amplified the sense of threat, leading to the use of violence. For some participants there was an interaction between real-world threats and paranoia. Participants described voices that were threatening or would warn of imminent threats from others. A number of participants' attempts to explain to themselves the onset of psychosis led them to believe they were being poisoned. The use of violence was driven by the belief that it was the best means of protecting oneself and others:

> 'I was smoking weed and I started hearing things. For example saying "Tommy is gonna kill ya, you'll have to get him". I'll go and get him, I'll go the second I can, I thought they were coming for me so I went for them.' (Garry)

> 'I heard it with my ears. It said "Your neighbour's raping his girlfriend". I heard it a few times and about a week before it happened. So, I went over with a hammer and I got in through his window.' (Sam)

Subtheme 2.3: Sensitivity to unfairness

Participants had rigid ideas of how they should be treated and were sensitive to unfair treatment. The frustrations they faced were often interpreted as intentional attempts to upset them:

> 'When I feel like other people are violating the terms of what they're supposed to do… I used to get angry quite a lot, especially with staff. Because I used to feel like they weren't treating me the way they were supposed to be treating me.' (Amadi)

Participants described ruminating about reasons why they had been treated unfairly or injustices that they had suffered in the past. There was a strong desire to restore equilibrium through violence:

> 'I really want to go and get revenge. I always be thinking about it and it got to a point where my girlfriend was like "You got to stop talking about it; it was like a year ago and still going on about it".' (Kyle)

> 'If somebody accidentally hit me in the face with a piece of wood, I'd want to slap them back, even if, even if it was an accident. I don't think it would be completely out of order. They caused me pain then, I think I would give them some pain back.' (Mateo)

This sense of unfairness was generalised by the participants to society as a whole. For example, two unprovoked attacks on strangers in the street by participants came from the belief that others had been dealt a better hand in life. Jealousy and resentment led to the use of violence:

> 'Something that happened that day, I spotted, maybe spotted some loving couple holding their hands together getting inside of a rich car, Mercedes let's say … fancy car, and I thought they looked happy and I thought … and in comparison … I instantly compared myself to them where I thought that they were happy and I wasn't happy so it built up my anger.' (Tomasz)

Theme 3: Violence relieves negative internal states

In this theme, violence was a response to internal states. Violence had an emotion regulation function and was triggered by psychological arousal and strong emotions (subtheme 3.1: Physiological drive). Violence could also be a desperate attempt to escape or stop voices, visions and paranoia (subtheme 3.2: Escape from psychotic experiences).

Subtheme 3.1: Physiological drive

Violence was a response to intense feelings of anger or anxiety and provided an effective way for the individual to regulate difficult emotions:

> 'Sometimes there's a pressure on the lungs. Your chest feels tight, your legs feel like jelly. Yeah, it's like you know when you get, what do they call it, your stomach churns. And you get pains in your arm, and then you let go, you kick off and it goes away. Anxiety, that's what they call it. That's it yeah, feels like I'm having a heart attack. And once you lash out with anger, it's released, that anxiety, the pressure.' (Sorin)

> 'I used to punch walls a lot, and my hands felt bad because my knuckles were all pushed in because I'd hit walls when I'm angry. I hit people. It was just a release and it hurts afterwards and it feel good like it takes it away.' (Kyle)

In these cases the victim often had done nothing to trigger the perpetrator or had done something minor that had triggered a disproportionate response:

> 'Just to hit somebody, random people were just being hit because I wanted to let the anger out and I didn't decide to punch a tree, I didn't decide to punch a stop sign on the way. I decided to punch somebody.' (Tomasz)

Participants described being very reactive to even minor triggers such as repetitive noises. Poor inhibitory control when angry or anxious often led to violence:

> 'I still get angry, very, very… bad anger. It comes up quickly, you know so it's hard to manage.' (Pasquale)

> 'There'd be no thoughts, I'd kick the shit out of them and they would take me to seclusion.' (Garry)

There was a lack of knowledge of how to manage frustrations or difficult emotions without violence. There were also limited opportunities for practising alternative ways of dealing with anger:

> 'I'll say, "Right, next time I'll try again, next time" and it's an ongoing thing, you can't practise all these skills until you're angry and it's hard to… to do everything right when you're angry.' (Pasquale)

Subtheme 3.2: Escape from psychotic experiences

Violence was sometimes an act of desperation. Participants described terrifying experiences during an acute psychotic phase. They were overwhelmed by voices, visual hallucinations or perceptual distortions. Voices encouraged violence as a way to make these experiences stop. Violence was seen as a last resort to escape these experiences or to prevent family members from witnessing them:

> 'I was freaking out. I was seeing people change into reptilian, shapeshifting aliens. I used to have conspiracy theories about it and it just got to my head. I started seeing people change in front of my eyes. I was a hundred percent sure it was real. I was too scared to talk about it. I was terrified … I thought if I did what I did, it would all stop. That's what the devil chant and voices were telling me to do this, it will stop. The moment I done it [stabbed someone] it just went quiet. Everything just went really quiet. The sun went in and I was like, this isn't going to stop, and I just walked out.' (Kyle)

Discussion

In this study we used qualitative methods to understand key psychological processes that may drive violent behaviour by people with psychosis. We conducted in-depth interviews with 20 patients with psychosis recruited from forensic psychiatric services in three regions of the UK. The rich descriptions shared by participants provided an insight into how they think about violence, the functions it serves and the perceived barriers to using alternative non-violent behaviours. Such insights can help orient clinicians to the patient perspective, allowing better calibration of clinical discussions about violence. Our analysis identified seven key psychological factors that contribute to the use of violence (Appendix 2). Violence is a learned behaviour, which can be both habitual (Factor 1) and underpinned by rules that engaged and justified an attack (Factor 2). Violence is often a protective strategy against a trio of sensitivities to other people: sensitivity to physical threat, from which violence protects (Factor 3); sensitivity to social disrespect, whereby violence increased status (Factor 4); and sensitivity to unfairness, whereby violence delivers revenge (Factor 5). Violence can have an emotion regulation function, whereby intense emotions are released (Factor 6), and violence can be an attempt to escape or gain control when overwhelmed by voices, visions and paranoia (Factor 7). The pattern of emphasis across these processes differs when explaining an individual patient's offending behaviour. This seven-factor framework is consistent with, and expands on, existing literature on violence in psychosis and provides multiple testable hypotheses about the underlying causal mechanisms. The multifactorial nature of the model reflects the complex nature of violence by people with psychosis. It can be used to distinguish between different patterns of violence, allowing for more individualised approaches to understanding and treating violence. Furthermore, it identifies potentially modifiable factors (habitual behaviour patterns, pro-violence beliefs and attitudes, signs of low tolerance of threat, social disrespect and injustice, poor emotion regulation and positive psychotic symptoms) and can be used to guide the development of new targeted interventions to reduce violence – an area that needs renewed attention.

Risk factors and mediators of violence

Learned behaviour

Through social learning processes violence can become an established part of one's behavioural repertoire.[25] Factors such as parental involvement in crime, early experiences of physical violence and violent victimisation are known risk factors.[4] Many participants were exposed to crime and violence from a young age, with violence being normalised or even glorified. At times this violence was extreme in nature (e.g. chased with knives, stabbings). It could be argued that such environments not only teach but at times necessitate violence. In this context pro-criminal beliefs and maladaptive rules and assumptions about violence develop. Such beliefs have been indicted in violence in the general population[26] but have not been explored as a mediator of violence in psychosis. Violent behaviour becomes habitual through use, with past violent behaviour being one of the strongest predictors of future violence.[4] Any future treatment should have a strong behavioural component (e.g. role-plays, behavioural experiments) to establish and strengthen competing prosocial behavioural responses to difficult situations.

Sensitivity to others' behaviour

Violence was often a response to other people's behaviour – triggered by the perception that others were being threatening, disrespectful or unfair. Similar to previous studies,[4] experiences of violent victimisation, bullying, neglect, abuse and social injustice were common. These increased hypervigilance for threat and hostile attribution biases, further amplified by psychosis symptoms (e.g. voices or paranoia). Hypervigilance and persecutory beliefs are common in psychosis and in most cases does not lead to violence. However, it was the combination of perceived threat and the belief that violence was an effective method of protecting oneself, gaining respect or justice that led to violent behaviour. The use of violence also prevented opportunities for the correction of misinterpretations (e.g. they are staring at me because they are going to attack) and positive beliefs about violence (e.g. violence keeps me safe). Violence elicited aggression from others, reinforcing the view that others are threatening. The non-occurrence of an attack was misattributed to having acted aggressively and thus successfully scaring the person off. Consequently, the belief that violence is necessary persisted. Treatments should incorporate techniques to test out and correct these misinterpretations, build a tolerance for the behaviour of others and help patients develop prosocial ways of achieving safety, social respect and justice to reduce their reliance on violence.

Emotion regulation

Studies have shown anger to be an important driver of violence in psychosis.[7,27] However, the influence of emotion regulation has not been explored, although there is some evidence it might play a role in violence in the general population.[28] Violence did appear to have an emotion regulation function. Participants described high emotional reactivity and poor ability to regulate their response. Violence was effective in releasing intense feelings of anger or anxiety. The descriptions provided of violence releasing or taking away difficult feelings are reminiscent of self-harm literature, in which some acts are performed without suicidal intent but in order to regulate intense emotional states.[29] Self-harm and violence frequently co-occur and the presence of one has been shown to increase the risk of the other.[24] Difficulties in emotion regulation, which have been implicated in self-harm,[30] may also play a role in violence. Future treatments could benefit from incorporating the development of emotion regulation skills.

Positive psychotic symptoms

For most participants positive psychotic symptoms, particularly paranoia and voices, contributed to violence by amplifying the aforementioned processes (sensitivity to others and emotion dysregulation). This is consistent with empirical findings that positive symptoms alone are a weak predictor of future violence.[4] However, although less common in the study's participant group, violence was sometimes a direct a response to being overwhelmed by delusions, voices and perceptual distortions, and was a desperate attempt to escape these experiences or make them stop. In two accounts, violence occurred during their first episode of psychosis, was ego dystonic and had occurred within 24 h of contact with mental health services.

Substance misuse

Finally, it is important to comment on the role of substance misuse, as this is one of the strongest predictors of violence in psychosis.[3,31] Surprisingly, no participants described substances as being a direct single cause of their violence, but rather substance use contributed across a number of the different factors. Involvement in taking drugs or drug dealing was an initial route into crime for several participants and led to some of the more extreme experiences of violence (e.g. between drug gangs). Alcohol and drug use increased anger and impulsivity. For some participants substances were used to relax and manage difficult feelings (emotion regulation) and agitation increased when going through withdrawals. Drug use also triggered or amplified psychosis symptoms such as voices and paranoia. Management of substance misuse should be included in any future treatment.

Strengths and limitations

To our knowledge, this is the first qualitative study to explore the psychological processes of violence in psychosis. However, there are a number of study limitations. The nature of qualitative research means the sample is small and not representative. Therefore it is exploratory and the findings need to be tested in larger, more varied samples. In addition, it may be that those willing to participate in the current study differ from the general forensic population, for example in their ability to reflect on their violence. However, there was a high uptake, with only two people approached about the study declining to take part. This work focused on violence by people with psychosis, which suggests that violence by such individuals differs in nature from that of the general population. However, this may not be the case and some elements of this model may have wider applicability. The study is reliant on retrospective accounts, which may not always be accurate. In addition, violence is a stigmatised issue and, although efforts were taken to manage this, participants may not have been completely open. However, the detailed descriptions of violence provided some assurances that this was not a significant problem. People with lived experience were involved in the study design and analysis; however, more participatory methods (e.g. interviews conducted by peer researchers) could have been used to enrich the analytical process and should be considered in future research.

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Supplementary material

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Data availability

The data are not publicly available because they contain information that could compromise the privacy of research participants. The data may be made available from the corresponding author, S.L., on reasonable request.

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Author contributions

S.L. conducted the interviews and analysis. All authors contributed to the design, analysis and write-up of the study.

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Declaration of interest

None.

Appendix 1

Three themes and seven subthemes illustrated by quotations

Theme 1: Violence is the dominant response mode

Subtheme 1.1: Violence is all I know

'I grew up with violence, I grew up with gangs. Violence is all I know.' (Garry)

'If you think like people are lying to you then that [violence] is the only way deal with it.' (Sorin)

Subtheme 1.2: Rules of engagement

'You know someone's saying something bad and talking shit about you, you go and deal with it. I lived by these rules for a long time.' (Kyle)

'Something could happen to me, so I don't stop until I know they're out.' (Jamar)

'I mean, once I've beaten them up and they're lying on the floor and they're bleeding or they're unconscious I will stop; I won't kill them.' (Pasquale)

'Sometimes like my friend will get in trouble and I have to fight because he's in trouble.' (Adam)

Theme 2: Violence protects against a trio of sensitivities

Subtheme 2.1: Sensitivity to disrespect

'I was not respected at home. I was not loved, you know, and I was abused. So I felt better when I was in the gang, I thought "Well, I am somebody now", do you know what I'm saying, even though I'm a criminal.' (Pasquale)

'All I want to do is fight. I always have to prove myself or if I think someone's better than me or something being violent is the way forward.' (Kyle)

'When I see someone back down from something, I think "Oh, he's now accepted a lower rank in the hierarchy than another person who's now taking his place in the ranking of the hierarchy". There are some people who stay completely out of it, and I struggle to understand how they do it.' (Mark)

'I was travelling on the bus, I thought people had taken the mick out of me, so I had a bit of a go at them. They were just sat really close to me and just laughing all the time. Thought they're probably making fun of me.' (Scott)

Subtheme 2.2: Sensitivity to physical harm

'Punches. Crutches hit across my head, iron bars hit across my head. You know I got stabbed when I was 17. I was in a coma.' (Juan)

'I became a scary person in, like, year seven, like no one would, like, fuck with me anymore because I'd, like, asserted my myself with violence.' (Lewis)

'You didn't punch them back, but in my mind I'm thinking "Yes, maybe I did the right thing but it's still making me feel scared, I still feel scared and anxious now, they'll continue to do that until I punch them".' (Pasquale)

'When I got stabbed, I kept calling the police, said I wanted police protection. I didn't press charges against the guy that stabbed me. But I kept thinking he was going to come back and finish me off. But that's the time when my schizophrenia started.' (Juan)

'I used to fight the wardens a lot in prison and I used to think it was them putting things in my food to make me hear the voices.' (Pasquale)

Subtheme 2.3: Sensitivity to unfairness

'They do want to frustrate me, yeah obviously they, they know it frustrates me, makes me angry, I but I don't know why they want to do that.' (Dean)

'Even if I killed him. Even if it takes like ten years, I have to get him back. Like I've got a couple of people like that, like' if I see him, yes, I have to get him back, I have to get him back. I don't know why. Every time I think about it, it gets… every time I think about this it gets me really angry. Like I get really agitated and stuff.' (Adam)

'And I was watching a YouTube video, I remember with (Dan) Bilzerian, he has more than me and he had a lot of things and I couldn't even get 20 quid on my credit card. So, I start thinking what use is my life right here. He's got everything and I got nothing, too different, too different. It killed me inside. I wanted to take his life.' (Reece)

Theme 3: Violence relieves negative internal states

Subtheme 3.1: Physiological drive

'It's like a, like a pressure but when you kick off it releases, relieves stress, so when you kick off you feel much better.' (Sorin)

'Anger can be released in a wrong way, you can see anger as a ticking bomb, as a ticking bomb inside of me. It can detonate. It can explode in the violence and aggression. Well, it happened to me on five occasions where I hit someone in the face because of my anger.' (Tomasz)

Subtheme 3.2: Escape from psychotic experiences

'I thought that a crisis team were taking my kids away to mutilate them and bring them back with all their guts hanging out and everything to show my wife and my dad and that's why I attacked my wife and my dad so that's it. Where's that come from I've got no idea, how that fed into violence I mean it's just ridiculous, it doesn't make any sense I can't put my finger on it, I just got no idea I just didn't want them to see my kid mangled, but it doesn't make any sense. But that was it but what turned it into violence, is I just didn't want my wife or dad to see my mutilated kids.' (Jack)

Appendix 2

Seven-factor model of violence in psychosis

Violence as the dominant response mode

Factor 1: Violence is all I know

(a) Violence modelled, normalised and reinforced by social network

(b) Reinforced by proceeds of crime and drug dealing

(c) Practice has ingrained behaviour

(d) Forms part of positive social identity

(e) Deficit in prosocial problem-solving skills

Factor 2: Rules of engagement

(a) If there is going to be a fight, make sure you throw the first punch

(b) Hurt them enough that they won't retaliate

(c) If your friend is in a fight, you have to get involved

(d) You deal with problems yourself, you don't involve the police

(e) If they cross a line, any level of violence is justified (black and white thinking)

Violence protects against a trio of sensitivities

Factor 3: Sensitivity to threat of physical harm

(a) Experience as victim of extreme violence

(b) Hypervigilance for signs of threat

(c) Misinterpretation others' behaviour (e.g. eye contact) as threatening

(d) Triggered or reinforced by paranoia and voices. Memories of violence protecting self and others from harm

(e) Belief that violence is protective and not using violence (i.e. prosocial response) is dangerous

Factor 4: Sensitivity to social disrespect
(a) Experiences of neglect, bullying, emotional abuse

(b) Low self-worth

(c) Hypervigilance for signs of disrespect

(d) Misinterpretation of others' behaviour as disrespectful or belittling

(e) Violence provides sense of self-esteem and status

(f) Others being fearful is interpreted as respect

(g) Belief that walking away from a fight is degrading

Factor 5: Sensitivity to unfairness
(a) Frustrations interpreted as intentional injustices by others

(b) Rumination about being treated unjustly

(c) Build-up of resentment towards others

(d) Revenge drive

Violence relieves difficult internal states
Factor 6: Physiological drive
(a) Heightened anxiety and/or anger

(b) Emotionally reactive

(c) Poor emotion regulation skills

(d) Violence relieves intense feeling of anger or anxiety

Factor 7: Escape from psychosis experiences
(a) Intense experiences of voices, visual hallucinations and perceptual distortions

(b) High levels of belief and absorption in positive symptoms

(c) High levels of distress

(d) Delusional experiences support use of violence (e.g. voices encouraging)

(e) Violence seen as a last option to stop or escape experiences

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Appendix C - Topic Guide

Note: these questions were a guide for the interview. The interview was semi-structured to respond to and explore what is said by the participant.

What has been your experience with aggression and violence?

When did you first start using violence?

What kinds of situations have led to violence for you?

Can you talk me through a situation that stands out in your mind? /a typical time / a worst case

- What was going on for you at the time?
- What were you thinking? Before, during, after
- What were you feeling? Before, during, after
- How did others react?
- What was the outcome?
- How do you think about it now?

What leads to you using violence? What things contribute to you being violence?

- Impact of substances?
- Impact of mental health?

Have there been times you have wanted to be violent and didn’t?

What was going on for you at the time?

- What were you thinking? Before, during, after
- What were you feeling? Before, during, after
- How did others react?
- What was the outcome?

How do you think about it now?

Is there anything else I haven’t asked about that I should have?

Is there anything else I would need to know to better understand violence?

Appendix D - Item Pool

Violence-activating cognitions item pool

1) I'll get violent if someone looks at me the wrong way.
2) Aggressive people make more money.
3) Someone looking at me in the street puts me on edge.
4) Violence is often the only way to get justice.
5) Sometimes I lash out when I'm feeling stressed.
6) Sometimes violence is the only option left.
7) I will hurt someone if they try to take advantage of me.
8) I do not let anyone put me down.
9) Being aggressive helps me win arguments.
10) Being violent puts you on top.
11) Someone looking at you is a sign they might attack.
12) Sometimes hurting someone is the only way to teach them a lesson.
13) Getting into fights is exciting.
14) Being aggressive helps me feel in control.
15) If someone disrespects me I will put them in their place.
16) I won't tolerate any sign of disrespect.
17) Shouting makes people listen to me.
18) Aggressive people are more likely to be successful in life.
19) I'm always ready for a fight.
20) It feels good to hurt someone who has hurt you.
21) I get a thrill from violence.
22) Getting aggressive makes me feel like I am taking action.
23) If someone puts me down I will make them regret it.
24) Getting aggressive makes people leave me alone.
25) Getting aggressive makes people take me seriously.
26) Women are more attracted to violent men.
27) I watch other people's body language for signs of aggression.
28) It's like justice to hurt someone who has hurt you.
29) Getting into a fight releases stress.

30) When a situation is hopeless, violence is the only option.
31) If someone makes me look stupid they will pay for it.
32) Violence makes people back off.
33) Being violent is the best way to deal with disagreements.
34) Most people are impressed by violence.
35) Getting aggressive teaches people not to mess with me.
36) Revenge is sweet.
37) If I'm angry kicking off makes me feel better.
38) When I feel desperate, violence is a way out.
39) If someone wrongs me they should be punished.
40) Getting aggressive is how I let people know I need space.
41) Being violent gets me what I want.
42) Real men are violent.
43) Using violence is the only way to protect myself.
44) If someone hurts me I will never let it go.
45) If I'm angry hurting someone else makes me feel better.
46) I get aggressive when I have run out of other options.
47) It is okay to hit someone if they insult you.
48) Being violent is how I let people know they have crossed a line.
49) Being aggressive is the only way to get what I want.
50) I won't tolerate people taking the piss out of me.
51) Being violent makes me feel safe.
52) I'd rather feel angry than upset.
53) I always feel more relaxed after I kick off.
54) If nothing else works then I resort to violence.
55) If someone says the wrong thing to me I will attack.
56) Being aggressive stops people picking on me.
57) Violence gets me what I want quickly.
58) I watch out for people challenging my status.
59) Lashing out is how I protect myself.
60) If I am anxious it makes me feel better to hit out.
61) People don't realise I'm struggling unless I lash out.
62) If someone does something to provoke me then it's their fault if I hurt them.
63) Being violent stops people taking advantage of me.
64) Being violent is a quick way to solve a problem.
65) Someone bumping into you is a sign of disrespect.
66) I need to be violent to protect myself.
67) Kicking off relieves stress.
68) Getting aggressive is how I let people know I am struggling.
69) The only way to avoid getting into fights is to stop going out.
70) Being violent stops people upsetting me.
71) Walking away from a fight makes me look like an idiot.
72) Violence is what I do.
73) Someone disagreeing with you is a sign of disrespect.

74) I'd probably be dead now if I didn't use violence.
75) Sometimes I only feel better after punching something.
76) I get aggressive to let people know I'm stressed.
77) If I think there is going to be a fight I make sure to throw the first punch.
78) I will always stand up for myself even if it means getting violent.
79) Violence is part of who I am.
80) I am sensitive to any small criticism.
81) Being aggressive has helped me protect other people.
82) Getting aggressive helps clear my mind.
83) If I thought someone was going to hurt me I would attack them first.
84) Being violent makes me feel strong.
85) Violence is how I best deal with problems.
86) I won't let anyone tell me what to do.
87) Violence helps you keep people safe.
88) Walking away from a fight makes me look weak.
89) Violence helps block out difficult emotions.
90) In a fight I won't stop until I know the other person won't get up again.
91) Winning a fight makes me feel successful.
92) Violence is something I am good at.
93) I want to make sure I am on top of the hierarchy.
94) Walking away from a fight means I will be more of a target next time.
95) Violence helps me feel numb.
96) In a fight I won't stop until I tire myself out.
97) Winning a fight makes me feel good about myself.
98) I know how to use aggression to get what I want.
99) Walking away from a fight leaves me feeling pathetic.
100) Life is about who is on top.
101) Walking away from a fight is dangerous.
102) Violence gives me a focus.
103) Being very violent will make sure nobody else tries to hurt me.
104) Getting into fights proves I'm a man.
105) Violence is a useful tool.
106) You are either on top or you are a nobody.
107) Walking away from a fight means I'll never feel safe.
108) I don't want to be violent, I just can't control myself.
109) Violence stops people taking me for an idiot.
110) Sometimes you need to be very violent to send a message.
111) Violence makes me feel powerful.
112) Violence is part of being human.
113) You are either a bully or you will get bullied.

114) When something upsets me, I can't control my actions.
115) If I feel threatened, I will carry a weapon.
116) Scaring people makes me feel powerful.
117) Aggression proves to others that I'm not afraid.
118) Violence is a necessary part of life.
119) Nice guys finish last.
120) When I'm angry, I lose control.
121) It is sensible to carry a weapon just in case.
122) Violence gives me control over other people.
123) Most people are violent.
124) If given the chance people will try and take advantage of me.
125) When I'm upset my emotions take over.
126) Violence makes me feel in control.
127) Violence is my automatic response to problems.
128) Other people enjoy upsetting me.
129) If provoked I just see red.
130) Those around me expect me to be violent.
131) Other people intentionally try to upset me.
132) When I'm angry I don't think, I just react.
133) The people I care about are impressed by violence.
134) Being aggressive stops people thinking I'm weak.
135) Other people always try to put me down.
136) Walking away from a fight makes me feel worse.
137) Where I am from you have to be violent to survive.
138) Being violent means people look up to me.
139) Walking away from a fight means I won't be able to stop thinking about it.
140) The people I am close to are often violent.
141) Being violent gets me respect.
142) If I walk away from a fight, I'll be in a bad mood for days.
143) Violence is respected where I was brought up.
144) Being violent gives me status.
145) The people I respect are impressed by violence.

Violence-inhibiting cognitions item pool

1) If I lose my temper, I always regret it.
2) Getting aggressive always makes me feel worse.
3) Only weak men are violent.
4) Getting aggressive is a sign you are losing control.
5) Walking away from a fight shows you are the bigger man.
6) Violence just leads to more violence.
7) Being aggressive makes you more of a target.
8) Being aggressive means you are more likely to get hurt.
9) Nothing gives me the right to hurt someone.

10) Being aggressive makes me feel bad about myself.
11) I feel proud of myself if I walk away from a fight.
12) Violence is seen negatively by most people.
13) People don't like aggressive people.
14) Once you get aggressive you have lost the argument.
15) Being aggressive makes life more difficult.
16) Violence never solves anything.
17) Being aggressive means people stop listening to you.

Appendix E – Factor analysis for Difficulties in Emotion Regulation Scale

The Short Form - Difficulties in Emotion Regulation Scale (Kaufman et al., 2016) is a self-report questionnaire designed to assess various dimensions of emotion regulation difficulties. The scale contained 18 items rated on a 5-point Likert scale and was originally proposed to have a six-factor structure including: Awareness, Clarity, Goals, Impulse, Nonacceptance, and Strategies. CFA showed poor model fit (scaled χ^2 = 816.583, df = 120, p < .001; Robust CFI = .878, Robust TLI = .844; Robust RMSEA = .098, 90% CI [.092, .105]).

The sample was randomly split (70:30) into derivation (n=581) and validation (n=249) subsets. EFA with the derivation sample was appropriate (KMO=0.92; Bartlett's test: χ^2=5526.25, df=153, p<0.001). Parallel analysis suggested a five-factor solution. Items were extracted using principal axis factoring with promax rotation. Two items ("When I am upset, I believe that I will end up feeling very depressed" and "When I am upset, it takes me a long time to feel better") were removed due to cross-loadings (>0.30).

The refined five-factor model explained 60% of the variance. One factor (containing three items related to emotional awareness) showed low or negative correlations with other factors (r=-0.02 to -0.21) and was removed from subsequent analyses. The remaining four-factor structure was validated through CFA with the validation sample and showed good model fit (scaled χ^2 = 142.993, df = 61, p < .001; CFI = 0.933, TLI = 0.915; RMSEA = 0.073, 90% CI [0.060, 0.087]; SRMR = 0.065).

The four factors were: (1) non-acceptance of emotional responses (4 items); (2) difficulties in impulse control (3 items); (3) lack of emotional clarity (3 items); and (4) difficulty engaging in goal-directed behaviour (3 items). Inter-factor correlations were moderate to high (0.71-0.94), supporting a higher-order factor of general emotion dysregulation. The higher-order factor model also showed acceptable fit, with the higher-order factor explaining between 71.2% and 93.5% of the variance in the four first-order factors.

Table S1: Four-Factor Structure of the DERS-SF

Factor	Item Content	EFA Loading	CFA Loading
Factor 1: Non-acceptance of emotional responses			
	When I am upset, I lose control over my behaviour.	0.94	0.83
	When I am upset, I have difficulty controlling my behaviours.	0.78	0.81
	When I am upset, I become out of control.	0.68	0.78
	When I am upset, I believe there is nothing I can do to make myself feel better.	0.40	0.70
Factor 2: Difficulties in impulse control			
	When I am upset, I have difficulty concentrating.	0.87	0.86
	When I am upset, I have difficulty focusing on other things.	0.87	0.90
	When I am upset, I have difficulty getting work done.	0.45	0.79
Factor 3: Lack of emotional clarity			
	I have difficulty making sense out of my feelings.	0.87	0.82
	I am confused about how I feel.	0.61	0.76
	I have no idea how I am feeling.	0.62	0.65
Factor 4: Difficulty engaging in goal-directed behaviour			
	When I am upset, I become embarrassed for feeling that way.	0.78	0.65
	When I am upset, I feel guilty for feeling that way.	0.59	0.76

Factor	Item Content	EFA Loading	CFA Loading
	When I am upset, I become irritated with myself for feeling that way.	0.52	0.86

Note: EFA loadings are from the derivation sample (n=581); CFA loadings are from the validation sample (n=249). Items related to emotional awareness ("I pay attention to how I feel," "I care about what I am feeling," "When I am upset, I acknowledge my emotions") as well as "When I am upset, I believe that I will end up feeling very depressed" and "When I am upset, it takes me a long time to feel better" were excluded from the final model.

Appendix F – Assessment and management of suppressors.

Suppression Effect Between Anger and Emotional Dysregulation

When examined separately, both emotional dysregulation ($\beta = 0.253$, $p < 0.001$) and anger ($\beta = 0.440$, $p < 0.001$) showed positive associations with physical violence. However, in the full model, their relationship pattern changed markedly, revealing a complex suppression effect.

Variance Inflation Factor (VIF) analysis confirmed a substantial correlation between anger and emotional dysregulation ($r = 0.733$), with a VIF of 2.16 when considering only these two variables. However, in the full model context, their individual VIFs were relatively low (anger: 1.266, emotional dysregulation: 1.006), suggesting that other predictors in the model helped distribute their shared variance.

Notably, when the direct effect of emotional dysregulation was constrained to zero, anger's effect on physical violence became non-significant ($\beta = 0.110$, $p = 0.132$). This finding demonstrates the statistical interdependence between these variables and confirms that their relationship cannot be adequately captured by considering either variable in isolation.

Mediation Analysis

To further investigate this relationship, a mediation model was tested where emotional dysregulation could affect recent physical violence both directly and indirectly through anger. The results revealed:

1. A significant positive indirect effect of emotional dysregulation on physical violence through anger ($\beta = 0.525$, $p = 0.001$)
2. A significant negative direct effect of emotional dysregulation on physical violence ($\beta = -0.693$, $p = 0.001$)
3. A strong positive effect of emotional dysregulation on anger ($\beta = 0.841$, $p < 0.001$)
4. A significant positive effect of anger on physical violence ($\beta = 0.624$, $p < 0.001$)

The total effect of emotional dysregulation on violence was negative but non-significant (β = -0.168, p = 0.073), indicating that the opposing direct and indirect pathways partially cancelled each other out. The mediation model explained 40.9% of the variance in physical violence, representing a substantial 7% increase over the direct effects model.

When the direct path from emotional dysregulation to physical violence was constrained to zero, the indirect effect through anger also lost significance, further confirming the interdependent nature of these pathways.

The key indicators of suppression effects include:

Increased explained variance: The model's R^2 increased by 10% when including both the direct and indirect pathways, indicating that modelling both variables together improves predictive power.

Strengthened effect sizes: The standardized coefficients for both anger and emotional dysregulation became stronger in the full model compared to their bivariate relationships.

Sign reversal: Emotional dysregulation changed from a positive predictor when examined alone to a negative predictor in the multivariate context.

Interdependence: When emotional dysregulation's direct effect was constrained to zero, anger's effect became non-significant, demonstrating that these variables enhance each other's predictive validity.

High correlation Anger and emotional regulation have a substantial correlation (r = 0.733) but showed opposing effects in the full model

Another explanation considered was that emotional dysregulation can increase violence risk primarily through heightened anger. However, when anger is controlled for, the remaining aspects of emotional dysregulation show a negative relationship with violence, suggesting that non-anger manifestations like withdrawal, or depression may actually be associated with decreased violence risk as distress is directed inward rather than outward.

Outcome

As there were no measures included in the study to allow assessment of this theory (e.g. depression measure or measure of self-harm), emotional dysregulation was removed from the model to prevent it overinflating the effects of the other variables and the variance explained through a suppression effect.

Suppression Effect Between presence of voices and distress from voice hearing.

When examined alone in an SEM the presence of voices had a none significant relationship with recent violence that was in the positive direction. When included with distress related to voice hearing it became significant and the direction of the association flipped indicating a suppressor effect. In addition, it enhanced the effects of all other variables in the model and contributed 6% of the variance explained. As this is likely due to its very related content with distress related to voice hearing, it was removed from the model.

Appendix G – Centrality indices

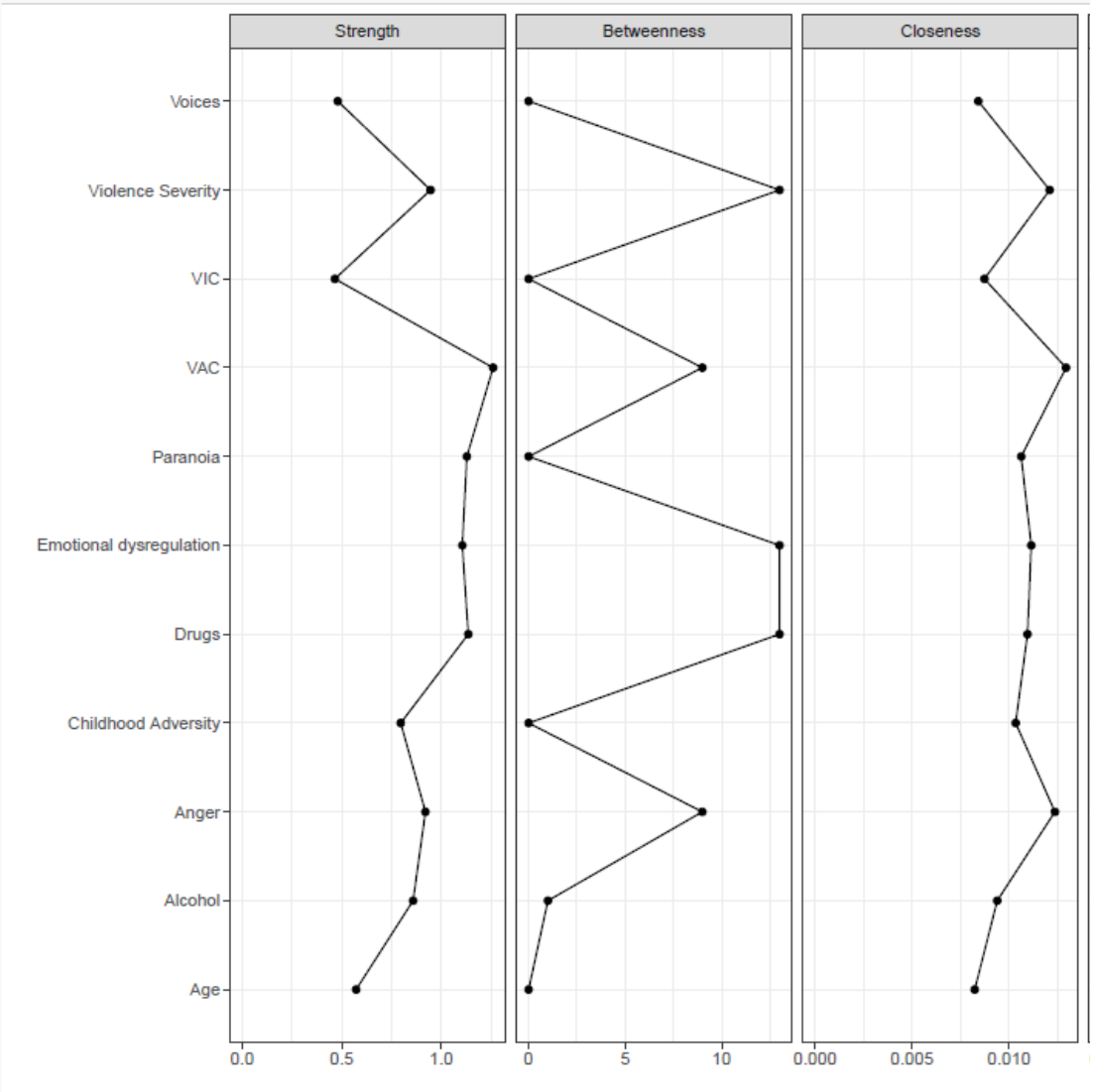


Figure S1: Centrality indices for all variables.

Centrality stability

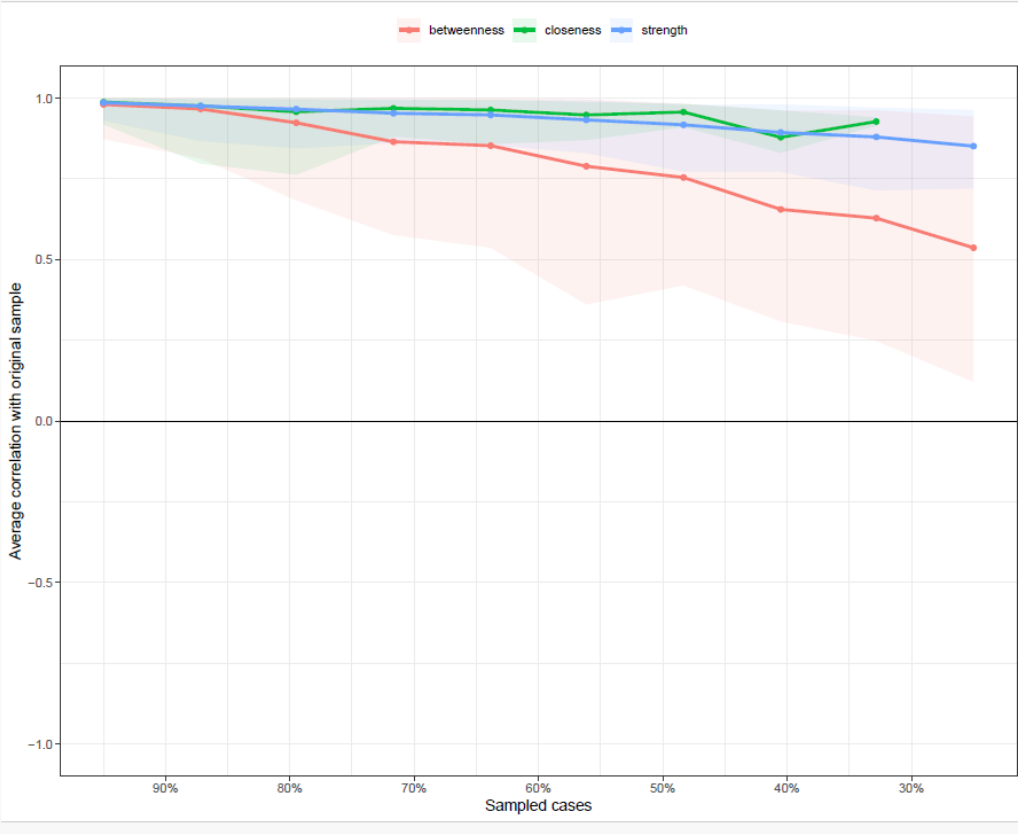


Figure S3: Showing the results of the case-drop subset bootstrapping.

Appendix H – Network analysis edge weight confidence intervals matrix

Table S2: Network analysis edge weight confidence intervals matrix

	1. Childhood Adversity		**2. Anger**		**3. Emotional dysregulation**		**4. VAC**		**5. VIC**		**6. Voices distress**		**7. Paranoia**		**8. Age**		**9. Violence Severity**		**10. Current drug use**		**11. Current alcohol use**	
	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI
1. Childhood Adversity	0.000	0.000	-0.072	0.050	0.000	0.086	0.046	0.204	0.000	0.139	0.000	0.106	0.051	0.204	0.000	0.090	0.000	0.116	0.057	0.294	-0.248	-0.052
2. Anger	-0.072	0.050	0.000	0.000	0.195	0.328	0.173	0.324	-0.072	0.000	0.000	0.090	0.063	0.206	-0.114	0.000	0.118	0.246	-0.101	0.081	0.000	0.139
3. Emotional dysregulation	0.000	0.086	0.195	0.328	0.000	0.000	0.162	0.296	0.127	0.251	0.251	0.381	0.046	0.184	0.000	0.076	-0.111	0.000	-0.179	0.000	-0.065	0.093
4. VAC	0.046	0.204	0.173	0.324	0.162	0.296	0.000	0.000	0.000	0.106	-0.142	0.000	0.267	0.402	-0.098	0.000	0.094	0.223	-0.085	0.131	-0.194	0.000
5. VIC	0.000	0.139	-0.072	0.000	0.127	0.251	0.000	0.106	0.000	0.000	-0.050	0.051	-0.068	0.041	0.000	0.139	-0.083	0.000	-0.193	0.000	0.000	0.165
6. Voices distress	0.000	0.106	0.000	0.090	0.251	0.381	-0.142	0.000	-0.050	0.051	0.000	0.000	0.000	0.167	-0.135	0.000	-0.088	0.000	-0.056	0.136	-0.133	0.000
7. Paranoia	0.051	0.204	0.063	0.206	0.046	0.184	0.267	0.402	-0.068	0.041	0.000	0.167	0.000	0.000	0.000	0.159	0.000	0.144	0.000	0.186	0.000	0.179
8. Age	0.000	0.090	-0.114	0.000	0.000	0.076	-0.098	0.000	0.000	0.139	-0.135	0.000	0.000	0.159	0.000	0.000	-0.178	-0.044	-0.353	-0.115	-0.108	0.060

	1. Childhood Adversity		2. Anger		3. Emotional dysregulation		4. VAC		5. VIC		6. Voices distress		7. Paranoia		8. Age		9. Violence Severity		10. Current drug use		11. Current alcohol use	
9. Violence Severity	0.000	0.116	0.118	0.246	-0.111	0.000	0.094	0.223	-0.083	0.000	-0.088	0.000	0.000	0.144	-0.178	-0.044	0.000	0.000	0.147	0.393	-0.160	0.000
10. Current drug use	0.057	0.294	-0.101	0.081	-0.179	0.000	-0.085	0.131	-0.193	0.000	-0.056	0.136	0.000	0.186	-0.353	-0.115	0.147	0.393	0.000	0.000	0.245	0.608
11. Current alcohol use	-0.248	-0.052	0.000	0.139	-0.065	0.093	-0.194	0.000	0.000	0.165	-0.133	0.000	0.000	0.179	-0.108	0.060	-0.160	0.000	0.245	0.608	0.000	0.000

Note: Each row represents correlations with confidence intervals. Values are presented to three decimal places with separate columns for lower and upper confidence intervals for each variable.

Appendix I- The Oxford Violence-Activating Cognitions Scale (OVAC)

People hold different views about how helpful violence is. Below are statements about aggression and violence. Please rate how much you believe the following statements by ticking one box for each.

Statement	**Do not believe it**	**Believe it a little**	**Believe it moderately**	**Believe it very much**	**Believe it totally**
1. Getting aggressive is how I let people know I need space.					
2. Walking away from a fight means I won't be able to stop thinking about it.					
3. Other people always try to put me down.					
4. I'd probably be dead now if I didn't use violence.					
5. When I'm angry, I lose control.					
6. Being violent makes me feel strong.					
7. When I feel desperate, violence is a way out.					
8. People don't realise I'm struggling unless I lash out.					
9. Walking away from a fight makes me feel worse.					
10. Walking away from a fight means I will be more of a target next time.					
11. Where I am from you have to be violent to survive.					

12. If someone does something to provoke me then it's their fault if I hurt them.					
13. I watch other people's body language for signs of aggression.					
14. If given the chance people will try and take advantage of me.					
15. I won't tolerate any sign of disrespect.					
16. The people I respect are impressed by violence.					
17. It's like justice to hurt someone who has hurt you.					
18. If I am anxious, it makes me feel better to hit out.					
19. Violence makes me feel powerful.					
20. Walking away from a fight leaves me feeling pathetic.					
21. Being aggressive is the only way to get what I want.					
22. I lash out when I'm feeling stressed.					
23. Other people enjoy upsetting me.					
24. I get aggressive when I have run out of other options.					
25. Violence is respected where I was brought up.					
26. I get aggressive to let people know I'm stressed.					
27. If someone puts me down, I will make them regret it.					
28. Violence makes me feel in control.					

Scoring Guide for the Oxford Violence-Activating Cognitions Scale (OVACS)

Subscale scores are calculated by summing the responses to the following items:

Violence to survive the social environment: item 11 + item 25 + item 16 + item 4

Attribution of negative intent from others: item 3 + item 23 + item 14 + item 13

Violence as a justified response: item 27 + item 15 + item 12 + item 17

Violence giving feelings of power: item 6 + item 28 + item 19 + item 21

Negative consequences of not being violent: item 20 + item 9 + item 2 + item 10

Violence regulating negative emotions: item 22 + item 26 + item 5 + item 1 + item 24 + item 8 + item 18 + item 7

Appendix J - The Oxford Violence-Inhibiting Cognitions Scale (OVIC)

People hold different views about how helpful violence is. Below are statements about aggression and violence. Please rate how much you believe the following statements by ticking one box for each.

Statement	**Do not believe it**	**Believe it a little**	**Believe it moderately**	**Believe it very much**	**Believe it totally**
1. If I lose my temper, I always regret it.					
2. Being aggressive means you are more likely to get hurt.					
3. . Violence is seen negatively by most people					
4. Getting aggressive always makes me feel worse					
5. People don't like aggressive people					
6. Being aggressive makes life more difficult.					
7. Being aggressive makes me feel bad about myself.					

Scoring Guide for the OVIC

Subscale scores are calculated by summing the responses to the following items

Negative personal consequences of violence: Item 1 +Item 4+ Item 7

Negative external consequences of violence: Item 2 + Item 3+ Item 5 + Item 6