

## BRIEF REPORTS

# Gender Differences in the Sensitivity to Posttraumatic Stress Disorder: An Epidemiological Study of Urban Young Adults

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The authors examine the relationship between 2 separate but interrelated findings in the epidemiology of posttraumatic stress disorder (PTSD): women's greater PTSD risk following traumatic events and the sensitizing effects of a prior trauma on the PTSD response to a subsequent trauma. Data come from a representative sample of 1,698 young adults from a large U.S. city. Analysis was conducted on the subset exposed to traumatic events. Women's risk for PTSD following assaultive violence was higher than men's. When assaultive violence preceded a later nonassaultive trauma in women, there was an increased risk (relative risk = 4.9) for PTSD, which was not observed in men. The relative risk estimate in women was significantly higher than in men. These findings suggest that assaultive violence elicits women's PTSD response directly and by sensitizing them to the effects of subsequent traumatic events of lesser magnitude.

*Keywords:* PTSD, gender differences, prior trauma, assaultive violence

A frequently replicated finding in the epidemiology of posttraumatic stress disorder (PTSD) is the predominance of female cases. This gender difference has not been traced to female excess risk of exposure to traumatic events in general or to the uneven distribution of specific event types associated with a markedly increased risk for PTSD (e.g., rape). Instead, there is evidence that the gender difference can be traced to the occurrence of PTSD following exposure, particularly when the traumatic events involve assaultive violence (Breslau, Chilcoat, Kessler, Peterson, & Lucia, 1999; Breslau, Kessler, Chilcoat, et al., 1998; Breslau, Wilcox, Storr, Lucia, & Anthony, 2004; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Stein, Walker, & Forde, 2000; Stein, Walker, Hazen, & Forde, 1997). Another frequently replicated finding concerns a suspected sensitizing effect of a prior trauma on the PTSD risk from a subsequent traumatic event (Bremner, Southwick, Johnson, Yehuda, & Charney, 1993; Breslau, Chilcoat, Kessler, & Davis, 1999; Davidson, Hughes, Blazer, & George, 1991; King, King, Foy, & Gudanoski, 1996; Kulka, Fairbank, Hough, Jordan, & Marmar, 1990; Solomon, Mikulincer, & Jakob, 1987; Zaidi & Foy, 1994). In this study, on the basis of an epidemiologic sample of young adults, we report new findings that shed light on these two distinct but interrelated research issues.

The definition of PTSD in the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed.; *DSM-III*; American Psychiatric

Association, 1980) and in subsequent *DSM* editions specifies the types of events that might cause PTSD. The most recent edition, the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994), broadened substantially the range of qualifying traumatic events, thereby increasing the lifetime cumulative incidence of exposure to traumatic events in the general population (Breslau & Kessler, 2001). Qualifying events occur more often among men than among women, though the gender gap (i.e., male excess) tends to be small (Breslau, 2002). An exception to the small gender gap pertains to the category of traumatic events that involves assaultive violence (e.g., shot/stabbed, badly beaten up, mugged/threatened with a weapon, raped), which occurs far more often among men (Breslau, Kessler, Chilcoat, et al., 1998; Breslau, Wilcox, et al., 2004). Although women are less likely than men to experience assaultive violence, once assaulted, they are more likely than men to develop PTSD (Breslau, Chilcoat, Kessler, & Davis, 1999; Breslau, Kessler, Chilcoat, et al., 1998; Breslau, Wilcox, et al., 2004; Kessler et al., 1995; Stein et al., 1997, 2000). Exceptions to the gender difference in population surveys have also been reported (Creamer, Burgess, & McFarlane, 2001).

With respect to the sensitizing effect of prior trauma on the risk for PTSD from a subsequent trauma, the published evidence is largely from samples of military personnel or treatment-seeking trauma victims (Bremner et al., 1993; Davidson et al., 1991; King et al., 1996; Kulka et al., 1990; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993; Solomon et al., 1987; Zaidi & Foy, 1994). These studies suggest that the PTSD risk (or the risk of other posttrauma psychological problems) is higher in persons who have experienced a prior traumatic event, especially an assaultive violence event. Similar findings were reported from a general community sample (Breslau, Chilcoat, Kessler, Peterson, & Lucia, 1999).

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In this report, we address questions about the sensitization issue. Although prior assaultive violence has been found to exert a greater sensitizing effect on the response to subsequent trauma compared to prior nonassaultive trauma (Breslau, Chilcoat, Kessler, & Davis, 1999), it is unclear whether its effect is constant between women and men. Women's greater risk for PTSD following assaultive violence rather than nonassaultive trauma raises the following questions: First, are women more susceptible than men to the influence of prior assaultive violence on the PTSD effect of a subsequent trauma? Second, does prior assaultive violence influence women's sensitivity to the PTSD effects of subsequent traumatic events of both types, assaultive and nonassaultive? In particular, among women, does prior assault influence the PTSD effects of subsequent nonassaultive trauma, an experience associated with a lower risk of PTSD than assaultive violence? Third, is the sensitizing effect of prior assaultive violence gender specific?

Data are from a sample of urban youths from whom we elicited complete lifetime histories of traumatic events. Among the subset who had experienced one or more traumatic events, we assessed *DSM-IV* PTSD in reference to a single trauma selected by the respondents as the worst from the complete list of *DSM-IV* qualifying traumatic events they had experienced. The availability of complete data on the age each traumatic event occurred allowed us to determine the presence and type of traumatic events that had preceded the worst event.

## Method

### Sample

A detailed description of the sample has been presented elsewhere (Breslau, Wilcox, et al., 2004; Kellam & Anthony, 1998; Storr, Reboussin, & Anthony, 2004; Werthamer-Larsson, Kellam, & Wheeler, 1991) and is summarized briefly. Participants were initially recruited as two cohorts of first-grade students in 19 primary schools selected within a public school system of a large mid-Atlantic city in the United States ( $n = 2,311$ ). When the cohorts reached young adulthood, the sample was traced and re-recruited. Nearly 75.0% of the surviving members of the cohorts were interviewed ( $n = 1,698$ ). Mean age at follow up was 21 years (range = 19–23). Women constituted 53.2% of the sample. African Americans constituted 71.0% of the sample and non-Hispanic Whites, 29.0%. Institutional review boards approved study protocols. Signed consent was obtained from parents for the children's participation in primary school and from each participant in young adulthood.

### Assessment of Traumatic Events and PTSD

The inquiry about lifetime history of *DSM-IV* qualifying traumatic events and PTSD was part of a face-to-face interview conducted by trained nonclinician interviewers. The section on trauma and PTSD had been developed and tested previously (Breslau, Kessler, Chilcoat, et al., 1998). It begins with a list of 18 events that operationalize the *DSM-IV* stressor criterion, except for combat events, which were unlikely to have been experienced by these young cohorts during nonwar years. For each event in the list, respondents were asked whether 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

respondent's age at each time. In cases with more than one traumatic event, a list of all 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). We evaluated PTSD in relation to that event using the PTSD section of Version 2.1 of the World Health Organization Composite International Diagnostic Interview (World Health Organization, 1997). A validation study found good agreement between the interview-based diagnoses of PTSD and diagnoses from independent clinical reinterviews (Breslau, Kessler, & Peterson, 1998). The category of assaultive violence includes the following: rape, held captive/tortured/kidnapped, shot/stabbed, sexual assault other than rape, mugged/threatened with weapon, or badly beaten up. The category of other event types includes the following: accidents, disaster, witnessing violence, discovering a dead body, learning about the sudden unexpected death of a close friend/relative, and learning of traumatic events suffered by close friend/relative. In addition to face validity, the classification into the two broad types of trauma, assaultive versus other events, received empirical support in factor analysis (Stein, Jang, Taylor, Vernon, & Livesley, 2002).

The use of the worst event in epidemiological studies is an efficient way to identify persons with PTSD when it is unfeasible to evaluate the PTSD effects of all the traumas reported by each respondent. Leading epidemiological instruments incorporate this approach. There is evidence that only a trivial number of respondents who had failed to meet PTSD criteria for their worst trauma met the criteria for other traumas they had experienced (Breslau, Davis, Peterson, & Schultz, 1997). A methodological investigation of the approach showed a modest overestimate of the conditional risk for PTSD and no bias in estimates of associations with sociodemographic factors (Breslau, Peterson, Poisson, Schultz, & Lucia, 2004). Further, the PTSD risk estimates across specific event categories were similar to the estimates based on representative (typical) events within the same categories. This suggests that trauma characteristics, which distinguish the worst (or most distressing) instances from typical instances of the same event category, have a minor influence on the probability of PTSD (Breslau, Peterson, et al., 2004).

### Statistical Analysis

Analysis was conducted on the subset of respondents with history of exposure to one or more traumatic events, for whom complete data were available (1,325 of the 1,401 who were exposed). We present the conditional probabilities of PTSD in men and women classified by type of worst event and by presence and type of prior trauma in Table 1. We used a multivariable model from which relative risk (RR) estimates were derived. The model included three predictors, that is, worst event (assaultive, nonassaultive), prior event (assaultive, nonassaultive, no prior event), and gender, plus their two- and three-way interactions. Age was included as a covariate to control for its effect. The model is illustrated by the following equation:

$$Y = \alpha + \beta_1(\text{gender}) + \beta_2(\text{worst event}) \\ + \beta_3(\text{prior trauma assault}) \\ + \beta_4(\text{prior trauma nonassault}) + \beta_5(\text{gender} \\ \times \text{worst event}) + \beta_6(\text{gender} \times \text{prior trauma assault})$$

Table 1  
*Conditional Probabilities of PTSD and Relative Risk by Type of Worst Event and Type of Prior Event in Men and Women*

|  | % PTSD | RR (95% CI)     | <i>p</i> |
|--|--------|-----------------|----------|
| Men ( <i>n</i> = 657)                                |        |                 |          |
| Worst event assaultive violence ( <i>n</i> = 153)    | 7.2    |                 |          |
| Prior event assaultive ( <i>n</i> = 56)              | 8.9    | 1.5 (0.6, 3.8)  | .39      |
| Prior event nonassaultive ( <i>n</i> = 31)           | 6.5    | 1.1 (0.2, 6.6)  | .94      |
| No prior event ( <i>n</i> = 66)                      | 6.1    | 1.0 (0.4, 2.5)  | .92      |
| Worst event nonassaultive violence ( <i>n</i> = 504) | 7.7    |                 |          |
| Prior event assaultive ( <i>n</i> = 205)             | 9.8    | 1.6 (0.9, 3.0)  | .12      |
| Prior event nonassaultive ( <i>n</i> = 128)          | 7.0    | 1.2 (0.5, 3.0)  | .67      |
| No prior event ( <i>n</i> = 171; Ref)                | 5.9    | 1.0             |          |
| Women ( <i>n</i> = 668)                              |        |                 |          |
| Worst event assaultive violence ( <i>n</i> = 144)    | 24.3   |                 |          |
| Prior event assaultive ( <i>n</i> = 30)              | 26.7   | 7.2 (2.7, 19.0) | <.001    |
| Prior event nonassaultive ( <i>n</i> = 35)           | 28.6   | 7.9 (3.1, 19.8) | <.001    |
| No prior event ( <i>n</i> = 79)                      | 21.5   | 5.7 (2.4, 13.8) | <.001    |
| Worst event nonassaultive violence ( <i>n</i> = 524) | 6.9    |                 |          |
| Prior event assaultive ( <i>n</i> = 90)              | 17.8   | 4.9 (2.1, 11.1) | <.001    |
| Prior event nonassaultive ( <i>n</i> = 181)          | 6.1    | 1.7 (0.6, 4.6)  | .28      |
| No prior event ( <i>n</i> = 253; Ref)                | 3.6    | 1.0             |          |

*Note.* Relative risk adjusted by age (RR) and 95% confidence interval (CI) estimated in general linear models of clustered data based on a binomial distribution. PTSD = posttraumatic stress disorder; Ref = reference.

$$\begin{aligned}
 &+ \beta_7(\text{gender} \times \text{prior trauma nonassault}) \\
 &+ \beta_8(\text{worst event} \times \text{prior trauma assault}) \\
 &+ \beta_9(\text{worst event} \times \text{prior trauma nonassault}) \\
 &+ \beta_{10}(\text{gender} \times \text{worst event} \times \text{prior trauma assault}) \\
 &+ \beta_{11}(\text{gender} \times \text{worst event} \\
 &\quad \times \text{prior trauma nonassault}) + \beta_{12}(\text{age}),
 \end{aligned}$$

where PTSD is the outcome (*Y*); gender = 1 if female and 0 if male; worst event = 1 if assaultive and 0 if nonassaultive; prior trauma is represented by two binary variables (in the first, assaultive = 1, and other = 0; in the second, nonassaultive = 1, and other = 0).

To take into account the clustered sample (19 schools), we used a variant of the Huber–White sandwich estimator of variance to obtain robust standard errors and variance estimates (Rogers, 1993; StataCorp, 2000; Williams, 2000). From this multivariable model, we derived estimates of PTSD RR and 95% confidence intervals (CIs; log link function; StataCorp, 2005) for subgroups of men and women, cross-classified by type of worst trauma and by the presence and type of prior trauma. RR with a 95% CI that does not include the null value of one is significant at  $\alpha < .05$ . Significance levels of partial regression coefficients were calculated with Wald chi-square tests. The regression model described above was used to derive RR estimates for PTSD within each gender as well as gender differences in RR. In contrast, the three-way interaction (i.e., Gender  $\times$  Worst Event  $\times$  Prior Trauma) was tested in a reduced model in which prior trauma was represented by a single binary term, prior assault versus prior nonassault or no prior trauma. We detected no difference between prior nonassault and no

prior trauma. A less conservative alpha level ( $p < .15$ ) has been suggested for testing interactions in logistic regression analysis (Hosmer & Lemeshow, 1989). Interactions with  $.05 > p < .15$  merit attention.

## Results

### *Traumatic Events and PTSD in Men and Women*

The occurrence of traumatic events and PTSD in this sample is described in detail in a previous report (Breslau, Wilcox, et al., 2004). Here we summarize key findings. Of the total sample of 1,698 young adults, 82.5% ( $n = 1,401$ ; 87.2% of men and 78.4% of women) were exposed to one or more *DSM-IV* qualifying traumatic events. The mean number of traumatic events was 4.8 (6.1 per male respondent and 3.7 per female respondent). Similarly high cumulative occurrence of *DSM-IV* traumatic events have been reported in community samples in the United States and Canada (Breslau, 2002). Among men who reported any exposure, 23.2% experienced assaultive violence as their worst event, and, of those, 7.1% met criteria for PTSD. Among women who reported any exposure, 21.4% experienced assaultive violence as their worst event, and, of those, 23.5% met criteria for PTSD. The probability of PTSD following a nonassaultive trauma did not vary significantly between the genders, 7.5% and 6.6% in men and women, respectively. No significant differences in PTSD were detected in race or in Race  $\times$  Gender interactions. Respondents' age was associated positively with the probability of PTSD.

### *Prior Trauma and the Risk for PTSD Following a Subsequent Trauma*

A higher percentage of men than women experienced a trauma at an earlier age than their age at the worst trauma, 64.0% versus

50.4%, and more men than women experienced assaultive violence prior to their worst event, 39.8% versus 18.2%. In 75.0% of the sample, age of prior trauma was 15 years or younger, with no detectable gender difference.

In Table 1, men and women are cross-classified into subsets by type of worst event and the presence and type of prior trauma. We present unadjusted conditional probabilities of PTSD in gender-specific subsets. We derived RR estimates (95% CIs) and  $p$  values from the multivariable logistic regression model, described above, using as a reference for each gender the subset whose worst event was nonassaultive and had no prior trauma. Among men, the conditional probability of PTSD varied little by (a) whether the worst event involved assaultive violence (7.2% vs. 7.7%) or (b) the presence and type of prior trauma. RR estimates were low and not statistically significant.

In contrast, among women, the conditional probability of PTSD following an assaultive violence event was markedly higher than following a nonassaultive event, 24.3% versus 6.9% (RR = 3.4; 95% CI = 2.1, 5.4). Further, the conditional probability of PTSD following *assaultive* worst event among women varied little by the presence or type of prior trauma: It was 26.7% if they had experienced prior assault, 28.6% if they had experienced other prior trauma, and 21.5% if they had experienced no prior trauma (RR ranged from 5.7 to 7.9). However, the conditional probability of PTSD following *nonassaultive* worst event among women varied by type of prior event: Among those who had experienced assaultive violence at an earlier age, it was markedly higher compared to those who had experienced no prior trauma, 17.8% versus 3.6% (RR = 4.9; 95% CI = 2.1, 11.1). Thus, among women, having a history of prior assaultive violence was associated with increased PTSD risk following a subsequent trauma of apparently lesser magnitude. Further, the RR among women with a nonassaultive worst event who had experienced prior assaultive violence was robustly larger than the RR among men in the corresponding subset, 4.9 versus 1.6, Wald  $\chi^2(1) = 6.8$ ,  $p = .01$ , suggesting that the sensitizing effect of early assault on the PTSD risk associated with a subsequent nonassaultive trauma is gender specific. Note that this test goes further than demonstrating a significant association (RR) in women but not in men. It establishes that the observed association differed significantly between women and men, a condition necessary for concluding that the association is gender specific.

The three-way interaction in the reduced equation, which combines prior nonassaultive event with no prior event, was significant at  $p = .10$ , Wald  $\chi^2(1) = 2.6$ . The significance of the interaction suggests that the sensitizing effect of prior assaultive violence on the PTSD risk following a subsequent nonassaultive event (but not subsequent assaultive event) might be specific to women. Put in other words, it suggests a gender-specific sensitizing effect of prior assault that applies specifically to the PTSD effect of a subsequent nonassault trauma.

## Discussion

In the cohorts of urban young adults, we found that in men, the risk for PTSD neither varied by trauma type, assaultive versus nonassaultive, nor by history of prior trauma. In contrast, women's PTSD risk varied by trauma type as well as by history of prior trauma. Women's PTSD risk following an assaultive violence event was markedly higher than their PTSD risk following other

types of traumatic events. Further, women's PTSD risk following nonassaultive trauma was higher if the prior event was assaultive violence, which seems to have amplified the PTSD response to a subsequent nonassaultive trauma nearly 5 times. Women's PTSD risk following assaultive violence did not vary in relation to prior exposure.

These findings, taken together, tend to support three conclusions about women's risk of PTSD following exposure. First, relative to other trauma types to which women are exposed, the risk of PTSD is markedly higher following assaultive violence. Second, when assaultive violence precedes a later nonassaultive trauma in women, there is an increased risk of PTSD following the nonassaultive trauma, which may reflect a process of sensitization induced by the earlier assaultive violence trauma. Third, the hypothesized sensitization suggested by the heightened PTSD risk following nonassaultive trauma in victims who experienced prior assault does not seem to occur following violent assault.

The generalizability of the results is limited by the nature of our community sample, which comprised urban young adults. Additionally, despite the relatively large sample, the typically low conditional probability of PTSD resulted in a small number of PTSD cases ( $n = 121$ ), limiting statistical power and precluding more complex analytic models that include all suspected codeterminants. The test of a gender difference in the sensitizing effect of prior assault on the PTSD response of a nonassault trauma (a test that does not address statistically the distinctiveness of the effect for subsequent nonassaultive vs. assaultive violence) reached significance at the conventional level of  $\alpha < .05$ . However, the gender difference in the specificity of the sensitization by type of prior event, as well as by type of subsequent event was significant only at a less conservative alpha, which has been suggested for interactions in logistic regression (Hosmer & Lemeshow, 1989). Replications in larger samples are needed. With respect to codeterminants, race and family socioeconomic status indicators were unrelated to the probability of PTSD in this sample (Breslau, Wilcox, et al., 2004). Major depression or anxiety disorders can not be considered potential confounders in the gender-PTSD differential (given that gender is fixed at birth), although history of these disorders increases the risk for PTSD. The general caveat about the reliance on retrospective data in epidemiological studies also applies to these results. Data on exposure and PTSD are based on respondents' accounts of their lifetime experiences and thus the accuracy of the data might be less than desired. However, the young age of the cohort would tend to attenuate this concern.

Like earlier reports on the effects of prior trauma, this study lacks information on the psychiatric consequences of prior trauma, specifically, whether prior exposure had resulted in PTSD. A study that compared the effect of prior trauma on victims who had experienced high or low numbers of PTSD symptoms (not PTSD) reported a greater impact on PTSD symptoms following a subsequent trauma only in those who had high PTSD symptoms from the prior trauma (Brunet, Boyer, Weiss, & Marmar, 2001). To document the sensitization process of increased reactivity to subsequent trauma, researchers need to conduct long-term prospective studies with repeated assessments of exposure and PTSD.

There are several plausible explanations for the gender difference in relation to assaultive violence observed in this epidemiological study. These differences can be traced not only to identifiable biological substrates but also to male-female differences in socialization and formative childhood experiences. With respect to

the former, the lines of research include neurophysiological laboratory experiments showing that women exhibit greater cardiac deceleration (*fear bradycardia*) compared to men when viewing unpleasant images (Bradley, Codispoti, Sabatinelli, & Lang, 2001). Related gender differences also were detected in preadolescents (McManis, Bradley, Berg, Cuthbert, & Lang, 2001). With respect to aspects of experience, assault is a more normative experience for men than women, often occurring in the process of rough-and-tumble play that tends to be more common to boys. The possibility that gender differences in physical size and strength, which places women at physical disadvantage vis-à-vis their male assailants, has been suggested as a potential explanation (Bradley et al., 2001). There is also the possibility that these biological, cultural, and developmental factors are interrelated.

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