

# Traumatic events and suicide-related outcomes among Mexico City adolescents

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**Background:** We report the prevalence and associations between traumatic events and suicidal ideation, suicide plans and suicide attempts among Mexican adolescents. **Methods:** The data are from a representative multistage probability household survey of 3,005 adolescents aged 12 to 17 years residing in the Mexico City Metropolitan Area that was carried out in 2005. We used discrete time survival analyses to model the net impact of retrospectively reported prior occurrence of traumatic events on ideation, plans and attempts, taking into account the onset of psychiatric disorders. **Results:** Prevalence of suicidality was high among respondents with traumatic events, ranging from a 43% prevalence of suicidal ideation among those with a history of 'Being raped' to a 25% prevalence of suicide attempts among those that reported 'Purposely injured, tortured or killed someone.' In cross-sectional estimates, any traumatic event was associated with an increase of 3.2 times the odds of suicide ideation, 5.1 times the odds of a plan and 6.6 times the odds of an attempt. Number of events was also associated with increasing suicidality such that those with three or more events were 13.7 times more likely to report a suicide attempt than those with none. Multivariate discrete time survival models that took into account a large number of demographic, suicide-related and psychiatric disorder variables reduced in strength but did not alter these basic relationships. **Conclusions:** We conclude that traumatic events such as rape and sexual assault have a profound impact upon suicidality and that this relationship is not entirely explained by the onset of psychiatric disorders. Comprehensive interventions for adolescent victims of traumatic events, especially those with a history of cumulative events, should include, but not be restricted to, treatment of any associated psychiatric disorder. **Keywords:** Suicide, risk factors, epidemiology, survey, adolescence, trauma, Mexico. **Abbreviations:** SROs: suicide-related outcomes; MAMHS: Mexican Adolescent Mental Health Survey; WMH-CIDI-A: World Mental Health computer assisted adolescent version of the Composite International Diagnostic Interview; PTSD: Posttraumatic Stress Disorder; ORs: odd-ratios.

Traumatic events, ranging from unavoidable life-course situations (such as the death of a loved one) to violent and life-endangering events (such as an assault or rape) are common phenomena among adults and adolescents in Mexico (Medina-Mora et al., 2005; Orozco-Zavala, Borges, Benjet, Medina-Mora, & López-Carrilo, under review) and elsewhere (Dube et al., 2001; Enns et al., 2006; Kessler, Davis, & Kendler, 1997; World Health Organization [WHO], 2002). These events cause profound distress and may lead to psychiatric disorders (Karam et al., 2006; Molnar, Buka, & Kessler, 2001b; Sparato, Mullen, Burgess, Wells, & Moss, 2004), particularly post-traumatic stress disorder (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Perkonig, Kessler, Storz, & Wittchen, 2000) and depression (Frank et al., 1996). Traumatic events during childhood and adolescent years, especially child abuse and neglect, have also been linked to completed suicide and suicide ideation and attempts among late-adolescents (Beautrais, Joyce, & Mulder, 1996; Dube et al., 2001; Fergusson, Woodward, & Horwood, 2000;

Gould et al., 1998; Johnson et al., 2002; Salzinger, Rosario, Feldman, & Ng-Mak, 2007) and adults (Enns et al., 2006; Molnar, Berkman, & Buka, 2001a). Prior research on the link between traumatic events and suicide usually has focused on a limited number of traumatic events, mainly childhood physical and sexual abuse, and has been limited to selected samples of patients, youths attending school, and adults interviewed retrospectively about childhood events (e.g., Beautrais et al., 1996; Har-kavy-Friedman, Nelson, Venarde, & Mann, 2004; Flannery, Singer, & Wester, 2001; Molnar et al., 2001a).

The study of the relationship between traumatic events and suicidality or suicide-related outcomes (SROs—i.e., suicidal ideation, suicide plan, and suicide attempt) (Silverman, Berman, Sanddal, O'Carroll, & Joiner, 2007b) is of particular interest in the Mexican adolescent population for multiple reasons. First, there has been a large increase in suicide deaths in Mexican youth in the past two decades. In fact, Mexico's increase was one of the greatest among 28 countries recently examined (Bridge, Goldstein, & Brent, 2006). Second, Mexican

Conflict of interest statement: No conflicts declared.

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Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA

adolescents experience exposure to many traumatic events at an early age (Medina-Mora et al., 2005). Moreover, by residing in such a large metropolis, they are exposed to economic hardship, increased drug trafficking, population density, fewer regulations and less enforcement of regulations with regards to traffic and other safety issues than developed regions of the world. These exposures might be expected to lead to a greater exposure to traumatic events. However, because little epidemiological data are available on adolescents from varying regions of the world, especially in low and middle income countries, we do not know if Mexican youth are more or equally exposed to traumatic events as compared to adolescents from other regions.

Prior studies have included only a limited number of suicide-related outcomes and psychiatric disorders when attempting to study the net impact of traumatic events on SROs. Moreover, in some cases, analyses of the data are based on cross-sectional associations without taking into account the time sequence of ages of occurrence of traumatic events, onset of psychiatric disorders and suicidality. Most importantly, although many severe forms of traumatic events are more likely to occur during the childhood and adolescent years (Breslau, Wilcox, Storr, Lucia, & Anthony, 2004), most prior studies have focused on SROs measured during adulthood and not on the short-term impact of these events during adolescence.

Beyond examining the relationship between traumatic events and SROs, an important next step for the field is to begin to understand how and why these constructs might be related. One somewhat obvious possibility is that this relationship is explained by the presence of psychiatric disorders. Traumatic events have been shown to increase the probability of psychiatric disorders (Kaplow, Dodge, Amaya-Jackson, & Saxe, 2005), and psychiatric disorders increase the probability of suicidality (Borges et al., 2006a; Kessler, Borges, & Walters, 1999; Nock & Kessler, 2006); thus the relationship between traumatic events and suicidality may be a function of these relationships. An important first step in understanding how and why traumatic events and suicidality are related is to understand the extent to which this relationship remains after taking into account the presence and accumulation of psychiatric disorders and other known risk factors (Salzinger et al., 2007). If a relationship exists after accounting for psychiatric disorders, a next step is to begin to understand what more specific factors might play a role in this relationship.

The purpose of this study was to address many of these prior limitations and to examine the relationship between a wide range of traumatic events and the subsequent occurrence of suicide ideation, plans, and attempts among a large, representative sample of adolescents in Mexico. In tandem with current nomenclature (Silverman, Berman, Sanddal,

O'Carroll, & Joiner, 2007a), in this paper *suicide ideation* refers to thinking of killing oneself, while *suicide plan* refers to instances in which one takes the additional step of formulating the method and program of action through which one expects to carry out the attempt. *Suicide attempts* are self-destructive behaviors not leading to death. Together, the three behaviors are referred to as *suicide-related outcomes* (SROs). Beyond examining the simple relationships between traumatic events and SROs, we tested whether the relationship differed based on numbers of traumatic events, types of suicidality, and whether the relationship remained after controlling for the presence of psychiatric disorders. These efforts will begin to illuminate the mechanisms through which traumatic events may increase adolescent suicidality.

## Methods

### Participants

The data for this study are from a representative multistage probability household survey carried out in 2005, designed to be representative of the 1,834,661 adolescents aged 12 to 17 that were permanent residents of private housing units in the Mexico City Metropolitan Area, the Mexican Adolescent Mental Health Survey (MAMHS). The final sample included 3,005 adolescents. In all strata, the primary sampling units were census count areas—or groups of them, similar to US census tracts, cartographically defined and updated by the Instituto Nacional de Estadística, Geografía e Informática (INEGI) in 2000 (INEGI, 2000). Secondary sampling units were city blocks (or groups of them) selected with probability proportional to size. All households within these city block units with adolescents were selected. One eligible member from each of these households was randomly selected using the Kish method of random number charts (Kish, 1965). The response rate of eligible respondents was 71%.

### Procedures

Fieldwork, which involved face-to-face interviews in the homes of the selected participants, was carried out from March through August of 2005. An oral and written explanation of the study was given to both parents and adolescents. Interviews were administered only to those participants for whom both a signed informed consent form from a parent and/or legal guardian and an assent form from the adolescent were obtained. All study participants were left a mental health resources card with contact information for different institutions where they could seek services should they wish to do so. The Human Subjects Committee of the National Institute of Psychiatry approved the recruitment, consent form and field procedures. The mean interview duration was 150 minutes.

Lay interviewers were extensively trained in field procedures, use of the diagnostic instrument and interview techniques with an initial week-long training by WHO-certified trainers who are also members of the

research team, followed by two days of in-field training. Additional booster sessions were held throughout the fieldwork in order to maintain quality throughout. A number of actions were taken for quality assurance, such as extensive interviewer training, creation of detailed field manuals, and continuous feedback and independent supervision of field managers, supervisors and interviewers. Finally, quality control programs designed for the World Mental Health Survey Initiative (<http://www.hcp.med.harvard.edu/wmh/>) were used to identify possible errors regarding the timing of events (onset and recency, age consistency), as well as possible missing patterns, and to introduce corrected values when possible.

### Measures

Suicidal outcomes and potential risk factors were assessed in the Mexican Adolescent Mental Health Survey using the World Mental Health computer assisted adolescent version of the Composite International Diagnostic Interview (WMH-CIDI-A) (Kessler & Üstün, 2004). The translation of the adolescent instrument was done according to the translation and back-translation recommendations of the World Health Organization. The WMH-CIDI-A is a downward extension of the adult version WMH-CIDI 3.0 used in the Mexico National Comorbidity Survey (Medina-Mora et al., 2005); the adult version has been validated in diverse countries and cultures (Haro et al., 2006) and reappraisal studies of the adolescent version are under way both in the US and in Mexico. The fieldwork was conducted by Berumen and Associates, an established survey research firm in Mexico that employed a group of interviewers who had received training in the CIDI according to the WHO protocol stipulated for participating WMH countries.

*Measures of suicide-related outcomes.* The WMH-CIDI-A contains a module that assesses several different suicidal outcomes consistent with prior recommendations and definitions (O'Carroll, Berman, Maris, & Moscicki, 1996), such as: suicide ideation ('Have you ever seriously thought about committing suicide?'), suicide plans ('Have you ever made a plan for committing suicide?'), and suicide attempts ('Have you ever attempted suicide?'). Based on evidence that potentially embarrassing behaviors are more highly reported in self-administered than interviewer-administered surveys (Turner et al., 1998), these experiences were listed in a self-administered booklet and labeled by letter (event A, suicide ideation; event B, suicide plan; event C, suicide attempt). The interviewer asked the participant to read each statement, and asked whether each experience ever happened to them by referring to the corresponding letter. If they responded affirmatively, the age of onset ('How old were you the first time you had this experience') and recency of the experience ('How old were you the last time you had this experience?') were also assessed.

*Assessment of traumatic events.* The WMH-CIDI-A measures 21 different lifetime traumatic events (such as rape, violence, serious injuries, domestic violence or serious illness), and their ages of occurrence with

questions such as: 'Were you ever involved in a very serious or life-threatening car accident?' For a comprehensive list of the traumatic events measured and their definitions please refer to the appendix. After the list of 21 events was assessed, the respondent was asked if there was any 'other event' that he or she suffered that had not been asked about in the prior list or which did not fit in any of the former categories. In this case, respondents were asked to give details about the event and this was recorded verbatim. In the analyses for this paper, we were able to read these answers and, whenever possible, to reclassify the answer to one of the categories that we created. Finally, the respondent was also able to select a 'Private Event' category, which was reserved for traumas for which the respondent did not feel comfortable providing details or disclosing the nature of the trauma. As multiple trauma in the Mexican population is common (Medina-Mora et al., 2005) and has been related to increasing levels of suicidality (Dube et al., 2001), we also report on the percentages of the population with none, exactly one, exactly two and three or more traumas. Due to sample size and similarity between some traumas, an *ad-hoc* grouping of traumatic events was made for some analyses based on the origin or type of trauma. For example, adolescents who reported being raped or sexually assaulted formed a single group based on the origin (sexual) of the trauma situation. Other groupings are also possible, such as 'natural' vs. 'manmade', but this would lead to an unnecessarily broad categorization.

*Covariates.* Interviews also assessed three sets of risk factors for suicide-related outcomes: socio-demographic factors, characteristics of suicidality, and prior DSM-IV mental disorders (Borges, Medina-Mora, Zambrano, & Garrido, 2006b; Borges et al., in press). For this report, these variables were used only as control variables for the hypothesized association between traumatic events and SROs. The socio-demographic factors included sex, age/cohort, education, current school attendance, employment history, marital history, ever having a child, and parental education. Characteristics of suicidality included: age at onset of ideation, time since onset of ideation, presence of a suicide plan among those who made attempts, and time since the onset of a plan. Respondent psychiatric disorders were assessed by the WMH-CIDI-A according to DSM-IV criteria for mood (major depressive disorder, dysthymia, and bipolar disorder), anxiety (panic disorder, agoraphobia without panic disorder, specific phobia, social phobia, generalized anxiety disorder, post-traumatic stress disorder, and separation anxiety disorder), impulse-control (oppositional-defiant disorder, conduct disorder, and attention deficit/hyperactivity disorder), and substance use (alcohol abuse, drug abuse, alcohol abuse with dependence, and drug abuse with dependence) disorders. A time-varying variable for any lifetime disorder was created to distinguish the year of the onset of a disorder (coded 1) from years prior to the onset of the disorder (coded 0). This variable was introduced as a control variable for any psychiatric or substance disorder in multivariate models. To obtain retrospective ages of onset, a question was first asked to obtain the exact age of onset of the disorder. If respondents were unable to report the exact age, a series of suggested probes were

used to clarify responses using anchoring events or stages such as grade in school.

### Statistical analysis

Cross-tabulations were used to estimate the lifetime prevalence of suicide ideation, plans, and attempts among those with different traumatic events. Crude logistic regression (Hosmer & Lemeshow, 2000) on cross-sectional data was used to assess the association between lifetime trauma and lifetime SROs. Multivariate discrete-time survival analysis with time-varying covariates (Efron, 1988) was used to study the associations between prior negative events and subsequent suicidality, while adjusting for socio-demographic variables and lifetime DSM-IV disorders. A discrete-time approach was used instead of the more traditional continuous-time approach because the MAMHS recorded the time to event at yearly intervals rather than on a continuous time scale and because the discrete-time approach facilitates the use of the many different time-dependent covariates included in our analyses (Willett & Singer, 1993). The use of survival analyses relied on retrospective age-at-onset reports to establish a temporal order between the predictors and the outcomes. This was done by treating the person-year as the unit of analysis and creating separate observational records for each year of a person's life up to and including the year at first onset of the SRO being modeled. A dichotomous variable was created to distinguish the year of the outcome (coded 1) from years prior to the outcome (coded 0). These data files were analyzed using logistic regression models that included a dummy variable control for each person-year at risk for the outcome. For every traumatic event, each of the three outcomes was assessed for the total sample. We also ran nested models for predicting suicide plans and attempts among ideators, and predicting attempts among those who made a plan and among those who did not make a plan. This approach has been used in other analyses of suicidality by our team since 1999 (Kessler et al., 1999; Borges et al., 2000).

In order to compare the odds of SROs associated with particular events we took advantage of the large number of person years to do sub-sample analyses. Three scenarios were considered. For those who had no events, person years at risk for each SRO were included from age 1 to age at interview. For those who had one and only one event, person years at risk for each SRO were included from age 1 until occurrence of the first traumatic event. Finally, for those with more than one event, we included person years continuing until occurrence of the second traumatic event. By modeling time to each traumatic event, we were able to calculate odds ratios for each and compare them to each other to assess their relative magnitude.

Survival coefficients were converted to odd-ratios (ORs) for ease of interpretation. Standard errors (SE) and significance tests were estimated using the Taylor series method (Wolter, 1985) with SUDAAN software (Research Triangle Institute, 2002) to adjust for the weighting and clustering of the data. The 95% confidence intervals (CIs) of the ORs are also reported and were adjusted for design effects on stratification and clustering, and unequal weighting of the observations.

Multivariate significance was evaluated using Wald  $\chi^2$  tests based on design-corrected coefficient variance-covariance matrices. Because of the multiple comparisons included in this report for each dependent variable, we emphasize findings with  $p < .01$  using two-tailed tests to help to avoid findings of false significance (Type I errors).

## Results

Details about this sample are presented elsewhere (Benjet et al., 2007). Briefly, after weighting, the sample was 50.1% females, 50.7% between 15 and 17 years of age, 81.2% were currently attending school, and 63.3% came from families where their parents had a junior high education or less. Suicide ideation was reported by 11.5% of the sample, 3.9% reported a plan and 4.3% reported an attempt, as defined above (see also Borges et al., 2008, forthcoming). Traumatic events were common, with 69% of respondents reporting at least one traumatic event in their lifetime. The most common traumatic event was the 'unexpected sudden death of a relative' (25.8%) and the least common was being 'kidnapped' (.4%).

### Relations between traumatic events and suicide-related outcomes

The lifetime prevalence of SROs varied largely depending on the type of traumatic event. As reported in Table 1, the highest prevalence of suicide ideation (43%) was found among those who reported rape; the highest prevalence of making a suicide plan (25%) and of making a suicide attempt (25%) was among those who reported killing, torturing or injuring somebody else. The majority of respondents who experienced one traumatic event also experienced other traumatic events. The exceptions to this observation were those few who experienced a single event, ranging from 5.7% of those who were raped, to 28.5% of those who had an unexpected death of a loved one. There was an increased prevalence of suicide ideation, plans and attempts with increased number of traumatic events. Among adolescents without any traumatic event, only 4.7% reported ideation and less than 1% reported a plan or a suicide attempt.

### Associations of traumatic events with SROs

Cross-sectional associations adjusted for sex and age between grouped traumatic events, number of events and SROs, and transitions between ideation and plans and attempts are presented in Table 2. For the total sample, with few exceptions, every group of traumatic events was positively associated with SROs. Any traumatic event was associated with an increase in suicide ideation, plans and attempts. Number of events was also associated with SROs such that those with three or more events were 13.7

**Table 1** Lifetime prevalence of suicide ideation, plan and attempt among adolescents ages 12–17 with traumatic events: Mexico City, 2005 ( $n = 3,005$ )\*

	<i>n</i>	%	% as single event type	Ideation		Plan		Attempt	
				<i>n</i>	% (SE)	<i>n</i>	% (SE)	<i>n</i>	% (SE)
<b>Life event</b>									
Raped	41	1.30	5.72	16	43.20 (9.26)	5	13.72 (6.03)	7	21.49 (7.51)
Sexually assaulted	131	4.69	12.41	49	36.87 (5.48)	22	16.85 (4.06)	25	20.11 (4.65)
Beaten up by caregiver	383	13.23	13.74	104	27.18 (2.53)	40	10.22 (2.01)	45	11.74 (2.18)
In region of terror	20	.74	8.72	2	9.88 (6.81)	2	9.88 (6.81)	1	6.24 (5.99)
Kidnapped	11	.36	.00	3	32.68 (11.37)	1	11.24 (11.01)	0	.00 (.00)
Toxic exposure/Automobile/Life-threatening accident	566	19.43	17.22	108	18.52 (1.65)	47	8.61 (1.39)	42	7.82 (1.06)
Disaster	89	3.08	11.53	7	9.98 (2.92)	4	5.53 (1.61)	3	5.27 (4.04)
Life threatening illness	199	6.90	12.48	36	20.22 (2.38)	15	7.72 (1.89)	19	10.36 (1.58)
Beaten up, by romantic partner or someone else	180	6.41	9.01	48	25.19 (2.88)	21	10.89 (2.61)	20	10.53 (2.61)
Mugged or threatened with a weapon	436	16.18	18.31	75	17.50 (1.89)	34	8.36 (1.52)	33	8.11 (1.46)
Stalked	208	7.10	10.11	60	30.19 (3.29)	26	14.56 (2.52)	32	17.18 (2.78)
Unexpected death of a loved one	759	25.80	28.48	118	15.27 (1.06)	46	6.10 (.76)	50	6.84 (.87)
Traumatic event of a loved one	220	7.70	14.33	44	18.03 (2.57)	17	7.12 (1.63)	15	6.11 (1.44)
Witnessed physical fights at home	576	19.42	20.36	129	22.05 (1.97)	51	8.81 (1.47)	53	9.54 (1.71)
Witnessed death or dead body or saw someone else seriously hurt	493	17.33	15.10	80	15.75 (1.31)	32	6.00 (1.03)	34	6.28 (1.05)
Accidentally caused serious injury or death	52	2.03	8.14	12	21.52 (6.21)	4	8.30 (3.75)	4	7.65 (3.74)
Purposely injured, tortured or killed someone	21	.70	8.71	7	33.25 (10.30)	5	24.48 (10.14)	5	24.48 (10.14)
Other/Private event	193	6.59	16.57	58	30.26 (3.00)	19	9.65 (2.72)	27	14.19 (3.25)
<b>Number of event types</b>									
None	983	31.08		45	4.72 (.80)	9	.93 (.30)	8	.83 (.35)
One	846	27.70		66	8.06 (.84)	21	2.54 (.51)	19	2.12 (.37)
Two	527	18.40		68	12.77 (1.28)	19	3.76 (.88)	23	4.76 (1.01)
Three or more	649	22.81		160	23.80 (1.53)	64	9.76 (1.32)	71	11.12 (1.52)

\*Refer to the annex for a full list of events and events questions. *n*'s are unweighted.

times more likely to report a suicide attempt than those with none. Among suicide ideators, having any event increased the likelihood of a transition to a plan and an attempt. Ideators with three or more events were especially more likely to make a transition to a suicide plan and attempt. Among ideators, being 'threatened with a weapon/stalked' was associated with increased odds of making a plan, and an attempt, with or without a plan.

### *Is the relation between traumatic events and SROs explained by the presence of psychiatric disorders*

In Table 3 we present the results of discrete time survival analyses estimating the associations between traumatic events and subsequent SROs, adjusted for demographics, suicide-related variables and the presence of any DSM-IV lifetime psychiatric disorders. Most traumatic events were positively associated with suicide ideation, plans and attempts in the discrete time survival models, although with reduced strength compared with the cross-sectional logistic models that only controlled for sex and age. Those with more events showed larger odds ratios in the total sample compared to those with none. Among ideators, the transition to a suicide plan was greatest for those reporting having been 'In region of terror/Disaster;' the transition to a suicide attempt

was elevated for several events, but only statistically significant for 'Beaten up by romantic partner or someone else/Mugged or threatened with a weapon/Stalked'. Number of events was not consistently associated with any of these transitions. In additional analyses (data not presented in tabular format) we explored for possible interactions between traumatic events and sex (56 possible interactions) and traumatic events and age groups (56 possible interactions). In more than one hundred interactions, we found three statistically significant interactions for sex and trauma and five for age and trauma, without clear tendencies for a particular trauma or a particular SRO.

We show in Figure 1 the survival curves for the relationship between number of events and onset of suicide attempts. Those with three or more traumatic events start to differentiate from all other groups early in life, and after age 11 have an accelerated survival curve.

### *Types of traumatic events*

In Table 4 we present results of an analysis on a subsample of respondents who reported either one (and only one) event or no events. We compared the magnitude of associations between specific types of events and SROs, taking into account all demo-

**Table 2** Association of traumatic events to lifetime suicide ideation, plan and attempt: Mexico City adolescents ages 12–17, 2005 (n = 3,005)

	Total sample (n = 3,005)						Ideators (n = 339)							
	Ideation		Plan		Attempt		Plan		Attempt		w/o a lifetime plan (n = 226)		Attempt among ideators	
	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%
Traumatic life event														
Raped/Sexually assaulted	4.0**	(2.5–6.6)	3.8**	(2.3–6.4)	4.6**	(2.7–7.6)	1.4	(.7–2.7)	1.8	(.9–3.5)	1.8	(.7–4.3)	1.7	(.6–4.7)
Beaten up by caregiver/Witnessed physical fights at home	3.2**	(2.5–4.1)	3.2**	(2.2–4.6)	3.5**	(2.5–5.0)	1.2	(.8–1.7)	1.3	(.8–2.3)	1.5	(.7–3.2)	1.2	(.5–2.8)
In region of terror/Disaster	.9	(.5–1.7)	2.0*	(1.0–4.0)	1.6	(.4–6.1)	3.6**	(1.5–8.5)	2.4	(.3–19.9)	3.6	(.4–37.6)	.8	(.1–8.9)
Toxic exposure/Automobile/Life-threatening accident/Life-threatening illness	2.3**	(1.8–3.1)	3.5**	(2.1–5.7)	3.2**	(2.5–4.2)	2.0**	(1.2–3.4)	1.9**	(1.3–2.8)	1.6	(.7–3.8)	1.4	(.6–3.3)
Beaten up, by romantic partner or someone else/Mugged or threatened with a weapon/Stalked	2.8**	(2.1–3.7)	3.8**	(2.6–5.4)	4.7**	(3.2–6.8)	1.9*	(1.0–3.7)	2.9**	(1.7–5.0)	2.1*	(1.2–3.9)	4.6*	(1.2–17.6)
Unexpected death of a loved one/Traumatic event of a loved one	1.6**	(1.2–2.0)	2.0**	(1.4–2.9)	2.1**	(1.4–3.1)	1.5	(1.0–2.4)	1.6	(1.0–2.7)	1.4	(.8–2.6)	1.4	(.6–3.3)
Witnessed death or dead body or saw someone else seriously hurt/Accidentally caused serious injury or death/Purposely injured, tortured or killed someone	1.7**	(1.4–2.0)	1.8*	(1.1–2.8)	1.9**	(1.3–2.8)	1.2	(.6–2.1)	1.3	(.7–2.3)	2.0*	(1.1–3.8)	.6	(.2–1.9)
Other/Private event														
Any event	3.2**	(2.4–4.3)	2.2*	(1.1–4.3)	3.5**	(1.9–6.3)	.7	(.4–1.5)	1.4	(.6–3.2)	2.3	(1.0–5.2)	1.4	(.4–5.3)
None	3.2**	(2.1–4.7)	5.1**	(2.6–10.0)	6.6**	(2.8–15.7)	2.1*	(1.2–3.7)	3.1*	(1.3–7.2)	2.2	(.6–7.9)	4.5	(.8–25.3)
One	1.0	–	1.0	–	1.0	–	1.0	–	1.0	–	1.0	–	1.0	–
Two	1.6*	(1.1–2.5)	2.5*	(1.2–5.3)	2.4*	(1.0–5.5)	1.8	(.8–4.1)	1.6	(.7–3.8)	1.0	(.2–4.6)	2.2	(.3–14.5)
Three or more	2.8**	(1.9–4.3)	3.8**	(1.7–8.2)	5.6**	(1.9–16.5)	1.7	(.8–3.5)	2.9	(.8–9.8)	1.5	(.3–9.0)	15.0*	(1.2–195.2)
	5.9**	(3.7–9.4)	10.0**	(5.1–19.7)	13.7**	(5.9–31.9)	2.6**	(1.5–4.6)	4.2**	(1.9–9.2)	3.5*	(1.0–11.6)	5.0	(.9–26.4)

\* OR significant at the .05 level, 2-sided test.

\*\* OR significant at the .01 level, 2-sided test.

Results are based on logistic regression models adjusted for age and sex.

**Table 3** Impact of prior traumatic events as risk factors for first onset of suicide ideation, plan and attempt: Mexico City adolescents ages 12-17, 2005 (n = 3,005)

	Total sample (n = 3,005)						Ideators (n = 339)						Attempt among ideators								
	Ideation			Plan			Attempt			Plan			Attempt			w/o a lifetime plan (n = 226)			With a lifetime plan (n = 113)		
	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%	
Traumatic life event																					
Raped/Sexually assaulted	2.3**	(1.5-3.7)	1.6	(.8-3.0)	2.6**	(1.4-4.9)	.9	(.4-1.9)	1.7	(.8-3.4)	1.5	(.4-5.1)	2.5	(.9-6.7)							
Beaten up by caregiver/Witnessed physical fights at home	2.5**	(2.0-3.2)	2.4**	(1.6-3.5)	2.4**	(1.4-4.0)	1.1	(.7-1.6)	1.0	(.5-1.8)	1.0	(.4-2.2)	.8	(.3-1.8)							
In region of terror/Disaster	.5	(.2-1.6)	1.8	(.5-6.5)	1.9	(.4-9.3)	6.0**	(2.6-13.6)	2.9	(.8-10.4)	5.8	(.8-42.1)	.8	(.1-4.3)							
Toxic exposure/Automobile/Life threatening accident/ Life threatening illness	1.8**	(1.3-2.5)	1.9	(1.0-3.8)	2.1**	(1.5-2.9)	1.2	(.7-2.1)	1.1	(.6-2.4)	1.3	(.6-2.8)	1.2	(.3-4.3)							
Beaten up by, romantic partner or someone else/Mugged or threatened with a weapon/Stalked	1.6*	(1.1-2.3)	2.0*	(1.1-3.8)	2.9**	(1.7-4.7)	1.9	(1.0-3.8)	2.8**	(1.5-5.3)	2.3	(.9-5.4)	4.4*	(1.1-17.3)							
Unexpected death of a loved one/Traumatic event of a loved one	1.0	(.8-1.4)	1.1	(.6-2.0)	1.3	(.7-2.3)	1.0	(.5-2.1)	1.2	(.6-2.8)	1.5	(.5-4.9)	.8	(.2-2.6)							
Witnessed death or dead body or saw someone else seriously hurt/ Accidentally caused serious injury or death/ Purposely injured, tortured or killed someone	1.3	(.8-1.9)	.8	(.4-1.6)	1.0	(.6-1.7)	.5	(.2-1.5)	1.0	(.4-2.3)	1.9	(.7-5.2)	.3	(.1-1.4)							
Other/Private event																					
Any event	2.6**	(1.8-3.7)	1.4	(.6-3.3)	2.7**	(1.5-4.7)	.5	(.2-1.3)	2.1	(.9-5.0)	3.0*	(1.0-8.8)	2.2	(.7-6.2)							
None	2.1**	(1.6-2.8)	2.2**	(1.5-3.3)	3.0**	(2.1-4.1)	1.3	(.8-2.0)	1.8*	(1.0-3.1)	1.3	(.6-2.6)	2.0	(.8-4.8)							
One	1.0	-	1.0	-	1.0	-	1.0	-	1.0	-	1.0	-	1.0	-							
Two	1.7**	(1.2-2.3)	2.1*	(1.2-3.7)	2.3**	(1.5-3.7)	1.7	(.8-3.5)	1.7	(.9-3.2)	1.0	(.5-2.0)	2.1	(.7-5.7)							
Three or more	2.4**	(1.8-3.2)	1.2	(.7-2.2)	2.4**	(1.3-4.2)	.5*	(.3-1.0)	1.2	(.5-2.7)	.8	(.3-2.1)	2.2	(.4-12.3)							
	3.4**	(2.3-5.0)	4.3**	(2.6-7.1)	5.4**	(3.1-9.3)	1.8*	(1.0-3.1)	2.0	(.8-5.1)	2.4	(.8-7.7)	1.4	(.5-4.1)							

\*OR significant at the .05 level, 2-sided test.

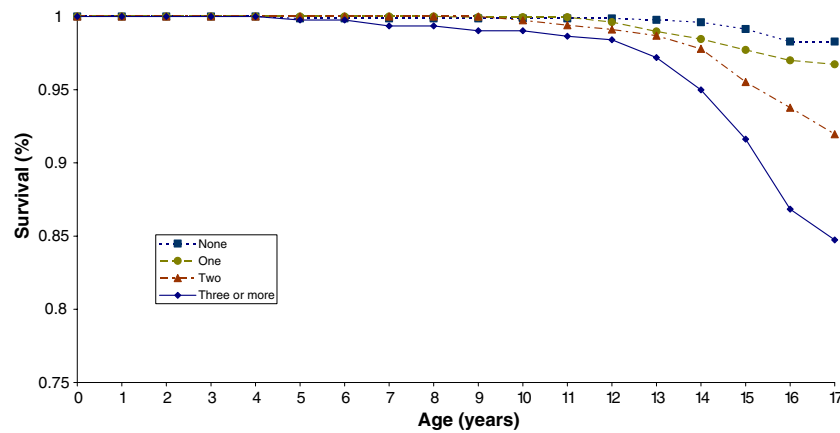
\*\*OR significant at the .01 level, 2-sided test.

Results are based on multivariate discrete-time survival model.

Each model controls for person-year and variables: any diagnostic, sex, age, education (time varying), attending school, employment, marriage, having a child, maximum parental education and (among ideators) different suicide-related variables: age of ideation (early, middle, late), time since ideation, previous plan, time since plan.

Cases with any missing values (including 998 and 999) on the suicidality AOO variables are deleted.

Time intervals (INT) are used as a control, but in different form for the 1st 3 columns and the last 4 columns.



**Figure 1** Cumulative age-of-onset distribution of lifetime suicide attempt, by number of traumatic events. Mexico City adolescents, ages 12–17, 2005 (N = 3,005)

**Table 4** Impact of a single type traumatic event on first onset of suicide ideation, plan and attempt: Mexico City adolescents ages 12–17, 2005 (n = 3,005)

	Total sample (n = 3,005)					
	Ideation		Plan		Attempt	
	OR	CI 95%	OR	CI 95%	OR	CI 95%
Traumatic life event (A)						
Raped/Sexually assaulted	3.2*	(1.2–9.1)	1.6	(.4–6.9)	4.5**	(1.6–12.6)
Beaten up by caregiver/Witnessed physical fights at home	1.7**	(1.2–2.4)	2.0	(.9–4.3)	1.4	(.6–3.1)
In region of terror/Disaster						
Toxic exposure/Automobile/Life threatening accident/Life threatening illness	1.9	(1.0–3.5)	1.7	(.6–5.1)	1.9	(.6–5.5)
Beaten up, by romantic partner or someone else/Mugged or threatened with a weapon/Stalked	1.9	(.7–4.8)	3.1	(.9–11.2)	4.8**	(1.6–14.5)
Unexpected death of a loved one/Traumatic event of a loved one	.6*	(.3–1.0)	.4	(.1–1.3)	.4	(.1–1.1)
Witnessed death or dead body or saw someone else seriously hurt/Accidentally caused serious injury or death/Purposely injured, tortured or killed someone	.4	(.1–1.5)	.8	(.2–3.8)	1.3	(.6–2.8)
Other/Private event	2.2	(.7–6.6)	1.6	(.3–7.8)	.8	(.1–7.0)

\*OR significant at the .05 level, 2-sided test.

\*\*OR significant at the .01 level, 2-sided test.

Results are based on multivariate discrete-time survival model.

Each model controls for person-year and variables: any diagnostic, sex, age, education (time varying), attending school, employment, marriage, having a child, and maximum parental education.

Cases with any missing values (including 998 and 999) on the suicidality AOO variables are deleted.

Time intervals (INT) are used as a control, but in different form for the 1st 3 columns and the last 4 columns.

Model includes time varying number of events <= 1.

graphics and psychiatric disorders. This analysis was done for the total sample only, as sample size limited our capacity to also study transitions among ideators. Most single events were associated with an increased likelihood of ideation, plans and attempts; however, events of sexual violence and other violence-related events (‘beaten up by romantic partner...’and ‘beaten up by caregiver...’) arose as especially deleterious.

## Discussion

### Main findings

We found that a report of lifetime SROs in the complete absence of any lifetime traumatic event was rare. Those respondents with a history of a traumatic

event reported higher suicide ideation, suicide plans and suicide attempts than respondents with no history of such events, and those with more than one traumatic event reported an even higher prevalence of ideation, plans and attempts. Our findings are in agreement with prior research in youth that found a larger prevalence of suicide attempts among persons that experience multiple types of childhood adversities, maltreatment and other traumatic events (Dube et al., 2001; Johnson et al., 2002). Extending prior research, we found large variations in the prevalence of other SROs depending on the type of event reported. It is more difficult to compare our results regarding suicide ideation and plans, as a limitation of prior research has been the limited scope of SROs considered. Nevertheless, prior research also found increased prevalence of ideation,

plans and attempts among adults in the US victims of child rape and molestation when compared to the general population controlling for other adversities and psychiatric disorders (Molnar et al., 2001a). Prior research on the impact of traumatic events upon psychopathology (Kessler et al., 1997) and suicidality (ideation and attempt) (Enns et al., 2006; Fergusson et al., 2000; Nock & Kessler, 2006) have also shown that a large list of adversities is associated with an increased prevalence of both.

For the most part, and with few exceptions, all types of traumatic events assessed in this study were associated with increased odds of SROs among those in the total sample, and for transitions among ideators. Multiple discrete time survival models that took into account the time order between traumatic events and SROs and a large number of other possible covariates, including psychiatric disorders, tended to diminish these associations but not eliminate them.

This finding suggests that the risk of suicidality among those with traumatic events was not fully accounted for by the occurrence of a prior psychiatric disorder and so additional mechanisms must be identified that explain this relationship (Salzinger et al., 2007). Although speculative at this point, prior research suggests that there may be several different pathways from the experience of early adverse events to the engagement in self-injurious and suicidal behaviors. For instance, prior research indicates that adolescents report engaging in both non-suicidal and suicidal self-injury most often to escape from intolerable thoughts and feelings, but also at times to counteract feelings of emotional numbness (Nock, Holmberg, Photos, & Michel, *in press*; Nock & Prinstein, 2004, 2005).

In the former pathway, traumatic events might lead to physiological or emotional hyperreactivity (Teicher et al., 2003), which is experienced as intolerable and therefore precipitates escape behavior in the form of suicidal thoughts and attempts. Indeed, recent research provides evidence of physiological hyperarousal and poor distress tolerance among adolescents who engage in self-injury (Nock & Mendes, *in press*) and also that this hyperreactivity to stress mediates the relation between psychopathology and suicidal thoughts and behaviors (Nock, Wedig, Holmberg, & Hooley, *in press*). In the latter pathway, early adverse events may lead to emotional numbing (Asmundson, Stapleton, & Taylor, 2004; Kaplow et al., 2005), which in turn leads to engagement in self-injurious behavior as a means of generating feeling. In support of this model, earlier work on this topic has demonstrated specific relations between symptoms of post-traumatic stress disorder and the feeling generation function of self-injury (Nock & Prinstein, 2005). Finally, beyond affect regulation, a person's response to traumatic or stressful life events may help explain why self-injury is more likely after such events. For in-

stance, it is possible that some people blame themselves for the stressful events and develop a self-blaming or self-critical cognitive style over time, which may lead to an increased likelihood of engaging in self-injury as a severe form of self-punishment. In support of such a model, recent research suggests that the experience of parental criticism (i.e., an early stressor) is associated with an increased risk of adolescent self-injury, especially when the adolescent has developed a self-critical cognitive style (Wedig & Nock, 2007). Similarly, another recent study showed that the relation between child maltreatment and the experience of suicidal thoughts and behaviors during adolescence is mediated by adolescent self-criticism (Glassman, Weierich, Hooley, Deliberto, & Nock, 2007). Taken together, these findings provide support for a model in which early adverse experiences may facilitate adolescent self-criticism or more negative thoughts toward the self, which then lead to engagement in self-directed aggression or suicidal behaviors. Importantly, most of these findings are retrospective or cross-sectional in nature; however, in combination with the results of the current study they provide information about factors that might help explain how and why the experience of traumatic events is related to adolescent suicidality.

Similar to prior research among adolescents (Beautrais et al., 1996; Fergusson et al., 2000) and adults (Dube et al., 2001; Enns et al., 2006; Molnar et al., 2001a), we found a dose-response relationship between the number of traumatic events and SROs in the total sample. In our study, there was no consistent pattern for a similar dose-response for plans and attempts among ideators when multiple controls were introduced. As we could not find prior research on this matter, these results need further replication.

The role of a particular traumatic event in the increased risk of a SRO, independent of any other traumatic event, is a matter of importance and has been discussed recently (Dube et al., 2001; Enns et al., 2006; Fergusson et al., 2000). In these previous reports, for the most part, when multiple controls were introduced to account for prior psychopathology and multiple events, the risks associated with any particular event were greatly reduced, and many individual events became non-significant. Given the large number of person-years in our study, we were able to compare the importance of pure, single events among those that had one event only or in those person-years up to one event among those that reported more than one. Consistent with most prior reports (Fergusson et al., 2000; Gould, Greenberg, Velting, & Shaffer, 2003; Johnson et al., 2002; Molnar et al., 2001a), but not all (Enns et al., 2006), in these analyses we found that victims of sexual violence and other violence-related events had consistently higher odds of SROs compared with those who reported other types of events.

On the other hand, we found no increase and even partial evidence of decreased odds of SROs among those that reported a pure episode of accidental loss, which was unexpected. Two possible explanations of the latter are that the impact of mourning exerts its effects directly and totally through a psychiatric disorder or that this loss, at this early age, exerts some kind of process that precludes suicidality, leading the person to place additional value on life and living. We cannot test these two conflicting possibilities, and this is clearly a matter that needs further research. Our finding that those who reported that they 'Purposely injured, tortured or killed someone' had higher odds of SROs also needs replication and calls for further research into conduct disorder and antisocial personality traits as risk factors for suicidality. Limitations due to the number of respondents that endorsed this item in our survey precluded us to further study this issue at this time.

### Limitations

These findings must be evaluated in the context of several study limitations. The MAMHS is a household survey that excluded youth who are institutionalized or living in the streets, both populations known to have a high prevalence of mental disorders and suicidal behavior (Gutiérrez & Vega, 2003). It is very likely that the prevalence of traumatic events is also underestimated, since those who have no permanent residence or live in government institutions (such as correctional institutions or orphanages) may have higher rates of exposure to traumatic life events. Another source of underestimation may be due to participants' unwillingness to disclose information, particularly for emotionally charged or embarrassing events. Second, the diagnostic instrument used in the MAMHS did not include an assessment of all DSM-IV disorders, some of which have been linked to increased risk of suicidal behavior, such as schizophrenia and other non-affective psychoses (Harkavy-Friedman et al., 2004; Kessler et al., 1999). Third, validity and reliability data were not obtained for the measures of ideation, plans and attempts and the validation of the adolescent-CIDI version used in this study is still under way. A further related limitation is our reporting of diagnostic classifications based on only one informant, namely, the adolescent. Fourth, although we examined suicide ideation, plans, and attempts, we did not measure non-suicidal self-injury (e.g., Nock & Prinstein, 2004, 2005), and so the epidemiology of this outcome awaits further study. Fifth, although we used a large range of traumatic events we did not include in these analyses developmental negative life course events (such as fights with parents or school failure, for example) that may also be related to suicidal behavior. As such life events were only ascertained for the last 12 months in our survey,

their role in the epidemiology of SROs in Mexico will be a matter of forthcoming analyses. Finally, data derived from retrospectively reported ages of onset are subject to recall errors.

### Conclusions

Mexican adolescents who have suffered a traumatic event during their childhood are at increased risk for suicidal ideation, making a suicide plan and for suicide attempts. Suicide prevention interventions for adolescent victims of traumatic events, especially those with a history of cumulative events, should include but not be restricted to psychiatric treatment, since not all of this risk was fully accounted for by the occurrence of a prior psychiatric disorder.

### Acknowledgements

This work was made possible by the support from an American Foundation for Suicide Prevention-Standard Research Grant to Dr Guilherme Borges. The Mexican Adolescent Mental Health Survey was supported by the National Council on Science and Technology in conjunction with the Ministry of Education (grant No. CONACYT-SEP-SSEDF-2003-CO1-22) and by the National Institute of Psychiatry Ramon de la Fuente Muñiz (DIES-4845). The survey was carried out in conjunction with the World Health Organization World Mental Health (WMH) Survey Initiative. We thank the WMH staff for assistance with instrumentation, fieldwork, and data analysis. These activities were supported by the United States National Institute of Mental Health (R01MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (R13-MH066849, R01-MH069864, and R01 DA016558), the Fogarty International Center (FIRCA R01-TW006481), the Pan American Health Organization, Eli Lilly and Company, Ortho-McNeil Pharmaceutical, Inc., GlaxoSmithKline, and Bristol-Myers Squibb.

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Manuscript accepted 31 October 2007

**Annex:** Traumatic events questions of World Mental Health adolescent version of the Composite International Diagnostic Interview (WMH-CIDI-A)\*

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Sexual abuse

Raped

1 The next two questions are about sexual assault. The first is about rape. We define this as someone either having sexual intercourse with you or penetrating your body with a finger or object when you did not want them to, either by threatening you, by using force or when you were so small that you didn't know what was happening. Did this ever happen to you?

Sexually assaulted

2 Other than rape, were you ever sexually assaulted, where someone touched you inappropriately, or when you did not want them to?

Domestic violence

Beaten up by caregiver

3 Were you ever badly beaten up by your parents or the people raising you?

Witnessed physical fights at home

4 Did you ever witness serious physical fights at home, like your father beating up your mother?

Disaster natural or man-made

In region of terror

5 Were you ever in a place where there was a war, revolution, military coup, or where there was ongoing terror of civilians for political, ethnic, religious or other reasons?

Disaster

6 Were you ever involved in a major natural disaster, like a devastating flood, hurricane, or earthquake?

Accident or illness

Toxic exposure/Automobile/Life threatening accident

7 Were you ever exposed to a poisonous chemical or substance that could cause you serious harm?

8 Were you ever involved in a serious or life-threatening car accident?

9 Were you in any other serious or life-threatening accident?

Life threatening illness

10 Did you ever have a life-threatening illness?

Violence

Beaten up by romantic partner or someone else

11 Were you ever badly beaten up by someone you were dating or with whom you were romantically involved?

12 Were you ever badly beaten up by anyone else?

Mugged or threatened with a weapon

13 Were you ever mugged, held up, or threatened with a weapon?

Stalked

14 Has someone ever stalked you – that is, followed you or kept track of your activities in a way that made you feel you were in serious danger?

Kidnapped

15 Were you ever kidnapped or held captive?

Death or trauma of a loved one

Unexpected death of a loved one

16 Did someone very close to you ever die unexpectedly; for example, they were killed in an accident, murdered, committed suicide, or had a fatal heart attack at a young age?

Traumatic event of a loved one

17 Did anyone very close to you ever have a very stressful or life-threatening experience, like being kidnapped, tortured or raped?

Death or trauma of someone else

Witnessed death or dead body or saw someone else seriously hurt

18 Did you ever see someone being badly injured or killed, or unexpectedly see a dead body?

Accidentally caused serious injury or death

19 Did you ever do something that accidentally led to the serious injury or death of another person?

Purposely injured, tortured or killed someone

20 Did you ever on purpose either seriously injure, torture, or kill another person?

Other/Private event

21 Were you ever a refugee – that is, did you ever flee from your home to a foreign country or place to escape danger or persecution?

22 Did you ever experience any other extremely upsetting or life-threatening event that I haven't asked about yet?

23 Sometimes people have experiences they don't want to talk about in interviews. I won't ask you to describe anything like this, but, without telling me what it was, did you ever have an extremely upsetting or life-threatening event that you didn't tell me about because you didn't want to talk about it?

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\*Traumatic events are not shown in the order presented to participants.