



Violence and mental disorders: a structured review of associations by individual diagnoses, risk factors, and risk assessment

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In this Review, we summarise evidence on the association between different mental disorders and violence, with emphasis on high quality designs and replicated findings. Relative risks are typically increased for all violent outcomes in most diagnosed psychiatric disorders compared with people without psychiatric disorders, with increased odds in the range of 2–4 after adjustment for familial and other sources of confounding. Absolute rates of violent crime over 5–10 years are typically below 5% in people with mental illness (excluding personality disorders, schizophrenia, and substance misuse), which increases to 6–10% in personality disorders and schizophrenia spectrum disorders, and to more than 10% in substance misuse. Past criminality and comorbid substance misuse are strongly predictive of future violence in many individual disorders. We reviewed national clinical practice guidelines, which vary in content and require updating to reflect the present epidemiological evidence. Standardised and clinically feasible approaches to the assessment and management of violence risk in general psychiatric settings need to be developed.

Introduction

For decades, a key concern in the mental health field has been whether psychiatric disorders increase the risk of violence. Although associations between serious mental illness and violence have long been identified, the precise nature of these associations has been the topic of considerable research, public health, and policy debate. The importance of the associations between mental illness and violence is underscored by the inclusion of violence risk as a key criterion for hospital detention in mental health laws, and from public surveys suggesting that the perception of violence in people with psychiatric disorders increases stigma. Furthermore, from a public health perspective, violence is considered preventable, and health-care interventions are among the population-based approaches used to reduce violence, crime, and victimisation.¹

In this Review, we summarise evidence examining associations between individual psychiatric diagnoses and violent outcomes, with an emphasis on high quality methods, which could lead to improvements in the assessment and management of violence and related risks. We have outlined relevant national clinical practice guidelines and examined to what extent the guidelines incorporate the evidence on the assessment and management of violence risk. Throughout, we have focused on clinical diagnoses based on the ICD and DSM, and interpersonal violence. Consequently, we have not considered in this Review verbal aggression, agitation, non-violent crimes, and other antisocial outcomes that are considered to have less public health importance. Furthermore, we have not included self-harm or suicide within our violence definition because these are distinct outcomes for interventions, services, and guidelines. We have excluded intimate partner violence for similar reasons.

Methods

We have highlighted studies that used officially registered violent outcomes, such as arrest or conviction. Self-report scales, although practical, are limited by recall bias, inter-rater variability, and missing outcomes for people unable to participate, which could be a direct consequence of developing the outcome (eg, incarceration following a violent offence) or exacerbation of the individual's mental health problems. Register-based outcomes have clear strengths in relation to these potential biases, as do objective, clearly defined markers (eg, incident reporting systems) not requiring patient contact. Another strength of using contact with the criminal justice system as an outcome is its public health relevance, given that it can consume health-care resources for assessment and future care.² Although conviction is the most robust measure, delays or diversions in the justice system, or variations in how mental health outcomes are recorded, suggest that arrests or charges can be considered as alternative outcomes, particularly when statistical power is limited or diversion from criminal justice is likely (eg, in populations that are vulnerable or have mental disorders).

Epidemiology of violence in mental disorders

In this section, for each diagnostic category we review the relative risks and findings from sibling controlled studies where possible (table 1, figure 1). We discuss the potential population impact of treatment, and report the absolute risks (figure 2). For the general population risks, data presented are from research based on 2 425 703 people (for lifetime outcomes)²⁰ and 2 504 190 people (for outcomes across a span of up to 10 years) in Sweden.²² The prevalence of violent assault²³ and psychiatric morbidity²⁴ have been shown to be similar in Sweden compared with the prevalence in other high-income countries. Diagnoses are considered separately; however,

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comorbidity is common,²⁵ and the presence of additional psychiatric disorders is associated with increased risk of violence.¹⁰

Schizophrenia

Over 20 primary studies have shown an increased risk of violence in people with schizophrenia spectrum disorders compared with general population samples, including after adjustment for sociodemographic factors and substance misuse.^{3-5,20} A meta-analysis of studies from 11 high-income countries reported that the odds of violence range from 1 to 7 in men, and from 4 to 29 in women.³ The odds of homicide for individuals with schizophrenia was higher than for other violent outcomes (pooled odds ratio [OR] schizophrenia versus general population controls 19.5 [95% CI 14.7–25.8]), although the absolute lifetime risk of perpetration is very low (0.3%).³ A consistent finding is the mediating role of comorbid substance misuse, which typically doubles the risk of violence³ and can increase this risk through multiple pathways,²⁶ including substances increasing psychotic symptoms, self-medication with substances, and shared risk factors for psychosis and substance misuse.²⁰ Studies using case registers have replicated these associations in Australia²⁷ and Denmark.⁵ Temporal ordering of disorder onset and violent outcome, rather than using lifetime diagnosis, has reported findings in a reanalysis of US national survey data that are consistent with register-based studies.¹⁰

Studies using unaffected sibling controls have provided more careful adjustment for residual confounding, including familial factors such as early environment and genetic liabilities (figure 1). In one such study (in Sweden between 1972 and 2009), 24 297 individuals with schizophrenia spectrum disorders were matched to general population and sibling controls,⁴ with increased odds of 1.8 (95% CI 1.7–1.9) for violent crime in unaffected siblings versus general population controls suggesting some familial confounding. The adjusted rate ratio for violent offending in individuals with schizophrenia versus their unaffected siblings was 4.2 (95% CI 3.8–4.5). Importantly, sibling studies have been replicated in Israel²⁸ and an updated investigation in Sweden.²⁰ The results were similar, although these studies used lifetime crime outcomes.

Absolute rates of violence in schizophrenia indicate the relevance of prevention and management of risk to clinical services, particularly when treating individuals in their first episode of illness. Over a lifetime, 23% of individuals with a diagnosis of schizophrenia in Sweden had a violent conviction.²⁰ Around 13% of individuals had violent convictions at an average age of 30 years after diagnosis of schizophrenia.²⁹ Using shorter time frames, the five-year incidence of violent conviction after first diagnosis was 11% in men and 3% in women.⁴ In first-episode psychosis, around one in ten individuals perpetrated physical interpersonal violence in the 1–3 years after first contact with clinical services.³⁰ Before first psychiatric contact, 12% of men who were subsequently diagnosed with a psychotic illness had violently offended according to a Danish national register

	Design	Population OR (95% CI)
Schizophrenia and related disorders		
Fazel et al (2009) ³	Systematic review*	4.0 (3.0–5.3) for men, 7.9 (4.0–15.4) for women; ORs mostly not adjusted for socio-economic factors. Men: k=13, n=9379 cases; women: k=6, n=5002 cases.
Fazel et al (2014) ⁴	Sibling study	7.4 (7.1–7.8) for patient vs population; 1.8 (1.7–1.9) for sibling vs population; n=24 297 cases; 26 357 unaffected siblings; 485 940 population controls. Adjusted for sociodemographic factors.
Stevens et al (2015) ⁵	Population-based epidemiological study	3.0 (2.7–3.4) for men; 7.5 (6.0–9.3) for women; n=471 cases who violently offended; total population sample of 521 340. IRR adjusted for sociodemographic and psychiatric factors.
Bipolar disorder		
Fazel et al (2010) ⁶	Systematic review*	4.6 (3.9–5.4); unadjusted OR. k=9, n=6383 cases; 112 944 controls.
Webb et al (2014) ⁷	Sibling study	2.8 (2.5–3.1) for patient vs population; 1.2 (1.1–1.4) for sibling vs population; n=15 337 cases; 14 677 unaffected siblings; 306 740 population controls. RR adjusted for sociodemographic and psychiatric factors.
Daff and Thomas (2014) ⁸	Population-based epidemiological study	3.7 (2.2–6.0); n=1076 cases; 4813 controls. Adjusted for demographic and psychiatric factors.
Depression		
NA	Systematic review	No studies found.
Fazel et al (2015) ⁹	Sibling study	3.0 (2.8–3.3) for patient vs population; 1.5 (1.3–1.6) for sibling vs population; n=47 158 cases; 33 516 unaffected siblings; 898 454 population controls. Adjusted for sociodemographic factors.
Van Dorn et al (2012) ¹⁰	Population-based epidemiological study	2.9 (2.1–4.0); bivariate OR for depression without substance use. n=1319 cases; 24 951 controls.
Attention deficit hyperactivity disorder		
Erskine et al (2016) ¹¹	Systematic review*	3.6 (2.3–5.7); OR for violence-related arrest. k=5, n=not reported.
Lundström et al (2014) ¹²	Sibling study	2.7 (2.0–3.8) for patient vs population; 1.3 (0.9–2.0) for sibling vs population; n=1366 cases; 898 unaffected siblings; 13 660 population controls. Adjusted for sociodemographic and psychiatric factors.
González et al (2013) ¹³	Population-based epidemiological study	1.8 (1.1–2.7); n=424 cases; 6945 controls. Adjusted for sociodemographic and psychiatric factors.
Autism spectrum disorders		
King and Murphy (2014) ¹⁴	Systematic review*	No pooled ORs found. One review found only two studies with unbiased samples of cases and controls.
Lundström et al (2014) ¹²	Sibling study	1.1 (0.6–1.9) for patient vs population; 1.1 (0.6–2.0) for sibling vs population; n=954 cases; 661 unaffected siblings; 9540 population controls. Adjusted for sociodemographic and psychiatric factors.
Heeramun et al (2017) ¹⁵	Population-based epidemiological study	1.4 (1.2–1.6); n=5739 cases; 289 995 general population controls. RR adjusted for sociodemographic and family history factors.
Personality disorder		
Yu et al (2012) ¹⁶	Systematic review*	3.0 (2.6–3.5); fixed effects OR for all personality disorders. k=10, n=9 578 cases; 327 293 controls.
NA	Sibling study	No studies found.
Moberg et al (2015) ¹⁷	Population-based epidemiological study	2.7 (2.2–3.2); n=1267 cases; total population sample of 49 398 (men). Adjusted for sociodemographic and psychiatric factors.

(Table 1 continues on next page)

investigation,³¹ and other research has indicated that over half of patients with violent offending histories committed their first violent crime before illness onset³² or first diagnosis.³³ In individuals with psychotic illnesses who commit homicide, around 40% do so during the first episode of illness before treatment initiation.³⁴ Individuals with schizophrenia spectrum disorders typically represent less than 10% of all homicide convictions,^{35–38} although a higher prevalence of 10–20% has also been found in studies incorporating information from forensic psychiatric evaluations.^{39,40} Studies typically exclude cases of murder-suicide; however, for studies in which murder-suicide is included, the prevalence of schizophrenia will be underestimated because previous contact with services to establish the presence of a mental disorder is relied on.³⁶

Bipolar affective disorder

One systematic review⁶ identified nine studies conducted in five countries between 1990 and 2010, and reported increased odds for violence in bipolar disorder of between 2.2 and 8.9 (pooled OR 4.6, 95% CI 3.9–5.4) compared with the general population.⁶ Studies using register linkage in Australia⁸ and survey data in the USA^{10,41} have shown similar associations. Furthermore, a study using Swedish population registers separately compared 15 337 individuals with bipolar disorder and 14 677 unaffected siblings with general population controls.⁷ Individuals with bipolar disorder had a 5-fold increased risk of violence compared with the general population, which was attenuated after adjustment for sociodemographic factors and substance misuse (adjusted OR 2.8, 95% CI 2.5–3.1).⁷ Risk of violent crime in unaffected siblings (compared with the general population) was also increased, suggesting familial confounding (1.2, 1.1–1.4).⁷ Absolute risks are less for bipolar disorder than those for schizophrenia spectrum disorders (figure 2), partly due to differences in age and sex distributions associated with these disorders, with a higher proportion of younger men with schizophrenia spectrum disorders than those with bipolar disorders. Absolute rates of violent crime are estimated at 8% in men and 2% in women with bipolar disorder, of which 70% occur in the 5 years after diagnosis,⁷ and 11% when using a lifetime outcome.²⁰

Depression

The relationship between depression and violence has not been researched to the same extent as suicide. One limitation of previous work has been the inclusion of selected groups with depression, such as inpatients, who could have been admitted to hospital due to violence risk. However, one investigation of 47 158 Swedish outpatients with depression reported a three times increased risk of violent offending after diagnosis, compared with the general population (adjusted OR 3.0, 95% CI 2.8–3.3).⁹ This finding replicated those from US household surveys^{10,41} and is consistent with longitudinal

	Design	Population OR (95% CI)
(Continued from previous page)		
Post-traumatic stress disorder		
MacManus et al (2015) ¹⁸	Systematic review*	3.2 (2.8–3.8); OR for after combat exposure aggression or violence in military personnel. k=3, n=13 203.
NA	Sibling study	No studies found.
MacManus et al (2013) ¹⁹	Population-based epidemiological study	2.2 (1.4–3.6); n=344 cases; 7256 controls. HR for after military-deployment violent offending adjusted for sociodemographic and military service factors.
Substance misuse		
Fazel et al (2009) ²	Systematic review*	7.4 (4.3–12.7); OR for individuals with substance misuse (including alcohol) without psychosis. k=13. n not available.
NA	Sibling study	No studies found.
Fazel et al (2014) ⁴	Population-based epidemiological study	16.2 (14.6–17.9) for men; 36.0 (27.0–48.0) for women; n=1570 men with drug use disorders out of 292 420 total; 755 women with drug use disorders out of 193 520 total. HR adjusted for age at diagnosis.
Alcohol use disorder		
NA	Systematic review	No studies found.
NA	Sibling study	No studies found.
Fazel et al (2014) ⁴	Population-based epidemiological study	9.0 (8.2–9.9) for men; 19.8 (14.6–26.7) for women; n=2834 men with alcohol use disorders out of 292 420 total; 1156 women with alcohol use disorders out of 193 520 total. HR adjusted for age at diagnosis.
For each disorder, separate studies are referred to for each study category (systematic review, sibling control study, and population-based epidemiological study). In cases where more than one relevant study using an objective outcome measure was found for a category, we selected one study on the basis of sample size. IRR=incidence rate ratio; HR=hazard ratio; NA=not applicable; OR=odds ratio; RR=relative risk. *Pooled ORs report random effects meta-analysis unless otherwise stated.		
Table 1: Risk of violence in psychiatric disorders in meta-analyses, sibling-control studies, and large primary general population control studies		

analyses of cohorts of adolescents and young adults in the Netherlands, the UK, and Finland.⁴² The Swedish study also reported some familial confounding by examining siblings and twins.⁹ Over a follow-up of around 3 years after diagnosis, 641 (3.7%) of 17 249 men and 152 (0.5%) of 29 909 women had violent convictions. When outcomes included self- and informant-reports, the MacArthur Violence Risk Assessment Study reported that 20 (10.3%) of 195 of patients with depression without substance misuse perpetrated violence in the 20 weeks after discharge from hospital.⁴³

ADHD

A meta-analysis of five studies of individuals diagnosed with ADHD before the age of 18 years noted an increased odds of violence-related arrest of 3.6 (95% CI 2.3–5.7) compared with controls who did not have ADHD.¹¹ An increased risk of incarceration, a proxy for violent offending, was also reported, which is consistent with another review that reported an increased imprisonment risk in this population.⁴⁴ Population surveys, although subject to limitations such as reliance on self-report measures rather than diagnostic interview, have shown that associations between ADHD and violence are moderated by high psychiatric and substance comorbidity.^{13,45} In a longitudinal sibling study of 1366 children diagnosed with ADHD in Stockholm County (Sweden),¹²

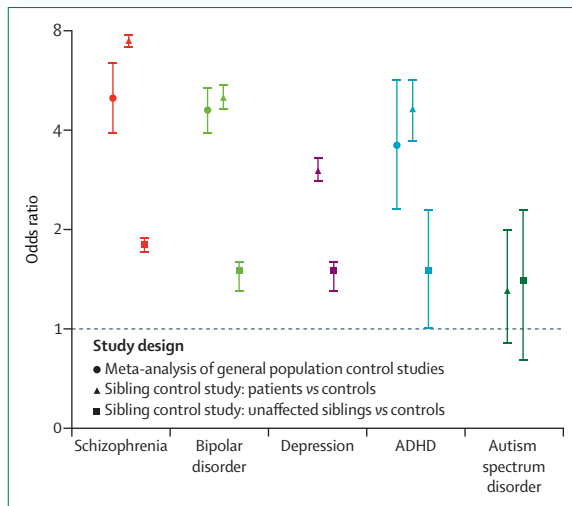


Figure 1: Relative risks of violence compared with general population controls from meta-analyses and longitudinal sibling-control studies
 Odds ratios are presented with 95% CI. Figures presented for comparison are without adjustment for substance use disorders or exclusion of individuals with substance misuse comorbidity. For references and study details see table 1.

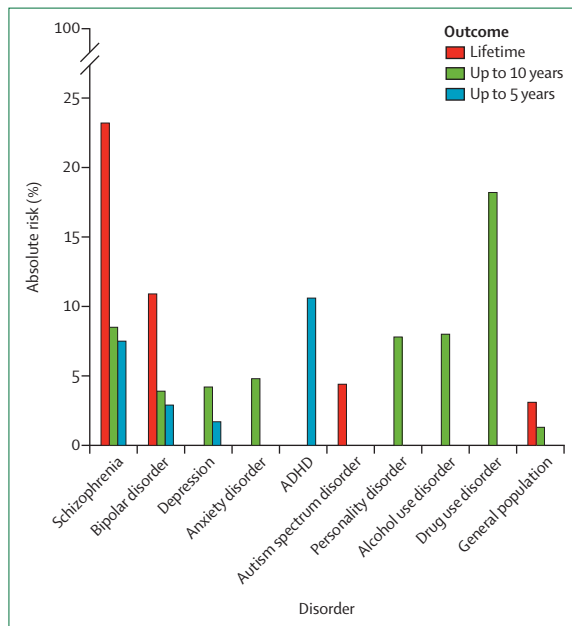


Figure 2: Absolute risk of violent conviction in mental disorders according to different time periods
 Data are from primary studies using register-based violent conviction outcomes in Sweden.^{4,7,9,15,20-22}

compared with population controls, the odds of violent offending was significant at 2.7 (95% CI 2.0–3.8) after adjusting for socioeconomic factors, substance misuse, and psychiatric comorbidities, of which one was conduct disorder. Unaffected siblings were also at a small increased risk of violent offending versus population controls,¹² which indicates familial confounding. In another register-based study, 14.7% of men and 3.6% of

women with a diagnosis of ADHD were convicted of a violent offence during 4 years of follow-up.²¹

Autism spectrum disorders

Research examining the association between autism spectrum disorders and the risk of violence has consisted mostly of prevalence studies and case series, with previous reviews finding very limited evidence addressing the relative risks.^{14,46} However, a longitudinal study of children in Stockholm compared 954 individuals with an autism spectrum disorder diagnosis with 9540 population controls for risk of violence.¹² A non-significant association with violent offending was found (OR 1.3, 95% CI 0.9–2.0), which was attenuated when adjusting for parental factors and comorbid substance misuse and conduct disorder (1.1, 0.6–1.9). This study also analysed full and half siblings of people with autism spectrum disorder, and there was no significant increase of risk compared with matched controls. Another population-based study in Sweden included 5739 individuals with autism spectrum disorder stratified by intellectual disability.¹⁵ The study reported an increased risk of violence in autism spectrum disorder (OR 1.4, 95% CI 1.2–1.6), which was accounted for by comorbidity with ADHD or conduct disorder. When stratified solely by intellectual disability, the relative risk of violent crime in people with autism was increased in those without intellectual disability, but there was no increased risk in individuals with co-occurring intellectual disability. Notably, 28% of all individuals diagnosed with autism spectrum disorder (of whom two-thirds were men) had ADHD or conduct disorder. The absolute rate of violent criminality in individuals with autism spectrum disorder (with or without comorbidities) was 4.4% (vs 2.6% in controls). Adjustment for conduct disorder, a diagnosis that might be acquired after contact with the criminal justice system, could result in underestimation of relative risks in these clinical populations, and this should be considered when interpreting such data.

Personality disorders

A meta-analysis pooled data from ten studies in Europe and the USA, totalling 9578 individuals with personality disorder compared with 327293 general population.¹⁶ Personality disorder was associated with a three times increased risk of violence (pooled OR 3.0, 95% CI 2.6–3.5), which was measured in included studies by either violent crime or self or informant reports. Similar effect sizes were found in a Danish population report⁵ and a study of 49 398 Swedish men who were assessed at military conscription and followed up in national crime registers,¹⁷ although in the Swedish study the largest subcategory was other and unspecified personality disorder.

Unsurprisingly, given that aggression and criminality from adolescence are included in the DSM diagnostic criteria, antisocial personality disorder is the most

important of all personality disorders in relation to violence risk; a review reported that 466 (14%) of 3295 individuals with this disorder had a violent outcome, and a substantially increased risk of violence versus the general population (pooled OR 10.4, 95% CI 7.3–14.0).¹⁶ Antisocial personality disorder is often considered separately to other personality disorders, such as in the clinical guidelines for England (appendix p 4). It should be noted that although there is some overlap, psychopathy¹⁷ is a distinct construct. Other work in personality disorder is cross-sectional,⁴¹ and associations have been found with antisocial, paranoid, narcissistic, and obsessive-compulsive personality disorder, and increased risk of violence in borderline personality disorder (in men in particular) cannot be excluded;⁴⁸ however, data are limited by reliance on self-report for diagnosis and outcome. Other data suggested coexisting antisocial personality disorder and psychiatric comorbidity contribute to the risk of violence in borderline personality disorder.⁴⁹ In terms of absolute risks, 8% of individuals with a diagnosis of any personality disorder perpetrated a violent offence in up to 10 years of follow-up in Swedish register data.²²

Post-traumatic stress disorder (PTSD)

Studies examining the relationship between PTSD and violence have focused on military populations and intimate partner violence. In a two-wave US survey (two interviews, 3 years apart), lifetime PTSD diagnosis in individuals with no history of military combat (n=33 215) was not associated with violence between waves when controlling for alcohol use and anger after trauma.⁵⁰ In military populations, with the use of the proxy of combat exposure for PTSD, pooled data from three studies in the USA and UK reported an association with aggression and violence after deployment (OR 3.2, 95% CI 2.8–3.8).¹⁸ Having a combat role,¹⁹ rather than deployment alone,⁵¹ is associated with violent offending. From register-based outcomes, in UK male soldiers deployed to Iraq and Afghanistan, PTSD remained associated with violent offending after deployment when adjusted for sociodemographic and military service factors (adjusted hazard ratio [HR] 2.2, 95% CI 1.4–3.6),¹⁹ and was also associated with violent offending after leaving service in this cohort.⁵² Associations between PTSD and violence have been shown in a survey of UK Armed Forces reservists after deployment.⁵³ Similar to general population studies, alcohol use is an important comorbidity in military samples.⁵⁴ In terms of absolute risks, 9% of UK male military personnel with PTSD can be estimated to violently offend within 7 years after deployment (compared with 3% of those without PTSD).¹⁹

Substance misuse

An umbrella review reported that substance misuse (when considered broadly, including alcohol) was the strongest risk factor for violence of psychiatric diagnoses

(pooled OR 7.4, 95% CI 4.3–12.7).⁵⁵ When considering only drug use disorders (excluding alcohol), clear associations with violence were found in another umbrella review⁵⁶ and in Swedish longitudinal data for violent offending in 292 420 men and 193 520 women, with HRs of 16.2 for men (95% CI 14.6–17.9) and 36.0 for women (27.0–48.0).⁴ Significant associations between substance misuse and violence have also been shown in longitudinal data for men who are conscripted to the military in Sweden¹⁷ and a US household survey.¹⁰

For individual drugs, evidence for independent associations with violence is more uncertain. A 2016 systematic review included 17 longitudinal studies of individual substances, most frequently marijuana, but findings were mixed and primary studies were mostly of low quality.⁵⁷ Studies of substances such as cannabis have often measured the frequency of use, rather than the disorder criteria.^{58,59} Systematic reviews of amphetamine,⁶⁰ crack cocaine,⁶¹ and opiate use⁶² have similarly been inconclusive, with substantial between-study heterogeneity and infrequent use of matched comparison groups, and isolation of effects is complicated by different formulations (eg, crack vs powdered cocaine).⁶³ A study of men who tested positive for anabolic steroids in Danish gyms compared with matched population controls reported a link with incarceration,⁶⁴ and a Swedish population survey of lifetime self-reported anabolic steroid use in men (n=10 365) noted non-significant increased odds of violent conviction after adjustment for other substances (OR 1.6, 95% CI 0.8–3.3).⁶⁵ Novel, high potency synthetic agents, such as synthetic cannabinoids, have been associated with agitation and violence, but polysubstance use, which is common, complicates interpretation.⁶⁶ There is evidence that psychedelic drugs, such as lysergide and psilocybine, could be an exception to the association with violence,^{67,68} although hallucinogen misuse in psychosis is associated with violence.²⁶ Absolute risks are high—a study using Swedish population data showed 18% of individuals with a drug use disorder (made at any inpatient or outpatient specialist care episode) committed a violent offence during a mean follow-up of up to 10 years.²²

Alcohol use disorders

Evidence for the association between alcohol use disorders and violence is strong, despite overlaps with substance misuse. In an umbrella review, the overall pooled weighted effect size was significant (OR 2.0, 95% CI 1.8–2.3; derived from the reported effect size),⁵⁶ supporting longitudinal findings from Swedish population data (HR for violent offending in alcohol use disorders of 9.0 for men [95% CI 8.2–9.9] and 19.8 for women [14.6–26.7]).⁴ A similar increased risk of violence was reported in 20 years of follow-up of a New Zealand birth cohort (n=1265), in which having five or more symptoms of alcohol misuse in the preceding year was associated with an incidence rate ratio for violent

See Online for appendix

offending of 8.0 in men (95% CI 6.4–10.1) and 15.4 in women (11.4–20.8).⁶⁹ In terms of absolute risks, Swedish population data showed 8% of individuals with a diagnosis of an alcohol use disorder committed a violent offence during a mean follow-up of up to 10 years.²²

Other psychiatric diagnoses

There are fewer studies reporting on the risk of violence in other diagnostic groups, although recent investigations using family-based designs have been informative (table 2). A large Swedish longitudinal study using sibling controls found a statistically significant association between anxiety disorders and violent conviction.²² A systematic review has identified that risk in gambling disorder extends beyond acquisitive offending to violent offending,⁷⁴ although case definition varies between

studies. Conduct disorder contributes significantly to the risk of violence as a comorbidity in neurodevelopmental disorders,¹⁵ and has been associated with violent outcomes in pooled data¹¹ and a longitudinal study.⁷³ Regarding eating disorders, little information is known about their relationship with violent offending.

Risk in perspective

Comparisons in absolute terms are important to contextualise risk estimates, including for the rare and most serious outcome of homicide, an event that can attract media coverage and contribute to stigmatising views of mental illness. Between 2006 and 2016, for example, 384 homicides in the UK (excluding Northern Ireland) were committed by people with schizophrenia and delusional disorders³⁸ (equating to 6% of all

	Design	Population	Outcome	HR, OR, or IRR (95% CI)
Eating disorders				
Yao et al (2017) ⁷⁰	Longitudinal, register-based.	n=957106 Swedish-born girls and women (11114 with anorexia nervosa, 5197 with bulimia nervosa).	Non-theft conviction.	Anorexia nervosa: HR 1.2 (1.0–1.3); non-significant when accounting for psychiatric comorbidities and unmeasured familial factors. Bulimia nervosa: HR 2.2 (1.9–2.5); attenuated, but remains significant, after accounting for psychiatric comorbidities and unmeasured familial factors.
Anxiety disorders				
Sariaslan et al (2020) ⁷²	Longitudinal, register-based.	Swedish population; n=2504190 without psychiatric diagnosis; 68244 with anxiety disorder diagnosis (excluding reactions to severe stress and adjustment disorders).	Violent conviction.	HR 2.0 (1.7–2.3) using within-family estimates comparing siblings; adjusted for demographic and psychiatric factors, and violence history.
Ten Have et al (2014) ⁷¹	Multiwave household survey, self-report.	n=5303 Dutch general population (539 with any anxiety disorder defined as phobic disorders, panic disorder, or generalised anxiety disorder).	Physical violence (kicking, biting, hitting, or trying to wound) between waves (3 years).	OR 1.8 (0.9–3.5); adjusted for sociodemographic characteristics and time at risk.
Obsessive-compulsive disorder				
Lundström et al (2014) ⁷³	Longitudinal, register-based.	n=857 children with obsessive-compulsive disorder in Stockholm; 8570 general population controls.	Violent conviction.	OR 0.7 (0.3–1.5); adjusted for parental factors and psychiatric comorbidity.
Intellectual disability				
Stevens et al (2015) ⁵	Longitudinal, register-based.	n=521340 Danish population (42 men and 4 women with intellectual disability who had offended).	Violent conviction.	IRR 1.7 (1.3–2.3) in men; adjusted for sociodemographic and psychiatric factors; insufficient number of female cases.
Moberg et al (2015) ¹⁷	Longitudinal, register-based.	n=49398 male Swedish military conscripts (524 with mental retardation).	Violent conviction.	OR 3.6 (2.7–4.8); adjusted for personal factors, conditions of upbringing, and early behaviour.
Gambling disorder				
Laursen et al (2016) ⁷²	Retrospective cohort, survey- and crime register-based.	n=18625 Danish population (384 identified as problem gamblers using lie-bet questionnaire).	Violent or sexual charges in the 6 year periods before and including the year of two surveys.	OR 2.2 (1.1–4.5) adjusted for sociodemographic factors, alcohol consumption, and smoking.
Conduct disorder				
Lichtenstein et al (2019) ⁷³	Longitudinal, register-based.	n=18649 Swedish twins; conduct problems measured with eight symptoms of oppositional defiant disorder and conduct disorder in parent interview (twins aged either 9 years or 12 years).	Violent criminality while aged 17–22 years.	HR 1.4 (1.2–1.5) for women, 1.2 (1.2–1.3) for men for a measurable increase in childhood conduct problems, adjusted for parental socioeconomic status. HR 4.0 (2.2–7.4) for 5–8 childhood conduct symptoms vs 0 for women; HR 3.0 (2.2–4.1) for men.

HR=hazard ratio; IRR=incidence rate ratio; OR=odds ratio.

Table 2: Summary of recent primary studies that have examined violent outcomes in other diagnostic categories

homicides); an average of 35 per year, or around 0.06 per 100 000 general population (aged 10 years and older) per year. The risk of stranger homicide is even rarer, and has been estimated to be one in 14 million.⁷⁵ In the same period, to compare with other causes of death that might draw public attention, there were 23 393 road accident fatalities in the UK,⁷⁶ an average of over 2 000 per year, or 3.5 per 100 000 total population per year. In the UK, there were an average of 29 people struck by lightning per year during 1988–2012⁷⁷ (or around 0.05 per 100 000), and two fatalities per year (or 0.003 per 100 000). New work on victimisation rates could also be considered. In a population-based study, incidence rates of outpatient or hospitalised injury in individuals with psychiatric disorders were increased compared with controls, but these victimisation incidence rates were typically not higher than perpetration rates for violent crime.²²

Risk factors in mental illness

Clarifying risk factors within a diagnostic category can inform the understanding of mechanisms and potential interventions. This understanding will assist in developing individualised assessments of risk, which can be linked to interventions to reduce risk. Several static (historical) and dynamic (time-varying or modifiable, or both) risk factors have been identified (table 3). Background criminal history factors, past violence, and co-occurring substance misuse stand out as replicated strong risk factors.^{79,81} Co-occurring substance misuse has also been identified as a risk factor for repeat offending in populations with psychiatric diagnoses,⁸³ whereas neighbourhood factors (eg, neighbourhood income, welfare recipients, and crime rate) were not causally associated with reoffending in psychotic illnesses, personality disorders, anxiety, depression or substance misuse.⁸⁴

Genetic influences between mental illness and violence

When studying the causes and implications of the mental illness–violence associations reported previously, it is important to integrate the evidence from genetic research. First, antisocial behaviour is heritable (about 50%).⁸⁵ Second, childhood conduct disorder, which is partly heritable, is a predictor of violence later in life.^{73,86} Third, aggression, oppositional defiant disorder, and conduct disorder in childhood (younger than 18 years) not only predict violence but also other psychiatric outcomes—including most of the diagnoses discussed in this Review.^{73,86,87} Fourth, twin,⁷³ sibling,⁸⁸ and molecular genetic studies⁸⁹ have shown that, to a considerable extent, these childhood behaviours are associated with adult disorders due to a common genetic cause. Fifth, violence (similar to mental health issues) is highly polygenic;⁹⁰ candidate genes for violent behaviour studies have not been confirmed in replication studies,⁹¹ and even if some single genes or gene-by-environment interaction at some point will be evident, any such gene

	Static	Dynamic
Sociodemographic risk factors		
Male sex ⁷⁷⁸	Y	N
Low socioeconomic status ⁷⁷⁸	Y	Y
Homelessness ⁷⁹	Y	Y
Criminal history risk factors		
Previous violent offence ^{79,78-80}	Y	N
Previous imprisonment ^{79,80}	Y	N
Previous non-violent offence ^{79,80}	Y	N
Family history risk factors		
Parent or sibling violent offence ^{78,80}	Y	N
Parental substance misuse ⁷⁷⁸	Y	N
Clinical risk factors		
Co-occurring substance misuse ^{8,78,79,81}	Y	Y
Victimisation ^{79,81}	Y	Y
Inpatient admission ^{79,78}	Y	Y
Self-harm or suicide attempt ^{79,78,79,81}	Y	Y
Hostility ⁷⁹	N	Y
Impulsivity ⁷⁹	N	Y
Diminished insight ⁷⁹	N	Y
Treatment non-adherence ⁷⁹	N	Y
Positive psychotic symptoms ⁷⁹	N	Y
Anger from persecutory beliefs ⁸²	N	Y

Based on studies of schizophrenia spectrum disorders, bipolar disorder, and depression. Factors are classified as static or dynamic, or both, according to whether the factor has been reported as a historical risk factor for violence (static) or a time-varying or modifiable (dynamic) risk factor. Y=Yes; N=No.

Table 3: Risk factors associated with violence in mental illness

or genes will have a negligible effect on the associations between the mental illness and violence. Sixth, genetic factors associated with psychiatric disorders and violent convictions are also associated with subthreshold psychiatric symptoms throughout the general population.^{92,93} In other words, these traits are continuous phenotypes rather than the categorical entities presently defined in diagnostic manuals or by criminal convictions. Thus, genes do not code for specific behaviours or diagnoses, but rather they influence our tendency for emotions and thought processes, which can increase the likelihood for a criminal act. Therefore, the next research challenge is to try to delineate the biological pathways that are important in the complicated nexus between the actual genes and their products and the actual behaviour. Promising avenues might include callousness, impulsivity, emotional dysregulation, paranoia, and disinhibition, which are common to many diagnoses.

Nevertheless, until more is understood about the underlying mechanisms in psychiatric disorders and the association between them and violence, decisions should be based on prognosis of individual disorders and use of validated clinical prediction models;⁷⁸ that is, for risk prediction, the present diagnostic system should continue to be used, with the awareness that causal risk factors could be a result of gene products, and these

	APA	NICE	RANZCP
Schizophrenia and related disorders	Part of standard evaluation; highlights acute phase. Details demographic and clinical risk factors (eg, distressing delusions and command hallucinations), suggests to consider admission and inform individuals at risk.	Mentioned as a component of comprehensive multidisciplinary assessment. Suggests crisis resolution and signposts to guideline for acute agitation.	Highlights first episode and comorbid substance misuse. Details clinical factors, suggests routine tools of low value, and stresses continuity and assertive substance use disorder treatment.
Bipolar disorder	Ability to predict from clinical data is insufficient. Suggests close monitoring of patients with violent ideas; substance misuse and psychosis increase risk.	Mentioned as a component of general risk assessment. Signposts to guideline for acute agitation.	Noted association with alcohol and substance misuse. No further directions.
Depression	Higher risk if accompanied by psychosis, impulsiveness, substance misuse, or past aggression. Suggests assessment of violence history, ideation and plans, and close monitoring, including for the safety of children.	Not mentioned other than suggesting urgent referral to mental health services if there is immediate risk.	Not mentioned.
ADHD	No adult guideline. No reference in equivalent paediatric guidelines.	Not mentioned.	Endorses NICE and Canadian attention deficit hyperactivity disorder resource alliance guidelines. Not mentioned other than suggesting to consider anti-aggressive medication if comorbid conduct disorder is present.
Autism spectrum disorders	No adult guideline. AACAP practice parameters mention physical aggression as one behavioural difficulty; risperidone and aripiprazole are approved for treatment.	Harm to others mentioned as part of comprehensive assessment; not further specified.	No guideline.
Borderline personality disorder	Consider risk of angry, impulsive, or violent behaviour; further assessment not specified. Describes scenarios (eg, relationship crises and care changes) and strategies (eg, cognitive).	Indicates to consider risk in crisis; assessment not specified. If risk is high, suggests referral to mental health services, and to consider hospital admission and child welfare.	Endorses Australian Government National Health and Medical Research Council guideline for borderline personality disorder. Violence risk is not mentioned.
Antisocial personality disorder	No guideline.	Outlines stepped approach to risk assessment, suggests referring to forensic services if immediate risk or history of severe violence, and advises specialists use formal tools. Emphasis on multi-agency care. Refers to role of cognitive behavioural therapy, treatment of comorbidity, including substance misuse, and hospital admission (appendix p 4).	No guideline.
Conduct disorder	AACAP practice parameters; assess personal and family history of violence. Comorbid substance misuse is predictive in boys (younger than 18 years old). Neuroleptics decrease aggression, but side-effects could outweigh benefits. If risk is imminent, hospitalisation (admission for assessment and treatment) should be considered.	Indicates aggression is part of comprehensive assessment; if needed, suggests developing a risk management plan for harm to others. Indicates to consider carefully monitored short-term treatment with risperidone for severe aggression unresponsive to psychosocial intervention.	No guideline; however, importance of addressing violence in conduct disorder is highlighted in document on the cost-effectiveness of early intervention in mental illness.
Post-traumatic stress disorder	Comments on the basis for potentially heightened aggression; further assessment is not specified. Suggests general monitoring and treating substance misuse.	Not mentioned other than recommending that if risk of either harm to self or others is high, concentrate on managing the identified risk first.	Endorses various guidelines, including NICE and APA.
Substance misuse	Highlights risk scenarios with various substances and intoxication or withdrawal states. Suggests assessing for homicidal thoughts and screening for domestic violence.	Generally assesses risk behaviour, including domestic violence; assessment not further specified.	No guideline, although relevance to violence noted in alcohol and illicit drugs policy documents.

APA,³⁴ NICE,³⁵ and RANZCP³⁶ guidelines are available. For individual references, see appendix pp 1–3. Substance misuse refers to both drug and alcohol use disorders. AAP=American Academy of Pediatrics; AACAP=American Academy of Child and Adolescent Psychiatry; APA=American Psychiatric Association; NICE=National Institute for Health and Care Excellence; RANZCP=Royal Australian and New Zealand College of Psychiatrists.

Table 4: References to the assessment and management of violence in clinical practice guidelines from the USA, England, and Australia and New Zealand

causal risk factors will be the basis of novel biological and psychological interventions.

Clinical practice guidelines

We identified relevant guidelines on clinical practice from England, the USA, and Australia and New Zealand, and reviewed their content on the assessment or management of aggression, violence, and risk to others (table 4, appendix pp 1–4). Although violence was widely mentioned as a component of a general comprehensive risk assessment, there were inconsistencies, gaps, and varying detail on risk management. Guidelines for antisocial personality disorder in England were the only

guidelines to recommend the use of a violence risk assessment tool by specialist services (appendix p 4), and Royal Australian and New Zealand College of Psychiatrists (RANZCP) guidelines on schizophrenia commented on the limitations of current tools in routine practice. Furthermore, the American Psychiatric Association (APA) and RANZCP guidelines on schizophrenia highlighted the acute phase or first episode as periods of high risk. Several guidelines (APA guidelines for schizophrenia, bipolar disorder, and depression; National Institute for Health and Care Excellence guidelines for antisocial personality disorder; RANZCP for schizophrenia and bipolar disorder; and American

Panel: Directions for future research

- In bipolar disorder, prospective studies are needed to clarify the relationship between disease phase and violence risk.
- In depression, the effect of treatment is unknown and will require investigation of pooled data from randomised controlled trials or observational studies that account for confounding by indication.
- Personality disorder is a heterogeneous category, and a more trait-based approach to understanding its associations with violence has been proposed.⁹⁷
- Owing to the considerable overlap between the misuse of individual substances, research should examine predominant classes or patterns of use and consider shared therapeutic targets.⁹⁸
- Interventions targeting violence risk in psychiatric settings need to be developed. Transdiagnostic treatment targets could include comorbid substance misuse, impulsivity, and disinhibition, whereas other targets could be more disorder-specific, such as persecutory delusions in schizophrenia.
- Violence should be included among outcomes to test the effectiveness of psychiatric treatments, and future cohort studies and trials should routinely collect violent outcome data in an objective and standardised manner.
- Clinically feasible risk prediction tools should be examined for potential utility as a support to clinical decision making.

Academy of Child and Adolescent Psychiatry practice parameters for conduct disorder) outlined the clinical factors to investigate during assessment, particularly comorbid substance misuse and a history of violence. High or imminent risk to others should lead to close monitoring and possible urgent referral to mental health services or hospital admission. Overall, there are considerable uncertainties in the guidelines on what constitutes the best approach to assessing violence risk and how to manage any increased risks of violence outside of acute illness. Methods for assessing and managing the risk of violence should be thoroughly considered when guidelines are revised.

Implications for research and practice

Important research gaps remain (panel). For clinical practice, the reviewed evidence highlights violence as an adverse outcome relevant across psychiatric services. However, experience in assessing and managing the risk of violence is typically within secure psychiatric (also known as forensic) services that are engaged only when serious violent offending has already occurred. One way to translate epidemiological knowledge more readily into general clinical practice is the use of prediction models to support clinical judgement. By improving the consistency, accuracy, efficiency, and transparency of risk assessment, clinically feasible assessment tools could, in

Search strategy and selection criteria

We searched PubMed, PsycINFO, and Global Health for English language studies published between March 27, 2009, and April 6, 2020. Search terms included ("violen*" or "homicid*") and synonyms for any included psychiatric diagnoses, such as ("bipolar" or "mania" or "manic*"), which were supplemented with terms covering a broader category of any mental disorder ("mental illness*" or "mental disorder*" or "psychiatric illness*" or "psychiatric disorder*" or "psychiatric diagnosis" or "psychiatric diagnoses"). We preferentially included large primary studies (with more than 500 participants) that compared violence rates in individuals who have a specific diagnosis with general population or unaffected sibling controls, and systematic reviews. Although no formal quality assessment was undertaken, we only included studies that had clear case definitions, outcome measurement, and clearly selected comparison groups. Reference lists were not manually checked, nor was a meta-analysis considered (due to clinical and methodological heterogeneity).

the future, allow a more stratified approach to violence risk in psychiatry,⁹⁸ in which interventions are targeted at those likely to derive the greatest absolute reduction in risk, thereby preserving resources. Although there could be overlapping causes of violence, risk prediction might work best in a diagnosis-specific manner. However, linkage to an intervention is necessary for any such tool to improve outcomes. To understand the potential clinical utility of such approaches, evidence appraisals need to look further than single measures of predictive accuracy, such as positive predictive value (which is the proportion of individuals identified to be at high risk of violence who go on to perpetrate violence), and should consider a full range of metrics, focused on the possible harms of misclassification when linked to a specific clinical decision for individual patients.⁹⁹ Furthermore, tools need to consider the latest evidence on independent risk factors, rather than focusing solely on needs or expert opinion. Clinicians and researchers have too often focused on positive predictive values, which has obscured the potential of these tools to safely screen out individuals with low risk to preserve resources (with high negative predictive values), or provide probability scores for risk (which is tested by how well the model is calibrated, and how cardiovascular and cancer survival risk calculators are used in practice).

Conclusion

In this Review, we have shown some individual psychiatric disorders, particularly schizophrenia spectrum, personality, and substance use disorders, are clearly associated with increased relative risks of violence. Better research designs and large-scale replications have led to more conservative estimates of this association. These studies have also shown that serious violence is rare

among individuals with mental illness. However, absolute rates of violence perpetration of 6–10% in personality disorders and schizophrenia spectrum disorders, and over 10% in substance misuse, mean that it is an important adverse outcome for clinical services to consider. Epidemiological work has allowed for modelling of the potential population effect of preventing violence perpetration in people with mental illness, and the consequences of prevention at an individual level for victims, patients, their carers, and clinical services. To enhance patient care, clinicians working in general psychiatric settings require clear practice guidelines for the assessment and management of violence risks beyond those related to behavioural disturbances during acute illness, which could be improved by using clinically feasible prediction models and tools.

Contributors

SF and DW drafted the sections on epidemiology, risk in perspective, risk factors in mental illness, clinical practice guidelines, and directions for future research. DW did the literature review, extracted the data, and prepared the tables and figures. PL drafted the section on genetic influences. All authors critically revised the manuscript.

Declaration of interests

We declare no competing interests.

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