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Triggers for violent criminality in psychotic disorders: A nationwide Swedish within-individual study of 3.1 million persons

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Importance

Absolute and relative risks of violence are increased in psychotic disorders, but the contribution of triggers for violent acts is uncertain.

Objectives

To examine whether a range of triggers are associated with violence risk in patients diagnosed with psychotic disorders and in individuals without a psychiatric diagnosis.

Design, Setting and Patients

Using a sample of all individuals born in Sweden between 1958 and 1988 (n=3,123,724), we identified patients in the National Patient Register who were diagnosed with schizophrenia-spectrum disorders (n=34,903), bipolar disorder (n=29,692) and unaffected controls (n=2,763,012). We then identified, within each sub-sample, persons who had experienced any of the following triggers between 2001 and 2014: violent victimisation, parental bereavement, self-harm, traumatic brain injury, unintentional injuries, and substance intoxication. By using within-individual models, we conducted conditional logistic regression to compare the risk of the individual engaging in violent acts in the week following the exposure to a trigger with earlier time periods of equivalent length. All time-invariant confounders (e.g., genetic and early environmental influences) were controlled for by this research design and we further adjusted for time-varying socio-demographic factors.

Main Outcomes and Measures

Adjusted odds ratios (aORs) of violent crime occurring in the week following the exposure to a trigger compared with earlier time periods.

Results

All of the examined triggers were associated with increased risk of violent crime in the week following exposure. For most triggers, the effects did not vary significantly by diagnosis, including unintentional injuries (aORs ranging from 3.5 to 4.8), self-harm (aORs=3.9-4.2), and substance intoxication (aORs=3.0-4.0). Differences by diagnosis included parental bereavement, which was significantly higher in patients with schizophrenia-spectrum disorders (aOR=5.0; 95% CI: 3.0-8.1) compared to individuals without a psychiatric diagnosis (aOR=1.7; 95% CI: 1.3-2.2).

Interpretation

In addition to identifying risk factors for violence, clarifying their timing may provide opportunities to improve risk assessment and management in individuals with psychotic disorders.

Patients diagnosed with schizophrenia-spectrum and bipolar disorders have higher rates of violent criminal convictions than the general population,^{1,2} particularly if they suffer from comorbid substance use disorders.^{3,4} A recent systematic review⁵ has further identified elevated rates of impulsivity and hostility, as well as non-adherence to treatment, as key modifiable risk factors for violence in psychotic disorders. An important limitation of the literature is the relative neglect of temporal effects; little is known about triggers that occur within days of the incident violent event. In other non-communicable disorders, particularly cardiovascular medicine, triggers have been shown to have important effects on serious outcomes. For example, modifiable psychological factors (e.g., anger, anxiety and depression), elevated work stress and unintentional work injuries can act as triggers of myocardial infarction and stroke.⁶

Three previous pilot studies⁷⁻⁹ conducted within Swedish correctional and forensic settings on a total of 327 individuals have suggested that certain symptoms and particularly alcohol intoxication and high doses of benzodiazepines may trigger violence within 24 hours. However, the generalizability of these findings remains limited due to their small and highly selected samples. Importantly, it is not known how such triggers act in individuals with psychosis; less than 20% of those included in previous work had a psychotic disorder, and whether these patient groups act differently from the general population needs clarification. The identification of triggers for violence is potentially clinically important for risk assessment, which is recommended in patients with schizophrenia by recent systematic reviews^{10,11} but currently relies mostly on historical factors and is moderately accurate at best.¹² In addition, delineating the role of triggers may assist in developing new treatments by, for example, identifying targets for cognitive behavioural therapy. This aligns with recent theoretical work in criminology emphasizing the ways in which situation-specific factors moderate individual risks of offending.¹³ Both

prediction of aggression and violent behaviours,¹⁴ and psychological treatments reducing risk,¹⁵ have limited real-world effects and providing more evidence on risk factors, such as triggers, could suggest novel interventions that could mitigate their impact.

To address the lack of evidence on triggers for violence in psychosis, we used nationwide Swedish data for approximately 3.1 million individuals born between 1958 and 1988, including 64,595 patients diagnosed with psychotic disorders. This represents a substantial increase in sample size compared to all previous work on risk factors for violence in psychosis – a 2013 systematic review of 110 studies was based on 45,533 patients.⁵ The review identified substance use, impulsivity, positive symptoms, treatment non-adherence, violent victimization, and self-harm as key risk factors. Two important limitations were further highlighted by the review; little is known about the causal and temporal mechanisms linking the risk factors to violence. By triggers, we mean proximal risk factors, including stressful life events, occurring in the week prior to the incident violent offence. We only considered triggers that had either been considered as risk factors or consequences of violence in previous studies.¹⁶⁻¹⁹ We adopted a within-individual design,²⁰ where each individual acted as his or her own control across time. This is important because this approach accounts for all constant factors within each individual (e.g., genetic and childhood environmental influences). We also addressed time-varying confounding by adjusting for a comprehensive set of socio-demographic factors that were reliably collected on each individual. In addition, we were able to explore whether our findings were moderated by individual diagnosis, as research suggests that the etiological determinants of violence risk differ between schizophrenia and bipolar disorder.²¹

Methods

Swedish nationwide registers

Statistics Sweden, an independent governmental agency, maintains a number of nationwide longitudinal registries with routinely gathered data derived from a number of governmental agencies linked by a personal identification number. Following an approval from the Regional Research Ethics Committee in Stockholm (2013/5:8), we were given access to anonymised data.

The National Patient Register (NPR) provided data on all inpatient hospitalisation episodes (ICD-8, -9 and -10; 1973-2013) and specialist outpatient care visits (ICD-10; 2001-2013).²² The Multi-Generation Register, which encompasses all Swedish residents, enabled us to link the participants to both of their biological parents. Emigration and mortality dates came from specific registers, respectively. Violent crime dates were taken from the National Crime Register, which includes all criminal convictions. We chose dates that crimes occurred rather than conviction dates. The Integrated Database for Labour Market Research (LISA) and the Small Area Marketing Statistics (SAMS) Register provided annual data on socio-demographic factors between 1990-2012, measured at each year end.

Sample

Our base sample consisted of all residents born between 1958 and 1988 who could be linked to both biological parents (n=3,435,357). We excluded individuals who died prior to study baseline (1 January 2001; n=56,721) and those with incomplete data on socio-demographics (n=254,834), leaving 91% of the original sample (n=3,123,724).

Measures

Violent crime

In keeping with previous work,^{23,24} we defined violent crime a conviction for homicide, assault, robbery, threats and violence against an officer, unlawful threats, unlawful coercion, kidnapping, illegal confinement, arson, intimidation, or sexual offences (rape, indecent assault, indecent exposure or child molestation, but excluding prostitution, hiring of prostitutes or child pornography possession).

Triggers

We examined two stressful life events; violent victimisation and parental bereavement. In addition, we examined three injury-related triggers (self-harm, traumatic brain injury (TBI) and unintended injuries) and substance intoxication (eTable 1). Diagnoses of violent victimisation,²⁵ traumatic brain injury,²⁶ and unintended injuries²⁷ have been validated. We excluded trigger events that occurred within 14 days of each other to avoid duplication of the same episode.

Psychotic disorders

To explore moderation effects, we identified individuals with lifetime diagnoses of schizophrenia-spectrum disorders (hereon referred to as schizophrenia) and bipolar disorder. NPR diagnoses of schizophrenia²⁸ or bipolar disorder²⁹ have been validated. We defined healthy controls as individuals who had never been diagnosed with any psychiatric disorder (excluding substance use disorder).

Socio-demographic factors

Single status was defined as not being married or registered in same-sex partnership. Low educational attainment referred to not achieving secondary school qualifications.³⁰

Frequent residential relocations indicated changing their residential address at least four times in a given year. Residence in a deprived neighbourhood indicated that the individual's standardised neighbourhood deprivation score³¹ ranked in the top decile.

Low family income indicated that the individual's disposable family income fell below the bottom decile. We also measured whether the individuals had been recipients of unemployment benefits, means-tested welfare benefits and/or disability pension.

Research design

To test the effects of triggers on violent crime, we adopted a within-individual design, where the included individuals were their own controls, which allowed us to control for time-constant confounders (e.g. genetic and early childhood environmental factors). The rationale is to examine the risk of the individual committing a violent crime in the 7 days following trigger exposure and comparing this risk with earlier control periods when they were unexposed. The control periods had an equivalent follow-up period of 7 days and were measured every 30 days prior to the exposure of the trigger, up to a maximum of 1,080 days (36 months). We allowed individuals to be exposed to multiple triggers throughout the entire follow-up period. We defined control periods for subsequent trigger exposures using the same criteria as above with one exception; we only retained control periods that had occurred after the preceding trigger event.

Analytic approach

We selected individuals who had been exposed to any of the six triggers between 1 January 2001 and 15 December 2013. From the index date of the trigger, we identified all

of the available retrospective control periods for each individual. Data on socio-demographic factors measured at the end of the previous year was recorded to adjust for potential bias.

We estimated odds ratios and corresponding 95% confidence intervals for the associations between each trigger and violent crime while adjusting for all individual-specific factors by fitting conditional logistic regression models with individuals as strata. Because the comparisons of violence risk across trigger exposures were made within each individual rather than between individuals, the research design controls for all constant factors within an individual (e.g., sex and ethnicity). In the crude model (Model I), we adjusted for age and calendar month. In the adjusted model (Model II), we further adjusted for time-varying socio-demographic factors, including single status, low educational attainment, frequent residential relocations, low family income, residence in deprived neighbourhoods and being the recipient of unemployment, social assistance or disability pension benefits. In complementary analyses, we tested whether narrower definitions of psychotic disorders, longer follow-periods and effect moderation by socio-demographic factors altered our findings (details in Supplemental Materials).

Results

Table 1 presents descriptive statistics for the distribution of socio-demographic characteristics within each group of individuals in the population (n=3,123,724) that had ever met criteria for schizophrenia (n=34,903; 1.1%), bipolar disorder (n=29,692; 1.0%) as well as the unaffected control subjects (n=2,763,012; 88.5%). All indicators of poor psychosocial functioning were more common in the psychotic disorders, and particularly in schizophrenia, when compared to the controls (Table 1).

[Table 1]

Absolute risks for violent crime were typically highest among individuals diagnosed with schizophrenia, followed by those diagnosed with bipolar disorder and, lastly, the unaffected controls (Table 2). Furthermore, we observed that the rates of a violent crime occurring in the week following a trigger was considerably elevated when compared to their respective control periods (Table 2). This finding was consistent for both psychotic disorders and the controls. Violent victimisation contributed to the largest absolute risks of violent offending with rates ranging between 70-177 violent crimes per 10,000 persons in the week following the victimisation event compared to 9-22 violent crimes per 10,000 persons during the control periods in the same individuals.

[Table 2]

We further found that there remained an increased relative risk of violent crime occurring immediately following the occurrence of all the examined triggers, even after all constant confounders (e.g., genetic and childhood family environmental influences) and a wide range of time-varying socio-demographic factors were accounted for (Figure). These findings were not materially different from the unadjusted models (eTable 2) or narrower definitions of the psychotic disorders (eTable 3). Moreover, we did not find strong evidence of effect modification by psychosis across the triggers with one exception; parental bereavement was associated with a five-fold odds increase in schizophrenia (OR=5.0; 95% CI: 3.0-8.1), which was significantly elevated as compared to the controls (OR=1.7; 95% CI: 1.3-2.2).

[Figure]

The effects of the triggers decayed across time (eTable 4), thus providing additional support for their transient effect on violence. This was most noticeable in the case of violent victimisation. Among patients diagnosed with schizophrenia, the risk of violent offending following victimisation dropped from a nearly 13-fold odds increase (OR=12.7; 95% CI: 8.2-19.6) in the first week to a fully attenuated association in the second week (OR=0.8; 95% CI: 0.4-2.0), which persisted into the third week (OR=1.1; 95% CI: 0.5-2.3). Similar results were found in bipolar disorder and the controls.

We found little evidence for the presence of moderation effects by socio-demographic factors (eTables 5-10). Following Bonferroni-correction, we found that only four tests (2.2%) were statistically significant. Consistent with a ceiling effect interpretation, we found that individuals in the control group who were recipients of welfare benefits and those who had only achieved a low level of education had lower relative risks of violent offending following exposure to violent victimisation and traumatic brain injury.

Discussion

We have conducted a nationwide within-individual study examining the role of triggers for violent criminality in 64,595 patients diagnosed with psychotic disorders and in 2,763,012 general population controls. The triggers included two stressful life events (parental bereavement and violent victimisation), three injury-related triggers (self-harm, TBI, and unintentional injuries), and substance intoxication.

We report three principal findings. First, we found statistically significant associations between all triggers and the rate of violent criminality in the week following the exposure compared with earlier control periods. Complementary sensitivity analyses using

different diagnostic criteria were consistent with our overall findings. Importantly, we also observed that the triggers had less effect as follow-up time increased. These findings strongly support the hypothesis that the recent exposure to a stressful life event, an intentional or unintentional injury, and having been diagnosed with substance intoxication increases the short-term risk of interpersonal violence in individuals with psychotic disorders and general population controls.

Second, we found that the absolute risks of violence occurring in the week following exposure to the triggers differed by individual diagnosis, with the strongest effects being observed in schizophrenia, followed by bipolar disorder and controls. However, we found no statistically significant differences in the relative risks across the three groups. The only exception to this rule was parental bereavement, where we found stronger relative risks in the psychotic disorders (OR=3.6-5.0) than in the controls (OR=1.7). An explanation for this finding is that elevated levels of social support from family members and close friends in the controls³² may act be protective. More generally, these findings suggest that interventions to minimize violence risk in individuals suffering from injuries and substance intoxication should not only target psychiatric patient groups but also the general population. Current clinical guidelines for alcohol use disorders³³ recommend that trained professionals in the health and social care sectors should routinely screen for harmful drinking and offer affected individuals structured brief advice to reduce their alcohol consumption. The efficacy of such brief interventions has been recently confirmed in a systematic review.³⁴ Non-experimental data have further suggested more comprehensive interventions aimed at reducing violence rates among individuals admitted to ED departments for violent injury victimisation by closely following up high-risk patients with a multidisciplinary team that includes physicians, nurses and social workers.³⁵ If such efforts prove to be effective in large-scale randomised trials, our

findings suggest that expanding them to include a wider range of injury and substance-related triggers may reduce violence rates in both patient and general population groups.

Third, our findings demonstrating that self-harm increases risk of interpersonal violence are novel. Prior studies^{36,37} have generally viewed self-harm as a consequence of interpersonal violence^{38,39} and research examining the direction of the association between self-inflicted and interpersonal violence is inconclusive.^{19,40} Our findings suggest that self-harming patients, particularly those with psychoses, are an important group to be assessed for interpersonal violence in addition to the routinely examined suicide risk.

Previous studies have considered all of these triggers as risk factors or consequences of violence¹⁶⁻¹⁹ but only three studies have considered triggers for violence using within-individual designs in small and highly selected clinical samples with a combined total of 70 patients with psychosis in total using short follow-up periods and without population controls.⁷⁻⁹

Limitations

Four methodological limitations should be considered. First, despite our efforts to minimise confounding, we cannot exclude the possibility that other time-varying variables simultaneously explain the co-occurrences of the examined triggers and violent criminality. In the case of the psychotic disorders, for instance, exposure to a specific trigger and the resulting violent outcome may be simultaneously caused by an acute phase of a psychotic or manic episode. The impact of such confounding factors are, however, likely to be marginal as our findings suggest that the relative risks of violence occurring following most triggers are either similar or stronger in magnitude in the unaffected controls compared with the patients diagnosed with psychotic disorders.

Future work should therefore focus on replicating these findings across different contexts and designs. More clinically rich cohorts could, in addition, examine the underlying causal mechanisms linking the triggers to each other as well as to later adverse outcomes, including acts of violence. By adopting life-course approaches, such studies could concurrently investigate a wide range of distal and proximal risk factors for violence in adulthood. These include impulsivity and positive symptoms that our datasets did not have reliable data to examine. Furthermore, the combination of such approaches with longer follow-up data could address whether recurrent exposures to a given trigger confer higher risks of violence than the first episode.

Second, our violent crime measure was derived from nationwide conviction data, which constitute a comprehensive measure of severe offences but less so for minor offences. The extent to which our results would have differed if we had access to data on non-reported violent acts and triggering events remains therefore an empirical question that should be addressed in future research. It is important to note, however, that alternative approaches, such as gathering self-reported data, tend to be subject to other methodological limitations, including increased measurement error,⁴¹ which artificially deflates estimates down to null.⁴² Third, the data on socio-demographic factors were measured at the end of each year. Any changes that had occurred between the end of the previous year up until the measurement of the trigger and control periods were consequently subject to misclassification bias. However, given that the combined effects of all socio-demographic factors did not impact on the crude associations, we expect such bias to be minimal. Fourth, it is possible for an individual to engage in interpersonal violence and consequently require treatment for being violently victimised. We attempted to separate these effects by only considering violent offences that occurred after hospital discharge.

The generalizability of the presented findings is an important consideration. Comparative studies on police recorded rates of common types of serious violent offences have shown to be fairly similar across high-income countries.⁴³ Prevalence estimates for psychotic disorders vary minimally across European countries and the United States.⁴⁴⁻⁴⁶ Age and disability-adjusted life years attributed to unintentional injuries are similar across Sweden, the UK, and the US.⁴⁷ Sweden's estimated alcohol sales per capita is comparable to that of the United States⁴⁸ and nationally representative data from Sweden and the United Kingdom on self-reported victimisation rates indicate marginal differences.^{49,50} Thus, for key exposures and our outcome, Sweden is not clearly different from Western Europe and the US.

Conclusions

In summary, using a novel approach and large sample size, we have shown the importance of triggers for violence risk in patients with psychotic disorders. By including general population controls, we were able to examine possible mechanisms by which they could act. Identifying triggers for violence has not been incorporated into many risk assessment approaches, but our findings suggest that it may provide opportunities to improve the monitoring and management of risk.

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