



The burden of full and subsyndromal posttraumatic stress disorder among police involved in the World Trade Center rescue and recovery effort

Robert H. Pietrzak^{a,b,*}, Clyde B. Schechter^c, Evelyn J. Bromet^d, Craig L. Katz^e, Dori B. Reissman^f, Fatih Ozbay^e, Vansh Sharma^e, Michael Crane^g, Denise Harrison^h, Robin Herbert^g, Stephen M. Levin^g, Benjamin J. Luftⁱ, Jacqueline M. Moline^j, Jeanne M. Stellman^k, Iris G. Udasin^l, Philip J. Landrigan^g, Steven M. Southwick^{a,b}

^a National Center for Posttraumatic Stress Disorder, VA Connecticut Healthcare System, West Haven, CT, USA

^b Department of Psychiatry, Yale University School of Medicine, New Haven, CT, USA

^c Department of Family and Social Medicine, Albert Einstein College of Medicine of Yeshiva University, Bronx, NY, USA

^d Department of Psychiatry, Stony Brook University, Stony Brook, NY, USA

^e Department of Psychiatry, Mount Sinai School of Medicine, New York, NY, USA

^f Office of the Director, National Institute for Occupational Safety and Health, Washington, DC, USA

^g Department of Preventive Medicine, Mount Sinai School of Medicine, New York, NY, USA

^h Department of Environmental Medicine, Bellevue Hospital Center/New York University School of Medicine, New York, NY, USA

ⁱ Department of Medicine, Division of Infectious Diseases, Stony Brook University, Stony Brook, NY, USA

^j Department of Population Health, Hofstra North Shore-Long Island Jewish School of Medicine, Great Neck, New York, USA

^k Department of Health Policy & Management, Mailman School of Public Health, Columbia University, NY, NY, USA

^l Department of Environmental and Occupational Medicine, University of Medicine and Dentistry of New Jersey, Piscataway, NJ, USA

ARTICLE INFO

Article history:

Received 7 January 2012

Accepted 8 March 2012

Keywords:

Posttraumatic stress disorder

Police

World Trade Center

Depression

Healthcare needs

ABSTRACT

Background: This study examined the prevalence, correlates, and perceived mental healthcare needs associated with subsyndromal PTSD in police involved in the World Trade Center (WTC) rescue and recovery effort.

Methods: A total of 8466 police completed an interview/survey as part of the WTC Medical monitoring and Treatment Program an average of four years after 9/11/2001.

Results: The past month prevalence of full and subsyndromal WTC-related PTSD was 5.4% and 15.4%, respectively. Loss of someone or knowing someone injured on 9/11 (odds ratios [ORs] = 1.56–1.86), pre-9/11 stressors (ORs = 1.30–1.50), family support (ORs = 0.83–0.94), and union membership (ORs = 0.50–0.52) were associated with both full and subsyndromal PTSD. Exposure to the dust cloud (OR = 1.36), performing search and rescue work (OR = 1.29), and work support (OR = 0.89) were additionally associated with subsyndromal PTSD. Rates of comorbid depression, panic disorder, and alcohol use problems (ORs = 3.82–41.74), and somatic symptoms and functional difficulties (ORs = 1.30–1.95) were highest among police with full PTSD, with intermediate rates among police with subsyndromal PTSD (ORs = 2.93–7.02; and ORs = 1.18–1.60, respectively). Police with full and subsyndromal PTSD were significantly more likely than controls to report needing mental healthcare (41.1% and 19.8%, respectively, versus 6.8% in trauma controls).

Conclusions: These results underscore the importance of a more inclusive and dimensional conceptualization of PTSD, particularly in professions such as police, as operational definitions and conventional screening cut-points may underestimate the psychological burden for this population. Accordingly, psychiatric clinicians should assess for disaster-related subsyndromal PTSD symptoms in disaster response personnel.

Published by Elsevier Ltd.

* Corresponding author. National Center for Posttraumatic Stress Disorder, VA Connecticut Healthcare System, Yale University School of Medicine, 950 Campbell Avenue 151E, West Haven, CT 06516, USA. Tel.: +1 860 638 7467; fax: +1 203 937 3481.

E-mail address: robert.pietrzak@yale.edu (R.H. Pietrzak).

1. Introduction

Police were among the largest occupational groups to respond to the September 11, 2001 terrorist attack on the World Trade Center (WTC). In addition to being exposed to the horrors of the 9/11

attacks, police played an integral role in rescue and recovery efforts that often involved long hours of arduous work, dangerous working conditions, and exposure to environmental hazards and human remains. Despite their being exposed to high levels of WTC-related traumas, studies have shown that police involved in the WTC rescue and recovery effort manifested considerable resilience to developing PTSD and related psychiatric conditions compared to other disaster workers (Bowler et al., 2010; Perrin et al., 2007). For example, a study by Perrin et al. (2007) examined the prevalence and correlates of WTC-related PTSD in a large, occupationally diverse sample of WTC rescue and recovery workers, and found that police had the lowest rates of PTSD (6.2%) compared to other workers, including firefighters, construction and sanitation workers, and unaffiliated volunteers (7.2–21.2%). Low rates of disaster-related PTSD in police may be explained by police screening procedures resulting in selection of a more resilient workforce; extensive training, preparation, or experience; and possible under-reporting of PTSD and related symptoms out of concern that they might be judged as unable to perform their work responsibilities (Greene et al., 2007; Perrin et al., 2007).

Although police may have lower rates of PTSD compared to other occupations, some studies have suggested they may be more likely to experience subsyndromal or partial PTSD (i.e., symptoms below threshold for a diagnosis of PTSD (Carlier et al., 1997; Maia et al., 2007)). Subsyndromal PTSD, which is often ignored in clinical settings, has been found to be chronic (Cukor et al., 2010; Jeon et al., 2007; Pietrzak et al., 2011), and associated with elevated rates of other psychiatric disorders such as major depressive disorder, generalized anxiety disorder, and panic disorder, as well as suicidality, and functional difficulties in a broad range of trauma-exposed individuals (Breslau et al., 2004; Cukor et al., 2010; Jeon et al., 2007; Maia et al., 2007; Marshall et al., 2001; Pietrzak et al., 2011; Schnurr et al., 2000). Despite the importance of examining disaster-related subsyndromal PTSD in police exposed to mass disaster, no study of which we are aware has examined its prevalence and correlates among police involved in the WTC rescue and recovery effort. Characterization of the prevalence and correlates of WTC-related subsyndromal PTSD may help to identify an additional proportion of this population who may be at-risk or in need of treatment. This information may also help inform disaster preparation, training, and intervention efforts.

The purpose of the current study was to examine the prevalence, correlates, and risk factors associated with full and subsyndromal WTC-related PTSD among police involved in the WTC rescue and recovery effort. Based on earlier research (Bowler et al., 2010; Carlier et al., 1995; Carlier et al., 1997; Maia et al., 2007; Perrin et al., 2007; Stellman et al., 2008), we hypothesized that: (1) the prevalence of subsyndromal PTSD would be higher than that of full PTSD; (2) risk factors for WTC-related full and subsyndromal PTSD would be similar, and would include exposure severity, especially traumatic losses during 9/11, demographic characteristics (lower age and education; Hispanic ethnicity), increased life stressors, and fewer sources of social support; and (3) police responders with full and subsyndromal PTSD would be more likely than police responders without these conditions to report need for mental health treatment.

2. Method

2.1. Participants

Participants were 8466 police who completed an initial evaluation as part of the World Trade Center-Medical Monitoring and Treatment Program (WTC-MMTP). The sample was comprised predominantly (>85%) of New York City police officers; and also

included Port Authority police, police from New York City and non-New York City sheriff's offices, and other non-New York City police departments. Initial evaluations were conducted between July 16, 2002 and September 11, 2008, an average of 3.9 (SD = 1.8; range: 0.8–7.0) years after 9/11/2001. The WTC-MMTP was established by the National Institute for Occupational Safety and Health at the Centers for Disease Control and Prevention to monitor and treat WTC-related medical and psychiatric conditions in WTC rescue and recovery workers. Five medical institutions have been providing medical monitoring and treatment services as part of the WTC-MMTP to police in the greater New York City and New Jersey area (Stellman et al., 2008). Eligible WTC responders worked or volunteered as part of rescue, recovery, restoration, or cleanup in Manhattan south of Canal Street, barge-loading piers in Manhattan, or the Staten Island landfill for at least 4 hours during 11–14 September 2001, 24 h during 11–30 September 2001, or for >80 h between 9/11/2001 and 12/31/2001. Police were recruited to the program through an extensive outreach effort that included union meetings, mailings, media articles, and telephone calls in multiple languages. All participants provided written informed consent. Institutional review boards of all participating institutions approved the study.

2.2. Assessments

2.2.1. WTC exposure

A clinician-administered interview was used to assess WTC-related exposures associated with PTSD (Bowler et al., 2010; Brackbill et al., 2009; Perrin et al., 2007; Stellman et al., 2008). These exposures included (a) early arrival (i.e., beginning work at the WTC worksite between 9/11/2001 and 9/13/2001); (b) being caught in the dust cloud; (c) working primarily/adjacent to the collapse site, known as the “pit” or the “pile” during 9/2001; (d) working greater than the median number of hours on the WTC site; (e) exposure to human remains (i.e., any exposure to human remains between September 11, 2001 and June 30, 2002); (f) involvement in search and rescue efforts during 9–10/01; (g) traumatic death of a colleague, family member or friend on 9/11; and (h) knowing someone who suffered an injury on 9/11.

2.2.2. Stressful life events

Fifteen negative life events (e.g., divorce/separation, personal illness, family illness or death) experienced the year before and since 9/11 were assessed using the Disaster Supplement of the Diagnostic Interview Schedule (Robins and Smith, 1983).

2.2.3. Posttraumatic stress disorder

The Posttraumatic Stress Disorder Checklist-Specific Version (PCL-S; Weathers et al., 1993; sample item: “In the past month, how much have you been bothered by repeated, disturbing memories, thoughts or images of the World Trade Center disaster?”), a 17-item self-report instrument based on DSM-IV criteria for PTSD, was used to assess WTC-related PTSD symptoms. Probable full PTSD was defined as a PCL score ≥ 50 and endorsement (i.e., moderate or greater severity of symptoms) of each of three DSM-IV criteria required for a diagnosis of PTSD (i.e., at least 1 of 5 symptoms of intrusion [Criterion B]; 3 out of 7 symptoms of avoidance/numbing [Criterion C]; and 2 out of 5 hyperarousal symptoms [Criterion D]). Subsyndromal PTSD was defined as meeting Criterion B and either Criterion C or D; or if Criterion B was met and at least one symptom from both Criterion C and D were endorsed (Breslau et al., 2004; Schnurr et al., 2000). The remainder of the sample was involved in WTC rescue and recovery work but did not meet criteria for full or subsyndromal PTSD (i.e., trauma controls). Cronbach's α on PCL-S in this sample was 0.94.

2.2.4. Depression

The Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001) is a self-report screening instrument for current depression symptoms based on DSM-IV criteria for major depressive disorder. Symptoms are rated on a 4-point scale from 0 = not at all to 3 = nearly every day. A score ≥ 10 , which has 88% sensitivity and 88% specificity in identifying DSM-IV major depressive disorder, was used to identify probable major depressive disorder. Item 9 assesses suicidal ideation. Cronbach's α on PHQ-9 items in this sample was 0.88.

2.2.5. Panic disorder

The Patient Health Questionnaire (PHQ; Spitzer et al., 1999) was used to assess probable panic disorder. The algorithm described by Spitzer et al. (1999) was used to identify probable panic disorder. Cronbach's α on PHQ items in this sample was 0.82.

2.2.6. Alcohol use problems

The CAGE Questionnaire (Ewing, 1984) is a 4-item instrument used to identify individuals with a possible alcohol problem. Despite its brevity, it has been shown to have good validity in screening large populations. A score of 2 or higher is indicative of a possible alcohol problem. Cronbach's α on CAGE items in this sample was 0.75.

2.2.7. Functional disability

The Sheehan Disability Scale (Leon et al., 1997) was used to assess the extent to which emotional difficulties caused functional impairment in 3 domains: work/school, social, and family life/home responsibilities. Scores range from 0 = not at all to 10 = extremely.

2.2.8. Somatic symptoms

The somatic subscale of the General Health Questionnaire (GHQ; Goldberg and Hillier, 1979) was used to assess general somatic symptoms (e.g., feeling ill and run down, having a headache). The scale has 7 items rated on a 4-point scale from "not at all" to "much more than usual." The sum of these items was analyzed. Cronbach's $\alpha = 0.86$.

2.2.9. Social support

Respondents were asked to endorse important sources of support while working at the WTC site. Sources of support assessed were spouse/partner, children, and parent(s) (summed to represent "total number of family supports during WTC;" range: 0–5), and supervisor and co-workers (summed to represent "total number of work supports during WTC;" range: 0–2).

2.2.10. Perceived mental healthcare needs

Participants were asked to endorse which services they think they might need in the next year. Response options included one-to-one counseling; alcohol counseling or treatment; medication for emotional problems; marriage counseling; religious counseling; stress management; peer support groups; and family counseling.

2.3. Data analysis

Demographic characteristics by PTSD status were compared using χ^2 statistics and multinomial logistic regressions. Risk factors and perceived mental healthcare needs associated with full and subsyndromal PTSD were examined using multinomial logistic regression analyses. Associations of PTSD status with psychiatric comorbidities and functional impairment were examined using two sets of multinomial logistic regression analyses. The first set adjusted for demographic characteristics; the second additionally

adjusted for all other psychiatric disorders to examine the unique relationship of PTSD status with these variables. Number of years from 9/11 to the date of assessment was entered as a covariate in all regression analyses.

3. Results

3.1. Prevalence of full and subsyndromal PTSD

A total of 455 (5.4%) police met criteria for full PTSD and 1300 (15.4%) for subsyndromal PTSD. Rates of full PTSD and subsyndromal PTSD among male police were 5.3% and 15.3%, respectively; rates among female police were 6.0% and 15.7%. The remaining 6711 (79.2%) respondents were trauma controls who were involved in WTC rescue and recovery work but did not meet screening criteria for full or subsyndromal PTSD.

3.2. Demographic, WTC exposure, and psychosocial characteristics

As shown in Table 1, compared to trauma controls, police with full PTSD were more likely to be older and of Hispanic or other/unknown race, have less than high school education, be widowed/separated/divorced, have lower income, and be non-union members. Compared to trauma controls, respondents with subsyndromal PTSD were more likely to be older, report other/unknown race, have a high school level of education, and to be non-union members, and were less likely to be never married. There were no significant demographic differences between police with full and subsyndromal PTSD. All WTC-related exposures except working primarily/adjacent to the pit and for a longer duration of time (above the median number of hours) were associated with full and subsyndromal PTSD; exposure to human remains was more common among respondents with full PTSD compared to subsyndromal PTSD. Respondents with both full and subsyndromal PTSD reported more life stressors before and since 9/11, with a greater OR observed for stressors before 9/11 for respondents with full PTSD than subsyndromal PTSD. Respondents with full PTSD reported fewer sources of family and work support while working on the WTC site.

3.3. Risk factors associated with full and subsyndromal PTSD

Table 2 shows associations of demographic, WTC exposure, and psychosocial variables with full and subsyndromal PTSD. Compared to trauma controls, older age, losing or knowing someone who suffered an injury on 9/11, and greater pre-9/11 stressors were associated positively with full and subsyndromal PTSD; high school or postsecondary education, union membership, and greater number of sources of family support while working on the WTC site were negatively associated with full and subsyndromal PTSD. Female sex, being married/cohabitating, being caught in the dust cloud, performing search and rescue work, and number of sources of work support while working at the WTC site were additionally associated with subsyndromal PTSD.

3.4. Psychiatric and functional correlates

Table 3 shows psychiatric screening and functioning variables by PTSD status. In analyses adjusted for demographics, respondents with full and subsyndromal PTSD were substantially more likely than trauma controls to screen positive for probable depression, panic disorder, alcohol use problem, and suicidal ideation (ORs = 3.43–76.32). They also scored higher on all subscales of the Sheehan Disability Scale, and on a measures of somatic symptoms (ORs = 1.19–2.24); these findings remained significant, though reduced in magnitude, after adjustment for demographics and

Table 1

Demographic characteristics, World Trade Center-related exposures, and psychosocial variables by PTSD status.

	Trauma controls	Subsyndromal PTSD	Full PTSD	<i>p</i>	Full PTSD vs. trauma controls	Subsyndromal PTSD vs. trauma controls
	<i>n</i> (% of sample)	<i>n</i> (% of sample)	<i>n</i> (% of sample)		OR (95% CI)	OR (95% CI)
Demographic characteristics	6711 (79.3)	1300 (15.4)	455 (5.4)			
Age				<0.001		
<35	1343 (20.0)	181 (13.9)	58 (12.7)		1.00 (ref.)	1.00 (ref.)
35–59	5302 (79.0)	1101 (84.7)	390 (85.7)		1.70 (1.28–2.26)	1.54 (1.30–1.82)
60+	65 (1.0)	18 (1.4)	7 (1.6)		2.49 (1.10–5.68)	2.05 (1.19–3.54)
Sex				0.461		
Male	5728 (85.3)	1103 (84.8)	379 (83.3)		1.00 (ref.)	1.00 (ref.)
Female	983 (14.7)	197 (15.2)	76 (16.7)		1.17 (0.91–1.51)	1.04 (0.88–1.23)
Race				0.010		
White/Non-Hispanic	3285 (48.9)	616 (47.4)	190 (41.8)		1.00 (ref.)	1.00 (ref.)
Black/Non-Hispanic	598 (8.9)	98 (7.5)	39 (8.6)		1.13 (0.79–1.61)	0.87 (0.69–1.10)
Hispanic	1393 (20.8)	268 (20.6)	110 (24.2)		1.37 (1.07–1.74)	1.03 (0.88–1.20)
Other/unknown	1435 (21.4)	318 (24.5)	116 (25.4)		1.40 (1.10–1.78)	1.18 (1.02–1.37)
Education				0.03463		
Less than high school	23 (0.4)	6 (0.5)	6 (1.4)		3.92 (1.59–9.69)	1.39 (0.56–3.42)
High school graduate	963 (15.0)	223 (17.8)	66 (15.2)		1.03 (0.79–1.35)	1.23 (1.05–1.45)
Postsecondary	5439 (84.6)	1021 (81.7)	362 (83.4)		1.00 (ref.)	1.00 (ref.)
Marital status				0.015		
Married/cohabiting	4784 (72.4)	941 (73.6)	310 (69.5)		1.00 (ref.)	1.00 (ref.)
Never married	1024 (15.5)	167 (13.1)	63 (14.1)		0.95 (0.72–1.26)	0.83 (0.69–0.99)
Widowed/separated/divorced	797 (12.1)	170 (13.3)	73 (16.4)		1.41 (1.08–1.84)	1.08 (0.91–1.30)
Income				0.04968		
\$0–\$40,000	237 (5.0)	44 (4.8)	31 (9.0)		1.98 (1.32–2.98)	0.97 (0.69–1.35)
\$40,000–\$70,000	2021 (42.9)	406 (44.0)	149 (43.6)		1.12 (0.89–1.41)	1.05 (0.90–1.21)
\$70,000+	2457 (52.1)	472 (51.2)	162 (47.4)		1.00 (ref.)	1.00 (ref.)
Union member				<0.001		
Member	6519 (97.7)	1243 (95.9)	421 (92.7)		1.00 (ref.)	1.00 (ref.)
Non-member	155 (2.3)	53 (4.1)	33 (7.3)		3.30 (2.24–4.86)	1.79 (1.31–2.46)
WTC-related exposures					Odds ratios (95% CIs) adjusted for demographic characteristics	
					Full PTSD vs. Trauma Controls	Subsyndromal PTSD vs. Trauma Controls
Total number of exposures	4.82 (0.02)	5.36 (0.05)	5.39 (0.08)	<0.001	1.36 (1.25–1.48)	1.22 (1.16–1.28)
Exposed to human remains	4026 (62.8)	857 (69.1)	319 (74.4)	<0.001	2.20 (1.62–2.99)	1.33 (1.11–1.59)
Arrived on 9/11 or 9/12	5507 (87.3)	1116 (91.4)	379 (89.6)	<0.001	1.80 (1.11–2.89)	1.59 (1.19–2.13)
Caught in dust cloud	1731 (27.0)	474 (38.2)	148 (34.5)	<0.001	1.43 (1.07–1.91)	1.54 (1.29–1.85)
Worked primarily or adjacent to pit during 9/01	5397 (84.2)	1050 (84.7)	358 (83.4)	0.9580	0.97 (0.67–1.41)	1.08 (0.85–1.38)
Total hours worked greater than median	3257 (50.8)	641 (51.7)	232 (54.1)	0.1837	1.26 (0.96–1.65)	1.14 (0.96–1.35)
Involved in search/rescue during 9/01 to 10/2001	4256 (66.4)	895 (72.2)	301 (70.2)	<0.001	1.37 (1.01–1.85)	1.35 (1.11–1.63)
Lost someone on 9/11	4556 (69.2)	1047 (82.5)	375 (84.8)	<0.001	2.78 (1.93–4.01)	2.00 (1.62–2.48)
Know someone who suffered injury on 9/11	3641 (55.6)	883 (69.0)	342 (78.3)	<0.001	2.10 (1.75–2.52)	2.10 (1.75–2.52)
Life stressors						
Number of stressors before 9/11	1.88 (0.02)	2.61 (0.06)	3.73 (0.13)	<0.001	1.55 (1.45–1.66)	1.27 (1.21–1.33)
Number of stressors since 9/11	0.92 (0.02)	1.23 (0.04)	1.39 (0.09)	<0.001	1.25 (1.14–1.36)	1.22 (1.14–1.29)
Social support						
Number of sources of family support while working on WTC site	2.79 (0.02)	2.70 (0.04)	2.26 (0.08)	<0.001	0.80 (0.73–0.86)	0.99 (0.94–1.04)
Number of sources of work support while working on WTC site	0.78 (0.01)	0.77 (0.02)	0.63 (0.04)	<0.001	0.75 (0.63–0.91)	1.01 (0.91–1.13)

Note. OR = odds ratio; WTC = World Trade Center; 95% CI = 95% confidence interval; SD = standard deviation; ref.=reference group. Statistically significant ORs and 95% CIs are shown in bold font.

Table 2

Results of a multinomial logistic regression analysis of variables associated with full and subsyndromal PTSD.

	Full PTSD vs. trauma controls		Subsyndromal PTSD vs. trauma controls	
	OR	95% CI	OR	95% CI
Demographics				
Age				
<35	1.00	—	1.00	—
35–59	1.70	1.28–2.26	1.54	1.30–1.82
≥60	2.49	1.10–5.68	2.05	1.19–13.54
Sex				
Male	1.00	—	1.00	—
Female	1.30	0.90–1.88	1.33	1.08–1.65
Race/ethnicity				
White/non-Hispanic	1.00	—	1.00	—
Black/non-Hispanic	0.83	0.48–1.44	0.91	0.68–1.23
Hispanic	1.20	0.85–1.69	1.11	0.91–1.35
Other/unknown	1.01	0.71–1.44	1.13	0.93–1.37
Education				
Less than high school	1.00	—	1.00	—
High school graduate or postsecondary	0.19	0.06–0.57	0.38	0.16–0.88
Marital status				
Never married/divorced/widowed	1.00	—	1.00	—
Married or cohabitating	1.24	0.92–1.69	1.34	1.12–1.59
Income				
\$40,000+/year	1.00	—	1.00	—
<\$40,000/year	1.70	0.98–2.96	1.24	0.86–1.78
Union membership status				
Non-union member	1.00	—	1.00	—
Union member	0.52	0.28–0.98	0.50	0.33–0.76
WTC-related exposures				
Exposed to human remains	1.32	0.96–1.83	1.13	0.95–1.34
Arrived on 9/11 or 9/12	1.24	0.77–1.99	1.27	0.98–1.64
Caught in dust cloud	1.11	0.82–1.50	1.36	1.15–1.60
Worked primarily or adjacent to pit during 9/01	0.95	0.65–1.40	0.89	0.721.09
Total hours worked greater than median	1.16	0.88–1.52	1.06	0.91–1.23
Involved in search/rescue during 9 to 10/01	1.09	0.79–1.50	1.29	1.08–1.54
Lost someone on 9/11	1.60	1.10–2.33	1.56	1.28–1.89
Know someone who suffered injury on 9/11	1.86	1.34–2.58	1.65	1.40–1.95
Life stressors				
Number of stressors before 9/11	1.50	1.40–1.60	1.30	1.25–1.36
Number of stressors since 9/11	0.94	0.86–1.03	1.03	0.97–1.09
Social support during WTC				
Number of sources of family support while working on WTC site	0.83	0.76–0.91	0.94	0.89–0.98
Number of sources of work support while working on WTC site	0.86	0.70–1.05	0.89	0.80–0.99

Note. Regression model is adjusted for number of years from 9/11 to the date of assessment. Adj OR = Adjusted odds ratios; 95% CI = 95% confidence interval. Statistically significant ORs and 95% CIs are shown in bold.

additional psychiatric comorbidity for all variables except suicidal ideation in respondents with subsyndromal PTSD. ORs for probable depression and panic disorder, and all aspects of functioning assessed, were significantly greater for respondents with full PTSD compared to subsyndromal PTSD.

3.5. Perceived mental healthcare needs

Table 4 displays perceived needs for mental healthcare services by PTSD status. Police with full and subsyndromal PTSD were substantially more likely than trauma controls to report a need for all services (ORs = 1.99–38.59), with the exception of peer support for respondents with subsyndromal PTSD; respondents with full

PTSD were more likely than those with subsyndromal PTSD to report needing one-to-one counseling, stress management, psychotropic medication, and marriage/family counseling.

4. Discussion

This study examined the prevalence, correlates, and perceived mental healthcare needs associated with full and subsyndromal WTC-related PTSD in a large sample of police involved in the WTC rescue and recovery effort. Past month prevalence rates of full and subsyndromal PTSD were 5.4% and 15.4%, respectively. As expected, the prevalence of full PTSD observed in this study was comparable to, albeit slightly lower, than that found in previous studies of police

Table 3

Psychiatric comorbidity, functional difficulties, and somatic symptoms by PTSD status.

					Odds ratios (95% CIs) adjusted for demographic characteristics		Odds ratios (95% CIs) adjusted for demographic characteristics and additional psychiatric comorbidity	
	Trauma controls	Subsyndromal PTSD	Full PTSD	P for trend	Full PTSD vs. trauma controls	Subsyndromal PTSD vs. trauma controls	Full PTSD vs. trauma controls	Subsyndromal PTSD vs. trauma controls
Psychiatric screening								
	n (% of sample)	n (% of sample)	n (% of sample)					
Probable depression	134 (2.0)	170 (13.3)	265 (59.5)	<0.001	76.32 (52.57–110.79)	7.64 (5.44–10.73)	41.74 (22.98–75.81)	7.02 (4.36–11.29)
Probable panic disorder	241 (3.7)	228 (18.11)	270 (60.9)	<0.001	42.86 (30.78–59.68)	5.09 (3.91–6.64)	28.56 (17.39–46.91)	5.24 (3.71–7.40)
Probable alcohol use problem	202 (3.0)	118 (9.2)	84 (18.8)	<0.001	5.94 (3.97–8.90)	3.43 (2.49–4.73)	3.82 (1.83–7.94)	2.93 (1.98–4.33)
Suicidal ideation	32 (0.5)	31 (2.4)	70 (15.8)	<0.001	46.64 (23.79–91.45)	7.39 (3.44–15.85)	5.84 (1.39–24.59)	3.97 (0.94–16.77)
Functioning								
	Mean (SE)	Mean (SE)	Mean (SE)					
Sheehan disability total score	1.47 (0.04)	5.51 (0.17)	13.89 (0.41)	<0.001	1.34 (1.30–1.38)	1.19 (1.17–1.22)	1.30 (1.24–1.37)	1.18 (1.15–1.22)
Work	0.48 (0.02)	1.76 (0.06)	4.27 (0.16)	<0.001	2.00 (1.86–2.15)	1.55 (1.47–1.63)	1.84 (1.63–2.07)	1.51 (1.41–1.62)
Social	0.50 (0.02)	1.93 (0.06)	5.19 (0.13)	<0.001	2.24 (2.08–2.40)	1.60 (1.53–1.69)	1.95 (1.74–2.18)	1.60 (1.49–1.71)
Family/life/home	0.54 (0.02)	1.91 (0.06)	4.98 (0.13)	<0.001	1.99 (1.87–2.12)	1.49 (1.43–1.56)	1.81 (1.64–2.01)	1.45 (1.36–1.54)
GHQ-somatic symptoms	1.35 (0.02)	2.75 (0.06)	4.38 (0.10)	<0.001	1.81 (1.70–1.94)	1.37 (1.31–1.42)	1.54 (1.38–1.73)	1.30 (1.23–1.38)

Note. Regression models are adjusted for number of years from 9/11 to the date of assessment; *n* = number of respondents; OR = odds ratio; 95% CI = 95% confidence interval; SE = standard error; GHQ = General Health Questionnaire. Statistically significant ORs and 95% CIs are shown in bold font.

responders involved in the WTC rescue and recovery effort—6.2% (Perrin et al., 2007) and 7.8% (Bowler et al., 2012). The rate of subsyndromal PTSD, however, was nearly 3 times greater. These findings suggest that 1 in 5 (20.8%) police exposed to WTC rescue and recovery work may have clinically significant WTC-related PTSD symptoms. Further, subsyndromal PTSD, which is not commonly assessed as part of screening efforts, was associated with substantially elevated rates of comorbid psychiatric disorders, functional difficulties, somatic symptoms, and perceived needs for mental healthcare.

The WTC-related work exposures that were the most strongly associated with WTC-related full and subsyndromal PTSD were losing someone on 9/11 and knowing someone injured in the disaster. Prior epidemiologic studies have similarly observed that unexpected loss and traumatic bereavement are related to both full and subsyndromal PTSD (Johannesson et al., 2009; Kristensen et al., 2009; Pietrzak et al., 2011). Line-of-duty deaths among police often have a broad psychological impact on an officer's peers, department, family, and the police community at large (Miller, 2007).

A greater number of stressors prior to 9/11 was also related to both full and subsyndromal PTSD. This finding, which is consistent

with research demonstrating that stressful life events are linked to psychopathology (McLaughlin et al., 2010), is important because it suggests that police who experience more stressful life events are more psychologically vulnerable to the effects of a major traumatic event. Importantly, union membership and greater family support while working on the WTC site played a protective role. This finding underscores the importance of interventions to bolster the stress-buffering effects of social support, and to promote family and community resilience following major disasters (Dowling et al., 2006; Walsh, 2007). Peer-based assistance programs such as the Police Organization Providing Peer Assistance (POPPA) program have been demonstrated to reach the majority of NYC police affected by the 9/11 attacks (Dowling et al., 2006), and may be helpful in assessing, monitoring, and treating psychological symptoms in this population.

Police with both full and subsyndromal WTC-related PTSD were substantially more likely than trauma controls to report a broad range of mental healthcare needs. Of note, police with subsyndromal PTSD were nearly five times as likely as trauma controls to report needing at least one of the mental health services assessed, the most common of

Table 4

Perceived needs for mental healthcare services by PTSD status.

	Trauma Controls	Subsyndromal PTSD	Full PTSD	<i>p</i>	Odds ratios (95% CIs) adjusted for demographic characteristics	
	<i>n</i> (% of sample)	<i>n</i> (% of sample)	<i>n</i> (% of sample)		Full PTSD vs. trauma controls	Subsyndromal PTSD vs. trauma controls
Total	6711 (79.3)	1300 (15.4)	455 (5.4)			
Any service need	457 (6.8)	258 (19.8)	187 (41.1)	<0.001	19.90 (13.19–30.01)	4.74 (3.68–6.11)
One-to-one counseling	270 (4.0)	239 (18.4)	206 (45.3)	<0.001	24.16 (15.58–37.49)	6.26 (4.30–9.13)
Stress management	317 (4.7)	227 (17.5)	199 (43.7)	<0.001	16.11 (10.66–24.33)	4.00 (2.81–5.69)
Psychotropic medication	176 (2.6)	153 (11.8)	188 (41.3)	<0.001	26.98 (16.98–42.87)	4.96 (3.19–7.71)
Marriage/family counseling	251 (3.7)	110 (8.5)	87 (19.1)	<0.001	6.64 (3.97–11.10)	2.40 (1.54–3.74)
Religious counseling	120 (1.8)	67 (5.2)	55 (12.1)	<0.001	6.13 (3.25–11.55)	2.24 (1.22–4.09)
Family counseling	99 (1.5)	35 (2.7)	35 (7.7)	<0.001	4.61 (2.17–9.80)	1.99 (1.01–3.94)
Peer support	68 (1.0)	33 (2.5)	37 (8.1)	<0.001	8.18 (3.81–17.59)	1.82 (0.76–4.38)
Alcohol counseling/treatment	17 (0.2)	16 (1.2)	33 (7.2)	<0.001	38.59 (10.05–148.24)	11.87 (2.90–48.62)

Note. All models are adjusted for number of years from 9/11 to the date of assessment; *n* = number of respondents; OR = odds ratio; 95% CI = 95% confidence interval. Statistically significant ORs and 95% CIs are shown in bold font.

which were one-to-one counseling, stress management, and psychotropic medication. Given the large magnitudes of the ORs observed, even in conservative analyses that adjusted for demographic characteristics and additional psychiatric comorbidity, this finding underscores the importance of assessing for subsyndromal PTSD in disaster-exposed police responders, as these individuals may be overlooked despite their perceiving significant needs for mental healthcare.

Results of this study have several clinical and public health implications. First, subsyndromal PTSD is not a diagnostic classification and may not be routinely identified as part of screenings in police and other disaster response personnel. Accordingly, clinicians may underestimate the burden of traumatic stress and related morbidities in this population. Second, because subsyndromal PTSD is associated with several comorbid psychiatric conditions, functional difficulties, and somatic symptoms, clinicians, disaster response organizations, and public health officials should direct their attention to more than PTSD alone, especially since these comorbidities can negatively affect quality of life. Third, the finding that nearly 20% of police with subsyndromal PTSD reported a need for mental healthcare, which encompassed a broad range of services, suggests that this population may also require resources in the aftermath of responding to a mass disaster. Fourth, pre-9/11 stressors were associated with WTC-related full and subsyndromal PTSD, which suggests that confidential and routine mental health screenings, perhaps in the context of primary care settings to reduce stigma, may be useful in monitoring stressful life events and psychological well-being of police. Occupational stressors such as the demands of work affecting home life, reduced control over one's workload, and low organizational support may also increase psychological distress in police (Collins and Gibbs, 2003; Maguen et al., 2009). While some treatments are efficacious in treating full PTSD (Bisson and Andrew, 2007), there are currently no evidence-based treatments for subsyndromal PTSD. Additional research is needed to evaluate interventions for this condition.

Methodological limitations of this study include recruitment of a volunteer sample of police and employment of self-report measures of psychological symptoms. Further, although, on average, respondents completed the survey 3.9 years after 9/11, the duration of time since 9/11 until the time of assessment ranged from 0.8 to 7 years. Consequently, retrospective recall bias may have influenced reporting of remote events for some participants; nevertheless, number of years from 9/11 until the time of assessment was entered as a covariate in all regression analyses. Finally, prevalence estimates of full and subsyndromal PTSD are based on symptoms experienced in the past month. Given that this sample of responders was first assessed an average of 3.9 years after 9/11, it is not clear whether these prevalences may have differed at earlier timepoints or whether prior treatment for PTSD symptoms may account for the lower prevalence of PTSD or change in PTSD classification (e.g., full PTSD to subsyndromal PTSD).

Notwithstanding these limitations, results of this study provide the first known examination of the prevalence, correlates, and perceived mental healthcare needs of full and subsyndromal WTC-related PTSD in a large sample of police involved in the WTC rescue and recovery effort. While only 5.4% of police met screening criteria for full WTC-related PTSD, more than 15% met screening criteria for subsyndromal WTC-related PTSD, which was associated with significantly elevated rates of comorbid psychiatric disorders, functional impairment, somatic symptoms, and increased perceived needs for mental healthcare services.

5. Conclusions

Taken together, these findings suggest that current screening and diagnostic criteria for disaster-related PTSD may be too

restrictive in identifying the full complement of police who have clinically significant psychiatric and functional difficulties, and who may need mental health services after responding to a mass disaster. They further underscore the importance of screening, monitoring, and treating disaster responders with subsyndromal PTSD. Additional research is needed to examine trajectories of disaster-related PTSD symptoms and related psychopathology in police involved in the WTC rescue and recovery effort, as well as to characterize variables associated with the persistence of chronic psychological distress and dysfunction in this population.

Conflict of interest

RHP is a consultant to CogState, Ltd. for work unrelated to this project. BJL has served as a consultant for and has received royalties from Baxter Pharmaceuticals for work unrelated to this project. None of the other authors have any conflicts of interest.

Contributors

RHP, CBS, EJB, and SMS managed the literature searches and wrote the initial draft of the manuscript. CBS undertook the statistical analysis. CLK, DBR, FO, VS, MC, DH, RH, SML, BJL, JMM, JMS, IGU, and PJJ collected the data, contributed to the conceptualization and design of the study, and provided critical comments and revisions of the manuscript.

Role of the funding source

This work was supported by the Centers for Disease Control and Prevention, National Institute of Occupational Safety and Health (contract 200-2002-0038 and grant 5U10 OH008232), the American Red Cross Liberty Fund, The September 11th Recovery Program, The Bear Stearns Charitable Foundation, The September 11th Fund, The Robin Hood Foundation. The findings and conclusions of this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, the U.S. Public Health Service, or the Department of Veterans Affairs National Center for Posttraumatic Stress Disorder. The sponsors of this study had no role in the study design, data collection, data analysis, data interpretation, or writing of the report.

Acknowledgment

The authors thank the staff of the World Trade Center Worker and Volunteer Medical Screening, Medical Monitoring and Treatment programs; the labor, community, and volunteer organization stakeholders; and the WTC rescue and recovery workers, who gave of themselves so readily in response to the WTC attacks and to whom the WTC Programs are dedicated.

References

- Bisson J, Andrew M. Psychological treatment of post-traumatic stress disorder (PTSD). *Cochrane Database of Systematic Reviews* 2007, Jul 18;3. CD003388.
- Bowler RM, Han H, Gocheva V, Nakagawa S, Alper H, DiGrande L, et al. Gender differences in probable posttraumatic stress disorder among police responders to the 2001 World Trade Center terrorist attack. *American Journal of Industrial Medicine* 2010;53:1186–96.
- Bowler RM, Harris M, Li J, Gocheva V, Stellman SD, Wilson K, et al. Longitudinal mental health impact among police responders to the 9/11 terrorist attack. *American Journal of Industrial Medicine* 2012;55:297–312.
- Brackbill RM, Hadler JL, DiGrande L, Ekenga CC, Farfel MR, Friedman S, et al. Asthma and posttraumatic stress symptoms 5 to 6 years following exposure to the World Trade Center terrorist attack. *Journal of the American Medical Association* 2009;302:502–16.

- Breslau N, Lucia VC, Davis GC. Partial PTSD versus full PTSD: an empirical examination of associated impairment. *Psychological Medicine* 2004;34:1205–14.
- Carlier IV, Gersons BP. Partial posttraumatic stress disorder (PTSD): the issue of psychological scars and the occurrence of PTSD symptoms. *Journal of Nervous and Mental Disease* 1995;183:107–9.
- Carlier IV, Lamberts RD, Gersons BP. Risk factors for posttraumatic stress symptomatology in police officers: a prospective analysis. *Journal of Nervous and Mental Disease* 1997;185:498–506.
- Collins PA, Gibbs AC. Stress in police officers: a study of the origins, prevalence and severity of stress-related symptoms within a county police force. *Occupational Medicine* 2003;53:256–64.
- Cukor J, Wyka K, Jayasinghe N, Difede J. The nature and course of subthreshold PTSD. *Journal of Anxiety Disorders* 2010;24:918–23.
- Dowling FG, Moynihan G, Genet B, Lewis J. A peer-based assistance program for officers with the New York City Police Department: report of the effects of Sept. 11, 2001. *American Journal of Psychiatry* 2006;163:151–3.
- Ewing JA. Detecting alcoholism. The CAGE questionnaire. *JAMA* 1984;252:1905–7.
- Goldberg DP, Hillier VP. A scaled version of the General Health Questionnaire. *Psychological Medicine* 1979;9:139–45.
- Greene E, Heilbrun K, Fortune WH, Nietzel MT. *Psychology of police*. Wrightsman's psychology and the legal system. 6th ed. Belmont, CA: Thomson Wadsworth; 2007.
- Jeon HJ, Suh T, Lee HJ, Hahm BJ, Lee JY, Cho SJ, et al. Partial versus full PTSD in the Korean community: prevalence, duration, correlates, comorbidity, and dysfunctions. *Depression and Anxiety* 2007;24:577–85.
- Johannesson KB, Lundin T, Hultman CM, Lindam A, Dyster-Aas J, Arnberg F, et al. The effect of traumatic bereavement on tsunami-exposed survivors. *Journal of Traumatic Stress* 2009;22:497–504.
- Kristensen P, Weisaeth L, Heir T. Psychiatric disorders among disaster bereaved: an interview study of individuals directly or not directly exposed to the 2004 tsunami. *Depression and Anxiety* 2009;26:1127–33.
- Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 2001;16:606–13.
- Leon AC, Olfson M, Portera L, Farber L, Sheehan DV. Assessing psychiatric impairment in primary care with the Sheehan Disability Scale. *International Journal of Psychiatry in Medicine* 1997;27:93–105.
- Maguen S, Metzler TJ, McCaslin SE, Inslicht SS, Henn-Haase C, Neylan TC, et al. Routine work environment stress and PTSD symptoms in police officers. *Journal of Nervous and Mental Disease* 2009;197:754–60.
- Maia DB, Marmar CR, Metzler T, Nobrega A, Berger W, Mendlowicz MV, et al. Post-traumatic stress symptoms in an elite unit of Brazilian police officers: prevalence and impact on psychosocial functioning and on physical and mental health. *Journal of Affective Disorders* 2007;97:241–5.
- Marshall RD, Olfson M, Hellman F, Blanco C, Guardino M, Struening EL. Comorbidity, impairment, and suicidality in subthreshold PTSD. *American Journal of Psychiatry* 2001;158:1467–73.
- McLaughlin KA, Conron KJ, Koenen KC, Gilman SE. Childhood adversity, adult stressful life events, and risk of past-year psychiatric disorder: a test of the stress sensitization hypothesis in a population-based sample of adults. *Psychological Medicine* 2010;40:1647–58.
- Miller L. Line-of-duty death: psychological treatment of traumatic bereavement in law enforcement. *International Journal of Emergency Mental Health* 2007;9:13–23.
- Perrin MA, DiGrande L, Wheeler K, Thorpe L, Farfel M, Brackbill R. Differences in PTSD prevalence and associated risk factors among World Trade Center disaster rescue and recovery workers. *American Journal of Psychiatry* 2007;164:1385–94.
- Pietrzak RH, Goldstein RB, Southwick SM, Grant Prevalence BF. Axis. I comorbidity of full and partial posttraumatic stress disorder in the United States: results from Wave 2 of the national epidemiologic survey on alcohol and related conditions. *Journal of Anxiety Disorders* 2011;25:456–65.
- Robins LN, Smith EM. The diagnostic interview schedule/disaster supplement. St Louis, MO: Washington University School of Medicine; 1983.
- Schnurr PP, Ford JD, Friedman MJ, Green BL, Dain BJ, Sengupta A. Predictors and outcomes of posttraumatic stress disorder in World War II veterans exposed to mustard gas. *Journal of Consulting and Clinical Psychology* 2000;68:258–68.
- Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary care evaluation of mental disorders. Patient Health Questionnaire. *Journal of the American Medical Association* 1999;282:1737–44.
- Stellman JM, Smith RP, Katz CL, Sharma V, Charney DS, Herbert R, et al. Enduring mental health morbidity and social function impairment in world trade center rescue, recovery, and cleanup workers: the psychological dimension of an environmental health disaster. *Environmental Health Perspectives* 2008;116:1248–53.
- Walsh F. Traumatic loss and major disasters: strengthening family and community resilience. *Family Process* 2007;46:207–27.
- Weathers F, Litz B, Herman D, Huska J, Keane T. The PTSD Checklist (PCL): reliability, validity, and diagnostic utility. Paper presented at the Annual Convention of the International Society for Traumatic Stress Studies, San Antonio, TX. 1993.