Psychotic experiences and accidents, injuries, and poisonings among adults in the United States

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ABSTRACT

Psychotic experiences (PEs) have been linked to an increased risk for accidents and injuries. However, this association remains little researched in many countries. To address this research gap, the current study used cross-sectional data from the United States to examine the association between PEs and accidents, injuries, and poisoning in a general population sample. Data were analyzed from 2274 individuals who completed the psychosis screen as part of the National Comorbidity Survey Replication (NCS-R). Information was obtained on PEs (hallucinations and delusions) and the experience of past 12-month accidents, injuries, and poisoning. Logistic regression analysis was used to examine the association while adjusting for demographic variables and common mental disorders (CMDs). In a fully adjusted model past 12-month PEs were associated with almost three times higher odds for reporting accidents, injuries, and poisoning (odds ratio [OR]: 2.97, 95% confidence interval [CI]: 1.13–7.74). The results of this study indicate that PEs are associated with higher odds for accidents and injuries among adults in the United States. Research is now needed to determine the direction of this association and the factors linked to it.

1. Introduction

Accidents and injuries are common and inflict a terrible toll on human health in countries across the world. In 2013, 973 million people were estimated to have sustained injuries that required medical attention while 4.8 million people died as a result of being injured (Haagsma et al., 2016). More recent data from the Global Burden of Disease Study has shown that injuries were responsible for over 10% of Disability-Adjusted Life Years (DALYs) in 2016 (GBD 2016 DALYs and Hale Collaborators, 2017). Besides physical consequences, research has highlighted that accidents and injuries are also associated with an increased risk for poorer mental health. In particular, studies have shown that for different types of injury, as many as 10–40% of those affected may develop anxiety, depression and posttraumatic stress disorder (PTSD) (Bienvenu et al., 2015; Jorge et al., 2004; Kennedy and

Duff, 2001; Williams and Murray, 2015). However, worse mental health might not only be a consequence of injury. Longitudinal research has shown that the relation may be bidirectional (Patten et al., 2010) and that psychiatric disorders such as anxiety and depression might be associated with increased odds for future injuries (Mykletun et al., 2011), with injury possibly being common in groups such as outpatients with major depressive disorder (Hung et al., 2016).

The current study will examine the association between psychotic experiences (PEs) and accidents, injuries, and poisonings among adults in the United States. PEs are subclinical delusions and hallucinations that are common in the general population (ca. 7%), which remit over time in about 80% of individuals (Linscott and van Os, 2013). Despite being predominantly transitory and a less severe manifestation on the psychosis continuum (Oh et al., 2015), a growing body of evidence suggests that PEs may nonetheless be associated with a number of

detrimental outcomes, including an increased risk for morbidity and mortality (Scott et al., 2018; Sharifi et al., 2015). In terms of the present study, there are several reasons why a focus on the PEs-accident/injury association is warranted. First, research has indicated that PEs may be associated with self-injurious behavior (Koyanagi et al., 2015a). Second, traumatic events such as automobile/life-threatening accidents that can result in injury have been linked to the first onset of PEs (McGrath et al., 2017b). Third, other research has indicated that there may also be a cross-sectional link between PEs and injury (Keraite et al., 2016; Moreno et al., 2013) and that assault with injury may lead to subsequent PEs (hallucinations) via specific trauma cognitive processing styles e.g. dissociation (Geddes et al., 2016).

Despite this research, the association between PEs and accidents, injuries, and poisonings remains little researched in many countries including the United States. This may be an important omission. Recent research has shown that not only are PEs prevalent in the general population in the United States (McGrath et al., 2015) but there is also evidence that injuries are common in this setting with as many as 12.6% of the U.S. population possibly experiencing traumatic injury (Davis et al., 2017) with accidents (unintentional injuries) being the third leading cause of death in 2016 (Xu et al., 2018). Importantly, other research has found that potentially injurious behavior such as physical victimization by the police both with and without a weapon is associated with PEs in this setting (DeVylder et al., 2017).

The main aim of this study is thus to examine the association between PEs and accidents, injuries, and poisoning while controlling for the presence of other psychiatric disorders. This may be important given that common mental disorders (CMDs) such as depression and anxiety as well as substance use and eating disorders have been linked to the onset of PEs (McGrath et al., 2016) and might be a risk factor for injury (Borges et al., 2005; Patten et al., 2010). However, the role of CMDs has not been a focus in several of the previous studies that have examined these associations.

2. Methods

2.1. Sample

We analyzed data from the National Comorbidity Survey Replication (NCS-R; (Kessler and Merikangas, 2004)). This face-to-face survey was conducted between 2001 and 2002, and used multi-stage probability sampling to achieve nationally representative samples of adults in the general population of the 48 contiguous states. The NCS-R contains 9090 adults (over the age of 18) who completed 'Part 1' of the survey, which included measures of DSM-IV psychiatric disorders. All respondents who screened positive for a psychiatric disorder were administered 'Part 2' of the survey, as were an additional probability subsample of other Part 1 respondents. A total subsample of 5554 respondents completed Part 2, and a random subsample (*n* = 2308) of these individuals completed the psychosis screen. Recruitment and consent procedures were approved by the institutional review boards of both Harvard Medical School and the University of Michigan. Informed consent was obtained from all participants.

2.2. Measures

2.2.1. Psychotic experiences (independent variable). PEs were assessed with the WHO−CIDI 3.0 Psychosis Screen (Kessler and Ustun, 2004), which is a validated measure used previously with nationally representative data from the U.S. (Kessler et al., 2005). Respondents were asked to report the past 12-month occurrence of six forms of PE, including: (1) visual hallucinations, (2) auditory hallucinations, (3) thought insertion, (4) thought control, (5) telepathy, and (6) delusions of persecution. Reporting at least one of these experiences constituted a positive screen for past 12-month PEs. Responses were not considered a PE when occurring in the context of falling asleep, dreaming, or substance use.

2.2.2. Injury (dependent variable). Accidents and injuries were measured using the single dichotomous item: "In the past 12 months did you have an accident, injury or poisoning that required medical attention?" All respondents who reported any form of injury were coded '1' in the analysis.

2.2.3. Covariates. The choice of covariates was based on past research examining injury outcomes (Cubbin et al., 2000). All models were adjusted for age (a continuous variable), sex (male, female), race (White, Black, Latino, Asian, Other), income (poor, near poor, non-poor in relation to the federal poverty line), education (in year length categories corresponding to less than high school, high school graduate, some college, college graduate and beyond). For marital status respondents were classified as being either married, single or divorced. CMDs were measured using past 12-month psychiatric disorders based on the World Mental Health Survey Composite International Diagnostic Interview (Kessler and Ustun, 2004), which is a fully structured lay interview to screen for diagnoses according to DSM-IV criteria. Respondents were coded as '1' (having a disorder) if they reported that they had at least one of the following psychiatric disorders at some point in the previous 12 months: mood disorder (dysthymia, depressive episode, major depressive disorder, bipolar I, bipolar II), anxiety disorder (agoraphobia with and without panic disorder, generalized anxiety disorder, panic attacks, panic disorder, post-traumatic stress disorder, social phobia), substance use disorder (drug abuse and dependence), alcohol use disorder (alcohol abuse and dependence), and eating disorder (anorexia, bulimia). Respondents not reporting the presence of any past 12-month psychiatric disorders were coded 0.

2.3. Statistical analysis

Individuals were dropped from the analysis (*N* = 5) if they reported having received a diagnosis of schizophrenia from a medical professional at any point in life. Individuals with missing values for any of the variables were also excluded resulting in an analytic sample of 2274 people. Descriptive statistics of the sample and stratified by the presence of injury/accident were first calculated. Next, multivariable logistic regression analysis was conducted to examine the relation between PEs and injury, adjusting for socio-demographic variables and psychiatric disorders. Standard errors were estimated through design-based analyses that used the Taylor series linearization method to account for the complex multistage clustered design, with US metropolitan statistical areas or counties as the primary sampling units. Sampling weights were used for all statistical analyses to account for individual-level sampling factors (i.e. non-response and unequal probabilities of selection). All analyses were performed with STATA SE 15.0. Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs). The level of statistical significance was set at *p* < 0.05.

3. Results

The mean (SD) age of the sample was 46.3 years (18.7) with 52.5% being female. Almost 3.0% of the weighted sample reported past 12-month PEs, while 8.7% reported an injury/accident/poisoning (Table 1). The prevalence of accidents and injuries was comparatively higher among those with PEs. In a multivariable logistic regression model that was adjusted for sociodemographic characteristics and psychiatric disorders, PEs were associated with 2.97 times higher odds (95% CI: 1.13–7.74) of reporting injury/accident/poisoning. Interestingly, past 12-month psychiatric disorder was not associated with accidents and injury whereas being divorced was associated with higher odds for accidents and injury (OR: 1.93, 95% CI: 1.19–3.12), while female sex (OR: 0.69, 95% CI: 0.50–0.96), older age (OR: 0.98, 95% CI: 0.96–0.99) and Black ethnicity (OR: 0.58, 95% CI: 0.36–0.94) were all linked to lower odds for accidents and injury (Table 2).

Table 1
Sample characteristics (overall and by presence or absence of past 12-month injury/accident/poisoning).

	Sample total N	Weighted%	Injury/Accident/Poisoning N	Weighted%	No Injury/Accident/Poisoning N	Weighted%	F-Statistic
Injury/accident/poisoning in past 12-months							
Yes	222	8.65%	222	100.00%	0	0.00%	
No	2052	91.46%	0	0.00%	2052	100.00%	
Psychotic experience in past 12-months							
Yes	81	2.96%	12	7.37%	69	2.54%	6.06*
No	2193	97.04%	210	92.63%	1983	97.46%	
Psychiatric disorder in past 12-months							
Yes	806	22.66%	96	29.49%	710	22.01%	3.56
No	1468	77.34%	126	70.51%	1342	77.99%	
Sex							
Male	946	47.46%	96	55.66%	850	46.69%	3.90
Female	1328	52.54%	126	44.34%	1202	53.31%	
Age[a]	2274	46.28%	222	40.59%	2052	46.82%	8.77**
Education							
0–11 years	368	19.10%	36	20.51%	332	18.97%	0.89
12 years	702	33.24%	65	34.69%	637	33.11%	
13–15 years	653	25.55%	67	28.61%	586	25.26%	
16+ years	551	22.10%	54	16.20%	497	22.66%	
Income							
Poor	484	21.62%	46	20.87%	438	21.69%	0.02
Nearly poor	355	15.58%	36	15.93%	319	15.55%	
Non-poor	1435	62.79%	140	63.20%	1295	62.75%	
Race/ethnicity							
Black	306	13.13%	23	9.81%	283	13.44%	0.82
Asian	0	0.00%	0	0.00%	0	0.00%	
Latino	214	11.27%	20	14.57%	194	10.96%	
White	1674	73.37%	173	74.50%	1501	73.27%	
Other	80	2.22%	6	1.12%	74	2.33%	
Marital Status							
Married	1275	55.30%	109	45.68%	1166	56.21%	2.47
Single	456	21.77%	53	27.74%	403	21.20%	
Divorced	543	22.94%	60	26.58%	483	22.59%	

All estimates were calculated using NCS-R weights; All values weighted proportions unless stated otherwise. Past 12-month psychiatric disorders include: substance use disorder (abuse or dependence), eating disorders (anorexia, binge eating, or bulimia), alcohol use disorder (abuse or dependence), anxiety disorders (generalized anxiety disorder, panic disorder, social phobia, agoraphobia with and without panic attacks, post-traumatic stress disorder), and mood disorders (major depressive disorder, dysthymia).

[**] $p < 0.01$.
[*] $p < 0.05$.
[a] Mean.

4. Discussion

To the best of our knowledge, this is the first study to specifically focus on the association between PEs and accidents, injuries, and poisoning using data from a nationally representative sample of the U.S. population. Results from a logistic regression analysis showed that individuals with any PEs had almost three times higher odds for experiencing accidents, injuries, or poisonings in the previous 12-months. Importantly, this result was obtained while controlling for the presence of comorbid psychiatric disorders, which previous research has indicated may be linked to PEs and comprise a separate risk factor for the occurrence of accidents and injuries.

The finding that PEs were associated with accidents, injuries and poisoning concurs with the results from several previous cross-sectional studies that have linked PEs to both accidents and injuries in multi- and individual-country settings (Keraite et al., 2016; Moreno et al., 2013; Scott et al., 2007). It is uncertain what underlies the association between PEs and accidents and injuries although it can be speculated that several mechanisms might be important. For example, it is possible that cognitive problems might be relevant in this context. More specifically, recent studies have used the WHO Disability Assessment Schedule II (WHODAS-II) and a modified version of it to show that PEs are associated with cognitive difficulties such as an inability to think clearly, concentrate and understand (Navarro-Mateu et al., 2017; Oh et al., 2018), which might increase the risk for accidents and injury when driving or when operating machinery at work for example.

Other studies have also reported that PEs are associated with an increased risk for non-suicidal self-injury (Koyanagi et al., 2015a) and attempted suicide (DeVylder et al., 2015; Koyanagi et al., 2015b; Yates et al., 2019). Although there has been little research on the association between PEs and suicide methods, this latter finding might be relevant given that there is some evidence that individuals with psychosis may be more likely to use violent methods (hanging, cutting, jumping etc.) when attempting suicide (Persett et al., 2018). Given this, an important task for future research will be to examine the suicide methods used by individuals with PEs to see if they have an increased risk for subsequent bodily injury after non-fatal attempts. It is also possible that comorbid conditions that we did not control for in the analysis might also be important for the observed association. For instance, a recent study linked paranoid ideation and auditory hallucinations to a higher number of attention-deficit/hyperactivity disorder (ADHD) symptoms (Marwaha et al., 2015), while other research has shown an association between adult ADHD and injury (Chien et al., 2017). Support for a possible role for other psychiatric disorders is also provided by a study which found that borderline personality disorder symptoms were an important mediator of the PEs-self injury association (Koyanagi et al., 2015a).

Given that this was a cross-sectional study, it is possible that experiencing accidents and injuries might also be a factor in the emergence of PEs. In particular, it is conceivable that what has been termed the 'neural diathesis-stress model' might be important in this respect, where traumatic injury acts as a psychosocial stressor that affects the

Table 2
Association between past 12-month PEs and injury/accidents/poisoning.

Variables	Injury/Accident/Poisoning (past 12 months)
Past 12-month psychotic experience	2.97 (1.13–7.74)*
Past 12-month psychiatric disorder	1.23 (0.76–1.98)
Sex (ref: male)	0.69 (0.50–0.96)*
Age	0.98 (0.96–0.99)**
Education	
0–11 years	1.72 (0.88–3.38)
12 years	1.54 (0.96–2.44)
13–15 years	1.55 (0.95–2.52)
16+ years	[a]
Income	
Poor	0.74 (0.43–1.27)
Nearly poor	0.93 (0.59–1.47)
Non-poor	[a]
Race/ethnicity	
Black	0.58 (0.36–0.94)*
Asian	[b]
Hispanic	1.03 (0.45–2.38)
Other	0.42 (0.13–1.37)
White	[a]
Married	[a]
Divorced	1.93 (1.19–3.12)**
Single	1.07 (0.60–1.91)
Observations	2274

The model was mutually adjusted for all the variables in the table; Results presented as odds ratios (ORs) with 95% confidence intervals (CIs).

[a] Reference category.
[b] Insufficient sample size to produce estimates.

Past 12-month psychiatric disorders include: substance use disorder (abuse or dependence), eating disorders (anorexia, binge eating, or bulimia), alcohol use disorder (abuse or dependence), anxiety disorders (generalized anxiety disorder, panic disorder, social phobia, agoraphobia with and without panic attacks, post-traumatic stress disorder), and mood disorders (major depressive disorder, dysthymia).

* $p < 0.05$.
** $p < 0.01$.

functioning of the hypothalamic-pituitary-adrenal (HPA) axis, which in turn impacts on the subcortical dopamine system and results in the subsequent emergence or exacerbation of psychotic symptoms (Walker et al., 2008). Support for the idea that injury/accident might act as an antecedent stressor in the emergence of PEs has come from a recent study which used retrospectively reported data from the World Mental Health Survey to show that automobile accidents and other life-threatening accidents were associated with the subsequent first onset of PEs (McGrath et al., 2017b). Other adverse experiences might also result in injury and then PEs. For example, DeVylder and colleagues used data from the Survey of Police–Public Encounters to show that physical violence by the police both with and without a weapon was associated with PEs (DeVylder et al., 2017). Finally, a recent study that examined the emergence of hallucinations in the aftermath of assault and injury also provides support for the notion that injury and the trauma associated with it might be important for PEs. It suggested that the way trauma is cognitively processed might be a factor in the occurrence and persistence of hallucinations (Geddes et al., 2016).

In passing it should be noted that other variables were also associated with injury and accidents in the analysis. Male sex and younger age were both associated with an increased risk for accidents and injuries, a finding that is in line with previous research (Cubbin et al., 2000) and may be related to an increased likelihood of engaging in risky behaviors – such as alcohol consumption – that could lead to injury (Santamarina-Rubio et al., 2014). Increased use of alcohol has also been hypothesized as possibly playing a role in the association previously observed between divorce and accidents (Lagarde et al., 2004), which was also seen in this study. The finding that Black ethnicity was associated with lower odds for accidents/injury is interesting given that

previous research has produced mixed results for the association between ethnicity and some forms of nonfatal injury (Berdahl and McQuillan, 2008). This result, however, accords with an earlier study that used data from the National Health Interview Survey to show that Black adults in the United States had a lower risk of nonfatal injury (Cubbin et al., 2000). Several mechanisms might help explain this result including differences in reporting accidents and injuries and/or in seeking/having access to medical care (Cubbin et al., 2000; Hulland et al., 2017).

This study has several limitations that should be discussed. First, given the dependent variable we used we were unable to differentiate between those who had suffered different forms of trauma or who may have experienced more than one traumatic event. In addition, we also lacked details about the events themselves as well as their consequences which would have helped us to more clearly understand the association between PEs and these different traumatic events. Future research should use more detailed questions when examining these associations. Second, we relied on self-reports of accidents, injuries, and poisonings and were not able to validate these responses against other types of data such as medical files or police reports. This may have been a problem as there is some evidence that self-reports of e.g. accidents (crashes) may be unreliable with social desirability bias possibly playing a role in this (af Wahlberg and Dorn, 2015; af Wahlberg et al., 2010). Third, as some childhood adversities have been associated with the onset of PEs throughout the life course (McGrath et al., 2017a), future studies examining the association between accidents, injuries, and PEs in adults should also include these events to determine if they play a role (for example, by increasing sensitivity to the stress of accidents and injuries in adulthood). Finally, as this study was cross-sectional, we were not able to establish causality or the temporal ordering of the observed associations.

In conclusion, this study has shown that PEs are associated with accidents, injuries, and poisonings in adults in the United States. This provides more evidence that PEs are linked to detrimental outcomes in adulthood. Further, if accidents and injuries are associated with the onset of PEs, then psychological interventions in the aftermath of these traumatic events might be important for mitigating or preventing their potentially detrimental impact on mental health (Giummarra et al., 2018).

Declaration of Competing Interest

The authors declare that they have no conflict of interest

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