

Gender Differences in Probable Posttraumatic Stress Disorder Among Police Responders to the 2001 World Trade Center Terrorist Attack

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Background Police responders to the 2001 World Trade Center (WTC) disaster were previously reported to have an increased prevalence of probable posttraumatic stress disorder (PTSD).

Methods Four thousand seventeen police responders (3,435 men and 582 women) were interviewed 2–3 years after 9/11/01 as part of the World Trade Center Health Registry. Demographic, occupational, and event-specific risk factors were evaluated for probable PTSD, determined by DSM-IV criteria using the Posttraumatic Stress Checklist (PCL).

Results Overall prevalence of probable PTSD was 8.3% (women: 13.9%; men: 7.4%, $P < 0.001$). Risk factors for both genders included 9/11-related injury and older age. For men, specific risk factors were: presence in WTC Towers on 9/11 and Hispanic ethnicity; and for women, witnessing horror and education less than a college degree.

Conclusions Significantly higher prevalence of probable PTSD was found for female police responders. Although consistent with civilian populations, this finding contrasts with other studies of PTSD and WTC rescue and recovery workers, and police prior to 9/11. Am. J. Ind. Med. 53:1186–1196, 2010. © 2010 Wiley-Liss, Inc.

KEY WORDS: 9/11 disaster; women; Posttraumatic stress disorder; DSM-IV diagnosis; police

INTRODUCTION

The commercial plane hijacking and subsequent attacks on the World Trade Center (WTC) on September 11, 2001,

resulted in ~2,700 immediate deaths and many injuries [Galea et al., 2002; City of New York Bureau of Vital Statistics, 2003]. Hundreds of police responders were present at Ground Zero within minutes of the first plane's impact [Levenson and Acosta, 2001]. The large police force assisted surviving victims and fenced off the WTC area during the early phase of the terrorist attack. Police also later guarded the morgues set up in nearby lobbies of office buildings, witnessed the continuous search for body parts, and worked at the Staten Island Fresh Kills landfill where debris, which included body parts, were taken. A total of 23 New York Police Department (NYPD) officers [City of New York, 2010], and 37 Port Authority of New York and New Jersey (Port Authority) police officers [Jersey PAoNYaN, 2010] lost their lives in the aftermath of the WTC attacks [Hagen and Carouba, 2002].

The attacks resulted in significant psychological distress throughout the U.S., and around the world [Ahern et al.,

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Contract grant sponsor: CDC/Agency for Toxic Substances and Disease Registry; Contract grant number: U50/ATU 272750-04.

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Accepted 28 May 2010

DOI 10.1002/ajim.20876. Published online 15 July 2010 Wiley Online Library (wileyonlinelibrary.com).

2002]. The police responders were among the first to be at the disaster site and consequently experienced many severely traumatic scenes of the planes crashing into the towers, of people jumping out of buildings and eventually of the complete destruction of the towers. Various 9/11-related stress experiences occurring within the first year after the attack have been studied [Centers for Disease Control and Prevention, 2002a,b; Galea et al., 2002; Schlenger et al., 2002; Silver et al., 2002; Lawyer et al., 2006] with differing prevalence rates of Posttraumatic Stress Disorder (PTSD). A study of the mental health impact on rescue and recovery workers enrolled in the World Trade Center Health Registry (WTCHR) [Perrin et al., 2007] noted probable PTSD levels in police responders of 7.2%—almost twice as high as the U.S. prevalence rates (4%): Department of Health and Human Services. Mental Health: A report of the Surgeon General. Table 2–6. http://www.surgeongeneral.gov/library/mentalhealth/tables_figures.html. Accessed March 11, 2010.

North et al. [2009] describe the succession and evolution of the diagnostic criteria for PTSD and discuss the significance of the type and severity of trauma as separate stressors contributing to the development of PTSD. Based on these three significant trauma characteristics emphasized by North et al. [2009], the WTC attack clearly was an unusually profound trauma experience, adversely affecting rescue and recovery workers who were on the scene of the WTC as well as others [Schlenger et al., 2002]. A longitudinal approach to tracking the effects of the attack is of particular importance as PTSD with co-morbidity of depression and anxiety can develop after a temporal delay of up to 6 years following a life-threatening event [Pole et al., 2001].

To address the need for longitudinal follow-up of the mental and physical effects of 9/11 beyond the immediate effects of the attack, the WTCHR was established in 2002 by the New York City Department of Health and Mental Hygiene (DOHMH) in partnership with the Agency for Toxic Substances and Disease Registry (ATSDR, an arm of the Centers for Disease Control and Prevention (CDC)). The 71,437 enrollee/participants in the WTCHR [either self-identified (70%) or by identified lists provided by employers and governmental agencies (30%)] included 30,665 rescue and recovery workers, police responders, firefighters, emergency medical services workers, construction or engineering personnel, sanitation workers, and volunteers [Farfel et al., 2008]. Enrollees in the WTCHR additionally included 14,665 Manhattan residents living south of Canal Street and 43,487 occupants of damaged and destroyed buildings, area workers, and passersby or people in transit. Most of the police responders enrolled in the WTCHR were employed by the New York City Police Department ($n = 3,757$) or by state agencies ($n = 336$).

Police responders are frequently exposed to trauma and violence in the normal course of their occupation. Because of the relatively high-risk nature of police work, applicants are

carefully screened for both psychological and physical health. In pre-employment screening, applicants are required to complete a large battery of psychological tests of personality, affect, and mood with detailed interviews by police psychologists. Screening of women police applicants is similar to that of men. Because training is identical for men and women police responders, comparable risk by gender was expected for developing PTSD in the aftermath of 9/11, showing consistency of duty-related stress symptoms among men and women police officers [Pole et al., 2001; Yehuda, 2002].

Significant risk factors for the development of PTSD among 9/11 rescue and recovery workers include gender, alcohol misuse, injury to self or a co-worker, death of a family member, and prior depression [Weissman et al., 2005; Katz et al., 2009]. Hispanic ethnicity was shown to be the most important risk factor [Galea et al., 2004]. A number of other reports following the WTC attack have been published on PTSD and co-morbid psychiatric symptoms, such as panic attacks, anxiety, depression, and anger [Katz et al., 2009]. Prior reports have also identified work-related risk factors associated with PTSD, including longer duration of work around the WTC, performing tasks different from those in one's general occupation and not having had pre-disaster training [Perrin et al., 2007; Farfel et al., 2008; Jayasinghe et al., 2008; Stellman et al., 2008; Brackbill et al., 2009].

Some studies used the Posttraumatic Stress Checklist (PCL) [Blanchard et al., 1996], while other studies of PTSD used the Impact of Event Scale [Horowitz et al., 1987] to assess these adverse mental health effects. Both measures ask the respondents to rate their feelings related to the particular traumatic stress event. Clinically, and in the DSM-IV, the diagnosis of PTSD is associated with three different symptom domains: (1) re-experiencing/intrusion, (2) avoidance/numbing, and (3) hypervigilance/hyperarousal. North et al. [2009] postulate that avoidance and numbing are the most specific symptom domains for PTSD, but that future research should focus on not only the type of symptoms but on the relationship of these diagnostic criteria to the characteristics of the particular trauma experienced.

Although there have been several reports on overall prevalence of PTSD among police responders in the WTCHR, risk factors for women and men police responders have not yet been investigated separately. Knowledge of gender-specific risk factors may assist in guiding police departments regarding what groups may require special attention after their deployment to avoid the development of PTSD. This present study investigates the mental health impact of the WTC disaster on police responders and the prevalence of symptoms consistent with chronic probable PTSD in the 4,017 men and women police responders who participated in the WTCHR 2–3 years after 9/11/01.

METHODS

Study Population

A total of 4,017 police responders (excluding 74 police responders who did not complete all of the PCL items) were successfully recruited and completed WTCHR baseline interviews using methods described previously [Farfel et al., 2008]. Police responders to the 9/11 terrorist attack and its aftermath were included if they had worked at least one shift from September 11, 2001 to June 30, 2002 at the WTC or related sites, such as the New York downtown area, or were involved in the transportation of the debris between the WTC site and barges. Excluded were those who worked exclusively at the Staten Island Landfill. Interviews were conducted between September 2003 and November 2004, using confidential computer-assisted telephone interviewing (CATI) for 3,759 police and in-person personal interviewing (CAPI) for 258 police. Interviews were conducted in English ($n=4,010$), Spanish ($n=4$), Cantonese ($n=1$), Mandarin ($n=1$), or Polish ($n=1$). It has been previously estimated [Murphy et al., 2007] that 69% of the 5,000 most highly exposed employees of the NYPD enrolled in the WTCHR.

Consent and Exclusions

A federal certificate of confidentiality was obtained.

Following Centers for Disease Control and New York City Health Department Institutional Review Board approval, all participants gave verbal consent.

Measures

Survey questions included items on mental health status and the potential development of PTSD, specific demographic characteristics, and work tasks during rescue and recovery efforts at the WTC. PTSD was assessed using the PCL, Civilian Version [Blanchard et al., 1996], a validated event-specific instrument that consists of 17 items corresponding to the clinical criteria for PTSD from the *Diagnostic and Statistical Manual of Mental Disorders, Revised Fourth Edition (DSM-IV)* [American Psychiatric Association, 1994]. This measure was designed for use when formal individual psychological evaluations for PTSD are not feasible, and it has shown high levels of sensitivity (0.94–0.97), specificity (0.86–0.99), positive predictive value (0.70–0.97), and diagnostic efficiency (0.83–0.96) [Brackbill et al., 2009]. Each symptom's severity is rated by the respondent using a 5-point Likert-type scale, with one signifying not having the symptom and five signifying having the most severe symptom. A response of three (moderate severity) or above on each item was used to indicate presence

of the symptom. Symptoms were further clustered into three subscales or "Domains" according to DSM-IV: Domain B—reexperiencing/intrusion; Domain C—avoidance/numbing; Domain D—hypervigilance/hyperarousal. A participant was considered to have "chronic probable" PTSD if he or she endorsed at least one of five items from Domain B; at least three of seven items from Domain C; and at least two of five items from Domain D. To facilitate comparisons across studies, PTSD prevalence was also calculated using both a cutoff PCL score ≥ 44 and a cutoff PCL score ≥ 50 (for the total score of the 17 items) as alternative definitions of "probable PTSD", recognizing that the PCL ≥ 44 cutoff score provides one of the highest levels of diagnostic efficiency at 0.94 [Blanchard et al., 1996].

To assess the potential for co-morbid and pre-existing mental health problems, participants were asked during the interview if they had had depression, anxiety, or other emotional problems since 9/11. If they answered affirmatively, they were asked if they had this before 9/11 and whether these symptoms got worse after 9/11.

Information about WTC-related exposures was collected in the structured interview [Brackbill et al., 2006]. It included: (1) life threat, including being caught in the dust/debris cloud that resulted from the collapse of the towers; (2) sustaining a cut or puncture wound, sprain or strain, burn, broken bone, or head injury on September 11, 2001; and (3) personally witnessing one or more of four specified horror events: an airplane hitting the WTC; buildings collapsing; people injured or killed; people falling or jumping from the WTC towers. Police responders were also asked to specify their employer and/or precinct, their locations during their 9/11-related activities, and whether they worked directly on the pile of debris at the WTC site.

Data Analysis

Descriptive statistics were used to report the demographic, disaster-specific exposures, and work characteristics of the participants.

The χ^2 test was used to examine differences between men and women on the proportions of responders scoring 3 or higher and 2 or lower on the individual PCL items, as well as differences in the proportions of those meeting DSM-IV criteria for each PCL subscale.

Logistic regression was performed to determine the relative strength of association between probable PTSD (according to DSM-IV criteria) and the explanatory demographic variables and specific risk factors [Geyh et al., 2005; Perrin et al., 2007; Stellman et al., 2008]. Multivariate logistic regressions were performed for men and women separately to identify gender-specific explanatory variables for probable PTSD. Variable selection was performed within each gender separately. Bivariate logistic regressions of PTSD status on all relevant variables were performed, and

those variables whose associations with PTSD were significant at the 0.05 level were included in the multivariate model. Potential confounders or effect modifiers that were considered included age, race/ethnicity, highest educational level, gender, and marital status. Except for age (in 10-year increments), household income, and highest educational level, all the variables in the final analysis models were categorical, and include ethnicity, marital status, and the 9/11 disaster-related work variables (having worked on WTC site pile or not, and employment by a specific police force).

A backward selection logistic regression model (with a *P*-value cutoff at 0.05) was performed for the association between PTSD outcome and independent variables, separately for men and women. Only variables with significant variance contributions were included as covariates in the final model. To address the fact that at least three definitions of probable PTSD based on the PCL have been commonly used by researchers (DSM-IV criteria, as was used in this analysis, PCL score ≥ 44 , and PCL score ≥ 50), adjusted odds ratios were calculated using each of the three different criteria for probable PTSD outcome.

Due to the observed difference in probable PTSD by gender and ethnicity, adjusted prevalence estimates were obtained using predicted marginals [Graubard and Korn, 1999]. These predicted marginal models included other confounders or effect modifiers if they showed a significant contribution in the logistic regression model. SAS, Version 9.2 [SAS Institute, Inc., 2008], was used for all statistical analyses and predicted marginal analyses were performed via SUDAAN 7 software [RTI International, 2005].

RESULTS

After excluding those who did not complete the PCL, 4,017 participants, 3,435 (85.5%) men, and 582 (14.5%) women were included in the current study. Table I describes the demographic characteristics of the total group, as well as separately for men and women. Mean age on 9/11 for the total group was similar for men and women. Responses to questions about race/ethnicity indicated that 70.4% of the police were white. The group of women was ethnically more diverse than men, with fewer white (48.8%) and more Hispanic (25.1%) and African-American (21.3%) women responders, compared with men (74.0% white, 15.1% Hispanic, and 6.2% African-American). Income differed between men and women, with women reporting lower household income. Ninety-nine percent of the police responders had greater than high school education, which was similar for men and women. More men reported that they were currently married, while more women were not married but living with a partner, widowed, divorced or separated, or never married.

Table II shows the occupational, exposure, and injury experiences of police responders. The largest group (88.1%) of police responders was employed by NYPD. More male police agency employees witnessed one or more types of horror compared with women. The most common events reported were seeing people injured and buildings collapsing. More women police responders reported seeing airplanes hitting the towers than men, although more men police responders reported that they witnessed seeing people injured in the attack. Cuts, the most common type of injury, were reported more by men; more women reported burns, and the least common injuries were concussions. More than half of the police responders reported that they were in the dust/debris cloud surrounding the site. A relatively small proportion of police responders reported being inside the WTC towers or buildings that were damaged during the attack. Due to the immediate physical proximity of Port Authority of New York and New Jersey command centers and offices within the WTC Towers, Port Authority police responders were the first to respond during and in the immediate aftermath of the attack. Port Authority responders had a significantly higher overall prevalence of probable PTSD (19.2%) than police responders working for other 9/11 employers (6.9%).

Depression, Anxiety, or Emotional Problems

Of the 1,038 police responders reporting any depression, anxiety, or emotional problems after 9/11/01, 72 (6.9%) indicated they had these symptoms prior to 9/11. Women reported symptoms of depression, anxiety, or emotional problems post-9/11 significantly more often than men (36.7% vs. 24.3%, $\chi^2 = 39.4$, $P < 0.001$), but did not differ from men prior to 9/11/01 (9.6% vs. 6.3%, $\chi^2 = 2.76$, $P = 0.09$).

Probable PTSD by Gender

Table III shows the prevalence of probable PTSD using the DSM-IV, PCL ≥ 44 , and PCL ≥ 50 criteria. Except for psychogenic amnesia within the avoidance subscale, women reported significantly higher frequency for each individual symptom in the PCL, and higher frequency of each of the three domains, reexperiencing/intrusion, avoidance/numbing, and hypervigilance/hyperarousal.

When examining the alternative PTSD scoring definitions (DSM-IV, PCL score ≥ 44 and PCL score ≥ 50), women similarly had higher prevalence of probable PTSD (13.9%, 14.3%, and 9.1%, respectively) than men (7.4%, 6.0%, and 3.5%, respectively). PTSD as defined by the DSM-IV criteria is the primary outcome shown in the tables, although all three definitions were examined in further analyses.

TABLE I. Demographic and Exposure Characteristics of the Study Population by Gender

	Total (N = 4,017)		Men (n = 3,435)		Women (n = 582)		Men versus women	
	N	%	n	%	n	%	χ^2	P-value
Age on 9/11 (years)								
18–24	97	2.4	78	2.3	19	3.3	2.1	0.3440
25–44	3,347	83.3	2,868	83.5	479	82.3		
45–65+	573	14.3	489	14.2	84	14.4		
Race/ethnicity								
White	2,827	70.4	2,543	74.0	284	48.8	210.5	<0.001
African American	338	8.4	214	6.2	124	21.3		
Hispanic	664	16.5	518	15.1	146	25.1		
Asian	96	2.4	84	2.5	12	2.1		
Multiracial and others	92	2.3	76	2.2	16	2.8		
Total household income ^a								
<\$25,000	24	0.6	17	0.5	7	1.2	74.8	<0.0001
\$25,000–<\$50,000	391	9.7	294	8.6	97	16.7		
\$50,000–<\$75,000	1,092	27.2	894	26.0	198	34.0		
\$75,000–<\$100,000	1,330	33.1	1,167	34.0	163	28.0		
≥\$100,000 or more	1,180	29.4	1,063	31.0	117	20.1		
Highest educational attainment								
Less than high school	25	0.6	20	0.6	5	0.9	11.3	0.024
High school diploma or graduate	2,472	61.5	2,143	62.4	329	56.5		
College graduate	1,195	29.8	1,011	29.4	184	31.6		
Postgraduate degree	305	7.6	245	7.1	60	10.3		
Unknown	20	0.5	16	0.5	4	0.7		
Marital status								
Now married	2,726	67.9	2,524	73.5	202	34.7	355.7	<0.001
Not married but living with partner	210	5.2	141	4.1	69	11.9		
Widowed, divorced, separated	414	10.3	283	8.2	131	22.5		
Never married	645	16.1	467	13.6	178	30.6		
Unknown	22	0.6	20	0.6	2	0.3		

^aFor the 241 participants whose income level was missing, data were imputed based on the median income of the census tract of the participant's residence on 9/11/01 from the 2000 US Census. Due to the small numbers of police responders in the <\$25,000 group, those with incomes <\$25,000 were combined with <\$50,000 to make up a "lowest income" group. When analyzed with this new grouping, PTSD prevalence was similar across income groups.

Gender Risk Factors for Developing Probable PTSD

Table IV shows significant factors for PTSD identified by stepwise logistic regression in gender-specific models. The strongest risk factor for probable PTSD 2–3 years later for both genders was reporting at least one injury.

For women, witnessing one or more types of horror during 9/11 resulted in nearly double the probable PTSD than among women who did not. Older women and women with less education had a significantly greater risk of probable PTSD.

Men who worked inside the Twin Towers or adjacent buildings that collapsed during 9/11 had twice the prevalence of probable PTSD than men who were not inside the towers.

Men of Hispanic ethnicity or Asian or multi-racial background had significantly higher levels of probable PTSD than white men. Similar to women, older men had a significantly higher prevalence of probable PTSD than younger men. In contrast to women, men who had less than college education or who witnessed a horror event on 9/11/01 did not report more probable PTSD.

The adjusted odds ratios resulting from the analysis of probable PTSD using the three alternative criteria of DSM-IV, PCL ≥ 44, and PCL ≥ 50 were compared (data not shown). Although, as noted in Table III, the prevalence of probable PTSD was reduced when the more restrictive criteria of PCL ≥ 50 were used, the risk factors for PTSD remained significant after adjustment, with the exception that witnessing a horror event and education less

TABLE II. Occupation, Exposure, and Injury Experiences of Police Responders

	Total (N = 4,017)		Men (n = 3,435)		Women (n = 582)		Men versus women	
	n	%	n	%	n	%	χ^2	P-value
Employer to 9/11								
NYPD	3,537	88.1	3,007	87.5	530	91.1	18.79	0.0021
Port Authority Police	94	2.3	86	2.5	8	1.4		
NY City Sheriff	76	1.9	66	1.9	10	1.7		
New York State Troopers	53	1.3	49	1.4	4	0.7		
Other state police	125	3.1	120	3.5	5	0.9		
Federal law enforcement	132	3.3	107	3.1	25	4.3		
Personally witnessed any horror on 9/11	2,478	61.7	2,144	62.4	334	57.4	5.32	0.02
See airplane going into the building	586	14.6	471	13.7	115	19.8	14.61	<0.001
See people injured	1,879	46.9	1,655	48.3	224	38.8	17.79	<0.001
See building collapsing	1,621	40.4	1,400	40.8	221	38.0	1.63	0.20
See people jumping/falling from building	674	16.8	569	16.6	105	18.1	0.79	0.38
Sustained any injury (excluding eye injury) on 9/11	795	19.8	697	20.3	98	16.8	3.73	0.053
Sprain	337	8.4	291	8.5	46	7.9	0.22	0.64
Broken bone	35	0.9	30	0.9	5	0.9	0.001	0.98
Concussion	28	0.7	21	0.6	7	1.2	2.51	0.11
Other injury	316	7.9	273	8.0	43	7.4	0.2	0.65
Cut	582	14.5	524	15.3	58	10.0	11.02	<0.001
Burn	85	2.1	65	1.9	20	3.4	5.71	0.02
Inside tower or other collapsed buildings								
Yes	153	3.8	139	4.1	14	2.4	3.66	0.06
No	3,864	96.2	3,296	95.5	568	97.6		
Caught in dust and debris cloud								
Yes	2,275	56.8	1,966	57.3	309	53.4	3.18	0.07
No	1,733	43.2	1,463	42.7	270	46.6		

than college were no longer statistically significant for women.

As is shown in Figure 1, women of all racial/ethnic groups have higher marginal prevalence of PTSD, with Hispanic and white women showing statistically significantly increased marginal prevalence of probable PTSD compared with Hispanic and white men, respectively.

The PCL domains of reexperiencing/intrusion, avoidance/numbing, and hypervigilance/hyperarousal were considered separately for determining risk factors. Results showed gender differences for reexperiencing/intrusion, avoidance/numbing, and for hypervigilance/hyperarousal using the DSM-IV criteria for PTSD. Among men, sustaining any injuries, witnessing horror, being inside the WTC towers, older age, and Hispanic ethnicity were significantly associated with each of the separate PCL domains. Among women, sustaining any injuries and witnessing horror were also associated with greater prevalence of higher scores on all three domains. Older age was associated with reexperiencing/intrusion and hypervigilance/hyperarousal, although Hispanic ethnicity was only associated with reexperiencing/intrusion, but not avoidance/numbing or hypervigilance/hyperarousal.

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DISCUSSION

Among responders to the WTC attack, police responders have the lowest overall rate of PTSD: prevalence rates were 8.3% for police, 9.1% for volunteers affiliated with an organization such as the Red Cross, 17.4% for firefighters, and 24.5% for non-affiliated volunteers, determined using the same DSM-IV criteria as in this report [Perrin et al., 2007]. A possible factor explaining the lower prevalence rates among police responders may be the intensive screening of applicants for potential psychiatric risk factors, resulting in selection of more resilient individuals.

Relatively few reports are available on the prevalence of PTSD among police. Although some researchers [Ozer et al., 2003; Marmar et al., 2006] report "robust" predictors of increased overall prevalence of chronic PTSD, such as peritraumatic panic reaction, most researchers who study

TABLE III. Prevalence of Chronic Probable Posttraumatic Stress Disorder (PTSD) and Individual PTSD Symptoms Among Police Responders, by Gender

	Total (N = 4,017)		Men (n = 3,435)		Women (n = 582)	
	N	%	n	%	N	%
Chronic probable current PTSD						
Determined by DSM-IV criteria	334	8.3	253	7.4	81	13.9
Determined by PCL-cutoff (≥ 44)	290	7.2	207	6.0	83	14.3
Determined by PCL-cutoff (≥ 50)	174	4.3	121	3.5	53	9.1
Endorsement on subdomain/individual items ^a						
Reexperiencing/intrusion^b	1,086	27.0	878	25.6	208	35.7
Intrusive memories	620	15.4	490	14.3	130	22.3
Dreams or nightmares	226	5.6	179	5.2	47	8.1
Flashbacks	257	6.4	186	5.4	71	12.2
Upset by reminders	735	18.3	581	16.9	154	26.5
Physical reminders	321	8.0	243	7.1	78	13.4
Avoidance/numbing^c	486	12.1	377	11.0	109	18.7
Avoids thoughts or feelings	784	19.5	620	18.1	164	28.2
Avoids reminders	426	10.6	316	9.2	110	18.9
Psychogenic amnesia	290	7.2	239	7.0	51	8.8
Loss of interest	369	9.2	279	8.1	90	15.5
Detachment or estrangement	377	9.4	296	8.6	81	13.9
Restricted range of affect	295	7.3	234	6.8	61	10.5
Sense of shortened future	558	13.9	436	12.7	122	21.0
Hypervigilance/hyperarousal^d	947	23.6	755	22.0	192	33.0
Insomnia	902	22.5	733	21.3	169	29.0
Irritability or anger	525	13.1	418	12.2	107	18.4
Difficulty concentrating	494	12.3	378	11.0	116	19.9
Hypervigilance	1,491	37.1	1,225	35.7	266	45.7
Jumpy or easily startled	446	11.1	328	9.6	118	20.3

^aEach symptom is answered on a 5-point Likert scale where 1 = not at all; 2 = a little bit; 3 = moderately; 4 = quite a bit; 5 = extremely. For each individual item, the percent endorsement was determined by responses rated 3 or greater.

^bReexperiencing/intrusion: at least one item endorsed.

^cAvoidance and numbing: at least three items endorsed.

^dHypervigilance/hyperarousal symptoms: at least two items endorsed.

rescue workers do not focus on police as a separate group [North et al., 2002; Benedek et al., 2007].

The prevalence of probable PTSD was significantly higher among women police responders than men responders in the WTCHR. In addition, the predicted marginal prevalence of probable PTSD among white and Hispanic women police responders was higher than among white and Hispanic men, adjusting for other demographic factors and 9/11-related work experiences. These findings, although consistent with reported gender differences in PTSD prevalence among the general population [Breslau et al., 1997, 1998; Zlotnick et al., 2001; Breslau, 2002; Gill et al., 2005; Tolin and Foa, 2006; Yehuda et al., 2006], were particularly unexpected considering that men and women police undergo the same screening process and that men police responders reported experiencing more traumatic events associated with 9/11. An examination of gender

differences in pre-morbid mental health showed that women police responders pre-9/11 did not report having had more depression, anxiety, or other emotional problems than men.

In addition to the observed gender differences in PTSD prevalence rates, such differences were also observed for the risk factors for PTSD. Having less than a college education or witnessing a horror event on 9/11 was a significant risk factor based on the backward elimination process using stepwise logistic regression only among the group of women. The risk factors of having been inside the Twin Towers or other collapsed buildings on the day of the attack or being of Hispanic ethnicity or Asian or multiracial background were unique to the men police responders. For both groups, the likelihood of developing PTSD increased significantly with advancing age or having sustained an injury. The observed association of older age with PTSD in both men and women police is similar to other reports [DiGrande et al., 2008], as is

TABLE IV. Risk Factors for Probable PTSD: Statistically Significant Adjusted Odds Ratios for Current Probable PTSD (Using DSM-IV Criteria) Among Police, by Gender

Risk factor	Men only		Women only	
	aOR	95% CI	aOR	95% CI
Age per 10 years	1.32	1.11–1.57	1.68	1.18–2.38
Race/ethnicity				
White (ref)	1			
African American	1.26	0.75–2.14		
Hispanic	1.71	1.22–2.40		
Asian and other	1.87	1.10–3.21		
Education				
Less than college			1.79	1.06–3.01
College degree and above (ref)			1	
Personally witnessed any horror on 9/11				
Yes			1.79	1.02–3.13
No (ref)			1	
Sustained injury on 9/11				
Yes	2.42	1.83–3.19	2.90	1.68–5.01
No (ref)	1		1	
Inside Twin Tower or adjacent building that collapsed during 9/11				
Yes	2.15	1.34–3.44		
No (ref)	1			

aOR, adjusted odds ratio.

Multivariable analyses were performed with or without income, which showed no difference. For the purpose of maximizing power, final models were run with the imputed income, if missing. Although low income has previously been shown to be a significant risk factor for developing PTSD in the general population except for the lowest income level (<\$25,000 total household income), it did not have a significant effect on PTSD in this police cohort. Due to the small numbers of police in the <\$25,000 group, those with incomes <\$25,000 were combined with <\$50,000 to make up a "lowest-income" group. When analyzed with this new grouping, PTSD prevalence was similar across income groups.

being of Hispanic ethnicity [Galea et al., 2004]. Gershon et al. [2002] investigated risk factors contributing to perceived work stress among older (>50) law enforcement officers in NYC, and similarly found that witnessing traumatic incidents was one of the significant factors (OR = 3.84), along with using maladaptive coping strategies (OR = 4.95). Gershon et al. [2002] also report that perceived work stress was highly associated with mental health symptoms such as depression (OR = 9.27), anxiety (OR = 6.84), somatization (OR = 5.74), and PTSD symptoms (OR = 2.89). Due to the small number of women participating (n = 2), gender differences were not examined.

Contrary to our findings of gender differences in probable PTSD among police responders, no significant gender differences in probable PTSD prevalence was reported for Gulf War veterans [Kulka et al., 1990; Sutker

et al., 1995]. In a study by Stellman et al. [2008] of WTC rescue and recovery workers, women represented 12.7% of the population studied, with a probable PTSD prevalence using a score ≥ 50 on the PCL of 12.1%, compared with 10.9% among men, but the difference in prevalence was not significant. Pole et al. [2001] similarly did not find significant gender differences in the frequency of PTSD symptoms among police officers in three urban police departments and the authors posit that training and selection could be a possible explanation. This was also supported by Stuber et al. [2006] who found no gender differences in 9/11-related probable PTSD prevalence among NYC residents although he reports an increased lifetime prevalence of PTSD among women.

In contrast to the above-cited studies showing no difference in PTSD rates by gender, higher prevalence rates of PTSD have been reported for non-police women [Breslau et al., 1997, 1998; Breslau, 2002], similar to the police women in this study. Breslau postulates that although women in the general population are less likely than men to experience traumatic events, women are more likely to develop PTSD following exposure to severe traumas such as assault (36%) compared to men (6%). A recent meta-analysis of factors attributed to the development of PTSD [Tolin and Foa, 2006] concluded that irrespective of the type of precipitating trauma, other past trauma, income, and history of affective disorders, women are 2–3.5 times more likely than men to develop PTSD following a traumatic event. Correspondingly, the WTCHR reported significantly more probable PTSD for women registrants overall (20%) than for men (14%) [Farfel et al., 2008].

Given that the pre-employment screening and training were similar for police women and men, the findings of elevated levels of PTSD in women needs to be further investigated to better understand its cause and to identify and implement preventive measures. This requires greater knowledge of known risk factors, such as prior childhood or sexual abuse, prior affective disturbance, being a single caretaker of young children [Hagen and Carouba, 2002] and possible potential differences in the way women self-report psychological symptoms. We were unable to evaluate these risk factors since questions on these topics were not included in the baseline interviews in the WTCHR. Theoretically, the jobs police women performed, and their relation to psychological exposures may have been different from those of men. However, on 9/11 and in the days that followed, many women reported they felt they had equal status to men police agency workers in their rescue work, as they were performing the same tasks [Hagen and Carouba, 2002].

This study is composed of police responders from New York City, the Port Authority, New York State and other agencies. Participants who worked for the Port Authority (PA) had higher rates of PTSD overall. This difference may arise from several exposure differences in demographic and

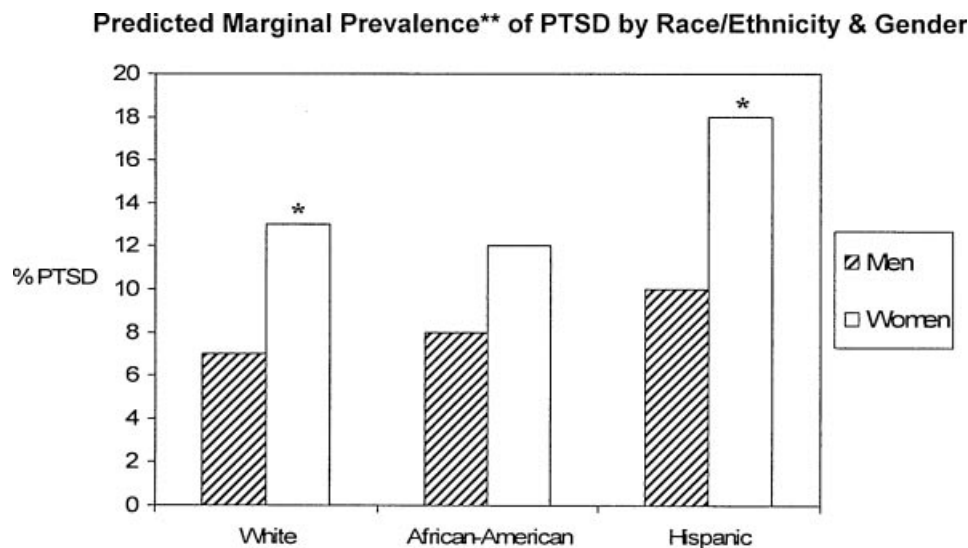


FIGURE 1. *Gender difference is significant in the total population ($P = 0.0002$), in the white population ($P = 0.004$), and in the Hispanic population ($P = 0.01$), while non-significant in African Americans. **Predicated marginal prevalence is adjusted by age, education, income, marital status, reported exposure to the dust cloud or not, witnessing any horror event or not, inside the WTC tower or other collapsed buildings or not, and injured or not during 9/11.

work characteristics in the PA police responders. PA WTCHR participants are older than non-PA employees, and are more likely to be Hispanic. A much higher percent of PA workers than non-PA workers witnessed the immediate horrifying events and reported having had injuries themselves. The Port Authority police had two command centers, as well as extensive office space within the WTC towers [Hagen and Carouba, 2002]. PA first responders had a higher mortality rate than all the other groups, which further increased the risk in their surviving peers for mental health effects.

There are several limitations to this study. Since the WTC Health Registry baseline interview took place 2–3 years after 9/11, this is a study of chronic residual probable PTSD. It is not known if the PTSD prevalence in the police responders may have been higher during the first year after the attack. Another limitation to the present study may be a potential non-response bias for those who no longer have PTSD symptoms and for those who had high levels of PTSD during the acute phase (first year post-trauma). Recall bias may have been present, as exposure and injury histories were based on self-report. Moreover, not all of the PTSD reported by the Registry respondents may reflect 9/11-associated morbidity due to the unavailability of information on pre- or post-9/11 trauma experiences. No data was obtained on “typical” police agency job assignments outside of the exposure and during and after work on the 9/11 disaster. This might have contributed to differential development of PTSD among different subsets of police responders to the events of 9/11. The extensive co-morbidity involving asthma, and gastro-esophageal reflux disorder among police and other 9/

11-exposed populations is beyond the scope of this article and will be addressed in future analyses.

Numerous other recognized risk factors for PTSD were not examined in the Registry’s baseline survey, including length of time on the force, having prior experiences of sexual violence, or personality characteristics such as resilience and hardiness. A follow-up interview has taken place at the WTCHR about 6 years after 9/11 and 3 years after these baseline data were collected. Analysis of these follow-up data for police responders is taking place and a brief report will be issued after its completion.

One might argue that uniformed police responders would have been in good mental health because of their extensive pre-employment screening. Future longitudinal investigations and in-depth clinical interviews may serve to answer the questions arising out of the observed difference in the proportion of women police responders with probable PTSD. In any interview setting, however, it is possible that sensitive information, such as prior mental health problems or sexual violence, may not be revealed.

Farfel et al.’s [2008] overview of the 9/11 experiences indicate that the adverse health impacts were found not only among rescue and recovery workers, but also extended to residents near the WTC, as well as area workers and persons in transit near the site on 9/11. They report increased frequency of serious psychological distress in addition to PTSD symptoms, which are approximately four times higher than national estimates of current PTSD (16% vs. 4%). They also report that PTSD among those recruited through lists from employers or lists of Lower Manhattan residents, who likely experience lower self-selection bias, was higher than

expected (12.7%). No other terrorist disaster has been of the same scope as the 9/11 WTC incident and Farfel et al.'s work confirmed the "substantial" health effects for a large group of both civilian/residential and first responders.

Police are typically among the first responders at the scene of disasters and terrorist events. Their ability to function with high competence and strong leadership is crucial in the management of these events. Further study of possible mediating personality factors such as resilience, hardiness, and self-efficacy is essential in preventing PTSD after traumas and disasters. In addition, further knowledge of the specific risk factors will likely assist in developing effective prevention and treatment programs for police.

ACKNOWLEDGMENTS

We thank the WTCR police agency enrollees, former Chief Police Surgeon, Dr. Robert Thomas, deceased, and Dr. Eli Kleinman, Supervising Chief Surgeon, New York City Police Department, New York City Patrolmen's Benevolent Association, Sergeant's Benevolent Association, Lieutenant's Benevolent Association, Detectives Endowment Association, Captain's Benevolent Association, the NYPD Medical Department and Psychology Department. We also acknowledge and thank our colleagues Robert Brackbill, Polly Thomas, Lorna Thorpe, Sharon Perlman, Steve Stellman, Mark Farfel, and the other staff of the DOHMH WTCR and Division of Epidemiology who provided invaluable assistance on data collection and analysis. This publication was supported in part by Grant/Cooperative Agreement # U50/ATU272750 from the ATSDR/CDC to the New York City DOHMH. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of ATSDR and The New York City DOHMH. This publication was also funded in part by Grant Number 1U50OH009739-1 from the National Institute for Occupational Safety and Health (NIOSH/CDC).

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