The associations between traumatic experiences and subsequent onset of a substance use disorder

WHO World Mental Health Survey Collaborators; Degenhardt, Louisa; Bharat, Chrianna; Glantz, Meyer D.; Bromet, Evelyn J.; Alonso, Jordi; Bruffaerts, Ronny; Bunting, Brendan; de Girolamo, Giovanni; de Jonge, Peter

Published in:
Drug and Alcohol Dependence

DOI:
10.1016/j.drugalcdep.2022.109574

Publication date:
2022

Drug and Alcohol Dependence 240 (2022) 109574

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

The associations between traumatic experiences and subsequent onset of a substance use disorder: Findings from the World Health Organization World Mental Health surveys

Louisa Degenhardt [a,*], Chrianna Bharat [a], Meyer D. Glantz [b], Evelyn J. Bromet [c], Jordi Alonso [d,e,f], Ronny Bruffaerts [g], Brendan Bunting [h], Giovanni de Girolamo [i], Peter de Jonge [j,k], Silvia Florescu [l], Oye Gureje [m], Josep Maria Haro [n], Meredith G. Harris [o,p], Hristo Hinkov [q], Elie G. Karam [r,s,t], Georges Karam [r,s,t], Viviane Kovess-Masfety [u], Sing Lee [v], Victor Makanjuola [w], Maria Elena Medina-Mora [x], Fernando Navarro-Mateu [y,z,aa], Marina Piazza [ab], José Posada-Villa [ac], Kate M. Scott [ad], Dan J. Stein [ae], Hisateru Tachimori [af], Nathan Tintle [ag], Yolanda Torres [ah], Maria Carmen Viana [ai], Ronald C. Kessler [aj], on behalf of the WHO World Mental Health Survey collaborators

[a] National Drug and Alcohol Research Centre, University of New South Wales, Sydney, Australia
[b] Department of Epidemiology, Services, and Prevention Research (DESPR), National Institute on Drug Abuse (NIDA), National Institute of Health (NIH), Bethesda, MD, USA
[c] Department of Psychiatry, Stony Brook University School of Medicine, Stony Brook, NY, USA
[d] Health Services Research Unit, IMIM-Hospital del Mar Medical Research Institute, Barcelona, Spain
[e] CIBER en Epidemiología y Salud Pública (CIBERESP), Spain
[f] Pompeu Fabra University (UPF), Barcelona, Spain
[g] Universitair Psychiatrisch Centrum - Katholieke Universiteit Leuven (UPC-KUL), Campus Gasthuisberg, Leuven, Belgium
[h] School of Psychology, Ulster University, Londonderry, United Kingdom
[i] IRCCS Istituto Centro San Giovanni di Dio Fatebenefratelli, Brescia, Italy
[j] Department of Developmental Psychology, University of Groningen, Groningen, the Netherlands
[k] Interdisciplinary Center Psychopathology and Emotion Regulation, University Medical Center Groningen, Groningen, the Netherlands
[l] National School of Public Health, Management and Development, Bucharest, Romania
[m] Department of Psychiatry, University College Hospital, Ibadan, Nigeria
[n] Parc Sanitari Sant Joan de Déu, CIBERSAM, Universitat de Barcelona, Sant Boi de Llobregat, Barcelona, Spain
[o] School of Public Health, The University of Queensland, Herston, Queensland, Australia
[p] Queensland Centre for Mental Health Research, The Park Centre for Mental Health, Queensland, Australia
[q] National Center of Public Health and Analyses, Sofia, Bulgaria
[r] Institute for Development, Research, Advocacy and Applied Care (IDRAAC), Beirut, Lebanon
[s] Department of Psychiatry and Clinical Psychology, St George Hospital University Medical Center, Beirut, Lebanon
[t] Balamand University, Faculty of Medicine, Beirut, Lebanon
[u] Ecole des Hautes Etudes en Santé Publique (EHESP), EA 4057, Paris Descartes University, Paris, France
[v] Department of Psychiatry, Chinese University of Hong Kong, Tai Po, Hong Kong
[w] Department of Psychiatry, College of Medicine, University of Ibadan; University College Hospital, Ibadan, Nigeria
[x] National Institute of Psychiatry Ramón de la Fuente Muñiz, Mexico City, Mexico
[y] Unidad de Docencia, Investigacion y Formación en Salud Mental, Servicio Murciano de Salud, Murcia, Spain
[z] Instituto Murciano de Investigación Biosanitaria Virgen de la Arrixaca, Spain
[aa] Centro de Investigación Biomédica en ERed en Epidemíologia y Salud Pública, Murcia, Spain
[ab] Instituto Nacional de Salud, Universidad Cayetano Heredia, Lima, Peru
[ac] Colegio Mayor de Cundinamarca University, Faculty of Social Sciences, Bogota, Colombia
[ad] Department of Psychological Medicine, University of Otago, Dunedin, Otago, New Zealand
[ae] Dept of Psychiatry & Mental Health and South African Medical Council Research Unit on Risk and Resilience in Mental Disorders, University of Cape Town and Groote Schuur Hospital, Cape Town, Republic of South Africa
[af] National Institute of Mental Health, National Center for Neurology and Psychiatry, Kodaira, Tokyo, Japan
[ag] Department of Mathematics, Statistics and Computer Science, Dordt College, Sioux Center, IA, USA
[ah] Center for Excellence on Research in Mental Health, CES University, Medellin, Colombia

* Corresponding author at: National Drug and Alcohol Research Centre, UNSW Sydney, Sydney, Australia.
E-mail address: l.degenhardt@unsw.edu.au (L. Degenhardt).

https://doi.org/10.1016/j.drugalcdep.2022.109574

Available online 16 July 2022

[ai] Department of Social Medicine, Postgraduate Program in Public Health, Federal University of Espírito Santo, Vitoria, Brazil
[aj] Department of Health Care Policy, Harvard Medical School, Boston, MA, USA

ARTICLE INFO

Keywords:
Substance use disorders
Trauma
Child maltreatment
World mental health surveys

ABSTRACT

Aim: Exposure to traumatic events (TEs) is associated with substance use disorders (SUDs). However, most studies focus on a single TE, and are limited to single countries, rather than across countries with variation in economic, social and cultural characteristics. We used cross-national data to examine associations of diverse TEs with SUD onset, and variation in associations over time.

Methods: Data come from World Mental Health surveys across 22 countries. Adults (n = 65,165) retrospectively reported exposure to 29 TEs in six categories: "exposure to organised violence"; "participation in organised violence"; "interpersonal violence"; "sexual-relationship violence"; "other life-threatening events"; and those involving loved ones ("network traumas"). Discrete-time survival analyses were used to examine associations with subsequent first SUD onset.

Results: Most (71.0%) reported experiencing at least one TE, with network traumas (38.8%) most common and exposure to organised violence (9.5%) least. One in five (20.3%) had been exposed to sexual-relationship violence and 26.6% to interpersonal violence. Among the TE exposed, lifetime SUD prevalence was 14.5% compared to 5.1% with no trauma exposure. Most TE categories (except organised violence) were associated with increased odds of SUD. Increased odds of SUD were also found following interpersonal violence exposure across all age ranges (ORs from 1.56 to 1.78), and sexual-relationship violence exposure during adulthood (ORs from 1.33 to 1.44), with associations persisting even after >11 years.

Conclusion: Sexual and interpersonal violence have the most consistent associations with progression to SUD; increased risk remains for many years post-exposure. These need to be considered when working with people exposed to such traumas.

1. Introduction

A traumatic event (TE) is defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as exposure to "actual or threatened death, serious injury or sexual violence" (American Psychiatric Association, 2013). This may occur directly to a person, or indirectly, by witnessing or learning of an event occurring to a loved one, or via repeated exposure to traumatic events that have occurred to others (as may occur among police, emergency healthcare personnel) (American Psychiatric Association, 2013).

Many studies of TEs focus on specific types of traumatic events (e.g. violence (Herrenkohl et al., 2008), sexual assault (Bagwell-Gray et al., 2015)) or particular groups and ages (e.g. combat veterans (Nichter et al., 2020) and children (Costello et al., 2002)). These studies explicate the vulnerability of particular groups and the severe aftermath that may be associated with specific traumatic events. General population studies find that exposure to TEs is a common occurrence. For example, the World Mental Health Surveys reported that 70.4% of respondents in 24 countries were exposed to at least one trauma in their lifetime, with one-third of them reporting three or more (Benjet et al., 2016). Specific prevalence rates varied across countries, but exceeded 80% in the US, Ukraine, Peru, and Lebanon (Benjet et al., 2016; Breslau et al., 1998; Mills et al., 2006; Ogle et al., 2014). The consequences of experiencing trauma are potentially relevant to a majority of people.

A frequently studied possible sequela of TEs is post-traumatic stress disorder (Breslau, 2002; Geoffrion et al., 2020; Kessler et al., 2018a; Kessler et al., 2018b; Lee and Young, 2001; Santiago et al., 2013) although other mental disorders including anxiety and depressive disorders have been found to be sequelae (Asselmann et al., 2018; Attanayake et al., 2009; Charlson et al., 2019; Copeland et al., 2007; Dworkin et al., 2017; Hart and Rubia, 2012; Maniglio, 2010; Turner and Lloyd, 1995). Substance use and substance use disorder (SUD) have also been found to be possible sequelae of TEs (Blumenthal et al., 2008; Brady and Back, 2012; Halpern et al., 2018; Meyers et al., 2018; Rogers et al., 2021; Sordi et al., 2015). Although TEs can lead to regular substance use (SU) and SUDs, the converse can also occur. For example, while a traffic accident TE may lead to substance use and possibly SUD, SU/SUD can lead to traffic accidents (Callaghan et al., 2013; Martin et al., 2017), and similar bidirectional associations may occur with other categories of TEs (e.g. Choenni et al., 2017; Langdon et al., 2017; Ruback et al., 2014).

In this paper, we explore TEs as risk factors for SUDs and therefore we consider only prior TEs and their associations with subsequent first onset of a SUD. There is evidence that exposure to trauma reduces an individual's capacity to tolerate stress (Najavits et al., 2017). This may explain the increased odds of initiating alcohol and illicit drug use to the extent that these substances may be used to reduce anxiety, distress and stress. Trauma exposure has also been found to be associated with poorer problem-solving skills; this may explain transitions to more regular and problematic patterns of drug use. If an individual repeatedly uses substances in order to cope with or avoid situations or problems, these situations may continue unresolved and therefore continue to cause concerns.

It is conceivable that exposure to TEs at different ages may be associated with differential levels of risk for beginning substance use or developing a SUD. For example, TEs earlier in life may incur greater risk, especially since they precede the more common periods during which substance use begins and accelerates to use disorder, whereas those experienced later in life may not carry such increases in risk. Contrastingly, some TEs may increase risk regardless of the age at which they occur, perhaps because the experiences were inherently more severe and related to a greater likelihood of later substance use as a form of self-medication (Khantzian, 1997). It may also be the case that the risk of such transitions varies as a function of time since such exposure occurred; some TEs may carry more long-lasting risks, whereas others might increase risks for shorter periods.

The World Mental Health (WMH) surveys provide a unique opportunity for a large multinational study of the prevalence of diverse categories of TEs and the associations of those TEs with the subsequent first onset of a SUD varied across life stages and as a function of time since first exposure. WMHS data have previously been used to examine potential variation in the magnitude of risk for the development of PTSD

(Kessler et al., 2017) and of psychotic experiences (McGrath et al., 2017). These studies found variation in the extent to which different kinds of traumatic exposures increased risk for these outcomes; and exposure to more traumatic experience types also increased risks for development of psychotic experiences.

The goals of this paper were to extend the available information on different TEs and their sequelae, which has implications for their treatment and to expand understanding about risk factors for SUDs which has implications for their prevention and possibly their treatment.

We examined:

1. Prevalence of TE categories, and the prevalence of alcohol and drug use and use disorders among people exposed to certain types and numbers of TE categories;
2. Associations between TEs and the subsequent first onset of a SUD varied across life stages; and
3. Associations between TEs and the subsequent first onset of a SUD as a function of time since first exposure.

2. Method

2.1. Sample

The WMH surveys are a coordinated set of community epidemiological surveys administered to representative samples of adult household residents in countries throughout the world (Kessler and Ustun, 2008). We examined 24 surveys administered in 22 countries that assessed lifetime TEs and SUDs. These 24 surveys conducted between 2001 and 2012 included four carried out in lower-middle income countries, seven in upper-middle income countries and thirteen in high-income countries (see Supplementary Table 1 for sample characteristics of all participating surveys). Most surveys were based on multi-stage, clustered area probability household sampling designs. Overall, the current study includes 65,165 respondents.

Surveys were conducted face-to-face by trained lay interviewers after obtaining informed consent using procedures approved by local institutional review boards. To reduce respondent burden, interviews were most often administered in two parts. Part I assessed core mental disorders and was administered to all participants. Part II assessed additional disorders and correlates and was administered to all Part I respondents with any Part I disorder plus a probability subsample of other Part I respondents. All Part II data was weighted by the inverse of respondents' probability of selection to Part II to restore representativeness. Additional weights were used to adjust for differential probabilities of selection within households, nonresponse, and to ensure the samples were representative of the target adult population. Further details about these weights are presented elsewhere (Heeringa et al., 2008).

2.2. Measures

TE exposure and SUDs were assessed with the WHO Composite International Diagnostic Interview (CIDI) Version 3.0 (Kessler and Üstün, 2004), a fully-structured lay-administered interview generating lifetime DSM-IV diagnoses. The CIDI was adapted for use in each participating country using standardised procedures (Mohler et al., 2016). Blinded clinical appraisals using the Structured Clinical Interview for DSM-IV have previously been shown to have generally good concordance with diagnoses based on the CIDI (Haro et al., 2006).

2.2.1. Traumatic experiences

The CIDI-3.0 assessed 29 types of TEs including 27 specific types from a list, one open-ended question about any TEs not listed, and a final yes-no question about any other lifetime TE that respondents did not wish to describe concretely (referred to as a "private event"). Respondents were asked the age of first exposure to each TE endorsed. The 29 TE types have previously been shown to classify in to six broad categories (Kessler et al., 2014): five TE types related to "exposure to organised violence" (e.g. civilian in war zone or region of terror, relief worker, refugee, having been kidnapped); five related to "participation in organised violence" (e.g. combat experience, witnessed atrocities or death, caused death or serious injury); four related to "interpersonal violence" (e.g. childhood physical abuse, witnessed physical fights at home as a child, mugged); six related to "sexual-relationship violence" (e.g. beaten by spouse or partner, raped, sexual assault, stalked); six related to "other life-threatening events" (e.g. life-threatening illness or accident, natural disaster, toxic chemical exposure); and three related to events involving loved ones, or "network traumas" (e.g. unexpected death of a loved one, life-threatening illness of a child).

2.2.2. Substance use and use disorders

The age of onset (AOO) of all substance use stages were assessed. For alcohol, use is defined as first time drinking a standard alcoholic drink and regular use as the first time individuals consumed 12 or more standard drinks in a year. Some variation exists in the type of drugs assessed between WMH surveys, however, a selection was assessed universally, including cannabis, cocaine and illicitly-used prescription drugs, the latter defined as having used without the recommendation of a health professional or for any reason other than a health professional said they should be used. For drugs, use is defined as first time using any drug. A series of questions operationalising the DSM-IV symptom criteria for lifetime use disorders, including abuse and dependence, were assessed for alcohol and drugs separately.

2.3. Analysis methods

Discrete-time survival analyses with person-year as the unit of analysis and a logistic link function were used to investigate the associations of TEs with subsequent first onset of a SUD, including both alcohol and drug use disorders. A person-year dataset was created such that each year in the life of each respondent (up to and including the AOO of the first SUD or age at interview, whichever came first) was treated as a separate observational record, with the year of SUD onset coded 1 and earlier years coded 0. Analyses were restricted to person-years where individuals had a history of either regular alcohol use or any drug use. TE categories were treated as time-varying covariates in all statistical models, with observations up to and including the year of first exposure to the TE category coded 0 and later years coded 1.

A series of discrete-time survival models were used to estimate associations of TEs with first onset of any SUD. First, we estimated associations of TEs with SUD onset occurring in four person-year groups which allowed us to examine whether the associations of TEs with SUD onset varied across life stages. The cut-points for the person-year groups (6–17, 18–21, 22–26 and 27+ years) were defined by quartiles from the life-table estimates of the survival function for SUD AOO produced using the SAS PROC LIFETEST procedure. Second, we estimated associations of TEs with SUD onset as a function of time since first TE exposure, with indicators for 0–2, 3–5, 6–10 and 11+ years since first exposure. This allowed us to examine the time-varying relationship between TE exposure with SUD onset. Previous analyses have shown age, sex, education, marriage status, and parental mental and substance history to be

important covariates when examining SUD onset (Degenhardt et al., 2019; Glantz et al., 2020; Hawkins et al., 1992; Lander et al., 2013). All multivariable analyses controlled for sex, age at interview (18–34, 35–49, 50–64, and 65+ years), person-year, survey, time-varying education level (student, low, low/average, high/average and high, based on country-specific distributions), time-varying marriage (never married, currently married, separated/widowed/divorced), history of parental mental disorder and history of parental SUD. To adjust for the presence of other mental disorders, a time-varying indicator for respondent's history of any other mental disorder was evaluated which captured the first onset of any depressive disorder, generalised anxiety disorder, bipolar disorder, panic disorder, social disorder, specific disorder and agoraphobia.

Due to the complexities in the way in which it was assessed, post-traumatic stress disorder (PTSD) could not be included as a time-varying covariate in these analyses. In order to account for the effect of PTSD on the relationship between TE and SUD, we conducted a sensitivity analyses in which the cohort was stratified by lifetime PTSD and all multivariate analyses rerun.

As the WMH data are both clustered and weighted, the design-based Taylor series linearization method was implemented in SAS® 9.4 (SAS Institute Inc., 2022) to estimate standard errors and evaluate statistical significance of coefficients. Coefficients were exponentiated and are reported as odds ratios (ORs). All significance tests were evaluated using 0.05-level two-sided tests.

3. Results

3.1. Prevalence of TE exposure

Pooled across all countries, 71.0% of respondents experienced at least one lifetime TE (Table 1; for details about individual TE prevalence, see Supplementary Table 2). Network TE (38.3%) was the most common TE category experienced, and exposure to organised violence the least common (9.5%). One quarter (26.0%) of respondents had been exposed to only one TE category, while one in ten (10.8%) had been exposed to four or more.

One in five (20.3 %) respondents had been exposed to sexual-relationship violence at some point in their lives (4.7 % had been beaten by spouse or partner; 3.4 %, raped; and 5.9 %, sexually assaulted; see Supplementary Table 2). One in four respondents had (26.6 %) been exposed to interpersonal violence (7.9 % had been exposed to childhood physical abuse; 14.9 % mugged or threatened with a weapon; and 6.0% beaten by someone other than a spouse/partner).

3.2. Prevalence of substance use and use disorders among those exposed to trauma

Among those who had been exposed to trauma, the prevalence of alcohol use, regular alcohol use and drug use were 85.4%, 69.2% and 30.6%, respectively. One in seven (14.5%) respondents who had experienced a TE had a lifetime SUD, compared to one in twenty with no trauma exposure (5.1%; Table 1, column 9). Cross-sectional prevalence also increased with exposure to an increasing number of TE categories such that 27.4% of those who had been exposed to four or more TE categories had a lifetime SUD. Among those with any trauma exposure, alcohol use disorders (12.9%; column 4) were more common than drug use disorders (4.9%; column 6).

3.3. Associations between TEs and subsequent first onset of any SUD

Table 2 summarises the associations between TE categories and subsequent first onset of any SUD across four person-year age groups, corresponding to the quartiles of SUD onset in the overall sample (ages 6–17 years, 18–21 years, 22–26 years and age 27 years and older). TEs, as a set (i.e. when all TE categories were considered together), were associated with first onset of a SUD across ($X^2_{24} = 45.84$, $p < 0.001$) and within all four person-year groups. A test for variation in the ORs across person-year age groups was significant only for participation in organised violence, which was associated with SUD onset in the 6–17-year age range group, and network traumas, which was associated with elevated risk up to age 21. This indicated that the risk for developing SUD following exposure to TEs did not vary by age for most categories. Interpersonal violence (ORs ranged from 1.56 to 1.78) within all four person-year groups, and sexual relationship violence during adulthood (>17 years; ORs ranged from 1.33 to 1.44) were associated with increased odds of subsequent SUD onset.

The estimates from the model examining associations of TE

Table 1
Cross-sectional conditional prevalence between lifetime substance use and substance use disorders (SUD) with type and number of traumatic experiences (TE).

	N[a]	% (SE) of all respondents	Alcohol use among TE exposed	Regular alcohol use[b] among TE exposed	Alcohol use disorder[c] among TE exposed	Drug use among TE exposed	Drug use disorder[c] among TE exposed	Only one substance use disorder among TE exposed	Both alcohol and drug use disorders among TE exposed	Any substance use disorder among TE exposed
		1	2	3	4	5	6	7	8	9
Traumatic experience categories										
Exposed to organised violence	6,579	9.5 (0.2)	80.8 (0.9)	65.3 (1.0)	12.8 (0.6)	28.8 (0.8)	4.9 (0.3)	11.3 (0.5)	3.3 (0.2)	14.5 (0.6)
Participated in organised violence	18,124	26.7 (0.3)	87.8 (0.4)	73.6 (0.5)	17.3 (0.4)	34.9 (0.5)	7.0 (0.2)	14.3 (0.3)	5.0 (0.2)	19.3 (0.4)
Interpersonal violence	19,207	26.6 (0.3)	89.5 (0.3)	74.1 (0.5)	19.8 (0.4)	37.2 (0.5)	8.3 (0.3)	16.1 (0.4)	6.0 (0.2)	22.1 (0.4)
Sexual-relationship violence	16,349	20.3 (0.3)	88.2 (0.4)	72.1 (0.5)	16.3 (0.4)	37.6 (0.5)	7.6 (0.2)	13.3 (0.4)	5.3 (0.2)	18.6 (0.4)
Other life-threatening experiences	23,491	33.7 (0.3)	88.0 (0.3)	72.3 (0.4)	15.7 (0.3)	32.7 (0.5)	5.7 (0.2)	13.3 (0.3)	4.1 (0.2)	17.3 (0.3)
Network traumatic experience	27,637	38.8 (0.3)	84.7 (0.3)	68.9 (0.4)	13.9 (0.3)	31.4 (0.4)	5.4 (0.2)	11.8 (0.3)	3.8 (0.1)	15.5 (0.3)
Number of traumatic experience categories										
Zero	16,787	29.0 (0.3)	76.2 (0.5)	56.7 (0.6)	4.3 (0.2)	19.5 (0.4)	1.4 (0.1)	4.4 (0.2)	0.6 (0.1)	5.1 (0.2)
One	16,158	26.0 (0.2)	82.4 (0.4)	64.7 (0.5)	7.8 (0.3)	25.0 (0.5)	2.7 (0.2)	7.2 (0.3)	1.7 (0.2)	8.8 (0.3)
Two	13,806	20.4 (0.2)	85.3 (0.4)	69.4 (0.5)	11.4 (0.4)	29.3 (0.6)	3.4 (0.2)	10.5 (0.4)	2.1 (0.2)	12.6 (0.4)
Three	9,709	13.8 (0.2)	87.1 (0.5)	71.3 (0.7)	15.8 (0.5)	33.8 (0.7)	6.2 (0.3)	13.4 (0.5)	4.3 (0.3)	17.7 (0.5)
Four or more	8,705	10.8 (0.2)	90.6 (0.4)	77.0 (0.7)	24.6 (0.7)	42.1 (0.7)	11.0 (0.4)	19.2 (0.6)	8.2 (0.4)	27.4 (0.7)
Any traumatic experience	**48,378**	**71.0 (0.3)**	**85.4 (0.2)**	**69.2 (0.3)**	**12.9 (0.2)**	**30.6 (0.3)**	**4.9 (0.1)**	**11.2 (0.2)**	**3.3 (0.1)**	**14.5 (0.2)**

SE, standard error.
Prevalence estimates are based on weighted data.
[a] N = The total unweighted number of respondents who experienced the specific traumatic experience.
[b] Regular use is defined as 12 or more drinks in a single year.
[c] Use disorder includes abuse and dependence for specific substance.

Table 2
Multivariable associations between traumatic experiences (TE) and the subsequent first onset of a substance use disorder[a] (SUD) in each of four person-year groups.

	First SUD onset quartile, age 6–17[b]		Second SUD onset quartile, age 18–21[c]		Third SUD onset quartile, age 22–26[d]		Fourth SUD onset quartile, age 27 +[e]		Test for the significance of the slope differences across 4 person-year groups[f]
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	X^2_3 [p]
Traumatic experience categories									
Exposed to organised violence	0.89	(0.67–1.18)	0.9	(0.70–1.15)	1.19	(0.90–1.58)	1.00	(0.85–1.17)	2.64 [0.450]
Participated in organised violence	1.30*	(1.12–1.50)	1.02	(0.89–1.16)	1.17	(0.98–1.39)	1.07	(0.95–1.20)	8.34 * [0.040]
Interpersonal violence	1.56*	(1.36–1.78)	1.64*	(1.44–1.86)	1.60*	(1.34–1.90)	1.78*	(1.57–2.01)	1.95 [0.583]
Sexual-relationship violence	1.10	(0.95–1.26)	1.33*	(1.13–1.56)	1.40*	(1.17–1.68)	1.44*	(1.26–1.64)	1.96 [0.580]
Other life-threatening TEs	1.12	(0.96–1.29)	1.12	(0.97–1.30)	1.14	(0.95–1.37)	0.99	(0.88–1.11)	2.51 [0.474]
Network TEs	1.25*	(1.07–1.48)	1.14*	(1.01–1.29)	1.17	(0.94–1.44)	0.92	(0.82–1.03)	16.36 * [0.001]
Joint test of all six indicators - X^2_6 [p]	105.85*	[<0.001]	101.66*	[<0.001]	77.64*	[<0.001]	146.20*	[<0.001]	45.84 * [< 0.001]
Unweighted number of outcomes		2,340		3,073		1,369		2,124	
Number of person-years		63,913		115,384		154,391		699,788	

OR, Odds ratio; CI, confidence interval; * Significant at the 0.05 level, two-tailed test.
All discrete time logistic regression analyses are based on weighted person-year data. Model included dummy variables for all traumatic experience categories entered simultaneously as predictors of first SUD onset controlling for country, age cohort, sex, education, marriage status, history of other mental disorder, and parental history of any mental disorder and any substance use disorder. History of other mental disorders includes depression; generalised anxiety disorder, (broad) bipolar disorder (includes bipolar I, bipolar II and bipolar subthreshold), panic disorder, social phobia, specific phobia and agoraphobia (without panic) disorder. If any disorder was not assessed in a particular survey, the diagnosis for all respondents was set to 'no' for that disorder. DSM-IV diagnostic hierarchy rules were applied to both depression and generalised anxiety disorder, such that people who met criteria for multiple related disorders were diagnosed as only having the disorder ranker higher in the hierarchy.
[a] Either alcohol or drugs.
[b] Model is restricted to between person-years 6 and 17.
[c] Model is restricted to between person-years 18 and 21.
[d] Model is restricted to between person-years 22 and 26.
[e] Model is restricted to person-years 27 and greater.
[f] A model including the interaction of traumatic experience category with SUD onset quartile person-year groups, adjusted for all covariates listed above, was estimated to test the difference between slopes across the person-year groups within each traumatic experience categories.

Table 3
Multivariable associations between traumatic experiences and the subsequent first onset of a substance use disorder[a] as a function of time since first exposure.

	Time since first exposure to trauma category (Ref: No exposure)								Test for the significance of the slope differences across 4 time periods since exposure to trauma
	0–2 years		3–5 years		6–10 years		11 + years		
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	X^2_3 [p]
Traumatic experience categories									
Exposed to organised violence	0.92	(0.70–1.21)	1.04	(0.78–1.39)	1.17	(0.94–1.45)	0.96	(0.80–1.15)	2.62 [0.455]
Participated in organised violence	1.13	(1.00–1.29)	1.09	(0.95–1.26)	1.21*	(1.07–1.38)	0.99	(0.87–1.13)	5.82 [0.121]
Interpersonal violence	1.55*	(1.32–1.81)	1.55*	(1.35–1.79)	1.63*	(1.48–1.81)	1.67*	(1.52–1.84)	1.31 [0.727]
Sexual-relationship violence	1.27*	(1.09–1.48)	1.23*	(1.04–1.45)	1.42*	(1.23–1.63)	1.28*	(1.13–1.44)	2.81 [0.421]
Other life-threatening TEs	1.18*	(1.03–1.34)	1.08	(0.93–1.25)	1.1	(0.96–1.26)	1.04	(0.92–1.17)	1.94 [0.585]
Network TEs	1.21*	(1.07–1.37)	1.1	(0.93–1.30)	1.14*	(1.01–1.29)	0.94	(0.82–1.07)	9.68 * [0.022]
Joint test of all six indicators - X^2_6 [p]	77.97*	[<0.001]	52.56*	[<0.001]	170.67*	[<0.001]	157.53*	[<0.001]	

OR, Odds ratio; CI, confidence interval; SUD, substance use disorder; TE, traumatic experience; * Significant at the 0.05 level, two-tailed test.
All discrete time logistic regression analyses are based on weighted person-year data. Model included four variables for each trauma category indicating first exposure to a TE in that category occurred in the past 0–2, 3–5, 6–10 and 11 + years. All trauma-time interaction variables were entered simultaneously as predictors of first SUD onset controlling for country, person-year intervals (onset quartiles), age cohort, sex, education, marriage status, history of other mental disorder, and parental history of any mental disorder and any substance use disorder. History of other mental disorders includes depression; generalised anxiety disorder, (broad) bipolar disorder (includes bipolar I, bipolar II and bipolar subthreshold), panic disorder, social phobia, specific phobia, and agoraphobia (without panic) disorder. If any disorder was not assessed in a particular survey, the diagnosis for all respondents was set to 'no' for that disorder. DSM-IV diagnostic hierarchy rules were applied to both depression and generalised anxiety disorder, such that people who met criteria for multiple related disorders were diagnosed as only having the disorder ranker higher in the hierarchy.
[a] Either alcohol or drugs.

categories as a function of time since first exposure with SUD onset are presented in Table 3. As a set, there was variation in the association between TE categories and risk of developing a SUD as a function of time since exposure ($X^2_{24} = 439.50$, $p < 0.001$).

For interpersonal violence and sexual-relationship violence, the ORs for first SUD onset persisted long after first exposure. Even after 11 or more years, both sexual and interpersonal were still associated with increased risk for developing a SUD. Exposure to network traumas was associated with increased odds of SUD onset only in the 0–2 and 6–10-year intervals following the first event. Exposure to other life-threatening TEs was associated with increased odds of SUD onset in the two-year interval following the first event, while increased odds of SUD onset were observed only in the 6–10-year interval following first participation in organised violence. In contrast, exposure to (rather than participation in) organised violence was not associated with SUD onset at any time period post-exposure.

To summarise, increased odds of subsequent SUD onset were observed at any life stage following exposure to interpersonal violence, and during adulthood following exposure to sexual-relationship violence, with both effects remaining long after first exposure. The associations between exposure to network traumas or participation in organised violence and SUD were strongest during the 6–17-year age period. There was no significant association between exposure to organised violence and first onset of a SUD.

For completeness, associations between TEs and the subsequent first onset of a SUD as a function of time since first exposure in each of four person-year groups were investigated. The results were largely supportive of the above findings (see Supplementary Table 3). Sensitivity analyses stratified by lifetime PTSD found that, among people with PTSD, the type of trauma had little impact on the odds of subsequent SUD. However, in the absence of PTSD, there was an effect of trauma on SUD similar to that observed in the main analyses (see Supplementary Tables 4–5).

4. Discussion

This study used a large cross-national sample to examine the association of specific traumatic exposure with risk of developing a SUD (alcohol or drugs). Around seven in ten people had been exposed to TEs, and one in seven of these had developed an SUD (compared to 5% of those with no exposure to TEs). These risks accumulated with exposure to an increasing array of TE types.

There was clear evidence of differential associations of categories of TEs with risk of developing problems with alcohol or illicit drugs. The TEs most consistently associated with development of SUDs were exposure to sexual and/or interpersonal violence. These robust associations, combined with the prevalence of exposure to these events, meant that, if we were to assume the AORs represented causal links, an estimated 11.2% of SUDs could be attributed to interpersonal violence and 3.5% to sexual violence.

The fact that sexual and interpersonal violence had the strongest associations with development of SUDs was striking; it is also consistent with previous WMHS findings showing that these forms of trauma exposure were also associated with the highest risk of developing PTSD (Kessler et al., 2017), and more strongly associated with the development of psychotic symptoms (McGrath et al., 2017). We also found that exposure to an increasing number of trauma types was associated with increasing risk of all levels of involvement with substance use, a dose response association that was also observed for the risk of psychotic symptoms. These findings suggest that some trauma exposure carries great risk for adverse outcomes than others: in the case of interpersonal and sexual violence, it could be related to the severity of the exposure and the extent to which physical and emotional boundaries are transgressed. The finding of a dose-response association also suggests that there may be some role of stress in the development of substance use disorders.

One potential explanation of the association between exposure to trauma and substance use is that this actually reflects the association of PTSD with risk of developing problematic substance use (María-Ríos and Morrow, 2020). It has been proposed that exposure to trauma alone may not carry elevated risk for developing SUD, but rather that it is PTSD which may increase the risk of incident substance use problems (María-Ríos and Morrow, 2020); conversely, it has been posited that those who develop PTSD and SUD may have had pre-existing vulnerabilities to the development of both disorders (María-Ríos and Morrow, 2020). Previous US research has found that people exposed to trauma without developing PTSD were not at any elevated risk of incident substance use and problems, whereas those who did develop PTSD had elevated risk (Breslau et al., 2003; Reed et al., 2007). Our sensitivity analyses, examining risk of trauma exposure for incident SUD among those who had versus those who had not developed PTSD, shed some light on these possibilities. Among those who had not developed PTSD, exposure to trauma did remain associated with elevated risk of later developing an SUD; this was not the case for those who developed PTSD.

Clinically, evidence suggests that integrating treatment of SUD and trauma-related disorders results in better outcomes (Roberts et al., 2016); a focus on development of problem-solving skills, strategies to deal with situations of conflict, emotional processing of the impact of trauma, and other cognitive and behavioural strategies may serve to address both the consequences of trauma and SUDs.

At the population level, however, our data suggest that, to the extent that some TEs may be causally related to the development of SUDs, and contribute to a significant proportion of SUD cases, efforts to reduce exposure to those TEs may have secondary benefits in reducing later SUD burden. These efforts include parenting programmes, which evidence suggests may serve to prevent and reduce children's exposure to violence (Coore Desai et al., 2017). There is also some evidence for programmes targeted towards high-risk parents such as home visitation (Levey et al., 2017). The possibility that such interventions may have such secondary impacts is important, given a lack of good evidence for widely effective approaches to the treatment of some SUDs, particularly stimulant drugs (Farrell et al., 2019). Further, including SUD prevention into interventions for individuals who experience TEs may expand their beneficial effects and mitigate risk for substance abuse problems.

There are several important limitations. First, the CIDI only assessed age of the first exposure to any given TE. Therefore, it was not possible to model repeated exposure to the same TE type, nor to examine whether cumulative exposures to the same type were associated with increased risk of developing an SUD, which could plausibly be the case. Second, respondent information on TEs and SUDs was based on retrospective self-report. Although careful attention was given in constructing the interview questions in a way which maximised respondents' recall and minimised reporting differences (Kessler and Üstün, 2004), there is potential unreliability of the timing of reported onset of these events and disorders.

Third, we were specifically focused upon the experience of trauma in these analyses. The scope of this analysis was to comprehensively analyse the association of TEs with SUDs and their transitions. Thus, we do not present findings from other intervening variables, such as mental disorders, that potentially modified these associations. Future studies will consider whether other variables such as mental disorders and social supports moderate the association of TE with onset of SUD. Fourth, much of the existing literature has tended to focus upon PTSD. It was not possible to include PTSD as a covariate, since in order to obtain unbiased

estimates of the prevalence of PTSD, the CIDI assesses PTSD for a randomly selected TE rather than every TE exposure that an individual had experienced. This meant that we only had information on the age of onset for the symptoms/disorder related to the traumatic event that had been selected (Kessler et al., 2018a). We could not be certain of the earliest age of onset of PTSD symptoms in relation to any TE, nor of the earliest age of PTSD in relation to any TE that had been experienced.

5. Conclusion

Exposure to traumatic events is very common. Exposure to those TEs that have the most consistent associations with progression to SUD – namely, exposure to sexual and physical violence - occurs among a sizeable minority and confers increased risk for developing SUD across the lifespan and irrespective of time since exposure. There is a need to consider these risks in working with people exposed to such traumas.

CRediT authorship contribution statement

Dr Kessler had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. *Concept and design:* Kessler, Bromet, Glantz, Degenhardt, Bharat. *Acquisition, analysis, or interpretation of data:* all authors. *Drafting of the manuscript:* Degenhardt, Bharat, Glantz, Bromet, Kessler. *Critical revision of the manuscript for important intellectual content:* all authors.

Acknowledgements

The World Health Organization World Mental Health (WMH) Survey Initiative is supported by the United States National Institute of Mental Health (NIMH; R01 MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the United States Public Health Service (R13-MH066849, R01-MH069864, and R01 DA016558), the Fogarty International Center (FIRCA R03-TW006481), the Pan American Health Organization, Eli Lilly and Company, Ortho-McNeil Pharmaceutical Inc., GlaxoSmithKline, and Bristol-Myers Squibb.

This work was supported by an Australian National Health and Medical Research Council (NHMRC) project grant (no. 1081984). L.D. is supported by an NHMRC Senior Principal Research Fellowship (1135991) and a US National Institute of Health (NIH) National Institute on Drug Abuse (NIDA) grant (R01DA1104470). C.B. is supported by a UNSW Scientia PhD scholarship and a National Drug and Alcohol Research Centre (NDARC) scholarship. NDARC, UNSW Sydney, is supported by funding from the Australian Government Department of Health under the Drug and Alcohol Program. Dr. Glantz's role on this study is through his involvement as a Science Officer on U01-MH60220. He had no involvement in the other cited grants. N.T. is the supported by National Science Foundation award (NSF-SMA 1560078).

We thank the staff of the WMH Data Collection and Data Analysis Coordination Centres for assistance with instrumentation, fieldwork, and consultation on data analysis. None of the funders had any role in the design, analysis, interpretation of results, or preparation of this paper. The views and opinions expressed in this report are those of the authors and should not be construed to represent the views of the World Health Organization, other sponsoring organizations, agencies, or governments.

The 2007 Australian National Survey of Mental Health and Well-being was funded by the Australian Government Department of Health and Ageing. The São Paulo Megacity Mental Health Survey is supported by the State of São Paulo Research Foundation (FAPESP) Thematic Project Grant 03/00204–3. The Bulgarian Epidemiological Study of common mental disorders EPIBUL is supported by the Ministry of Health and the National Center for Public Health Protection. The Colombian National Study of Mental Health (NSMH) is supported by the Ministry of Social Protection. The Mental Health Study Medellín – Colombia was carried out and supported jointly by the Center for Excellence on Research in Mental Health (CES University) and the Secretary of Health of Medellín. The ESEMeD project is funded by the European Commission (Contracts QLG5–1999-01042; SANCO 2004123, and EAHC 20081308), (the Piedmont Region (Italy)), Fondo de Investigación Sanitaria, Instituto de Salud Carlos III, Spain (FIS 00/0028), Ministerio de Ciencia y Tecnología, Spain (SAS 2000–158-CE), Departament de Salut, Generalitat de Catalunya, Spain, DIUE de la Generalitat de Catalunya (2017 SGR 452; 2014 SGR 748), Instituto de Salud Carlos III (CIBER CB06/02/0046, RETICS RD06/0011 REM-TAP), and other local agencies and by an unrestricted educational grant from GlaxoSmithKline. The Israel National Health Survey is funded by the Ministry of Health with support from the Israel National Institute for Health Policy and Health Services Research and the National Insurance Institute of Israel. The World Mental Health Japan (WMHJ) Survey is supported by the Grant for Research on Psychiatric and Neurological Diseases and Mental Health (H13-SHOGAI-023, H14-TOKUBETSU-026, H16-KOKORO-013, H25-SEISHIN-IPPAN-006) from the Japan Ministry of Health, Labour and Welfare. The Lebanese Evaluation of the Burden of Ailments and Needs Of the Nation (L.E.B.A.N.O.N.) is supported by the Lebanese Ministry of Public Health, the WHO (Lebanon), National Institute of Health / Fogarty International Center (R03 TW006481–01), anonymous private donations to IDRAAC, Lebanon, and unrestricted grants from, Algorithm, AstraZeneca, Benta, Bella Pharma, Eli Lilly, Glaxo Smith Kline, Lundbeck, Novartis, OmniPharma, Pfizer, Phenicia, Servier, UPO. The Mexican National Comorbidity Survey (MNCS) is supported by The National Institute of Psychiatry Ramon de la Fuente (INPRFMDIES 4280) and by the National Council on Science and Technology (CONACyT-G30544- H), with supplemental support from the Pan American Health Organization (PAHO). Te Rau Hinengaro: The New Zealand Mental Health Survey (NZMHS) is supported by the New Zealand Ministry of Health, Alcohol Advisory Council, and the Health Research Council. The Nigerian Survey of Mental Health and Wellbeing (NSMHW) is supported by the WHO (Geneva), the WHO (Nigeria), and the Federal Ministry of Health, Abuja, Nigeria. The Northern Ireland Study of Mental Health was funded by the Health & Social Care Research & Development Division of the Public Health Agency. The Peruvian World Mental Health Study was funded by the National Institute of Health of the Ministry of Health of Peru. The South Africa Stress and Health Study (SASH) is supported by the US National Institute of Mental Health (R01-MH059575) and National Institute of Drug Abuse with supplemental funding from the South African Department of Health and the University of Michigan. The Psychiatric Enquiry to General Population in Southeast Spain – Murcia (PEGASUS-Murcia) Project has been financed by the Regional Health Authorities of Murcia (Servicio Murciano de Salud and Consejería de Sanidad y Política Social) and Fundación para la Formación e Investigación Sanitarias (FFIS) of Murcia. The Ukraine Comorbid Mental Disorders during Periods of Social Disruption (CMDPSD) study is funded by the US National Institute of Mental Health (RO1-MH61905). The US National Comorbidity Survey Replication (NCS-R) is supported by the National Institute of Mental Health (NIMH; U01-MH60220) with supplemental support from the National Institute of Drug Abuse (NIDA), the Substance Abuse and Mental Health Services Administration (SAMHSA), the Robert Wood Johnson Foundation (RWJF; Grant 044708), and the John W. Alden Trust.

N.T. received funding from the National Science Foundation - NSF-SMA 1560078. D.J.S. is supported by the Medical Research Council of South Africa (MRC).

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

The WHO World Mental Health Survey collaborators are Sergio Aguilar-Gaxiola, MD, PhD; Ali Al-Hamzawi, MD; Mohammed Salih Al-Kaisy, MD; Jordi Alonso, MD, PhD; Yasmin Altwaijri, PhD;Laura Helena

Andrade, MD, PhD; Lukoye Atwoli, MD, PhD; Corina Benjet, PhD; Guilherme Borges, ScD; Evelyn J. Bromet, PhD; Ronny Bruffaerts, PhD; Brendan Bunting, PhD; Jose Miguel Caldas-de-Almeida, MD, PhD; Graça Cardoso, MD, PhD; Somnath Chatterji, MD; Alfredo H. Cia, MD; Louisa Degenhardt, PhD; Koen Demyttenaere, MD, PhD; Silvia Florescu, MD, PhD; Giovanni de Girolamo, MD; Oye Gureje, MD, DSc, FRCPsych; Josep Maria Haro, MD, PhD; Meredith G. Harris, PhD; Hristo Hinkov, MD, PhD; Chi-yi Hu, MD, PhD; Peter de Jonge, PhD; Aimee Nasser Karam, PhD; Elie G. Karam, MD; Norito Kawakami, MD, DMSc; Ronald C. Kessler, PhD; Andrzej Kiejna, MD, PhD; Viviane Kovess-Masfety, MD, PhD; Sing Lee, MB, BS; Jean-Pierre Lepine, MD; John McGrath, MD, PhD; Maria Elena Medina-Mora, PhD; Zeina Mneimneh, PhD; Jacek Moskalewicz, PhD; Fernando Navarro-Mateu, MD, PhD; Marina Piazza, MPH, ScD; Jose Posada-Villa, MD; Kate M. Scott, PhD; Tim Slade, PhD; Juan Carlos Stagnaro, MD, PhD; Dan J. Stein, FRCPC, PhD; Margreet ten Have, PhD; Yolanda Torres, MPH, Dra.HC; Maria Carmen Viana, MD, PhD; Daniel V. Vigo, MD, DrPH; Harvey Whiteford, MBBS, PhD; David R. Williams, MPH, PhD; and Bogdan Wojtyniak, ScD.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.drugalcdep.2022.109574.

References

American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental Disorders, Fifth edition. American Psychiatric Association, Washington, DC.

Asselmann, E., Wittchen, H.U., Lieb, R., Perkonigg, A., Beesdo-Baum, K., 2018. Incident mental disorders in the aftermath of traumatic events: a prospective-longitudinal community study. J. Affect Disord. 227, 82–89. https://doi.org/10.1016/j.jad.2017.10.004.

Attanayake, V., McKay, R., Joffres, M., Singh, S., Burkle Jr., F., Mills, E., 2009. Prevalence of mental disorders among children exposed to war: a systematic review of 7,920 children. Med. Confl. Surviv 25 (1), 4–19. https://doi.org/10.1080/13623690802568913.

Bagwell-Gray, M.E., Messing, J.T., Baldwin-White, A., 2015. Intimate partner sexual violence: a review of terms, definitions, and prevalence. Trauma Violence Abus. 16 (3), 316–335. https://doi.org/10.1177/1524838014557290.

Benjet, C., Bromet, E., Karam, E.G., Kessler, R.C., McLaughlin, K.A., Ruscio, A.M., Koenen, K.C., 2016. The epidemiology of traumatic event exposure worldwide: results from the World Mental Health Survey Consortium. Psychol. Med. (2), 327–343. https://doi.org/10.1017/s0033291715001981.

Blumenthal, H., Blanchard, L., Feldner, M.T., Babson, K.A., Leen-Feldner, E.W., & Dixon, L.J.C.P.R. (2008). Traumatic event exposure, posttraumatic stress, and substance use among youth: A critical review of the empirical literature. *4*(4), 228–254.

Brady, K.T., Back, S.E., 2012. Childhood trauma, posttraumatic stress disorder, and alcohol dependence. Alcohol Res. 34 (4), 408–413.

Breslau, N., 2002. Epidemiologic studies of trauma, posttraumatic stress disorder, and other psychiatric disorders. Can. J. Psychiatry 47 (10), 923–929. https://doi.org/10.1177/070674370204701003.

Breslau, N., Kessler, R.C., Chilcoat, H.D., Schultz, L.R., Davis, G.C., Andreski, P., 1998. Trauma and posttraumatic stress disorder in the community: the 1996 Detroit Area Survey of Trauma. Arch. Gen. Psychiatry 55 (7), 626–632.

Breslau, N., Davis, G.C., Schultz, L.R., 2003. Posttraumatic stress disorder and the incidence of nicotine, alcohol, and other drug disorders in persons who have experienced trauma. Arch. Gen. Psychiatry 60 (3), 289–294. https://doi.org/10.1001/archpsyc.60.3.289.

Callaghan, R.C., Gatley, J.M., Veldhuizen, S., Lev-Ran, S., Mann, R., Asbridge, M., 2013. Alcohol- or drug-use disorders and motor vehicle accident mortality: a retrospective cohort study. Accid. Anal. Prev. 53, 149–155. https://doi.org/10.1016/j.aap.2013.01.008.

Charlson, F., van Ommeren, M., Flaxman, A., Cornett, J., Whiteford, H., Saxena, S., 2019. New WHO prevalence estimates of mental disorders in conflict settings: a systematic review and meta-analysis. Lancet 394 (10194), 240–248. https://doi.org/10.1016/s0140-6736(19)30934-1.

Choenni, V., Hammink, A., van de Mheen, D., 2017. Association between substance use and the perpetration of family violence in industrialized countries: a systematic review. Trauma Violence Abus. 18 (1), 37–50. https://doi.org/10.1177/1524838015589253.

Coore Desai, C., Reece, J.A., Shakespeare-Pellington, S., 2017. The prevention of violence in childhood through parenting programmes: a global review. Psychol. Health Med. 22 (sup1), 166–186. https://doi.org/10.1080/13548506.2016.1271952.

Copeland, W.E., Keeler, G., Angold, A., Costello, E.J., 2007. Traumatic events and posttraumatic stress in childhood. Arch. Gen. Psychiatry 64 (5), 577–584. https://doi.org/10.1001/archpsyc.64.5.577.

Costello, E.J., Erkanli, A., Fairbank, J.A., Angold, A., 2002. The prevalence of potentially traumatic events in childhood and adolescence. J. Trauma Stress 15 (2), 99–112. https://doi.org/10.1023/a:1014851823163.

Degenhardt, L., Bharat, C., Glantz, M.D., Sampson, N.A., Scott, K., Lim, C.C.W., Kessler, R.C., 2019. The epidemiology of drug use disorders cross-nationally: findings from the WHO's World Mental Health Surveys. Int. J. Drug Policy 71, 103–112. https://doi.org/10.1016/j.drugpo.2019.03.002.

Dworkin, E.R., Menon, S.V., Bystrynski, J., Allen, N.E., 2017. Sexual assault victimization and psychopathology: a review and meta-analysis. Clin. Psychol. Rev. 56, 65–81. https://doi.org/10.1016/j.cpr.2017.06.002.

Farrell, M., Martin, N.K., Stockings, E., Borquez, A., Cepeda, J.A., Degenhardt, L., McKetin, R., 2019. Responding to global stimulant use: challenges and opportunities. Lancet 394 (10209), 1652–1667. https://doi.org/10.1016/s0140-6736(19)32230-5.

Geoffrion, S., Goncalves, J., Robichaud, I., Sader, J., Giguère, C., Fortin, M., Guay, S., 2020. Systematic review and meta-analysis on acute stress disorder: rates following different types of traumatic events, 1524838020933844 Trauma Violence Abus.. https://doi.org/10.1177/1524838020933844.

Glantz, M.D., Bharat, C., Degenhardt, L., Sampson, N.A., Scott, K.M., Lim, C.C.W., Kessler, R.C., 2020. The epidemiology of alcohol use disorders cross-nationally: findings from the World Mental Health Surveys. Addict. Behav. 102, 106128 https://doi.org/10.1016/j.addbeh.2019.106128.

Halpern, S.C., Schuch, F.B., Scherer, J.N., Sordi, A.O., Pachado, M., Dalbosco, C.,. Von Diemen, L. (2018). Child Maltreatment and Illicit Substance Abuse: A Systematic Review and Meta-Analysis of Longitudinal Studies. *27*(5), 344–360. doi:⟨https://doi.org/10.1002/car.2534⟩.

Haro, J.M., Arbabzadeh-Bouchez, S., Brugha, T.S., De Girolamo, G., Guyer, M.E., Jin, R., Vilagut, G., 2006. Concordance of the Composite International Diagnostic Interview Version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO World Mental Health surveys. Int. J. Methods Psychiatr. Res. 15 (4), 167–180.

Hart, H., Rubia, K., 2012. Neuroimaging of child abuse: a critical review. Front Hum. Neurosci. 6, 52. https://doi.org/10.3389/fnhum.2012.00052.

Hawkins, J.D., Catalano, R.F., Miller, J.Y., 1992. Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: implications for substance abuse prevention. Psychol. Bull. 112 (1), 64–105. https://doi.org/10.1037/0033-2909.112.1.64.

Heeringa, S., Wells, J., Hubbard, F., Mneimneh, Z., Chiu, W., Sampson, N., Berglund, P., 2008. Sample designs and sampling procedures. WHO World Ment. Health Surv.: Glob. Perspect. Epidemiol. Ment. Disord. 14–32.

Herrenkohl, T.I., Sousa, C., Tajima, E.A., Herrenkohl, R.C., Moylan, C.A., 2008. Intersection of child abuse and children's exposure to domestic violence. Trauma Violence Abus. 9 (2), 84–99. https://doi.org/10.1177/1524838008314797.

Kessler, R., Heeringa, S., Pennell, B.-E., Zaslavsky, A.M., 2018a. Chapter 2: methods of the world mental health surveys. In: Bromet, E., Karam, E., Koenen, K.C., Stein, D. (Eds.), Trauma and Postraumatic Stress Disorder: Global Perspectives from the WHO World Mental Health Surveys. Cambridge University Press, Cambridge, pp. 13–42.

Kessler, R.C., Ustun, T., 2008. The WHO Mental Health Surveys. Glob. Perspect. Epidemiol. Ment. Disord.

Kessler, R.C., Üstün, T.B., 2004. The World Mental Health (WMH) Survey Initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). Int. J. Methods Psychiatr. Res. 13 (2), 93–121. https://doi.org/10.1002/mpr.168.

Kessler, R.C., Rose, S., Koenen, K.C., Karam, E.G., Stang, P.E., Stein, D.J., McLaughlin, K.A., 2014. How well can post-traumatic stress disorder be predicted from pre-trauma risk factors? An exploratory study in the WHO World Mental Health Surveys. World Psychiatry 13 (3), 265–274.

Kessler, R.C., Aguilar-Gaxiola, S., Alonso, J., Benjet, C., Bromet, E.J., Cardoso, G., Koenen, K.C., 2017. Trauma and PTSD in the WHO World Mental Health Surveys. Eur. J. Psychotraumatol. 8 (Sup. 5), 1353383 https://doi.org/10.1080/20008198.2017.1353383.

Kessler, R.C., Aguilar-Gaxiola, S., Alonso, J., Bromet, E.J., Gureje, O., Karam, E.G., Zaslavsky, A.M., 2018b. The associations of earlier trauma exposures and history of mental disorders with PTSD after subsequent traumas. Mol. Psychiatry 23 (9), 1892–1899. https://doi.org/10.1038/mp.2017.194.

Khantzian, E.J., 1997. The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. Harv. Rev. Psychiatry 4 (5), 231–244.

Lander, L., Howsare, J., Byrne, M., 2013. The impact of substance use disorders on families and children: from theory to practice. Soc. Work Public Health 28 (3–4), 194–205. https://doi.org/10.1080/19371918.2013.759005.

Langdon, K.J., Rubin, A., Brief, D.J., Enggasser, J.L., Roy, M., Solhan, M.,. Keane, T.M. (2017). Sexual Traumatic Event Exposure, Posttraumatic Stress Symptomatology, and Alcohol Misuse Among Women: A Critical Review of the Empirical Literature. *24*(1), 5–22. doi:⟨https://doi.org/10.1111/cpsp.12167⟩.

Lee, D., & Young, K.J.I.R. o P. (2001). Post-traumatic stress disorder: Diagnostic issues and epidemiology in adult survivors of traumatic events. *13*(3), 150–158.

Levey, E.J., Gelaye, B., Bain, P., Rondon, M.B., Borba, C.P., Henderson, D.C., Williams, M.A., 2017. A systematic review of randomized controlled trials of interventions designed to decrease child abuse in high-risk families. Child Abus. Negl. 65, 48–57. https://doi.org/10.1016/j.chiabu.2017.01.004.

Maniglio, R., 2010. Child sexual abuse in the etiology of depression: a systematic review of reviews. Depress Anxiety 27 (7), 631–642. https://doi.org/10.1002/da.20687.

María-Ríos, C.E., Morrow, J.D., 2020. Mechanisms of shared vulnerability to post-traumatic stress disorder and substance use disorders. Front. Behav. Neurosci. 14, 6.

Martin, J.L., Gadegbeku, B., Wu, D., Viallon, V., Laumon, B., 2017. Cannabis, alcohol and fatal road accidents. PLoS One 12 (11), e0187320. https://doi.org/10.1371/journal.pone.0187320.

McGrath, J.J., Saha, S., Lim, C.C.W., Aguilar-Gaxiola, S., Alonso, J., Andrade, L.H., Kessler, R.C., 2017. Trauma and psychotic experiences: transnational data from the World Mental Health Survey. Br. J. Psychiatry 211 (6), 373–380. https://doi.org/10.1192/bjp.bp.117.205955.

Meyers, J.L., Sartor, C.E., Werner, K.B., Koenen, K.C., Grant, B.F., Hasin, D., 2018. Childhood interpersonal violence and adult alcohol, cannabis, and tobacco use disorders: variation by race/ethnicity? Psychol. Med. 48 (9), 1540–1550.

Mills, K.L., Teesson, M., Ross, J., Peters, L., 2006. Trauma, PTSD, and substance use disorders: findings from the Australian National Survey of Mental Health and Well-Being. Am. J. Psychiatry 163 (4), 652–658. https://doi.org/10.1176/appi.ajp.163.4.652.

Mohler, P., Dorer, B., de Jong, J., Hu, M., 2016. Translation: overview. Guidelines for Best Practice in Cross-Cultural Surveys. Ann Arbor, MI: Survey Research Center. Institute for Social Research, University of Michigan.

Najavits, L.M., Hyman, S.M., Ruglass, L.M., Hien, D.A., Read, J.P., 2017. Substance use disorder and trauma. American Psychological Association.

Nichter, B., Hill, M., Norman, S., Haller, M., Pietrzak, R.H., 2020. Impact of specific combat experiences on suicidal ideation and suicide attempt in U.S. military veterans: results from the National Health and Resilience in Veterans Study. J. Psychiatr. Res 130, 231–239. https://doi.org/10.1016/j.jpsychires.2020.07.041.

Ogle, C.M., Rubin, D.C., Siegler, I.C., 2014. Cumulative exposure to traumatic events in older adults. Aging Ment. Health 18 (3), 316–325. https://doi.org/10.1080/13607863.2013.832730.

Reed, P.L., Anthony, J.C., Breslau, N., 2007. Incidence of drug problems in young adults exposed to trauma and posttraumatic stress disorder: do early life experiences and predispositions matter? Arch. Gen. Psychiatry 64 (12), 1435–1442. https://doi.org/10.1001/archpsyc.64.12.1435.

Roberts, N.P., Roberts, P.A., Jones, N., Bisson, J.I., 2016. Psychological therapies for post-traumatic stress disorder and comorbid substance use disorder. Cochrane Database Syst. Rev. (4) https://doi.org/10.1002/14651858.CD010204.pub2.

Rogers, C.J., Forster, M., Grigsby, T.J., Albers, L., Morales, C., Unger, J.B., 2021. The impact of childhood trauma on substance use trajectories from adolescence to adulthood: findings from a longitudinal Hispanic cohort study. Child Abus. Negl. 120, 105200 https://doi.org/10.1016/j.chiabu.2021.105200.

Ruback, R.B., Clark, V.A., Warner, C., 2014. Why are crime victims at risk of being victimized again? Substance use, depression, and offending as mediators of the victimization-revictimization link. J. Inter. Violence 29 (1), 157–185. https://doi.org/10.1177/0886260513504626.

Santiago, P.N., Ursano, R.J., Gray, C.L., Pynoos, R.S., Spiegel, D., Lewis-Fernandez, R., Fullerton, C.S., 2013. A systematic review of PTSD prevalence and trajectories in DSM-5 defined trauma exposed populations: intentional and non-intentional traumatic events. PLoS One 8 (4), e59236. https://doi.org/10.1371/journal.pone.0059236.

SAS Institute Inc., 2022.

Sordi, A.O., Hauck, S., Laitano, H.V., Halpern, S.C., Schuch, S.B., Kessler, F.H.P.,. drug dependence. vol. 3, n., 3: 227, 6 p. (2015). Childhood trauma and resilience: Vulnerabilities to develop crack/cocaine dependence.

Turner, R.J., Lloyd, D.A., 1995. Lifetime traumas and mental health: the significance of cumulative adversity. J. Health Soc. Behav. 36 (4), 360–376.