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Vulnerability to assaultive violence: further specification of the sex difference in post-traumatic stress disorder

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ABSTRACT

Background. We examine potential sources of the sex differences in post-traumatic stress disorder (PTSD) in the community.

Methods. Data were obtained from a representative sample of 2181 persons aged 18–45 years in the Detroit primary metropolitan statistical area, which is a six-county area containing more than four million residents. A random digit dialling method was used to select the sample and a computer-assisted telephone interview was used to obtain the data. DSM-IV PTSD was assessed with respect to a randomly selected trauma from the list of qualifying traumas reported by each respondent.

Results. The lifetime prevalence of exposure and the mean number of traumas were lower in females than males. The overall conditional risk of PTSD (i.e. the probability of PTSD among those exposed to a trauma) was approximately twofold higher in females than males, adjusting for the sex difference in the distribution of trauma types. The sex difference was due primarily to females' greater risk following assaultive violence. The sex difference in the avoidance and numbing symptom group following assaultive violence exceeded the sex differences in other symptom groups.

Conclusions. Future research should focus on sex differences in the response to assaultive violence, including potential explanations for females' greater probability to experience avoidance and numbing.

INTRODUCTION

Epidemiological surveys in the United States report higher rates of post-traumatic stress disorder (PTSD) in females than in males (Helzer *et al.* 1987; Breslau *et al.* 1991, 1997, 1998*a*; Davidson *et al.* 1991; Norris 1992; Kessler *et al.* 1995, 1999; Stein *et al.* 1997). This sex difference is not due to the higher rate of exposure to traumatic events in females. On the contrary, the lifetime prevalence of traumatic events is higher in males, as is the proportion with a history of multiple traumatic events (Breslau *et al.* 1991, 1997; Norris 1992; Kessler *et al.* 1995, 1999; Stein *et al.* 1997). Females do report higher rates of rape and other sexual assault, experiences that are associated with a high risk of PTSD in both sexes (Norris, 1992; Kessler *et al.* 1995). However, when type of traumatic events was held constant, risk of PTSD in females was still higher than in males (Kessler *et al.* 1995). Previous studies that have examined this differential vulnerability failed to detect any evidence that the greater vulnerability of females was explained by sex differences in the number or type of prior traumas (Breslau *et al.* 1997, 1999) or was markedly reduced when pre-existing psychiatric disorders were taken into account.

There is some evidence to suggest that the sex difference in the risk of PTSD might vary across types of trauma and might be wider in connection with events that involve intentional (assaultive) violence than other types of events,

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such as disaster, witnessing acts of violence, or severe accidents (Norris 1992; Kessler *et al*. 1995). This issue has been neither explicitly formulated nor systematically examined. Also, previous epidemiological studies have focused on traumatic events nominated by respondents as the worst they had ever experienced, precluding the possibility of obtaining an unbiased estimate of the risk of PTSD across trauma types (Kessler *et al*. 1995, 1999). Traumas designated as the worst, or most upsetting, represent the extreme end of the distribution of experiences defined as potential causes of PTSD, leading to overestimating the conditional risk of PTSD (Breslau *et al*. 1998*b*).

In this report, we examine the sex difference in PTSD in the 1996 Detroit Area Survey of Trauma, a representative probability sample of 2181 persons aged 18 to 45 years. A complete history of traumatic events was gathered from each respondent and PTSD was assessed in connection with an event randomly selected from the list of events reported by each respondent. The analysis proceeds as follows. First, we describe the lifetime prevalence of traumatic events in females and males and the occurrence rates of exposure across the lifespan of the respondents. Secondly, we compare the conditional risk of PTSD in females *versus* males across traumatic events and examine whether the excess risk in females varies a cross event types. Finally, we present sex comparisons of the rates of criterial symptoms of PTSD following exposure to various categories of trauma, and examine whether the greater propensity of females to experience PTSD symptoms varies across symptom groups.

Three symptom groups constitute the syndrome of PTSD in DSM-IV (American Psychiatric Association, 1994): re-experiencing the trauma (1 of a list of 5 is required); avoidance and numbing (3 of a list of 7 are required); and hyperarousal (2 of a list of 5 are required). It has been previously observed that the avoidance and numbing symptom group is the least frequently met criterion, and that the requirement of 3 symptoms in that group might be overly restrictive (Green, 1993; Kilpatrick & Resnick, 1993). The avoidance and numbing criterion is critically significant to the diagnosis of PTSD, as only a small fraction of those who report sufficient symptoms in the other symptom groups 'pass' this criterion (Green, 1993; Kilpatrick & Resnick, 1993). A sex difference in the probability of reporting symptoms of avoidance and numbing might account for the sex difference in PTSD. We examine this and other potential explanations in this analysis.

METHOD

Sample and data

The 1996 Detroit Area Survey of Trauma is a representative sample of 2181 persons 18–45 years of age in the Detroit primary metropolitan statistical area (PMSA). The Detroit PMSA is a six-county area that contained 4226654 residents at the time of the 1990 census and 1922173 in the 18–45 age range, of whom the majority (77%) resided in suburban and rural communities and only a small minority (23%) resided in the City of Detroit (Census of Population and Housing, 1990). A random digit dialling method was used to select the sample and a computer-assisted telephone interview was used to obtain the data (Potthoff, 1994; Survey Sampling, Inc., 1996). The sampling method is described in detail in Breslau *et al*. 1998*b*). The method yields a representative sample of the population of the area, because virtually all area households ($>97\%$) had a telephone, according to the 1990 census. Screening was completed in 76·2% of households and the cooperation rate in eligible households was 86·8%, yielding an overall response rate of 66·1%. The sample was weighted to adjust for differences in number of age-eligible persons in the household, for oversampling of men, and for differences in the probability of completing the interview. Finally, to approximate the sample distribution to the population of the Detroit PMSA, post-stratification weights were applied based on the joint distribution of age, sex, race, income, and education in the 1990 US Census. A comparison of the distributions of sample characteristics with those of the population of comparable age in the area suggests that we succeeded in getting a representative sample with respect to key demographic characteristics, including sex, race, marital status, education, employment, income and county of residence (Breslau *et al*. 1998*b*).

The interview began with an enumeration of 19 types of traumatic events that operationalize

the DSM-IV definition as explicated in its accompanying text (see Table 1). An endorsement of an event type was followed by questions on the number of times an event of that type had occurred and the respondent's age at each time. A procedure was implemented for identifying complex, interrelated events (e.g. a subject was raped, beaten-up, and threatened with a weapon on the same occasion) and code them as a single distinct event. A computer selected one random event out of the list of distinct events reported by each respondent for evaluation with respect to PTSD, using a slightly modified version of the Diagnostic Interview Schedule IV (DIS-IV) (Robins *et al.* 1995) and the Composite International Diagnostic Interview (CIDI), Version 2.1 (World Health Organization, 1997), which is modelled after it. The instrument is a fully structured diagnostic interview, designed to be administered by experienced interviewers without clinical training. Subjects' responses were used to diagnose PTSD based on DSM-IV criteria. A validation study conducted in a stratified random subset of the sample ($N = 53$) found high agreement between the telephone administered structured interview and independent clinical re-interviews conducted on the telephone by two clinicians, blind to respondents' initial PTSD diagnosis (sensitivity = 95·6% and specificity = 71·0%) (Breslau *et al.* 1998*c*). As to the validity of telephone interviews, research in survey methodology has shown little effect of mode of administration of structured instruments (Groves, 1989). Moreover, a study that focused on the NIMH-DIS demonstrated the validity of data obtained by telephone, compared to face-to-face interviews (Wells *et al.* 1988). (See also Rohde *et al.* 1997 for similar results in relation to clinical psychiatric interviews.)

Data analysis

Analysis of sex differences in exposure to trauma was based on the complete list of traumas reported by the respondents and was estimated on the weighted data. Sex differences in the conditional risk of PTSD across trauma types, in comparison, were estimated on the randomly selected traumas, one from each respondent's list. In addition to the weights described above, each randomly selected event was weighted by the number of events reported by the respondent. The weighting adjusts for the variation across respondents in the selection probabilities of events, due to differences in the number of events experienced. Data are presented on 19 specific types of events, as well as 4 classes of events into which the specific types were grouped (Table 1). Direct personal traumas were divided into two classes, separating events that involved intentional violence, referred to as 'assaultive violence', from other types of directly experienced traumas, referred to as 'other injury or shocking experience'. A third category covers traumas involving learning about traumatic events experienced by others, while a fourth category, learning about the sudden unexpected death of a family member or a close friend, was separated from the third category because of its high prevalence in the population.

We used a series of univariate analyses to compare the prevalence of various traumatic events in females and males. Based on respondents' reports of their lifetime exposure to traumatic events, including the age at each event, we estimated the occurrence rates of exposure in females and males at various ages, using standard life-table methods (Lawless, 1982). At each age interval, the estimated rate represents the risk of exposure, using as the denominator the total person-years at that interval. This should be distinguished from the hazard rate of first exposure, which would be based on person-years at a specific age interval contributed only by those who had not been previously exposed. SUDAAN (Research Triangle Institute, 1992) was used to take into account the sample weights and to obtain standard errors for estimates based on weighted data. Similar analyses were conducted to estimate the sex difference in the conditional risk of PTSD after exposure to various traumatic events, using data on the randomly selected traumas.

RESULTS

Sex differences in lifetime exposure to traumatic events

Information on lifetime exposure to traumatic events is presented in Table 1. The vast majority of both females and males reported exposure to at least one trauma; the lifetime prevalence in females was lower than in males, 87·1% *v.*

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Table 1. *Lifetime prevalence of exposure to traumatic events by sex*

	Females ($N = 1074$)		Males ($N = 1107$)	
	Exposed (%)	S.E.	Exposed (%)	(S.E.)
Assaultive violence	32·4	(1·7)	43·3	(1·7)
Military combat	0·2	(0·2)	2·8	(0·6)
Rape	9·4	(1·1)	1·1	(0·4)
Held captive/tortured/kidnapped	2·0	(0·5)	1·7	(0·5)
Shot/stabbed	1·8	(0·5)	8·2	(1·0)
Sexual assault other than rape	9·4	(1·1)	2·8	(0·6)
Mugged/held-up/threatened with weapon	16·4	(1·3)	34·0	(1·6)
Badly beaten-up	9·8	(1·1)	13·1	(1·2)
Other injury or shocking event	52·0	(1·8)	68·0	(1·6)
Serious car accident	23·5	(1·6)	32·8	(1·6)
Other serious accident	9·5	(1·1)	18·5	(1·3)
Natural disaster	15·3	(1·3)	17·9	(1·3)
Life-threatening illness	5·9	(0·8)	3·6	(0·6)
Child's life-threatening illness	3·5	(0·7)	2·6	(0·5)
Witnessed killing/serious injury	18·6	(1·4)	40·1	(1·7)
Discovering a dead body	6·2	(0·9)	9·1	(1·0)
Learning of traumas to others	61·8	(1·8)	63·1	(1·7)
Close relative raped/sexually assaulted	34·6	(1·7)	30·5	(1·6)
Close relative attacked	12·4	(1·2)	20·1	(1·4)
Close relative car accident	37·0	(1·8)	42·0	(1·7)
Close relative other accident	10·6	(1·1)	13·8	(1·2)
Sudden unexpected death of relative/friend	59·0	(1·8)	61·1	(1·7)
Any trauma	87·1	(1·2)	92·2	(1·0)

Based on the total pool of traumatic events compiled from the complete lists of events reported by the respondents.

92·2% ($z = 3{\cdot}31$, $P < 0{\cdot}001$). Among exposed persons, the mean number of traumatic events was significantly lower in females than in males, 4·3 *v.* 5·3 ($t = 5{\cdot}6$, $P < 0{\cdot}001$). However, as can be seen in Table 1, this overall pattern of a lower exposure in females obscures an important variation in sex differences across event types. Females had a significantly lower prevalence of assaultive violence than males, 32·4% *v.* 43·3% ($z = 4{\cdot}51$, $P < 0{\cdot}001$), as well as of other injury or shocking event, 52% *v.* 68% ($z = 6{\cdot}53$, $P < 0{\cdot}001$). In contrast, there were little differences between the sexes in the rates of learning about traumas to others, 61·8% *v.* 63·1% ($z = 0{\cdot}51$, $P = 0{\cdot}610$), and sudden unexpected death of a loved one, 59·0% *v.* 61·1% ($z = 0{\cdot}85$, $P = 0{\cdot}390$). Within the category of assaultive violence, females had significantly higher rates of rape ($z = 7{\cdot}25$, $P < 0{\cdot}001$) and of other sexual assault ($z = 5{\cdot}27$, $P < 0{\cdot}001$), but significantly lower rates of other types of assaultive violence, chiefly being shot or stabbed ($z = 5{\cdot}27$, $P < 0{\cdot}001$), mugged/threatened with a weapon ($z = 8{\cdot}16$, $P < 0{\cdot}001$), and having been badly beaten-up ($z = 2{\cdot}11$, $P = 0{\cdot}040$). A significant sex difference was also found in military combat ($z = 4{\cdot}20$, $P < 0{\cdot}001$), although the rates in this sample were low. Within the category of other injury or shocking events, noteworthy sex differences were observed in serious accidents – motor vehicle ($z = 4{\cdot}15$, $P < 0{\cdot}001$) and other serious accidents ($z = 5{\cdot}19$, $P < 0{\cdot}001$) – and witnessing acts of violence ($z = 9{\cdot}45$, $P < 0{\cdot}001$), all reported far more often by males. These results were unchanged when race, education, income and marital status were controlled.

Sex comparisons of the risk of exposure across various ages

Results from standard life table methods show that the rate of occurrence of assaultive violence in both sexes peaked at 16–20 years of age and fell sharply during the subsequent decade. There is clear evidence of sex differences across most age ranges, with males showing higher rates than females. During the fourth decade of life, rate of assaultive violence for males remained the same as at age 30, whereas for females the rate continued the downward trend that began after age 20.

Sex differences by age were also observed with respect to other injury or shocking experience. In contrast with assaultive violence and other injury or shocking experience – the two

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Table 2. *The conditional risk of PTSD among respondents exposed to specific traumas by sex*

	Females		Males	
	PTSD (%)	(S.E.)	PTSD (%)	(S.E.)
Assaultive violence	35·7	(5·6)	6·0	(3·3)
Military combat	*	—	0	(0·0)
Rape	49·0	(12·2)	†	—
Held captive/tortured/kidnapped	78·2	(18·3)	0	(0·0)
Shot/stabbed	0	(0·0)	18·1	(15·8)
Sexual assault other than rape	24·4	(11·7)	15·7	(15·5)
Mugged/held-up/threatened with weapon	17·5	(9·0)	2·4	(1·4)
Badly beaten-up	56·2	(12·1)	6·4	(5·4)
Other injury or shocking event	5·4	(2·0)	6·6	(1·9)
Serious car accident	3·6	(2·8)	1·6	(1·2)
Other serious accident	28·3	(10·8)	10·4	(7·3)
Natural disaster	0	(0·0)	7·3	(5·6)
Life-threatening illness	1·0	(1·2)	1·2	(1·3)
Child's life-threatening illness	0	(0·0)	17·8	(15·7)
Witnessed killing/serious injury	2·8	(2·8)	9·1	(3·3)
Discovering a dead body	0·5	(0·5)	0	(0·0)
Learning of traumas to others	3·2	(1·3)	1·4	(0·8)
Sudden unexpected death of relative/friend	16·2	(3·6)	12·6	(3·6)
Any trauma	13·0	(1·6)	6·2	(1·2)

Based on the sample of events randomly selected from the list of events reported by each respondent.
The table has been shortened by deleting information on specific event types under the category 'Learning of traumas to others'. The estimates for these individual event types are based on small numbers and do not vary across the events.
* Military combat was not a randomly selected event for any female.
† Rape was not a randomly selected event for any male.

categories of direct personal traumas – learning about traumas to others and sudden unexpected death of a loved one varied little by sex. In both sexes, learning about trauma to others peaked at age 16–20 years and then fell precipitously, whereas sudden unexpected death of a loved one remained at the peak level up to age 45.

The conditional risk of PTSD in females and males

Sex-specific estimates of the conditional risk of PTSD, that is, the risk of PTSD among those exposed to traumatic events, are presented in Table 2. The estimates are based on the randomly selected events from the list of events reported by each respondent. The conditional risk of PTSD associated with any trauma was 13·0% in females and 6·2% in males ($z = 3{\cdot}29$, $P < 0{\cdot}001$) (female to male ratio = 2·10). The overall sex difference in the conditional risk of PTSD was due primarily to females' greater risk of PTSD following exposure to assaultive violence. Specifically, the conditional risk of PTSD associated with assaultive violence was 35·7% in females *v.* 6·0% in males ($z = 3{\cdot}41$, $P < 0{\cdot}001$) (female to male ratio = 5·95), whereas the sex differences in the three other categories of traumatic events were not significant (5·4% *v.* 6·6% ($z = 0{\cdot}45$, $P = 0{\cdot}653$) for other injury or shocking event, 3·2% *v.* 1·4% ($z = 1{\cdot}27$, $P = 0{\cdot}204$) for learning about traumas to others, and 16·2% *v.* 12·6% ($z = 0{\cdot}69$, $P = 0{\cdot}490$) for sudden unexpected death of a loved one). Controlling for key sociodemographic characteristics did not alter these results.

Females' higher risk for PTSD applied to all but one event type subsumed under assaultive violence on which sex comparisons could be made (Table 2). The exception was having been shot/stabbed, for which males had a higher PTSD risk than females, 18% *v.* 0%. However, the number of females whose randomly selected event was shot/stabbed was only 5, reflecting the rare occurrence of this event type in females (Table 1). Estimates of the conditional risk of PTSD based on small numbers of exposed cases are imprecise. In this case, the upper limit of the 95% confidence interval associated with the observed value of zero is 52·2%. The sex difference in the conditional risk is not significant ($P = 0{\cdot}55$).

On two event types comparisons could not be made: military combat was not a randomly selected event for any female; and, rape was not

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Table 3. *Percentages of PTSD cases resulting from various types of traumas*

	Females		Males	
	(%)	(S.E.)	(%)	(*s.e.*)
Assaultive violence	54·1	(6·7)	15·4	(7·8)
Military combat	0·0	(0·0)	0·0	(0·0)
Rape	15·2	(4·5)	0·0	(0·0)
Held captive/tortured/kidnapped	4·2	(3·2)	0·0	(0·0)
Shot/stabbed	0·0	(0·0)	7·9	(7·4)
Sexual assault other than rape	7·6	(3·8)	0·7	(0·7)
Mugged/held-up/threatened with weapon	8·0	(4·4)	3·0	(1·9)
Badly beaten-up	19·1	(5·5)	3·5	(2·9)
Other injury or shocking event	11·8	(4·2)	40·4	(9·4)
Serious car accident	1·8	(1·4)	2·4	(1·9)
Other serious accident	8·3	(3·8)	9·2	(6·6)
Natural disaster	0·0	(0·0)	6·5	(5·0)
Life-threatening illness	0·1	(0·1)	0·2	(0·2)
Child's life-threatening illness	0·0	(0·0)	2·5	(2·4)
Witnessed killing/serious injury	1·4	(1·4)	19·7	(7·0)
Discovering dead body	0·1	(0·1)	0·0	(0·0)
Learning of trauma to others	7·5	(2·9)	5·9	(3·3)
Sudden unexpected death	26·6	(5·8)	38·5	(9·4)

Based on PTSD cases associated with the randomly selected traumatic events.

The table has been shortened by deleting information on specific event types under the category 'Learning of traumas to others'. The estimates for these individual event types are based on small numbers and do not vary across the events.

a randomly selected event for any male. The absence of females exposed to military combat is of little consequence for the overall sex difference in the conditional risk of PTSD or for the conditional risk associated with assaultive violence, because none of the handful of males whose randomly selected event was military combat met PTSD criteria. However, the absence of males whose randomly selected event was rape has important implications for these comparisons, because the observed risk to females for PTSD associated with rape was high. To address the disparity between the sexes in the percentage exposed to rape, we compared the conditional risk of PTSD between the sexes, deleting those whose randomly selected event was rape. In the remaining subset ($N = 1925$), the conditional risk of PTSD associated with assaultive violence was 32·3% (S.E. = 6·4) in females and 6·0% (S.E. = 3·3) in males ($z = 3·08$, $P < 0·001$) (female to male ratio = 5·39). The conditional risk of PTSD associated with any trauma was 11·5% (S.E. = 1·6) in females and 6·2% (S.E. = 1·2) in males ($z = 2·63$, $P < 0·01$); (female to male sex ratio = 1·85).

In a separate analysis, we estimated the sex differences in the conditional risk of PTSD by the method of direct standardization, (Lilienfeld & Stolley, 1994), which 'corrects' for the sex difference in the distribution across types of traumatic events, setting the distribution of events equal to the observed females' distribution. The PTSD rate per 10000 males and females was then calculated, applying the observed sex-specific conditional risks of PTSD associated with various event types. In the absence of data for estimating males' risk for PTSD associated with rape, the observed females' risk was applied to both sexes. The female to male ratio of PTSD associated with assaultive violence, based on the standardized data, was 2·24 (699/312 per 10000) and for any trauma, 1·64 (1295/790 per 10000).

The distribution of PTSD cases across trauma types

The distributions of PTSD cases across the types of traumatic events that have led to the disorder are presented in Table 3. In both sexes, the single most frequent cause of PTSD was sudden unexpected death of a loved one, with 26·6% of female cases and 38·5% of male cases attributable to an event of this type. We also found that a higher proportion of females than males with PTSD was attributable to assaultive violence, 54·1% *v.* 15·4%. This sex difference is in large part the result of females' higher risk for PTSD following events of this type, as the percentage

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Table 4. *Percentages meeting criteria for PTSD symptom groups by sex and event category*

	Re-experiencing		Avoidance/numbing		Hyperarousal	
	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)
Assaultive violence	85·2	54·9	52·2	18·8	63·1	35·1
	($z = 3{\cdot}97$, $P < 0{\cdot}001$)		($z = 3{\cdot}92$, $P < 0{\cdot}001$)		($z = 3{\cdot}25$, $P < 0{\cdot}002$)	
Sudden unexpected death	82·2	65·2	21·3	20·4	49·9	39·4
	($z = 3{\cdot}05$, $P = 0{\cdot}002$)		($z = 0{\cdot}15$, $P = 0{\cdot}881$)		($z = 1{\cdot}50$, $P = 0{\cdot}134$)	
Other injury/shock	71·6	65·3	9·4	11·3	42·9	29·8
	($z = 1{\cdot}23$, $P = 0{\cdot}219$)		($z = 0{\cdot}46$, $P = 0{\cdot}646$)		($z = 2{\cdot}25$, $P = 0{\cdot}024$)	
Learning about trauma to others	61·0	55·3	7·4	7·0	30·3	24·1
	($z = 0{\cdot}98$, $P = 0{\cdot}327$)		($z = 0{\cdot}10$, $P = 0{\cdot}920$)		($z = 1{\cdot}14$, $P = 0{\cdot}254$)	

Based on responses to PTSD items associated with the randomly selected traumatic events.
Event categories appear in a descending order in terms of their PTSD liability.

whose randomly selected event was assaultive violence was approximately the same in both sexes, 19·7% in females and 15·8% in males. The sex differences in the distribution of types of assaultive violence contributed to this finding as well.

PTSD symptom groups in females and males

Table 4 presents the proportions of exposed females and males who met criteria for each of the three symptom groups that constitute the DSM-IV PTSD syndrome in response to the randomly selected trauma. Several observations can be made. First, with respect to all event categories, the proportions of females and males who met criteria for reexperiencing were considerably higher than for the other symptom groups. Secondly, avoidance and numbing was the symptom group with the lowest rate across all event categories. Thirdly, females reported higher rates of reexperiencing and hyperarousal in connection with all event categories, although the sex differences reached significance only in some of the comparisons. Fourthly, sex differences on all three symptom groups were the largest in connection with assaultive violence, with females showing significantly higher rates. Additionally, with respect to avoidance and numbing, on which rates were generally low in both sexes, more than half of the females who were exposed to assaultive violence met this criterion, compared to less than 20% of the males. In contrast, for other event categories, sex differences in avoidance and numbing were negligible.

We also calculated the female to male ratios of endorsing each of the three symptom groups following assaultive violence. The sex ratio for re-experiencing was 1·5, avoidance/numbing was 2·8 and hyperarousal was 1·8. A generalized estimating equations (GEE) approach to Poisson regression (Diggle *et al*. 1994) was used to estimate the cross-product ratios involving the three symptom groups, to test the differences in the sex ratios between pairs of symptom groups. The cross-product ratio for avoidance/numbing *v*. re-experiencing was 1·79 (95% CI 1·06, 3·03) ($P = 0{\cdot}031$), for avoidance/numbing *v*. hyperarousal, 1·54 (95% CI 0·98, 2·44) ($P = 0{\cdot}062$), and for re-experiencing *v*. hyperarousal, 1·16, (95% CI 0·79, 1·70) ($P = 0{\cdot}452$). These findings indicate that the female to male ratio of endorsing the avoidance/numbing symptom group was significantly higher (or nearly significantly higher) than the sex ratio of endorsing each of the other two symptom groups.

DISCUSSION

The key findings of this study are as follows: (1) while the vast majority of both sexes have experienced at least one trauma, the lifetime prevalence was lower in females; (2) overall, the conditional risk of PTSD (i.e. the probability of PTSD among those exposed to traumas) was approximately twofold higher in females than males, even when the sex difference in the distribution of trauma types is taken into account; (3) the sex difference in the conditional risk of PTSD is due primarily to the greater risk to females after assaultive violence; (4) more than half of female cases of PTSD in the community (compared to 15% of male cases) is attributable to assaultive violence; and (5)

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females exposed to assaultive violence were significantly more likely than male counterparts to report avoidance and numbing symptoms.

Previous epidemiological studies have documented a higher prevalence of PTSD in females than males (Helzer *et al.* 1987; Davidson *et al.* 1991; Breslau *et al.* 1991, 1997; Kessler *et al.* 1995, 1999; Norris, 1992; Stein *et al.* 1997). The interpretation of this consistent finding has varied. Several reports concluded that the higher prevalence of females reflects a greater vulnerability to the PTSD effects of traumatic events, based on the findings that the sex difference remains when trauma type is held fixed (Kessler *et al.* 1995; Breslau *et al.* 1997; Norris, 1992). On the other hand, a recent review of some of the same epidemiological data has proposed that females are not more vulnerable than males, but that they 'experience traumatic events that are intrinsically more devastating in type and severity' (Solomon & Davidson, 1997, p. 7), citing evidence from Kessler *et al.* (1995) that females were markedly more likely to be raped. Our analysis replicates the previous findings regarding the sex difference in PTSD and indicates that the difference is not due to females' more frequent exposure to rape. While females do experience rape more often than males, this accounts for only a part of the sex difference in the conditional risk of PTSD. Using various analytical strategies to address the sex difference in the distribution of trauma types, we found that for females the higher conditional risk of PTSD held-up.

Our analysis indicates that the higher risk for PTSD in females is by no means a generalized vulnerability, but appears to be a vulnerability observed primarily with respect to the effects of assaultive violence. Similar data can be found in two previous reports, although they have not been explicitly noted. In the National Comorbidity Survey, the PTSD risk associated with molestation and being threatened with a weapon was much higher in females than in males, whereas the PTSD risk associated with disaster, witnessing acts of violence, and severe accidents differed little between the sexes (Kessler *et al.* 1995). In another epidemiological survey, the risk of PTSD associated with exposure to crime (i.e. robbery, physical assault and sexual assault) was considerably higher in females than in males, whereas the risk of PTSD associated with disaster and accidents differed little between the sexes (Norris, 1992). We found that the risk of exposure to assaultive violence in both sexes is highest in late adolescence and early adulthood, i.e. 16–20 years of age. We also found that the steep downward trend than begins at age 20 continues in females (but not in males) throughout the fourth decade of life. These findings suggest that in females excess risk of PTSD is likely to be most pronounced during adolescence and early adulthood.

Females reported higher rates of re-experiencing and hyperarousal across all four categories of traumas. However, higher prevalence of avoidance/numbing in females *v.* males was observed only in response to assaultive violence, a finding that accounts in large part for females' greater risk for PTSD following events in this category. That is, in females higher risk for PTSD is due largely to their higher risk for symptoms of avoidance/numbing following traumatic experiences that involve assaultive violence. One might hypothesize that exposure to assaultive violence is far more threatening and injurious to females, given the high probability that the perpetrators are males, who wield greater physical power.

Two issues in this report warrant comment. The first concerns the response rate we obtained in this survey and the second concerns the lifetime prevalence of exposure to traumatic events. With respect to the first, although we obtained a high response rate among age eligible persons, 86·8%, we succeeded in completing eligibility screening in only 76·2% of households, bringing down our overall response rate to 66·1%. This figure, although relatively low, is well within the range of response rates obtained in recent years in telephone surveys used for official health and economic statistical reports, such as *Morbidity and Mortality Weekly Reports*. It is reassuring that comparisons with census data show that the sample is representative of the population of the geographic area with respect to key characteristics, including sex and racial composition, education, income, employment status, marital status and place of residence (Breslau *et al.* 1998*b*). Furthermore, we did not identify a single statistically significant predictor of non-response out of this list of sociodemographic variables. Nonetheless, we cannot dismiss unequivocally the possibility that

persons who do not wish to participate in surveys in general, or did not wish to participate in this telephone survey in particular and were unwilling to answer the screening questions differ on relevant characteristics from those who completed the screening.

With respect to the second point, our estimates of the lifetime prevalence of exposure to traumatic events are higher than previously reported, 92·2% in males and 87·1% in females. However, none of the previous surveys has used the DSM-IV stressor definition, which is more inclusive than in previous DSM editions. It should be noted that our estimates of exposure are only slightly higher than those reported in a recent survey in Winnipeg, Canada, which were 81·3% in males and 74·2% in females, although that survey did not comprehensively cover the DSM-IV stressor definition. Furthermore, our estimates of the lifetime prevalence of specific traumas, such as rape, sexual assault, disaster, are similar to those in the National Comorbidity Survey (Kessler *et al*. 1995), although the overall prevalence of exposure cannot be compared due to the different DSM editions used in the two studies.

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