

Posttraumatic Stress Disorder and Suicide Attempts in a Community Sample of Urban American Young Adults

Holly C. Wilcox, PhD; Carla L. Storr, ScD; Naomi Breslau, PhD

Context: Previous research has shown that exposure to traumatic events, especially sexual trauma during childhood, is associated with an increased risk of attempted suicide. However, no information is available as to whether the increased risk of attempted suicide is related primarily to posttraumatic stress disorder (PTSD) following traumatic experiences or applies also to persons who experienced trauma but did not develop PTSD.

Objective: We examine the association between exposure to traumatic events with and without resulting PTSD and the risk of a subsequent suicide attempt in a community sample of urban young adults.

Design: A cohort study followed young adults who had participated in a randomized trial of all first-grade students entering 19 public schools.

Setting: Baltimore, Maryland, an urban setting.

Participants: A total of 1698 young adults (mean age, 21; 47% male; 71% African American) who represented 75% of the original cohort of 2311 persons.

Main Outcome Measure: Relative risk of a subsequent suicide attempt associated with PTSD and with exposure to assaultive and nonassaultive traumas (no PTSD), as estimated using discrete time survival analysis.

Results: Posttraumatic stress disorder was associated with increased risk of a subsequent suicide attempt. The PTSD–suicide attempt association was robust, even after adjustment for a prior major depressive episode, alcohol abuse or dependence, and drug abuse or dependence (adjusted relative risk, 2.7; 95% confidence interval, 1.3–5.5; $P < .01$). In contrast, exposure to traumatic events without PTSD was not associated with an increased risk of attempted suicide.

Conclusions: Posttraumatic stress disorder is an independent predictor of attempted suicide. Exposure to traumatic events without PTSD is not associated with a later suicide attempt.

Arch Gen Psychiatry. 2009;66(3):305-311

Author Affiliations:

Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, Maryland (Dr Wilcox); Department of Family and Community Health, University of Maryland School of Nursing, Baltimore (Dr Storr); and Department of Epidemiology, Michigan State University, East Lansing (Dr Breslau).

SUICIDE WAS THE THIRD LEADING cause of death for young people in the United States in 2005.¹ Although official data on suicide attempts are not compiled in the United States, it is estimated that there are approximately 421 200 to 842 400 suicide attempts annually for people aged 15 to 24 years (using a 100-200:1 ratio for attempted to completed suicide).¹ History of a suicide attempt has been identified as one of the best predictors of a future attempt as well as completed suicide.^{2,3} It is estimated that approximately 43% of the variability in suicidal behaviors (as defined as suicide or suicide attempt) is attributable to genetics, while the remaining 57% is to environmental factors.⁴⁻⁶ Community surveys have found that psychiatric disorders,

primarily affective disorders, are key risk factors for suicide attempts.⁷ Recent reports have suggested that posttraumatic stress disorder (PTSD) is associated with elevated risk of a suicide attempt. It is unclear, however, whether only persons with the disorder or any persons who have experienced trauma are at increased risk of attempting suicide. Previous studies on persons who have experienced traumatic events have not distinguished between persons who were exposed to trauma who have PTSD and those who had not developed the disorder, with respect to the risk of a suicide attempt.

Recent evidence shows that community and clinical samples with PTSD resulting from traumas such as sexual abuse, rape, exposure to combat, and natural disasters are at increased risk for suicidal

thoughts and behaviors.⁷⁻¹⁰ The National Comorbidity Survey, using data from a nationally representative sample of 5877 US residents aged 15 to 54 years, found that those with PTSD were 6 times as likely (95% confidence interval [CI], 3.4-10.7) as demographically matched controls to attempt suicide.⁷ The European Study on the Epidemiology of Mental Disorders (ESEMED), a household survey on a probability sample of 21 425 adults in 6 European countries, found that the rate ratio for PTSD associated with lifetime suicide attempts was 1.9 (95% CI, 1.2-2.9).⁹ A limitation of these studies is that they did not adjust for other psychiatric disorders. Preexisting psychiatric disturbances have been linked with a higher probability of exposure to traumatic events and PTSD.¹¹⁻¹⁶ Because psychiatric disorders have also been found to be associated with suicide attempts,¹⁷ a failure to adjust for them may bias the results.

Depression is associated with traumatic experiences and PTSD¹⁸ and is a well established risk factor for suicide attempts.¹⁹ Clinical samples of patients with mood disorders have reported a strong association between PTSD and attempted suicide.²⁰⁻²² Among patients with a lifetime history of a major depressive episode (MDE), PTSD and depression appear to be independently associated with risk for suicidal behaviors.²¹ Two community surveys reported that PTSD is independently associated with suicide after adjusting for comorbid psychiatric disturbances. Davidson and colleagues⁸ found that individuals with PTSD were approximately 15 times more likely to attempt suicide than those without PTSD, and the association remained after adjusting for depressive symptoms. Sareen and colleagues,¹⁰ using data from the Canadian Community Health Survey of more than 35 000 people, found a more than 2-fold association between a suicide attempt in the past year and current PTSD, adjusting for psychiatric and physical disorders. However, using a large community sample of adolescents and young adults, Wunderlich and colleagues²³ found that, despite a strong association between PTSD and attempted suicide in univariate analyses, this association was no longer significant when comorbid disorders were included in a multivariate model. Belik and colleagues²⁴ have reported that traumatic events were linked with suicide attempts even after adjusting for the effects of mental disorders. However, that study did not sort out in the analysis the temporal sequencing between onset of mental disorder, exposure to trauma and/or PTSD, and the suicide attempt. Davidson and colleagues²⁵ found a positive association between sexual assault and attempted suicide that remained significant after controlling for posttraumatic symptoms and psychiatric comorbidity. However, Davidson and colleagues did not measure PTSD, but rather posttraumatic symptoms. The authors asked about sexual assault history with no follow-up about symptoms directly associated with the sexual assault. The posttraumatic symptoms could have resulted from any trauma experienced by persons who have reported sexual assault.

Several studies have suggested an association between trauma exposure (with no explicit reference to PTSD) and suicide attempts. They have reported that persons with suicidal behavior are more likely to report that they have been exposed to traumatic events, especially

sexual trauma during childhood.²⁶⁻²⁸ These studies do not report whether the elevated risk of a suicide attempt applied only to the subset of persons who had been exposed to trauma and developed PTSD or also to those who did not develop PTSD. Information on this question can potentially advance our understanding of the causal pathways that link trauma and subsequent suicide attempts.

In this study, we address this gap. We estimate the association of a suicide attempt with exposure to traumatic events with and without resulting PTSD in a community sample of urban young adults. We use time-to-event analysis, allowing for time-dependent covariates that establish temporal order between trauma (and PTSD), the suspected causes, and a subsequent suicide attempt. The analytic approach also allows us to take into account the role of preexisting psychiatric disorders. Additionally, we explore the possibility of a differential impact of trauma type (assaultive violence vs other traumas that do not involve assaultive violence) on attempted suicide.

METHODS

SAMPLE

Data are from a prospective study conducted in the context of an epidemiologically-based group-randomized prevention trial.^{29,30} During 2 successive school years (1985 and 1986), a total of 2311 young adults (49.8% male; 67.1% ethnic minority, mostly African American) entered first grade in 19 primary schools in a single public school system of a mid-Atlantic city in the United States (cohort I, 1985 [n=1196]; cohort II, 1986 [n=1115]). The 19 schools were located in 5 urban areas that varied in socioeconomic status from very poor to moderate income, and in the degree of racial segregation. Within each area, 3 or 4 schools were sorted into homogenous sets and selected for the trial. Fifteen years later, when participants were aged 20 to 23 years (mean age, 21 years), nearly 75% of the survivors (n=1698) were interviewed face-to-face to assess the occurrence of lifetime traumatic experiences and PTSD.³¹ Those lost to follow-up were more likely to be white and male, but did not differ by year of first grade entry or eligibility for subsidized lunch (proxy for socioeconomic status). A National Death Index search was conducted after the field work concluded in 2002 and 36 participants had died; 15 were homicides; 5, natural causes; 11, accidents; and 1, confirmed suicide. There were 4 deaths for which the cause was undetermined or inconclusive: 1 had a gunshot wound to the head; 2, acute narcotic intoxication; and 1, multiple injuries. Another 5 were not verified by National Death Index data (no social security number matched), but were confirmed dead by family members. The cause of death was not assessed in these 5 individuals. Because the participants were aged 20 to 23 years at the time of the National Death Index search, the sample had not passed through the age of risk for death by suicide. Detailed information on the field work and the sample was reported previously.³²⁻³⁴

ASSESSMENT OF KEY VARIABLES

Exposure to traumatic events, PTSD, and suicide attempts were assessed as part of a 90-minute standardized interview administered by experienced lay interviewers who were extensively trained before they began fieldwork. Suicide attempt was measured by asking, "Have you ever attempted suicide?" Age at first

suicide attempt was assessed via standardized questions embedded within a multiitem assessment of major depressive disorder, based on an adapted version of the National Institute of Mental Health Diagnostic Interview Schedule.^{35,36} Major depressive episode was assessed using the adapted version of the National Institute of Mental Health Diagnostic Interview Schedule covering clinical features associated with depression, age of onset of each clinical feature, and recency. This version of the Diagnostic Interview Schedule assigns respondents to subgroups of cases and noncases based on the diagnostic criteria of the *DSM-III-R*. All 31 symptom questions were asked of everyone, regardless of whether they had anhedonia or depressed mood for 2 weeks or longer.

The section on traumatic events was developed in the 1996 Detroit Area Survey.³⁷ It begins with a list of 18 events that operationalize the *DSM-IV* stressor criterion. Questions on combat were included in the assessment but not in the analysis because none of the participants had been in combat. For each event in the list, respondents were asked if they had ever experienced an event of that type. An endorsement of an event type was followed by questions about the number of times it had occurred and the age of the respondent at each time. In cases with more than one traumatic event, a list of all of the events reported by the respondent was read back by the interviewer, and the respondent was asked to identify the one event that was the "most stressful to you" (the worst). Posttraumatic stress disorder was evaluated for that event, using the PTSD section of version 2.1 of the World Health Organization Composite International Diagnostic Interview.³⁸ A validation study in an epidemiological community sample found good agreement between this interview's diagnosis of PTSD and independent clinical reinterviews.³⁷

The 18 traumatic events were grouped into 2 broad categories: events that involve assaultive violence and those that do not. The first category, assaultive violence, included 6 event types: raped, badly beaten up, held captive, tortured, or kidnapped, shot, stabbed, mugged, threatened with a weapon, and sexual assault other than rape. All 12 other event types were included in the second category. These were serious car accident, other serious accident, natural disaster, life-threatening illness, child's life-threatening illness, witnessing a killing or serious injury, discovering a dead body, learning of a close friend or relative who was attacked, raped, or sexually assaulted, suffering a serious car accident or some other serious accident, and learning of the sudden unexpected death of a close friend or relative.

The assessments of alcohol and drug use disorders conformed to the general approach used in the National Comorbidity Survey.³⁹ In addition to the alcohol problems screening question, the questionnaire included the following question: "Was there ever a time in your life when people told you they thought you drank too much or when you thought you might have a drinking problem?" in an effort to increase sensitivity to clinically significant alcohol dependence.⁴⁰ Abuse and dependence were conceptualized as a clinical syndrome (alcohol abuse or dependence [AAD] and drug abuse or dependence [DAD]), and the variables in this study were based on the occurrence of clinical features of drug or alcohol abuse (1) or dependence (≥ 3). The minimum age of any of the abuse and dependence indicators was used as the age of onset for the disorder. Other details on the follow-up assessments have been reported by Storr and colleagues³² and by Wilcox and Anthony.³³

Study protocols were approved by the institutional review board of Johns Hopkins University; Michigan State University's institutional review board also approved the data analysis activities. Signed consent was obtained from each participant.

Survival analysis methods were used to estimate the relative hazard of attempted suicide for exposure to traumatic events and PTSD, followed by covariate adjustment for sex, race, cohort, MDE, AAD, and DAD, whereby the age of onset of MDE, AAD, or DAD occurred prior to the age at occurrence of exposure to the worst event. We included as covariates potential confounders, but not variables that could be on the causal pathway from trauma and PTSD to suicide attempt. We adjusted for preexisting depressive episodes and drug or alcohol use disorders, which could have made participants more vulnerable to exposure to trauma or to PTSD as well as to attempted suicide (that is, they are potential confounders). Suicide attempt was removed from the criteria for MDE so it would not inflate the estimates of the association between MDE and suicide attempts. All survival analyses measured the time to first suicide attempt since entry into first grade. For those who did not report suicide attempt(s), the censoring time was age at last assessment.

Persons with missing age of suicide attempt ($n=4$) or missing age for their worst traumatic event ($n=4$) were excluded. There were 14 respondents who reported the same age for the occurrence of the traumatic event and the suicide attempt. Because we were not able to sort out temporality, these 14 individuals were censored the year before their age at the traumatic event and attempt and thus did not contribute to data analyses. The analyses were conducted on a total sample of 1661 persons (person-years, 8386).

We used discrete-time survival analyses with covariates, as suggested by Cox⁴¹ and more recently by Willet and Singer⁴² and Singer and Willet.⁴³ Posttraumatic stress disorder, MDE, AAD, and DAD were time-dependent covariates. The analyses condition on school and thus take into account the original sampling design of the study, which was based on clustering of students within schools. This stratified analysis also accommodates data interdependencies. We have found that school variation was high at baseline across a number of measures. Once we condition on school, many variables show little variation at the classroom level because children were balanced across classrooms.^{44,45} Thus, balancing classes within schools was an efficient way to control for school and community characteristics (eg, see Breslow and Day⁴⁶). This approach is especially useful when the suicide attempt might depend on socially shared determinants that are not easily quantifiable (eg, widely shared religious beliefs and local area norms about suicide-related behavior).

RESULTS

In the sample, 1273 persons (81%) were exposed to 1 or more traumatic events in their lifetime and, of those exposed, 100 developed PTSD (8% of those exposed to traumatic events; 6% of the total sample). Of trauma-exposed persons with PTSD, 36% reported that their traumatic event involved assaultive violence. Of trauma-exposed persons who did not develop PTSD, 20% reported that their traumatic event involved assaultive violence. As seen in **Table 1**, 10% of persons with PTSD had attempted suicide, a proportion higher than that of those without PTSD (2% of trauma-exposed participants and 5% of those who had never been exposed to traumatic events).

We estimated the risk of a suicide attempt in relation to PTSD and exposure to assaultive and nonassaultive

Table 1. Lifetime Suicide Attempt and Traumatic Exposure/PTSD Across Subgroups of the Sample

Characteristic	No (%)					
	No Trauma Exposure (n=297; 19%)		Trauma Exposure Only (n=1173; 75%)		PTSD (Among Those Exposed to Trauma [n=100; 6%])	
	No Attempt (n=281)	Attempt (n=16)	No Attempt (n=1144)	Attempt (n=29)	No Attempt (n=90)	Attempt (n=10)
Sex						
Male	100 (98)	2 (2)	589 (98)	11 (2)	42 (94)	3 (6)
Female	181 (93)	14 (7)	555 (97)	18 (3)	48 (87)	7 (13)
Race						
Not minority	73 (94)	5 (6)	324 (96)	15 (4)	31 (84)	6 (16)
Minority	208 (95)	11 (5)	820 (98)	14 (2)	59 (94)	4 (6)
Cohort						
1st Grade 1985	133 (92)	11 (8)	580 (98)	14 (2)	44 (86)	7 (14)
1st Grade 1986	148 (97)	5 (3)	564 (97)	15 (3)	46 (94)	3 (6)

Abbreviation: PTSD, posttraumatic stress disorder.

Table 2. Impact of Exposure to Nonassaultive and Assaultive Violence Without PTSD and With PTSD on Suicide Attempts^a

Predictor	RR (95% CI)	P Value
Model 1: unadjusted		
Nonassaultive	0.8 (0.5-1.4)	.45
Assaultive	0.8 (0.4-1.8)	.65
PTSD	3.1 (1.5-6.2)	.001
Model 2: adjusted for demographic variables ^b		
Nonassaultive	0.8 (0.5-1.4)	.53
Assaultive	0.8 (0.4-1.8)	.64
PTSD	2.7 (1.4-5.5)	.005
Model 3: adjusted for demographic variables and MDE ^c		
Nonassaultive	0.8 (0.5-1.4)	.49
Assaultive	0.7 (0.3-1.5)	.45
PTSD	2.6 (1.3-5.3)	.007
MDE	6.0 (3.4-10.6)	<.001
Model 4: adjusted for demographic variables and lifetime AAD ^c		
Nonassaultive	0.9 (0.5-1.4)	.55
Assaultive	0.8 (0.4-1.8)	.63
PTSD	2.8 (1.4-5.6)	.004
AAD	1.6 (0.9-2.9)	.12
Model 5: adjusted for demographic variables and lifetime DAD ^c		
Nonassaultive	0.8 (0.5-1.4)	.53
Assaultive	0.7 (0.3-1.6)	.45
PTSD	2.8 (1.4-5.7)	.004
DAD	2.8 (1.6-4.8)	<.001
Model 6: adjusted for demographic variables and lifetime AAD, DAD, and MDE ^c		
Nonassaultive	0.8 (0.5-1.4)	.51
Assaultive	0.7 (0.3-1.5)	.35
PTSD	2.7 (1.3-5.5)	.005
MDE	5.3 (2.9-9.5)	<.001
AAD	0.8 (0.4-1.7)	.61
DAD	2.2 (1.2-4.3)	.01

Abbreviations: AAD, alcohol abuse or dependence; CI, confidence interval; DAD, drug abuse or dependence; MDE, major depressive episode; PTSD, posttraumatic stress disorder; RR, relative risk.

^aA total of 917 participants were exposed to nonassaultive violence and did not develop PTSD, 238 were exposed to assaultive violence and did not develop PTSD, and 100 developed PTSD. The reference group was not exposed to trauma during the time interval.

^bDemographic covariates include sex, race, and cohort (first grade in 1985 or 1986).

^cAdjusted for MDE, AAD, and DAD that occurred prior to PTSD; PTSD, MDE, AAD, and DAD were time-dependent covariates.

events without PTSD (**Table 2**). The reference group within each time/age interval is defined as all persons who did not experience a traumatic event up to that time. The results show that neither assaultive nor nonassaultive traumatic events alone, without PTSD, were associated with

increased risk of a subsequent suicide attempt. In contrast, PTSD following exposure to a traumatic event had a robust and consistent association with a subsequent suicide attempt across the series of models that adjusted for sex, race, and cohort (age), as well as preexisting AAD,

Table 3. Impact of PTSD From Assaultive and Nonassaultive Violence on Suicide Attempts^a

Predictor	RR (95% CI)	P Value
Model 1: unadjusted		
Nonassaultive	1.9 (0.6-6.1)	.30
Assaultive	4.5 (2.0-10.1)	<.001
Model 2: adjusted for demographic variables ^b		
Nonassaultive	1.7 (0.5-5.5)	.39
Assaultive	3.4 (1.5-7.8)	.004
Model 3: adjusted for demographic variables and MDE ^c		
Nonassaultive	1.9 (0.6-6.2)	.29
Assaultive	3.1 (1.3-7.1)	.009
MDE	5.8 (3.2-10.5)	<.001
Model 4: adjusted for demographic variables and lifetime AAD ^c		
Nonassaultive	1.7 (0.5-5.7)	.36
Assaultive	3.4 (1.5-7.8)	.004
AAD	1.4 (0.7-2.7)	.30
Model 5: adjusted for demographic variables and lifetime DAD ^c		
Nonassaultive	1.8 (0.5-6.0)	.34
Assaultive	3.6 (1.5-8.2)	.003
DAD	2.5 (1.4-4.4)	.003
Model 6: adjusted for demographic variables and lifetime AAD, DAD, and MDE ^c		
Nonassaultive	2.0 (0.6-6.5)	.27
Assaultive	3.2 (1.4-7.5)	.007
MDE	5.2 (2.8-9.6)	<.001
AAD	0.8 (0.4-1.7)	.55
DAD	2.0 (1.0-3.9)	.04

Abbreviations: AAD, alcohol abuse or dependence; CI, confidence interval; DAD, drug abuse or dependence; MDE, major depressive episode; PTSD, posttraumatic stress disorder; RR, relative risk.

^aA total of 36 participants were exposed to assaultive violence with PTSD and 64 to nonassaultive violence with PTSD. The reference group has been exposed to at least one traumatic event but did not develop PTSD.

^bDemographic covariates include sex, race, and cohort (first grade in 1985 or 1986).

^cAdjusted for MDE, AAD, and DAD that occurred prior to PTSD; PTSD, MDE, AAD, and DAD were time-dependent covariates.

DAD, and MDE. The estimated relative risk (RR) is 2.7 (95% CI, 1.3-5.5; $P < .01$) for model 6, which adjusted for all covariates (Table 2). Other findings replicate previous observations on risk factors for attempting suicide. For example, the RR estimate of attempted suicide associated with MDE was high and significant (RR, 5.3 in model 6). Alcohol abuse or dependence prior to PTSD was null in all models, while DAD had a 2- to 3-fold increased risk of attempted suicide. The estimate of attempted suicide risk associated with PTSD did not differ by sex; an interaction term of PTSD by sex was not statistically significant ($P = .79$ interaction term in model 6).

To explore whether the association of PTSD with subsequent suicide attempt differed by the type of event (assaultive vs nonassaultive) that resulted in PTSD, we conducted survival analysis in the subset of persons exposed to traumatic events (Table 3). In these models, the reference group within each time/age interval is persons who were exposed to traumatic events but did not develop PTSD. Posttraumatic stress disorder caused by exposure to traumatic events that did not involve assaultive violence was not significantly associated with a suicide attempt (estimated RR, 2.0; 95% CI, 0.6-6.5; $P = .27$ for model 6 adjusting for all covariates), whereas PTSD involving assaultive violence had a robust and consistent association with attempted suicide across the series of models (estimated RR, 3.2; 95% CI, 1.4-7.5; $P < .01$ for model 6). The difference between these relative risk estimates was not statistically significant ($P = .50$ for model

6); however, the lack of a statistically significant difference may be due to limited statistical power. We found no sex differences in the risk of a suicide attempt associated with either event type.

COMMENT

Persons exposed to trauma who developed PTSD were at an increased risk of attempted suicide. The association linking PTSD to a later suicide attempt was sustained in models that adjusted for established risk factors, including sex and preexisting major depression (adjusted RR, 2.7; 95% CI, 1.3-5.5; $P < .01$). In contrast, persons exposed to traumatic events who did not develop PTSD were not at increased risk of a suicide attempt compared with persons who had never experienced a traumatic event. With respect to exposure in persons who did not develop PTSD, the results did not vary by type of traumatic event or assaultive vs nonassaultive violence.

Several limitations should be considered in the interpretation of the results. First, our sample is predominantly African American young adults who grew up in an urban metropolitan area. The generalizability of the findings to other populations is unknown. Second, participation at follow-up in young adulthood was incomplete (75%), although it was high for prospective community studies that have followed up children to adulthood. Third, the reliance on retrospective assess-

ment of age at exposure and age at suicide attempt during young adulthood is a limitation that this study shares with previous studies. Retrospective accounts of traumatic events are subject to recall bias. Persons with psychiatric disturbances may be more likely to recall negative experiences.^{47,48} However, the young age of the respondents and the relatively short interval between the time when traumatic events occurred and the time of the interview³¹ weakens the potential for recall bias. Fourth, the assessment was conducted by trained nonclinicians who used a structured interview without access to supplementary information that might be elicited by clinicians. However, the assessment procedure of PTSD in this study had been evaluated against blind clinical assessments, yielding high estimates of concordance.³⁷ Fifth, some may suggest that the criteria for traumatic events are overinclusive, ie, by including learning about traumatic events occurring to others. We used the *DSM-IV* stressor criteria and the examples given in the text. The 81% lifetime exposure is typical to US community studies that used the *DSM-IV*. The lifetime prevalence in the recent National Comorbidity Survey Replication, which also used the *DSM-IV*, was greater than 82% (calculated from National Comorbidity Survey Replication public use data). To address the issue of event magnitude and the possibly overinclusive stressor definition in the *DSM-IV*, we separated traumas involving assaultive violence (ie, high magnitude events) from other traumas (Table 2); we found that neither category in the absence of PTSD was associated with an increased risk of attempting suicide.

Our study has important strengths that represent a step forward in understanding the trauma–suicide attempt relationship. First, we investigated the effect of exposure to traumatic events on a subsequent suicide attempt, separating trauma-exposed persons who developed PTSD, a subset of less than 10% of those exposed to traumatic events, from trauma-exposed persons who did not develop PTSD. Previous studies have not separated these subgroups of exposed persons. This distinction appears to be critical in understanding the relationship of trauma to subsequent suicide attempts. We also explored the relative effect of type of trauma (assaultive violence vs non-assaultive trauma) among persons who developed PTSD on the risk of attempting suicide. This analysis revealed a more than 3-fold increase in the risk of attempted suicide among persons with PTSD from assaultive violence that was statistically robust (relative to exposed persons with no PTSD), whereas the increased risk of a suicide attempt in persons with PTSD from nonassaultive events was of lower magnitude and not significant. Second, using age at onset data, careful attention was paid to the temporal relationship between suicide attempts and the suspected risk factors, exposure to traumatic events, and PTSD. Third, in addition to adjusting for other psychiatric conditions that are associated with increased risk of attempted suicide, our analytical method took advantage of group-based matching in this study, allowing us to hold constant contextual characteristics related to neighborhood and school.

The mechanisms involved in the association between PTSD and suicide attempts are not known. There could be a common preexisting predisposition to PTSD

and suicide attempts that was present before the trauma occurred. Studies of early trauma and suicidal behaviors have implicated depression and impulsivity as possible mediators^{49,50} or possible preexisting susceptibility traits.⁵¹

The major finding of this study is that PTSD, but not trauma, is an independent predictor of a subsequent suicide attempt in this sample. Persons who had been exposed to traumatic events, including traumatic events of high magnitude that involve assaultive violence, who did not develop PTSD were not at increased risk of a suicide attempt. Three research groups have reported, via estimates of population-attributable risk, that up to 20% of suicide attempts in young people are attributable to exposure to child sexual abuse.⁵²⁻⁵⁴ Although we did not focus explicitly on child sexual abuse, our results point to the need to base risk estimates of attempted suicide on data that take into account the psychiatric response to the trauma. By distinguishing between trauma-exposed persons without and with PTSD, we found that it is PTSD that is associated with an increased risk of a suicide attempt. Whether or not this finding applies to sexual abuse in childhood or adulthood should be investigated in future studies.

Submitted for Publication: May 30, 2008; final revision received October 2, 2008; accepted October 3, 2008.

Correspondence: Holly C. Wilcox, PhD, Department of Psychiatry and Behavioral Science, Johns Hopkins University, 600 N Wolfe St, CMSC 346, Baltimore, MD 21287 (hwilcox1@jhmi.edu).

Financial Disclosure: None reported.

Funding/Support: This study was supported by grants MH-71395 and MH-48802 from the National Institute of Mental Health (Dr Breslau) and grants DA-09897 and DA-04392 from the National Institute on Drug Abuse (James C. Anthony, PhD).

Role of the Sponsor: The sponsors had no role in the design and conduct of the study, collection, management, analysis, and interpretation of data, or preparation, review, or approval of the manuscript.

Additional Contributions: We would like to extend our deepest gratitude to the young adults and families who participated in this project.

REFERENCES

1. Department of Health and Human Services, Centers for Disease Control and Prevention. *Web-based Injury Statistics Query and Reporting System (WISQARS)*. Atlanta, GA: Centers for Disease Control and Prevention; 2007.
2. Wichstrøm L. Predictors of adolescent suicide attempts: a nationally representative longitudinal study of Norwegian adolescents. *J Am Acad Child Adolesc Psychiatry*. 2000;39(5):603-610.
3. Harris EC, Barraclough B. Suicide as an outcome for mental disorders: a meta-analysis. *Br J Psychiatry*. 1997;170:205-228.
4. Roy A. Genetic and biologic risk factors for suicide in depressive disorders. *Psychiatr Q*. 1993;64(4):345-358.
5. Roy A, Segal NL, Sarchiapone M. Attempted suicide among living co-twins of twin suicide victims. *Am J Psychiatry*. 1995;152(7):1075-1076.
6. McGuffin P, Marusic A, Farmer A. What can psychiatric genetics offer suicidology? *Crisis*. 2001;22(2):61-65.
7. Kessler RC, Borges G, Walters EE. Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. *Arch Gen Psychiatry*. 1999; 56(7):617-626.

8. Davidson JR, Hughes D, Blazer DG, George LK. Post-traumatic stress disorder in the community: an epidemiological study. *Psychol Med*. 1991;21(3):713-721.
9. Bernal M, Haro JM, Bernert S, et al; ESEMED/MHEDEA Investigators. Risk factors for suicidality in Europe: results from the ESEMED study. *J Affect Disord*. 2007;101(1-3):27-34.
10. Sareen J, Cox BJ, Stein MB, Afifi TO, Fleet C, Asmundson GJ. Physical and mental comorbidity, disability, and suicidal behavior associated with posttraumatic stress disorder in a large community sample. *Psychosom Med*. 2007;69(3):242-248.
11. Breslau N, Lucia VC, Alvarado GF. Intelligence and other predisposing factors in exposure to trauma and posttraumatic stress disorder: a follow-up study at age 17 years. *Arch Gen Psychiatry*. 2006;63(11):1238-1245.
12. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol*. 2000;68(5):748-766.
13. Hapke U, Schumann A, Rumpf HJ, John U, Meyer C. Post-traumatic stress disorder: the role of trauma, pre-existing psychiatric disorders, and gender. *Eur Arch Psychiatry Clin Neurosci*. 2006;256(5):299-306.
14. Koenen KC, Fu QJ, Ertel K, Lyons MJ, Eisen SA, True WR, Goldberg J, Tsuang MT. Common genetic liability to major depression and posttraumatic stress disorder in men. *J Affect Disord*. 2008;105(1-3):109-115.
15. Stein MB, Hoffer M, Perkonig A, Lieb R, Pfister H, Maercker A, Wittchen HU. Patterns of incidence and psychiatric risk factors for traumatic events. *Int J Methods Psychiatr Res*. 2002;11(4):143-153.
16. Storr CL, Ialongo NS, Anthony JC, Breslau N. Childhood antecedents of exposure to traumatic events and posttraumatic stress disorder. *Am J Psychiatry*. 2007;164(1):119-125.
17. Goldsmith SK, Pellmar TC, Kleinman AM, Bunney WE, eds. *Reducing Suicide: a National Imperative*. Washington, DC: Institute of Medicine; 2002.
18. Breslau N, Davis GC, Peterson EL, Schultz LR. A second look at comorbidity in victims of trauma: the posttraumatic stress disorder-major depression connection. *Biol Psychiatry*. 2000;48(9):902-909.
19. Henriksson MM, Aro HM, Marttunen MJ, Heikkinen ME, Isometsa ET, Kuoppasalmi KI, Lonnqvist JK. Mental disorders and comorbidity in suicide. *Am J Psychiatry*. 1993;150(6):935-940.
20. Oquendo M, Brent DA, Birmaher B, Greenhill L, Kolko D, Stanley B, Zelazny J, Burke AK, Fircingogullari S, Ellis SP, Mann JJ. Posttraumatic stress disorder comorbid with major depression: factors mediating the association with suicidal behavior. *Am J Psychiatry*. 2005;162(3):560-566.
21. Oquendo MA, Friend JM, Halberstam B, Brodsky BS, Burke AK, Grunebaum MF, Malone KM, Mann JJ. Association of comorbid posttraumatic stress disorder and major depression with greater risk for suicidal behavior. *Am J Psychiatry*. 2003;160(3):580-582.
22. Brent DA, Oquendo M, Birmaher B, Greenhill L, Kolko D, Stanley B, Zelazny J, Brodsky B, Bridge J, Ellis S, Salazar JO, Mann JJ. Familial pathways to early-onset suicide attempt: risk for suicidal behavior in offspring of mood-disordered suicide attempters. *Arch Gen Psychiatry*. 2002;59(9):801-807.
23. Wunderlich U, Bronisch T, Wittchen HU. Comorbidity patterns in adolescents and young adults with suicide attempts. *Eur Arch Psychiatry Clin Neurosci*. 1998;248(2):87-95.
24. Belik SL, Cox BJ, Stein MB, Asmundson GJ, Sareen J. Traumatic events and suicidal behavior: results from a national mental health survey. *J Nerv Ment Dis*. 2007;195(4):342-349.
25. Davidson JR, Hughes DC, George LK, Blazer DG. The association of sexual assault and attempted suicide within the community. *Arch Gen Psychiatry*. 1996;53(6):550-555.
26. Roy A, Hu XZ, Janal MN, Goldman D. Interaction between childhood trauma and serotonin transporter gene variation in suicide. *Neuropsychopharmacology*. 2007;32(9):2046-2052.
27. Roy A. Relationship of childhood trauma to age of first suicide attempt and number of attempts in substance dependent patients. *Acta Psychiatr Scand*. 2004;109(2):121-125.
28. Kingree JB, Thompson MP, Kaslow NJ. Risk factors for suicide attempts among low-income women with a history of alcohol problems. *Addict Behav*. 1999;24(4):583-587.
29. Kellam SG, Werthamer-Larsson L, Dolan LJ, Brown CH, Mayer LS, Rebok GW, Anthony JC, Laudoff J, Edelsohn G. Developmental epidemiologically based preventive trials: baseline modeling of early target behaviors and depressive symptoms. *Am J Community Psychol*. 1991;19(4):563-584.
30. Kellam SG, Rebok GW, Ialongo N, Mayer LS. The course and malleability of aggressive behavior from early first grade into middle school: results of a developmental epidemiologically-based preventive trial. *J Child Psychol Psychiatry*. 1994;35(2):259-281.
31. Breslau N, Wilcox HC, Storr CL, Lucia VC, Anthony JC. Trauma exposure and posttraumatic stress disorder: a study of youths in urban America. *J Urban Health*. 2004;81(4):530-544.
32. Storr CL, Reboussin BA, Anthony JC. Early childhood misbehavior and the estimated risk of becoming tobacco-dependent. *Am J Epidemiol*. 2004;160(2):126-130.
33. Wilcox HC, Anthony JC. The development of suicide ideation and attempts: an epidemiologic study of first graders followed into young adulthood. *Drug Alcohol Depend*. 2004;76(suppl):S53-S67.
34. Wilcox HC, Kellam SG, Brown CH, Poduska J, Ialongo NS, Wang W, Anthony JC. The impact of two universal randomized first- and second-grade classroom interventions on young adult suicide ideation and attempt. *Drug Alcohol Depend*. 2008;95(suppl 1):S60-S73.
35. Robins LN, Helzer JE, Croughan J, Ratcliff KS. National Institute of Mental Health Diagnostic Interview Schedule: its history, characteristics, and validity. *Arch Gen Psychiatry*. 1981;38(4):381-389.
36. Robins LN, Helzer JE, Croughan J, et al. National Institute on Mental Health Diagnostic Interview Schedule (DIS). Mezzich JE, Jorge MR, Salloum IM, eds. *Psychiatric Epidemiology: Assessment, Concepts and Method*. Baltimore, MD: The Johns Hopkins University Press; 1994.
37. Breslau N, Kessler RC, Chilcoat HD, Schultz LR, Davis GC, Andreski P. Trauma and posttraumatic stress disorder in the community: the 1996 Detroit Area Survey of Trauma. *Arch Gen Psychiatry*. 1998;55(7):626-632.
38. World Health Organization. *World Health Organization Composite International Diagnostic Interview (CIDI) Core Version 2.1, Interviewer's Manual*. Geneva, Switzerland: World Health Organization; 1997.
39. Anthony JC, Warner LA, Kessler RC. Comparative epidemiology of dependence on tobacco, alcohol, controlled substances, and inhalants: basic findings from the National Comorbidity Survey. *Exp Clin Psychopharmacol*. 1994;2:244-268.
40. Crum RM, Green KM, Storr CL, Chan YF, Ialongo N, Stuart EA, Anthony JC. Depressed mood in childhood and subsequent alcohol use through adolescence and young adulthood. *Arch Gen Psychiatry*. 2008;65(6):702-712.
41. Cox DR. Regression models and life-tables. *J Roy Stat Soc B*. 1972;34:187-220.
42. Willett JB, Singer JD. Investigating onset, cessation, relapse, and recovery: why you should, and how you can, use discrete-time survival analysis to examine event occurrence. *J Consult Clin Psychol*. 1993;61(6):952-965.
43. Singer JD, Willett JB. Designing and analyzing studies on onset, cessation, and relapse: using survival analysis in drug abuse prevention research. *NIDA Res Monogr*. 1994;142:196-263.
44. Brown CH. Statistical methods for preventive trials in mental health. *Stat Med*. 1993;12(3-4):289-300.
45. Kellam SG, Brown CH, Poduska JM, Ialongo N, Wang W, Toyinbo P, Petras H, Ford C, Windham A, Wilcox HC. Effects of a universal classroom behavior management program in first and second grades on young adult behavioral, psychiatric, and social outcomes. *Drug Alcohol Depend*. 2008;95(suppl 1):S5-S28.
46. Breslow NE, Day NE. Statistical methods in cancer research volume I: the analysis of case-control studies. *IARC Sci Publ*. 1980;(32):5-338.
47. Brewin CR, Andrews B, Gotlib IH. Psychopathology and early experience: a reappraisal of retrospective reports. *Psychol Bull*. 1993;113(1):82-98.
48. Schraedley PK, Turner RJ, Gotlib IH. Stability of retrospective reports in depression: traumatic events, past depressive episodes, and parental psychopathology. *J Health Soc Behav*. 2002;43(3):307-316.
49. Molnar BE, Buka SL, Kessler RC. Child sexual abuse and subsequent psychopathology: results from the National Comorbidity Survey. *Am J Public Health*. 2001;91(5):753-760.
50. Dube SR, Anda RF, Felitti VJ, Chapman DP, Williamson DF, Giles WH. Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: findings from the Adverse Childhood Experiences Study. *JAMA*. 2001;286(24):3089-3096.
51. Brodsky BS, Oquendo M, Ellis SP, Haas GL, Malone KM, Mann JJ. The relationship of childhood abuse to impulsivity and suicidal behavior in adults with major depression. *Am J Psychiatry*. 2001;158(11):1871-1877.
52. Brown J, Cohen P, Johnson JG, Smailes EM. Childhood abuse and neglect: specificity of effects on adolescent and young adult depression and suicidality. *J Am Acad Child Adolesc Psychiatry*. 1999;38(12):1490-1496.
53. Brent DA, Baugher M, Bridge J, Chen T, Chiappetta L. Age- and sex-related risk factors for adolescent suicide. *J Am Acad Child Adolesc Psychiatry*. 1999;38(12):1497-1505.
54. Fergusson DM, Lynskey MT, Horwood LJ. Childhood sexual abuse and psychiatric disorder in young adulthood I: prevalence of sexual abuse and factors associated with sexual abuse. *J Am Acad Child Adolesc Psychiatry*. 1996;35(10):1355-1364.