Trauma and psychotic experiences: transnational data from World Mental Health Survey

Short title: Trauma and psychotic experiences

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Abstract

Background: Traumatic events (TEs) are associated with increased risk of psychotic experiences (PEs), but it is unclear whether this association is explained by mental disorders prior to PE onset. **Aims**: To investigate the associations between TEs and subsequent PE onset after adjusting for post-traumatic stress disorder and other mental disorders. **Methods:** We assessed 29 TE types and PEs from the World Mental Health surveys and examined the associations of TEs with subsequent PEs onset with and without adjustments for mental disorders. **Results:** Respondents with any TEs had three times the odds of other respondents of subsequently developing PEs (OR=3.1, 95% CI=2.7-3.7), with variability in strength of association across TE types. These associations persisted after adjustment for mental disorders. **Conclusions:** Exposure to TEs predicts subsequent onset of PEs even after adjusting for comorbid mental disorders.

Extensive evidence indicates that exposure to childhood trauma or other adversities is associated with increased risk of subsequent psychotic experiences (PEs).[1] In a recent analysis of data from the WHO World Mental Health (WMH) surveys, McGrath et al[2] found that childhood adversities, such as sexual or physical abuse, were associated with increased risks of subsequent PEs even after adjustment for lifetime comorbid mental disorders. Exposure to traumatic events (TEs) later in development has also been linked to increased risk of subsequent PEs. Cross-sectional[3] and longitudinal[4, 5] studies have found especially high PE risk associated with TEs involving interpersonal violence.[6, 7] There is also evidence of a dose-response relationship between number of TEs and risk of subsequent PEs.[6, 8] However, many TEs are predicted by prior mental disorders and associated with an increased risk of subsequent mental disorders, most notably post-traumatic stress disorder (PTSD).[9-11] We recently demonstrated that the associations of PEs with mental disorders (including PTSD) are often bidirectional.[12] Thus, it seems reasonable to hypothesize that the associations of TEs with subsequent onset of PEs might be influenced by comorbid mental disorders.[13] This could be true either because lifetime mental disorders with onsets prior to TEs are associated both with increased risk of subsequent TE exposure (e.g., bipolar disorder associated with increased risk of interpersonal violence, ADHD associated with increased risk of motor vehicle collisions) and because TEs are associated with increased risk of subsequent mental disorders (both PTSD and other disorders). The main aim of this study was to examine the associations of type and number of TEs with the subsequent onset of PEs across 16 WMH countries and to evaluate the extent to which these associations were explained statistically by PTSD and other mental disorders.

Methods

Samples

The WMH surveys are a coordinated set of community epidemiological surveys administered in probability samples of the non-institutionalized civilian household population in countries throughout the world (www.hcp.med.harvard.edu/WMH).[14] We examined data from 16 WMH surveys that included both a Psychosis Module and items related to trauma exposure. These 16 countries are distributed across North and South America (Colombia; Mexico; Peru; Brazil; USA); Africa (Nigeria); the Middle East (Lebanon); the South Pacific (New Zealand) and Europe (Belgium, France, Germany, Italy, the Netherlands, Portugal, Romania, Spain). The majority of these surveys were based on multi-stage, clustered area probability household sampling designs, the exceptions being Belgium, Germany and Italy, which used municipal resident registries to select respondents (Supplementary Table S1). The weighted (by sample size) average response rate across all 16 surveys was 70.5%.

In keeping with previous studies of PEs,[2, 6, 12] we made the *a priori* decision to exclude individuals reporting PEs who screened positive for possible schizophrenia/psychosis and manic-depression/mania (i.e., respondents who were either told by a doctor that their PEs were caused by these conditions or who were treated with antipsychotic medications for these symptoms). This resulted in excluding 130 respondents (0.5% of all respondents), leaving 24,464 respondents for this study (see Supplementary table S1).

Procedures

All WMH interviews were conducted face-to-face by trained lay interviewers in the homes of respondents. Informed consent was obtained before beginning the interview. Procedures for obtaining informed consent and data protection (ethical approvals) were reviewed and approved by the institutional review boards of the collaborating organisations in each country.[15] Standardised interviewer training and quality control procedures were used consistently in the surveys.

All WMH interviews had two parts. Part I, administered to all respondents, contained assessments related to core mental disorders (Depression, Mania, Panic Disorder, Specific Phobia, Agoraphobia, Generalized Anxiety Disorder, Substance Use). Part II, which included other mental disorders, TEs and PEs, was administered to respondents who met lifetime criteria for any Part I disorder and a random proportion of the rest. Respondents in the Part II sample were weighted by the inverse of their probability of selection to restore representativeness. Additional weights were used to adjust for differential probabilities of selection within households, nonresponse, and to match the samples to population socio-demographic distributions.[15]

Data collection and data items

The instrument used in the WMH surveys was the WHO Composite International Diagnostic Interview (CIDI), [15] a validated fully-structured diagnostic interview (https://www.hcp.med.harvard.edu/wmhcidi/download-the-who-wmh-cidi-instruments/) designed to assess the prevalence and correlates of a wide range of mental disorders according to the definitions and criteria of both the DSM-IV and ICD-10 diagnostic systems. DSM-IV criteria are used in the current report. WHO translation, back-translation, and harmonisation protocols were used to adapt the CIDI for use in each participating country.

Psychotic experiences (PEs)

The Psychosis Module included questions about 6 PE types – 2 related to hallucinatory experiences and 4 related to delusional experiences (Supplementary table S2a, S2b). The respondents were asked if they ever experienced each PE (e.g., "*Have you ever seen something that wasn't there that other people could not see?"; "Have you ever heard any voices that other people said did not exist?*" etc.). Only PEs occurring when the person was '*not dreaming, not half-asleep, or not under the influence of alcohol or drugs*' were included. For those with PEs, age-of-onset of PEs was also assessed.

Mental disorders

The WMH version of the CIDI assessed lifetime history of 21 mental disorders including *mood disorders*; *anxiety disorders*; *behaviour disorders*; *eating disorder*; and *substance use disorders* (Supplementary table S2c). Clinical reappraisal studies indicate that lifetime diagnoses based on the CIDI have good concordance with diagnoses based on blinded clinical interviews.[16]

Traumatic experiences

The CIDI assessed 29 TEs which have been broadly classified into six categories. Details of these categories have been published elsewhere.[17] These categories are: *collective violence* (civilian in a war zone, refugee, civilian in region of terror, kidnapped, relief worker in war zone); *caused/witnessed bodily harm* (purposely injured, tortured, or killed someone, combat experience, accidentally caused serious injury or death, saw atrocities, witnessed death/dead body or saw someone seriously hurt); *interpersonal violence* (beaten up by caregiver, witnessed physical fight at home, and beaten up by someone else); *intimate partner/sexual violence* (raped, sexually assaulted, beaten up by spouse/romantic partner, stalked, traumatic event to loved one, private event, some other event); *accidents/injuries* (child with serious illness, natural disaster, life-threatening illness, toxic chemical exposure, other life threatening accident, automobile accident); and *other traumas* (unexpected death of a loved one, mugged or threatened with a weapon, man-made disaster). Information on age at first exposure associated with each TE was also collected. Of note, this study extends our previous report on the subset of TEs that occurred in childhood[2] by evaluating the impact of TEs occurring across the life span.

Statistical Analysis

Lifetime prevalence of each TE was calculated using cross-tabulation. Discrete-time survival analysis with person-year as the unit of analysis was used to investigate the associations of exposure to TEs with the subsequent first onset of PEs. A person-year dataset was created such that each year in the life of each respondent (up to and including the age of onset of PE or their age at interview, whichever came first) was treated as a separate observational record. In all analyses the year of PE onset was coded as 1 and earlier years coded as 0 on a dichotomous outcome variable. TEs were coded as 1 only beginning the year after the onset of TEs to ensure that we were not including onsets of TE and PE occurring in the same year. We estimated 29 bivariate models (i.e., considering only one TE type out of 29 types at a time) in predicting PEs adjusting for age-cohort, gender, person-year dummy variables, and country. We then estimated a series of multivariate models: (a) M1 included all TEs simultaneously as predictors without considering the number of TEs (type model); (b) M2 included number of TEs coded as dummy variables (exactly 1, exactly 2,…,5 or more TEs) without any information on type of TEs (number model); (c) M3 included both type and number of TEs (simple interactive model); and (d) M4 included type and number of TEs along with a separate interaction term between each type and each number of other co-occurring TEs (complex interactive model). The latter models showed the 'marginal effects' of each type of TE, where a marginal-effect is the 'partial derivative effect' (a unique contribution) of a specific TE to PEs while the contribution from all other TEs remains constant. Due to the co-occurring nature of TEs, it is difficult to fractionate the impact of individual TEs on PEs using models M1-M3. While M3 assumed simple interactions, M4 allowed each type of TE to vary in slope as a function of number of co-occurring TEs. The model with the best fit to the data according to the Akaike Information Criterion (AIC) was carried forward into subsequent examination of the extent to which associations of TEs with subsequent PEs changed when we adjusted for history of PTSD (M5) and also other temporally prior (to the PE) mental disorders (M6).

As the WMH data are both clustered and weighted, the design-based Taylor series linearization implemented in SUDAAN software was used to estimate standard errors and evaluate the statistical significance of coefficients. Survival coefficients were exponentiated and reported as odds ratios. All significance tests were evaluated using .05-level two-sided tests.

RESULTS

Prevalence of TEs in those with and without PEs

Of the 24 464 respondents, more than two-thirds (n=18 535, 71.8%) reported exposure to at least one TE in their lifetime (Supplementary table S3). The lifetime prevalence of TE exposure among respondents with PEs was 90.4% compared to 70.5% in those with no PEs. Among respondents with PEs, there was a wide variation in the frequency of exposure to specific types of TEs, with the highest prevalence reported for unexpected death of a loved one (45.6%) followed by witnessed death or saw someone seriously hurt (41.8%), and mugged or threatened with weapon (29.9%). In this sample, more than three-quarters (75.8%) of the TEs occurred before the onset of PEs, while only 19.2% occurred after PE onset (χ^2_1= 337.3, p <.001) (Supplementary table S3).

The associations of type and number of TEs with PEs

Table 1 summarizes the bivariate and multivariable associations of type and number of TEs with subsequent first onset of PEs. Overall, respondents with any TE had three-fold increased odds of subsequent onset of PEs (OR=3.1, 95% CI=2.7-3.7) compared to respondents with no TEs. In the bivariate models, all but three TE types (civilian in war zone or region of terror, and relief worker in war zone) were significantly associated with elevated odds of subsequent PEs. The significant ORs ranged between 1.6 and 3.5 with the highest being associated with rape (OR=3.5, 95% CI=2.7- 4.4), and the lowest with unexpected death of a loved one (OR=1.6, 95% CI=1.4-1.9) and natural disaster (OR=1.6, 95% CI=1.2-2.1).

In M1, which adjusted for all TEs types, 13 of the 29 TE types were significantly associated with onset of PEs, with ORs ranging from 0.3 (95% CI = 0.1-0.8) for relief worker in a war zone to 2.0 (95% CI = 1.0-3.8) for being a refugee. As a set, TEs were significantly associated with PEs (χ^2_{29} = 745.7, p<.001), and there was significant variation in the magnitude of associations across TEs (χ^2_{28} = 71.7, p<.001). With respect to *number* of TEs (M2), a dose-response relationship between TEs and PEs, was evident with the ORs increasing monotonically as exposure to TEs increased (χ^2_5 = 355.9, p<.001).

In M3 which adjusted for both *type* and *number* of TEs, 12 TEs were significantly associated with PEs: 10 with increased odds of subsequent PEs while two TEs ('relief worker in war zone', 'civilian in war zone') were protective with respect to subsequent PE onset. The ORs associated with *number* of TEs were consistently elevated and in the range 1.7-1.3, indicating that the relative-odds of subsequently having PEs among respondents with more than one prior TE were between 1.7 and 1.3 times the relative-odds implied by multiplying together the marginal ORs. For example, a respondent who had been exposed to beaten by caregiver, raped, sexually assaulted, and an automobile accident would

have an expected OR of subsequent PEs of 5.0 compared to someone with no TE exposure (i.e.,1.6 x 1.6 x 1.5 x 1.3). Given that the number of possible TE combinations ($2^{29} - 1$ = more than 2M) is vast, M3 makes the simplifying assumption that the ORs describing interactions are identical for all co-occurring TEs involving the same number of TEs. However, we found that the test for variation in ORs was significant ($\chi^2_{28} = 64.6$, $P < .001$), indicating variation across TE types in the interaction of TE type and number of other TEs in predicting and PEs. Thus, we next evaluated a more complex interactive model (M4) that considered distinct interactions for specific TEs together with number of other co-occurring TEs.

Table 2 presents a set of complex interactive models with both type and number of TEs (M4) as well as models adjusted for mental disorders (M5-M6). Twelve TEs were significantly associated with PE onset in the 'marginal-effects' models. Interestingly, several TEs showed stronger associations with PE in this model. For example, those who endorsed 'raped' had about five-fold increased odds of subsequent onset of PEs (OR=4.9, 95% CI=2.5-9.5). The 'marginal effect' for number of TEs was significant ($\chi^2_1 = 5.1$, $P = 0.024$). The result shows that for every one unit increment of number of TEs, we expect a 10% increase in the odds of subsequent onset of PEs regardless of the type of TEs (OR=1.1, 95% CI=1.0-1.3).

Four out of the 29 interaction terms of type and number of TEs were significantly associated with PEs ('witnessed physical fights at home', 'raped', 'stalked', 'other life threatening accident'). This significant interaction indicates that the effect of specific TEs on PEs was different at varying levels of other co-occurring TEs.

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When we adjusted for PTSD (M5), the pattern of findings (effect size, direction, and significance) remained remarkably similar. Similarly, when we adjusted for all mental disorders assessed in the surveys (M6, including PTSD), the patterns were generally consistent although for a handful of TEs, the ORs were slightly attenuated. Overall, these results indicate that the significant associations of specific TEs with onset of PEs were not explained by prior (to the PEs) mental disorders.

Discussion

Based on a large dataset from 16 countries, we confirmed that TEs are associated with a three-fold increased odds of subsequent first onset of PEs. There was a dose-response relationship between higher numbers of TE types and odds of PEs. The findings are consistent with recent literature that traumatic events are associated with PEs in a dose-dependent fashion.[3-6, 8] In addition, the study contributed two important findings: First, TEs were not equipotent with respect to the subsequent first onset of PEs. Second, comorbid mental disorders (including PTSD) did not account for the associations of TEs with PEs.

With respect to the variation in the strength of association across TE types, prior research has often failed to use statistical models that adequately address the inter-correlated nature of TEs. We constructed multivariable models that included a comprehensive list of 29 TE types, and incorporated number of TEs per person, as well as interactive models. Similar to our earlier analysis of childhood adversities and PE onsets,[2] we found that not all TEs had equivalent associations with subsequent first onset of PEs. For example, in the marginal effect in Model (M4), we found that only 12 of the 29 TE types were associated with an increased risk of subsequent PEs. Six of the ten TEs related to interpersonal violence, intimate partner and sexual violence were associated with PEs (effect sizes ranged from 1.8 to 4.9 for 'witnessed physical fight at home' and 'raped' respectively). Those who endorsed 'raped' had five-fold increased odds of subsequent onset of PEs (OR=4.9, 95% CI=2.5-9.5). The general pattern of findings indicates a complex interactive association between TE types and number of TEs. In the complex interactive model (M4), we also found that those who were exposed to more TEs were more likely to develop a first onset PE regardless of type of TEs. This is consistent with the hypothesis that TE exposure is a risk factor for psychosis,[18] and also lends additional support for the important role of stress in etiologic pathways underpinning risk of PEs. Interestingly, in some models, 'civilian or relief worker in war zone' showed protective effects with respect to subsequent PEs onset. This is consistent with previous WMH survey studies with TEs, which suggest that respondents who had war experience may have a reduced risk of mental or physical disorders compared to the general population.[19] This may partly be due to a selection effect and/or to prior exposure promoting resilience.[19] In summary, the nature of the relationship between exposure to TEs and subsequent PEs is more nuanced than previously thought.

With respect to the explanatory effects of comorbid disorders, we found that the associations of TEs with PEs were mostly unchanged after adjustment for mental disorders that began prior to the onset of PEs. This adjustment included both confounding effects (i.e., mental disorders that both predicted

subsequent occurrence of TEs and later onset of PEs) and mediating effects (i.e., TEs predicting subsequent onset of mental disorders that, in turn, are predictors of later PEs). No attempt was made to distinguish between the two types of effects. The finding that comorbid mental disorders do not account for the associations of TEs with subsequent PEs is consistent with our earlier findings that there was little or no influence of mental disorders on the associations of childhood adversities with PEs.[2] In particular, we found that PTSD did not appear to play a substantial role in accounting for the associations of TEs with PEs. This was in contrast to an earlier finding, where those with both exposure to TEs and associated PTSD were at greater risk of lifetime PEs.[8] However, our finding is consistent with the hypothesis that some (but not all) TEs may be 'sufficient' causes of subsequent PE onset (i.e., an intervening mental disorder is not required to trigger PEs). Of course, genetic factors and other unmeasured confounders could influence this association.

Even though the exact mechanisms linking TEs to PEs remain poorly understood, there is considerable recent interest in how socially mediated-factors and traumatic events may influence the etiology of PEs. TEs may create a constitutional disposition for PEs which may include heightened vulnerability to stress,[20] elevated emotional reactivity and dysregulation,[19, 21] and deficits in cognitive control.[22] For example, it is feasible that psychopathology emerges as the end product of distress and anxiety due to maladaptive stress and emotional reactions of TEs, which in turn may lead to dopamine sensitization. These pathways may influence psychosis vulnerability.[23] Stress-related changes in the hypopituitary axis could also impact on brain circuitry via epigenetic mechanisms, leading to vulnerability to subsequent PEs.[24]

While the current study has many strengths (e.g., range of TE types, large sample size, range of countries, uniform methodology for data collection), it also has several limitations which deserve comment. We excluded those who screened positive for possible psychotic disorders based on self-reporting having received a psychosis diagnosis or having used antipsychotic medications to treat the reported PEs. However, it is possible that some respondents who reported PEs had an untreated psychotic disorder. We also relied on retrospective reports about age of onset, which might have led to a recall bias. However, we note that several prospective studies have confirmed the association between TEs and subsequent PEs.[4, 5] While we had age of onset for each type of TE, we could not define the pattern of exposure across the life course (e.g. we could not identify those who only had childhood exposure, versus those that had both childhood and adult exposure). We failed to control for all plausible correlates of both TE exposure and PEs, as we wanted to focus on comorbid mental disorders and we were concerned that other plausible correlates (e.g., socio-economic status and

education) could be either causes or consequences of both TE exposure and PEs. Finally, while our findings are consistent with the hypothesis that particular types of TE exposure may contribute to the development of subsequent PEs, the surveys are cross-sectional and thus unable to determine causal pathways.

Despite these limitations, our study found that many of the TEs (11 out of 29) were independently associated with subsequent PEs in a large, community-based transnational study that were not mediated by mental illness. The robust literature now linking TEs and subsequent PEs may enrich epidemiological landscape of PEs, and can provide important clues to the etiology and pathogenesis of PEs.

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A complete list of all within-country and cross-national WMH publications can be found at http://www.hcp.med.harvard.edu/wmh/.

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Footnote to acknowledge WMH collaborators

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Table 1. Bivariate and multivariate association of temporally prior traumatic experiences with subsequent onset of psychotic experiences

Type of traumatic experiences	Bivariate models[a]		M1 - Multivariate type model[b]		M2 - Multivariate number model[c]		M3- Multivariate type and number model[d]	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
I. Collective violence								
Civilian in war zone	**1.0**	(0.6-1.5)	**0.7**	(0.4-1.0)	-	-	**0.6***	(0.4-1.0)
Refugee	**2.0***	(1.1-3.6)	**2.0***	(1.0-3.8)	-	-	**1.8**	(0.9-3.5)
Civilian in region of terror	**1.6**	(1.0-2.6)	**1.2**	(0.7-2.0)	-	-	**1.1**	(0.7-1.9)
Kidnapped	**2.3***	(1.5-3.7)	**1.0**	(0.6-1.6)	-	-	**1.0**	(0.6-1.6)
Relief worker in war zone	**0.6**	(0.3-1.6)	**0.3***	(0.1-0.8)	-	-	**0.3***	(0.1-0.9)
Any collective violence	**1.5***	(1.1-1.9)	**NA**		**NA**		**NA**	
II. Caused/witnessed bodily harm								
Purposely injured, tortured or killed someone	**2.7***	(1.3-5.4)	**1.1**	(0.5-2.4)	-	-	**1.1**	(0.5-2.5)
Combat experience	**1.8***	(1.1-3.0)	**1.3**	(0.8-2.2)	-	-	**1.3**	(0.8-2.1)
Accidentally caused serious injury or death	**3.1***	(2.2-4.5)	**1.6***	(1.1-2.3)	-	-	**1.6***	(1.1-2.3)
Saw atrocities	**1.7***	(1.2-2.4)	**0.9**	(0.6-1.3)	-	-	**0.9**	(0.7-1.4)
Witnessed death/dead body or saw someone seriously hurt	**2.0***	(1.8-2.4)	**1.4***	(1.2-1.7)	-	-	**1.3***	(1.1-1.6)
Any caused/witnessed bodily harm	**2.0***	(1.8-2.4)	**NA**		**NA**		**NA**	
III. Interpersonal violence								
Beaten up by caregiver	**2.6***	(2.2-3.1)	**1.7***	(1.4-2.1)	-	-	**1.6***	(1.3-1.9)
Witnessed physical fight at home	**2.1***	(1.8-2.4)	**1.2***	(1.0-1.5)	-	-	**1.1**	(1.0-1.4)
Beaten up by someone else	**2.1***	(1.6-2.7)	**1.0**	(0.8-1.3)	-	-	**1.0**	(0.8-1.4)
Any interpersonal violence	**2.5***	(2.2-2.8)	**NA**		**NA**		**NA**	
IV. Intimate partner/sexual violence								
Raped	**3.5***	(2.7-4.4)	**1.7***	(1.2-2.3)	-	-	**1.6***	(1.2-2.3)
Sexually assaulted	**2.7***	(2.2-3.3)	**1.5***	(1.2-2.0)	-	-	**1.5***	(1.1-1.9)
Beaten up by spouse/romantic partner	**2.4***	(1.9-3.1)	**1.2**	(0.9-1.6)	-	-	**1.3**	(1.0-1.6)
Stalked	**2.4***	(1.9-3.1)	**1.2**	(0.9-1.6)	-	-	**1.2**	(0.9-1.6)
Traumatic event to loved one	**2.6***	(2.1-3.3)	**1.3***	(1.0-1.7)	-	-	**1.4***	(1.1-1.8)
Private event	**2.5***	(1.9-3.3)	**1.5***	(1.1-2.0)	-	-	**1.5***	(1.1-2.0)
Some other event	**1.9***	(1.4-2.7)	**1.3**	(0.9-1.8)	-	-	**1.3**	(0.9-1.8)
Any intimate partner/sexual violence	**3.2***	(2.7-3.7)	**NA**		**NA**		**NA**	
V. Accident/injuries								
Child with serious illness	**2.2***	(1.6-3.1)	**1.6***	(1.1-2.2)	-	-	**1.5***	(1.1-2.1)
Natural disaster	**1.6***	(1.2-2.1)	**1.1**	(0.8-1.5)	-	-	**1.1**	(0.8-1.4)
Life-threatening illness	**1.7***	(1.3-	**1.2**	(1.0-	-	-	**1.2**	(0.9-1.4)

		2.0)	**2**	1.5)				
Toxic chemical exposure	**2.4***	(1.7-3.3)	**1.5***	(1.1-2.2)	**-**	-	**1.5***	(1.1-2.1)
Other life threatening accident	**2.0***	(1.5-2.6)	**1.2**	(0.9-1.6)	**-**	-	**1.2**	(0.9-1.6)
Automobile accident	**2.1***	(1.7-2.5)	**1.4***	(1.1-1.7)	**-**	-	**1.3***	(1.1-1.6)
Any accident/injuries	**2.0***	(1.7-2.3)	**NA**		**NA**		**NA**	
VI. Other traumas								
Unexpected death of a loved one	**1.6***	(1.4-1.9)	**1**	(1.0-1.3)	**-**	-	**1.1**	(0.9-1.3)
Mugged or threatened with a weapon	**2.0***	(1.6-2.5)	**1.3**	(1.0-1.6)	**-**	-	**1.2**	(0.9-1.6)
Man-made disaster	**1.8***	(1.3-2.5)	**1.0**	(0.7-1.4)	**-**	-	**1.0**	(0.7-1.4)
Any other traumas	**1.8***	(1.5-2.1)	**NA**		**NA**		**NA**	
Any traumatic events	**3.1***	(2.7-3.7)	**NA**		**NA**		**NA**	
Joint significance of all 29 traumatic events	**NA**		**X^2_{29} = 745.7*, P <.001**		**NA**		**X^2_{29} = 128.4*, P <.001**	
Differences in the ORs of the 29 traumatic events	**NA**		**X^2_{28} = 71.7*, P <.001**		**NA**		**X^2_{28} = 64.6*, P <.001**	
Number of traumatic events								
1 traumatic event	**-**	-	**-**	-	**2.3***	(1.9-2.8)	**-**	-
2 traumatic events	**-**	-	**-**	-	**3.5***	(2.8-4.4)	**1.7***	(1.4-2.1)
3 traumatic events	**-**	-	**-**	-	**4.0***	(3.1-5.1)	**1.5***	(1.1-2.0)
4 traumatic events	**-**	-	**-**	-	**5.0***	(3.8-6.7)	**1.5***	(1.1-2.2)
5+ traumatic events	**-**	-	**-**	-	**7.6***	(6.1-9.5)	**1.3**	(0.8-2.1)
Joint significance of the 5 number-of-traumatic event measures	**NA**		**NA**		**X^2_5 = 355.9*, P <.001**		**X^2_4 = 34.0*, P <.001**	

*Significant at the .05 level, 2-sided test

[a]Each lifetime traumatic event type was used as a predictor of psychotic experiences onset in separate discrete-time survival model controlling for age-cohorts, gender, person-year dummies and country

[b]Model was estimated with dummy variables for all temporally prior traumatic events entered simultaneously including the controls specified above

[c]Model was estimated with dummy variables for all number of traumatic events without any information about type of traumatic events entered simultaneously including the controls earlier

[d]Model was estimated with dummy variables for type and number of traumatic events (starting at exactly 2 TEs, exactly 3 TEs, 4 or more TEs) entered simultaneously as predictors of psychotic experiences onset including the controls specified in (a)

Table 2. Multivariate associations of traumatic experiences (TE) with the subsequent first onset of psychotic experiences, with and without adjustment for prior and intervening mental disorders

Type of traumatic experiences	M4 - Multivariate type + number + type*number[a]		M5 (adjusted for PTSD)[b]		M6 (adjusted for mental disorders)[c]	
	Marginal effects OR	(95% CI)	Marginal effects OR	(95% CI)	Marginal effects OR	(95% CI)
I. Collective violence						
Civilian in war zone	**0.4**	(0.1-1.0)	**0.4**	(0.1-1.0)	**0.4***	(0.1-1.0)
Refugee	**3.0**	(0.8-11.0)	**2.9**	(0.8-10.7)	**2.9**	(0.8-10.3)
Civilian in region of terror	**2.5**	(0.6-9.8)	**2.5**	(0.6-9.8)	**2.4**	(0.6-9.6)
Kidnapped	**1.3**	(0.3-5.7)	**1.3**	(0.3-5.7)	**1.2**	(0.2-5.7)
Relief worker in war zone	-[e]	-[e]	-[e]	-[e]	-[e]	-[e]
II. Caused/witnessed bodily harm						
Purposely injured, tortured, or killed someone	-[e]	-[e]	-[e]	-[e]	-[e]	-[e]
Combat experience	**1.2**	(0.2-5.7)	**1.1**	(0.2-5.7)	**1.2**	(0.2-5.9)
Accidentally caused serious injury or death	**2.3**	(0.7-7.7)	**2.3**	(0.7-7.7)	**1.7**	(0.6-4.5)
Saw atrocities	**1.5**	(0.5-4.7)	**1.5**	(0.5-4.7)	**1.5**	(0.5-4.6)
Witnessed death/dead body or saw someone seriously hurt	**1.9***	(1.4-2.5)	**1.9***	(1.4-2.5)	**1.8***	(1.3-2.5)
III. Interpersonal violence						
Beaten up by caregiver	**2.0***	(1.4-2.9)	**2.0***	(1.4-2.8)	**1.9***	(1.3-2.7)
Witnessed physical fight at home[d]	**1.8***	(1.4-2.3)	**1.8***	(1.4-2.3)	**1.8***	(1.4-2.3)
Beaten up by someone else	**1.9**	(0.9-4.2)	**1.9**	(0.9-4.2)	**1.8**	(0.8-3.9)
IV. Intimate partner/sexual violence						
Raped[d]	**4.9***	(2.5-9.5)	**4.8***	(2.5-9.5)	**4.3***	(2.2-8.4)
Sexually assaulted	**2.2***	(1.4-3.6)	**2.2***	(1.3-3.5)	**2.0***	(1.3-3.3)
Beaten up by spouse/romantic partner	**1.4**	(0.8-2.6)	**1.4**	(0.8-2.6)	**1.3**	(0.7-2.3)
Stalked[d]	**3.4***	(2.0-5.6)	**3.4***	(2.0-5.6)	**3.0***	(1.8-5.0)
Traumatic event to loved one	**2.0***	(1.1-3.5)	**2.0***	(1.1-3.5)	**1.8***	(1.0-3.3)
Private event	**2.0**	(0.9-4.5)	**2.0**	(0.9-4.5)	**1.9**	(0.9-4.2)
Some other event	**1.5**	(0.7-3.1)	**1.5**	(0.7-3.1)	**1.4**	(0.7-2.9)
V. Accident/injuries						
Child with serious illness	**1.8**	(0.7-4.5)	**1.8**	(0.7-4.5)	**1.9**	(0.8-4.6)
Natural disaster	**1.2**	(0.7-2.0)	**1.2**	(0.7-2.0)	**1.2**	(0.7-1.9)
Life-threatening illness	**1.5***	(1.0-2.3)	**1.5***	(1.0-2.3)	**1.5**	(1.0-2.3)
Toxic chemical exposure	**1.5**	(0.7-3.4)	**1.5**	(0.7-3.4)	**1.5**	(0.7-3.2)
Other life threatening accident[d]	**2.1***	(1.3-3.4)	**2.1***	(1.3-3.4)	**2.0***	(1.3-3.3)
Automobile accident	**2.0***	(1.4-3.0)	**2.0***	(1.4-3.0)	**2.0***	(1.3-2.9)
VI. Other traumas						
Unexpected death of a loved one	**1.5***	(1.1-2.0)	**1.5***	(1.1-2.0)	**1.5***	(1.1-2.0)
Mugged or threatened with a weapon	**1.9***	(1.1-3.5)	**1.9***	(1.1-3.5)	**1.8**	(1.0-3.3)
Man-made disaster	**1.2**	(0.5-2.8)	**1.2**	(0.5-2.8)	**1.2**	(0.5-2.9)
	X^2_{29} = 140.9*, P <.001		**X^2_{29} = 139.9*, P <.001**		**X^2_{29} = 118.2*, P <.001**	
VII. Number of other co-occurring TEs	**1.1***	(1.0-1.3)	**1.1***	(1.0-1.3)	**1.1***	(1.0-1.3)
	X^2_1 = 5.1*, P = 0.024		**X^2_1 = 5.2*, P = 0.023**		**X^2_1 = 5.2*, P = 0.023**	

*Significant at the .05 level, 2-tailed test

[a]Model was estimated with dummy variables for type and number of temporally prior traumatic events and interaction terms for each type of TEs and number of other TEs including the controls: age-cohorts, gender, person-year dummies and country

[b]Model specification in (a) and additionally control for temporally prior post-traumatic stress disorder only

[c]Model specification in (a) and additionally control for 21 temporally prior and intervening mental disorders (PTSD inclusive),

[d]The interaction term for this TE and the number of other co-occurring TEs was significant

Total person-years used for this multivariate model is 1,041,109

[e]Results are not applicable due to unstable estimates

Supplementary table S1. World Mental Health (WMH) sample characteristics by World Bank income categories, and sample for psychotic experiences (PEs)

Country by income category	Survey[a]	Sample characteristics	Field dates	Age range	Sample size		Response rate[c]
					Part I	PEs sample	
Low and lower middle income countries							
Colombia	NSMH	All urban areas of the country	2003	18-65	4426	722	87.7
Nigeria	NSMHW	21 of the 36 states in the country	2002-3	18-100	6752	1417	79.3
Peru	EMSMP	5 urban areas (approximately 38% of the total national population)	2004-5	18-65	3930	530	90.2
Upper-middle income countries							
Brazil - São Paulo	São Paulo Megacity	São Paulo metropolitan area	2005-7	18-93	5037	2922	81.3
Lebanon	LEBANON	Nationally representative	2002-3	18-94	2857	1029	70
Mexico	M-NCS	All urban areas of the country	2001-2	18-65	5782	715	76.6
Romania	RMHS	Nationally representative	2005-6	18-96	2357	2357	70.9
High-income countries							
Belgium	ESEMeD	Nationally representative	2001-2	18-95	2419	319	50.6
France	ESEMeD	Nationally representative	2001-2	18-97	2894	301	45.9
Germany	ESEMeD	Nationally representative	2002-3	18-95	3555	408	57.8
Italy	ESEMeD	Nationally representative	2001-2	18-100	4712	617	71.3
New Zealand[d]	NZMHS	Nationally representative	2003-4	18-98	12790	7263	73.3
Portugal	NMHS	Nationally representative	2008-9	18-81	3849	2053	57.3
Spain	ESEMeD	Nationally representative	2001-2	18-98	5473	1159	78.6
The Netherlands	ESEMeD	Nationally representative	2002-3	18-95	2372	348	56.4
The United States	NCS-R	Nationally representative	2002-3	18-99	9282	2304	70.9
All countries combined					**78487**	**24464**	**70.5**

[a] NSMH (The Colombian National Study of Mental Health);NSMHW (The Nigerian Survey of Mental Health and Wellbeing); EMSMP (La Encuesta Mundial de Salud Mental en el Peru); LEBANON (Lebanese Evaluation of the Burden of Ailments and Needs of the Nation); M-NCS (The Mexico National Comorbidity Survey); RMHS (Romania Mental Health Survey); ESEMeD (The European Study Of The Epidemiology Of Mental Disorders); NZMHS (New Zealand Mental Health Survey); NMHS (Portugal National Mental Health Survey); NCS-R (The US National Comorbidity Survey Replication).

[b] Brazil, New Zealand and Romania did not have an age restricted sample. All other countries, with the exception of Nigeria (which was age restricted to ≤ 39) were age restricted to ≤ 44.

[c] The response rate is calculated as the ratio of the number of households in which an interview was completed to the number of households originally sampled, excluding from the denominator households known not to be eligible either because of being vacant at the time of initial contact or because the residents were unable to speak the designated languages of the survey. The weighted average response rate is 70.5%.

[d] For the purposes of cross-national comparisons we limit the sample to those 18+.

Supplementary table S2a. Six CIDI Psychotic experiences types in six European (ESEMed[a]) sites (Belgium, France, Germany, Italy, Netherlands, Spain)

Item	Type	Description
A. Saw a vision (Visual hallucinations)	**1**	Did you ever see something that wasn't really there that other people could not see? Please do not include any times when you were dreaming or half-asleep or under the influence of alcohol or drugs.
B. Heard voices (Auditory hallucinations)	**2**	Did you ever hear things that other people said did not exist, like strange voices coming from inside your head talking to you or about you, or voices coming out of the air when there was no one around. Please do not include any times when you were dreaming or half-asleep or under the influence of alcohol or drugs.
C. Thought insertion/withdrawal	**3**	Did you ever believe that some mysterious force was inserting many different strange thoughts -- that were definitely not your own thoughts – directly into your head by means of x-rays or laser beams or other methods?
D. Mind control/passivity	**4**	Did you ever feel that your mind had been taken over by strange forces with laser beams or other methods that were making you do things you did not choose to do. Again, do not include times when you were dreaming or under the influence of alcohol or drugs.
E. Ideas of reference	**5**	Did you ever believe that some strange force was trying to communicate directly with you by sending special signs or signals that you could understand but that no one else could understand. Sometimes this happens by special signs coming through the radio or television.
F. Plot to harm/follow	**6**	Did you ever believe that there was an unjust plot going on to harm you or to have people follow you that your family and friends did not believe existed?

[a] ESEMeD = European Study of the Epidemiology of Mental Disorders

Supplementary table S2b. Six CIDI Psychotic experiences types in 10 non-ESEMed sites (Colombia, Lebanon, Mexico, Brazil, Nigeria, Peru, Portugal, Romania, USA and New Zealand)

Item	Type	Description
A. Saw a vision (Visual hallucinations)	**1**	Did you ever see something that other people who were there could not see.
	1a	Did this every happen when you were not dreaming, not half-asleep, and not under the influence of alcohol or drugs?
B. Hearing voices (Auditory hallucinations)	**2**	Did you ever hear things that other people said did not exist, like strange voices coming from inside your head talking to you or about you, or voices coming out of the air when there was no one around.
	2a	Did this every happen when you were not dreaming, not half-asleep, and not under the influence of alcohol or drugs?
C. Thought insertion/withdrawal	**3**	Did you ever believe that some mysterious force was inserting many different strange thoughts -- that were definitely not your own thoughts – directly into your head by means of x-rays or laser beams or other methods?
	3a	Did this every happen when you were not dreaming, not half-asleep, and not under the influence of alcohol or drugs?
D. Mind control/passivity	**4**	Did you ever feel that your mind had been taken over by strange forces with laser beams or other methods that were making you do things you did not choose to do.
	4a	Did this every happen when you were not dreaming, not half-asleep, and not under the influence of alcohol or drugs?
E. Ideas of reference	**5**	Did you ever believe that some strange force was trying to communicate directly with you by sending special signs or signals that you could understand but that no one else could understand. Sometimes this happens by special signs coming through the radio or television.
	5a	Did this every happen when you were not dreaming, not half-asleep, and not under the influence of alcohol or drugs?
F. Plot to harm/follow	**6**	Did you ever believe that there was an unjust plot going on to harm you or to have people follow you that your family and friends did not believe existed?
	6a	Did this every happen when you were not dreaming, not half-asleep, and not under the influence of alcohol or drugs?

Note: For the assessment of psychotic experiences we included items 1a, 2a, 3a, 4a, 5a, and 6a. Similarly for the assessment of hallucination types we included types 1a and 2a, and for the assessment of delusional experiences we included types 3a, 4a, 5a, and 6a.

Supplementary table S3. Prevalence of traumatic experiences (TE) among respondents with and without lifetime psychotic experiences (PE) (n = 24,464)

Type of traumatic experiences	Total Sample			Without PE			With PE			Respondents endorsing both lifetime TE and PE							
										TE prior to PE onset		TE in the same year as PE onset		PE prior to TE onset		Goodness-of-fi test for equal proportion[a]	
	n	%[b]	S.E	n	%[b]	S.E	n	%[b]	S.E	%[b]	S.E	%[b]	S.E	%[b]	S.E	X_1^2	[p]
I. Collective violence																	
Civilian in war zone[c]	1423	**6.4**	0.3	1331	**6.5**	0.3	92	**4.6**	0.8	**70.9**	7.3	**2.2**	1.4	**26.9**	7.2	**111.6***	<.00
Refugee[c]	714	**3.0**	0.2	666	**3.0**	0.3	48	**2.7**	0.6	**76.2**	7.4	**1.7**	1.6	**22.1**	7.2	**22.6***	<.00
Civilian in region of terror[c]	699	**3.3**	0.2	622	**3.2**	0.2	77	**4.5**	0.7	**61.4**	7.6	**5.0**	2.7	**33.6**	7.3	**12.9***	<.00
Kidnapped	370	**1.1**	0.1	289	**1.0**	0.1	81	**2.9**	0.4	**43.8**	7.5	**5.1**	2.2	**51.2**	7.6	**2.2**	0.13
Relief worker in	242	**1.2**	0.1	225	**1.2**	0.1	17	**0.9**	0.3	**40.3**	14.5	**9.9**	9.3	**49.8**	15.4	-[f]	-[f]

war zone[c]																
Any collective violence	2454	**9.7**	0.3	2214	**9.7**	0.3	240	**9.9**	0.9	**62.6**	4.4	**3.4**	1.2	**34.0**	4.4	**24.5***	<.00
II. Caused/witnessed bodily harm																
Purposely injured, tortured, or killed someone[d]	153	**0.7**	0.1	121	**0.7**	0.1	32	**1.8**	0.5	**53.4**	12.8	**2.8**	2.9	**43.7**	12.7	-[f]	-[f]
Combat experience[c]	578	**2.9**	0.2	512	**2.8**	0.2	66	**5.1**	0.9	**52.3**	8.7	**1.4**	1.1	**46.3**	8.7	**230.7***	<.00
Accidentally caused serious injury or death	457	**1.5**	0.1	375	**1.4**	0.1	82	**3.2**	0.4	**65.4**	6.3	**3.1**	2.4	**31.4**	6.1	**61.8***	<.00
Saw atrocities	992	**4.0**	0.2	853	**3.8**	0.2	139	**6.4**	0.8	**46.3**	6.1	**7.8**	3.7	**46.0**	7.1	**0.0**	0.97
Witnessed death/dead body or saw someone seriously hurt	6422	**24.4**	0.4	5475	**23.1**	0.4	947	**41.8**	1.5	**52.5**	2.7	**4.9**	0.9	**42.6**	2.7	**5.9***	0.01
Any caused/witnessed bodily harm	6981	**26.8**	0.4	5980	**25.6**	0.4	1001	**43.7**	1.5	**54.3**	2.6	**4.8**	0.8	**40.8**	2.5	**11.2***	0.00
III. Interpersonal violence																
Beaten up by caregiver	2948	**8.2**	0.2	2417	**7.4**	0.2	531	**19.4**	1.1	**87.8**	1.9	**4.2**	1.1	**8.0**	1.7	**223.3***	<.00
Witnessed physical fight at home[e]	3238	**12.0**	0.3	2704	**11.2**	0.3	534	**22.4**	1.3	**84.0**	2.7	**4.8**	1.4	**11.3**	2.5	**233.2***	<.00
Beaten up by someone else	1650	**5.4**	0.2	1381	**5.1**	0.2	269	**9.6**	0.8	**60.6**	4.0	**9.1**	2.4	**30.2**	3.6	**39.1***	<.00
Any interpersonal violence	5733	**17.9**	0.3	4811	**16.6**	0.3	922	**35.2**	1.5	**84.8**	1.8	**3.9**	0.8	**11.3**	1.7	**392.8***	<.00
IV. Intimate partner/sexual violence																
Raped	1485	**3.5**	0.2	1140	**2.9**	0.1	345	**12.1**	1.0	**63.8**	4.0	**6.7**	1.6	**29.5**	3.8	**72.1***	<.00
Sexually assaulted	2179	**6.1**	0.2	1727	**5.4**	0.2	452	**15.4**	1.0	**68.9**	3.3	**6.7**	1.7	**24.4**	3.1	**169.7***	<.00
Beaten up by spouse/romantic partner	1796	**4.3**	0.2	1469	**3.9**	0.2	327	**10.2**	0.8	**46.6**	4.1	**8.1**	2.1	**45.3**	4.2	**0.0**	0.84