Journal of Affective Disorders 306 (2022) 62–70

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Prevalence and correlates of suicidal ideation in World Trade Center responders: Results from a population-based health monitoring cohort

Rachel Gibson [a,*], Julia M. Whealin [b,c], Christopher R. Dasaro [d], Iris G. Udasin [e], Michael Crane [d], Jacqueline M. Moline [f], Denise J. Harrison [g], Benjamin J. Luft [h], Andrew C. Todd [d], Clyde Schechter [i], Sandra M. Lowe [j], Adriana Feder [j], Robert H. Pietrzak [k,l,m]

[a] Department of Psychology, University of the Hawaii at Hilo, HI, USA
[b] VA Pacific Islands Health Care Center, Honolulu, HI, USA
[c] Department of Psychiatry, John A. Burns School of Medicine, Manoa, HI, USA
[d] Department of Environmental Medicine and Public Health, Icahn School of Medicine, New York, NY, USA
[e] Environmental and Occupational Health Sciences Institute (EOHSI) Clinical Center, Rutgers University, Piscataway, NJ, USA
[f] Department of Occupational Medicine, Epidemiology and Prevention, Northwell Health, Rego Park, NY, USA
[g] New York University Grossman School of Medicine, New York, NY, USA
[h] SUNY at Stony Brook School of Medicine, Commack, NY, USA
[i] Department of Family and Social Medicine, Albert Einstein College of Medicine at Yeshiva University, Bronx, NY, USA
[j] Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, USA
[k] Department of Psychiatry, Yale School of Medicine, New Haven, CT, USA
[l] U.S. Department of Veterans Affairs National Center for Posttraumatic Stress Disorder, VA Connecticut Healthcare System, West Haven, CT, USA
[m] Department of Social and Behavioral Sciences, Yale School of Public Health, New Haven, CT, USA

ARTICLE INFO

Keywords:
Suicidal ideation
First responders
Police
Symptomics
Depression
Disaster

ABSTRACT

Background: Suicidal ideation (SI) is an early risk factor for suicide among disaster responders. To date, however, no known study has examined the prevalence, and pre-, peri-, and post-disaster risk correlates of SI in World Trade Center (WTC) responders, one of the largest disaster response populations in U.S. history.
Methods: The prevalence, and pre-, peri- and post-event correlates of SI were assessed in a population-based health monitoring cohort of 14,314 police responders and 16,389 non-traditional responders (e.g., construction workers) who engaged in response, recovery, and clean-up efforts following the 9/11/2001 terrorist attacks on the WTC. Multivariable analyses were conducted to identify correlates and individual psychiatric symptoms associated with SI in each group.
Results: A total 12.5% of non-traditional and 2.2% of police WTC responders reported SI. Depression, functional impairment, alcohol use problems, and lower family support while working at the WTC site were associated with SI in both groups of responders. Symptom-level analyses revealed that three symptoms accounted for approximately half of the variance in SI for both groups—feeling bad about oneself, or that one has let down oneself or family; feeling down, depressed, or hopeless; and sense of foreshortened future (44.7% in non-traditional and 71% in police).
Limitations: Use of self-report measures and potentially limited generalizability.
Conclusions: SI is prevalent in WTC disaster responders, particularly non-traditional responders. Post-9/11 psychiatric symptoms reflecting guilt, shame, hopelessness, and associated functional impairment are most strongly linked to SI, suggesting that interventions targeting these factors may help mitigate suicide risk in this population.

1. Introduction

In the United States, suicide is the fourth leading cause of death for adults aged 18 to 64 years (Centers for Disease Control, 2019). Given that rates of suicide have increased over the last two decades (Hedegaard et al., 2020), identifying and offering help to individuals before

* Corresponding author.
E-mail address: rachell9@hawaii.edu (R. Gibson).

https://doi.org/10.1016/j.jad.2022.03.011
Received 3 January 2022; Received in revised form 2 March 2022; Accepted 7 March 2022
Available online 10 March 2022

they attempt suicide has become a public health priority (US Department of Health and Human Services, 2021). Suicidal ideation (SI), defined as having thoughts about suicide or death, is widely recognized as an early risk factor for possible suicide attempt (O'Connor and Portzky, 2018). Accordingly, characterization of factors that distinguish individuals with SI is critical to understanding who may benefit from suicide prevention efforts (Knox et al., 2004).

The estimated past-year prevalence of SI in the general US adult population is 4.8%, and as high as 15.6% over a lifetime (Substance Abuse and Mental Health Services Administration, 2018; Nock et al., 2008b). Numerous factors have been linked with SI in the general population, including demographic characteristics such as female gender (Kessler et al., 1999; Nock et al., 2008a), white race/ethnicity (Borges et al., 2012), single/unpartnered relationship status (Kessler et al., 1999; Nock et al., 2008a), exposure to life stressors (Liu and Miller, 2014; Nock et al., 2008b), mental health (Kessler et al., 1999; Nock et al., 2010, 2008a) or substance use disorders (Nock et al., 2010), and physical disability (Russell et al., 2009).

One less frequently examined risk factor for SI is exposure to extreme stress (Beristianos et al., 2016a, 2016b; Stein et al., 2010), which may be experienced during and in the aftermath of a large-scale disaster (Brown et al., 2018; Jafari et al., 2020; Reifels et al., 2018; Substance Abuse and Mental Health Services Administration, 2015). A growing body of research suggests that individuals who encounter extremely stressful events as a condition of their occupation are at higher risk for SI than those who do not (Chopko et al., 2014; Violanti, 2004). For example, emergency responders report rates of SI well above that observed in the general population, with estimated lifetime prevalence of 46.8% for firefighters (Stanley et al., 2015), 37.0% for emergency medical personnel (Abbot et al., 2015) and 23.1% for police (Violanti et al., 2009). Suicidal thoughts and behaviors are generally also found to be higher among those who have been exposed to disaster, and in particular, man-made disasters such as political terrorism, mass shootings and accidents (Reifels et al., 2018; Stein et al., 2010).

A burgeoning body of research has examined risk factors associated with SI in occupational groups that commonly encounter extreme stress. Among police officers, for example, pre-existing risk factors include younger age (Carleton et al., 2018), female gender, lower education, and single/unpartnered relationship status (Carleton et al., 2018; Violanti et al., 2009). Peri-event factors associated with SI include occupational stress (Chopko et al., 2014; Syed et al., 2020), exposure to traumatic stimuli (e.g., to death or injury) in the course of police work (Bishopp and Boots, 2014; Chopko et al., 2014; Violanti, 2004), lack of social interaction (Bishopp and Boots, 2014), and relationship problems (Chopko et al., 2014; Violanti et al., 2019). Other SI risk factors found in police include major depressive disorder (MDD; Bishopp and Boots, 2014; Chopko et al., 2014; di Nota et al., 2020; Violanti et al., 2009), posttraumatic stress disorder (PTSD; Chopko et al., 2014; di Nota et al., 2020; Violanti, 2004), and alcohol and drug use problems (Chopko et al., 2014; di Nota et al., 2020; Violanti et al., 2019).

Currently, several gaps remain in the literature on SI in occupations that commonly encounter extreme stress. First, much of the research examining such groups, including police, is hindered by small sample sizes that lack the gender and racial/ethnic diversity needed to assess a broad range of pre-, peri-, and post-event stressors that may be linked to SI (Violanti, 2004; Violanti et al., 2009). Second, it is unclear whether similar stressors may differentially relate to SI in different occupational groups who may vary with respect to disaster preparedness. Differential severity and nature of exposure to stressors and traumatic exposures encountered within various occupations often confounds conclusions about risk, particularly because SI can peak years following an extreme event (DeWolfe, 2000; Kessler et al., 2008; Kõlves et al., 2013; Pietrzak et al., 2012b; Substance Abuse and Mental Health Services Administration, 2015). Third, examination of stressors often fails to account for factors that confer resilience to psychopathology and seldom separates occupational groups with differing levels of resilience. Police, firefighters, and EMTs, for example, receive extensive training designed to buffer the impact of extreme stressors. Less is known about SI risk factors for workers who typically lack specialized training in disaster preparedness (e.g., non-traditional first responders). Fourth, most prior work has focused on the relation between mental health disorders such as MDD and PTSD and SI risk, instead of individual symptoms of these multi-faceted disorders, which may show more nuanced associations. Indeed, emerging research suggests that a symptom-level or 'symptomic' approach that examines how individual symptoms may be linked to SI may provide more clinically nuanced insight into possible prevention and treatment targets for SI, as well as functional outcomes (Fried and Nesse, 2014; Kachadourian et al., 2019, 2021).

To address the aforementioned gaps, we analyzed data from a large, population-based health monitoring cohort of more than 30,000 disaster responders, including 14,314 police responders and 16,389 non-traditional responders (e.g., utility, abatement, construction, transportation, clean-up, and sanitation workers), following a shared extreme stressor. Both groups assisted in rescue, recovery, and clean-up efforts following the 9/11/2001 terrorist attacks (9/11) on the World Trade Center (WTC). Potential stressors encountered by these workers included exposure to a hazardous working environment, contact with toxins, death of colleagues or loved ones, and witnessing death/human remains (Pietrzak et al., 2014, 2012a). This sample provides a unique opportunity to examine the prevalence of SI in occupational groups with (i.e., police) and without (i.e., non-traditional responders) disaster preparedness training, as well as pre-, peri-, and post-event factors associated with SI following a shared extreme stressor.

We had two overarching aims: (1) to characterize the prevalence of SI in police and non-traditional WTC responders; and (2) to identify risk and protective factors associated with SI in these groups. For aim 2, we grouped these variables temporally, assessing pre-event (demographics, history of mental health disorder, life stressors prior to 9/11), peri-event (WTC exposures as well as social support from family and work during WTC recovery work) and post- event factors (e.g., life stressors post 9/11, as well as resulting functional impairment and mental health problems). Further, we employed symptom-level analyses to identify individual symptoms of depression and PTSD associated with SI.

2. Methods

2.1. Sample

Participants were WTC general responders participating in the WTC Health Program (WTC-HP), a regional clinical consortium comprising five medical institutions in the greater New York City area. All WTC-HP data collected at each of the five institutions have been stored and managed since 2002 by the General Responder Data Center, located at the Icahn School of Medicine at Mount Sinai in New York City. In the current study, data were analyzed from 14,314 police responders and 16,389 non-traditional responders (e.g., utility, abatement, construction, transportation and sanitation workers, administrators, and volunteers) who completed their first health monitoring visit at the WTC-HP a median of 5.5 years after 9/11/01, including all questionnaires used in this study. The study was carried out in accordance with the latest version of the Declaration of Helsinki; the study design was reviewed and approved by the Mount Sinai Institutional Review Board.

2.2. Assessments

2.2.1. Suicidal ideation

SI was assessed using item 9 from the Patient Health Questionnaire-9: (Kroenke and Spitzer, 2002) "Over the last 2 weeks, how often have you been bothered by the following problems: thoughts you might be better off dead or of hurting yourself in some way?" Items were coded 0 ("not at all"), 1 ("several days"), 2 ("more than half the days"), or 3 ("nearly every day"). Incident suicidal ideation was operationalized as

endorsement of "1" or higher.

2.2.2. Sociodemographic characteristics

Age (continuous), gender, race/ethnicity (White, Black, Hispanic, other), education (>high school, ≤high school), marital status (single/never married, married/partnered, widowed/separated/divorced), and annual income (≤$80,000, >$80,000).

2.2.3. History of mental health disorders prior to 9/11

Participants were asked via self-report whether a health professional ever diagnosed them with anxiety disorder, depression, or PTSD before 9/11/2001.

2.2.4. Number of life stressors in the year prior to / post 9/11

Two separate counts of 15 potential life stressors from the Disaster Supplement of the Diagnostic Interview Schedule (Robin and Smith, 1983), e.g., "lost a job/laid off/lost income," "divorced from spouse," "had debt trouble," "serious illness/injury."

2.2.5. Number of WTC-related stressor exposures ("WTC exposures")

Count of 10 exposures: 1) arrived at the WTC site between 9/11 and 9/13/2001; 2) worked primarily/adjacent to the collapse site, known as the 'pit' or the 'pile' during September 2001; 3) participated in search and rescue; 4) worked longer than the median number of hours at the WTC site; 5) exposed to human remains; 6) was caught in the dust cloud; 7) slept at the site; 8) death of a colleague, friend or family member because of 9/11; 9) received treatment for an illness or injury during WTC recovery work; and 10) knew someone who suffered an injury on 9/11.

2.2.6. WTC-related social support

Number of important sources of family support (count range 0 to 5 [spouse, partner, children, parent{s}, other family]) and work support (dichotomized [supervisor and/or co-workers] vs. none) while working for the WTC recovery effort.

2.2.7. WTC-related medical conditions

Count of three WTC-related conditions, including asthma, sinusitis, and gastroesophageal reflux disease (GERD).

2.2.8. Depression

The Patient Health Questionnaire (PHQ-8; Kroenke et al., 2001; Kroenke and Spitzer, 2002) was used to screen for depression with a score of 10 indicative as a positive screen for depression. Items on the PHQ-8 correspond to those used to assess major depressive disorder using the Diagnostic and Statistical Manual of Mental Disorders. Cronbach's alpha = 0.93 in non-traditional responders and 0.89 in police responders.

2.2.9. WTC-related PTSD symptoms

The PTSD Checklist Specific-Stressor Version (PCL-S) (Blanchard et al., 1996; Weathers et al., 1993) is a self-report measure comprised of 17 items (range 17–85) that assess DSM-IV symptoms of PTSD (Cronbach's alpha = 0.96 in non-traditional responders and 0.95 in police responders). Example items assess trauma-related emotional numbing (i.e., feeling emotionally numb or being unable to have loving feelings), trauma cue-related physiological reactivity (i.e., heart pounding, trouble breathing, sweating following reminders of the event) and irritability/anger, all indexed in relation to WTC-related experiences. Probable WTC-related PTSD was operationalized as a score ≥ 44.

2.2.10. Alcohol use problems

The CAGE Questionnaire (King, 1986) is a four-item scale used to identify problems with alcohol use. A score of 2 or higher indicates possible problematic use.

2.2.11. Functional impairment

The Sheehan Disability Scale (SDS; Sheehan et al., 1996) is a three-item scale used to assess functional impairment in work, family, and social life. Items were averaged, and a score of 5 or higher, indicative of moderate or greater impairment, was considered a positive screen for functional impairment (Williams, 2000).

2.3. Data analysis

All analyses were stratified by occupational responder type—police vs. non-traditional WTC responders—as these groups differ with respect to disaster preparedness and training, as well as in prevalence of major WTC-related health conditions (e.g., Pietrzak et al., 2014). Analyses were conducted using SPSS (version 28; IBM Corp, Armonk, N.Y., USA) and proceeded in three steps. First, we computed chi-square analyses and analyses of variance to compare demographic, exposure and psychosocial characteristics between responders who did and did not screen positive for SI. These analyses included main effect terms for all of the variables shown in Table 1. Second, we conducted hierarchical multivariable logistic regression analyses to examine independent correlates of SI in police and non-traditional WTC responders. Independent variables were grouped based on their temporal relationship to WTC attacks, with pre-event variables including sociodemographic characteristics (age, gender, race/ethnicity, education level, marital status, income, history of mental health disorder, and life stressors prior to 9/11) entered in Step 1; peri-event variables (WTC exposures and social support during WTC work) in Step 2; and post-event variables (life stressors post 9/11, WTC-related medical conditions, depression, WTC-related PTSD symptoms, problematic alcohol use, and functional impairment) in Step 3. Variance explained for logistic regression models was estimated using Nagelkerke's R-squared. Third, we examined the relation between individual PTSD and MDD symptoms assessed by the PCL-S and PHQ-8, and SI using the R package relaimpo. This analysis decomposes the explained variance in a dependent variable (i.e., SI) while accounting for intercorrelations among independent variables (i.e., individual PCL-S and PHQ-8 items; Tonidandel and LeBreton, 2010). All of the pre-, peri-, and post-event variables that were significantly associated with SI in multivariable regression models were included in these analyses.

3. Results

On average, WTC responders completed the initial survey on 3/27/06 (median = 11/10/05; range = 7/16/2002 to 6/19/2014), 5.5 years after 9/11/2001. Of 14,314 police responders, 58.6% (n = 8393) were non-Hispanic White, 23.2% (n = 3324) Hispanic, 11.8% (n = 1686) Non-Hispanic Black, and 6.4% (n = 911) bi/multi-racial or another ethnicity. Mean age at the time of data collection was 43.2. Most police (84.9%, n = 12,151) were male, and 2.2% (2.6% of females and 2.1% of males) reported SI within the last two weeks.

Of 16,389 responders in non-traditional occupations, 56.2% (n = 9217) were non-Hispanic White, 27.5% (n = 4514) Hispanic, 10.4% (n = 1709) non-Hispanic Black, and 5.8% (n = 949) bi/multi-racial or another ethnicity. Mean age was 45. Most non-traditional responders (86.2%, n = 14,125) were male, and 12.5% (16.3% of females and 11.8% of males) reported SI.

Table 1 presents results of bivariate comparisons of sociodemographic characteristics, and pre, peri and post-event variables by SI for each responder group. Among police responders, variables that were significantly associated with SI included marital status, income, history of mental health disorder, life stressors prior to and post 9/11, WTC-related medical conditions, depression, WTC-related PTSD symptoms, functional impairment, and problematic alcohol use. Among non-traditional responders, variables that were significantly associated with SI included gender, race/ethnicity, education, marital status, income, history of mental health disorder, life stressors prior to and post

Table 1
Pre, peri and post-event variables by SI status in police (n = 14,314) and non-traditional (n = 16,389) WTC responders.

		Police responders					Non-traditional responders				
		SI		No SI		Test of diff,	SI		No SI		Test of diff,
		n/Mean	%/SD	n/Mean	%/SD		n/Mean	%/SD	n/Mean	%/SD	
Full sample		311	2.2%	14,003		97.8%	2042	12.5%	14,347	87.5%	311
Pre-event variables											
Age in years		44.68	7.51	41.79	7.04	7.15	44.82	10.11	45.10	10.16	1.16
Gender	Male	255	82.0%	11,896	85.0%		1672	81.9%	12,452	86.8%	
	Female	56	18.0%	2107	15.0%	2.08	369	18.1%	1895	13.2%	35.50***
Race/ethnicity	Non-Hispanic White	178	57.2%	8215	58.7%		957	46.9%	8260	57.6%	
	Non-Hispanic Black	38	12.2%	1648	11.8%		158	7.7%	1551	10.8%	
	Hispanic	68	21.9%	3256	23.3%		818	40.1%	3696	25.8%	
	Bi/multiracial or other	27	8.7%	884	6.3%	3.09	109	5.3%	840	5.9%	186.12***
Education	High school or less	189	60.8%	8317	59.4%		1499	73.4%	10,222	71.2%	
	Some college or higher	122	39.2%	5686	40.6%	0.24	543	26.6%	4125	28.8%	4.10*
Marital status	Single/never married	57	18.3%	1802	12.9%		340	16.7%	2188	15.3%	
	Married/partnered	155	49.8%	9338	66.7%		1051	51.5%	9101	63.4	
	Widowed/separated/divorced	99	31.8%	2863	20.4%	39.07***	651	31.9%	3058	21.3%	131.77***
Income	≤$80,000/year	213	68.5%	8455	60.4%		1739	85.2%	10,783	75.2%	
	>$80,000/year	98	31.5%	5548	39.6%	8.38**	303	14.8%	3564	24.8%	99.22***
History of mental health disorder		117	37.6%	1182	8.4%	313.94***	641	31.4%	2034	14.2%	387.82***
Life stressors prior to 9/11		1.77	2.42	1.14	1.62	−6.64***	2.36	3.05	1.53	2.20	−15.09***
Peri-event variables											
WTC exposures		5.0	2.02	5.04	1.98	−4.07	3.66	2.06	3.53	1.95	−2.69***
Social support – family		1.54	1.41	2.15	1.46	7.29	1.11	1.31	1.57	1.43	13.90***
Social support – work		0.58	0.75	0.75	0.77	3.85	0.36	0.65	0.55	0.75	11.03***
Post-event variables											
Life stressors post 9/11		4.71	3.40	2.53	2.25	−16.67***	5.44	3.63	3.11	2.91	−32.76***
WTC-related medical conditions		164	54.1%	6540	47.8%	4.78*	791	39.5%	5554	39.4%	0.01
Depression (PHQ-8)		197	63.3%	892	6.4%	1404.99***	1533	75.1%	2713	18.9%	2937.47***
WTC-related PTSD symptoms (PCL-C)		197	63.3%	1144	8.2%	1090.81***	1603	78.5%	3423	23.9%	2510.27***
Functional impairment (SDS)		203	65.3%	1445	10.3%	901.87***	1511	74.0%	3925	27.4%	1754.06***
Problematic alcohol use (CAGE)		69	22.2%	673	4.8%	186.99***	480	23.5%	1490	10.4%	291.00***

Note. Suicidal ideation was operationalized as a score of ≥1 on the two-part suicide question from the Patient Health Questionnaire (PHQ)-9. Depression was measured by a score ≥ 10 on the PHQ-8. WTC-related Posttraumatic Stress Disorder (PTSD) was measured by a score ≥ 44 on the PTSD Checklist Specific-Stressor Version (PCL-S). Functional impairment was measured by a mean score ≥ 5 on the Sheehan Disability Scale (SDS). Problematic alcohol use was operationalized as a score ≥ 2 on the CAGE Questionnaire. Significant association: *$p < .05$, **$p < .01$, ***$p < .001$.

9/11, WTC exposures, social support (both family and work), depression, WTC-related PTSD symptoms, functional impairment, and problematic alcohol use.

Table 2 presents results of multivariable logistic regression models. Among police responders, first (pre-event factors), second (peri-event factors) and third (post-event factors) steps accounted for 10.4%, 12.1% and 32.0% of the variance in SI, respectively; in non-traditional responders, these steps accounted for 9.3%, 10.9% and 36.0% of the variance in SI, respectively. In police responders, older age, positive screens for depression, functional impairment, and problematic alcohol use were positively associated with SI, while Hispanic ethnicity, married/partnered and widowed/separated/divorced marital status, and a greater number of supportive family members while working at the WTC site were negatively associated with SI. Among non-traditional responders, greater number of life stressors post 9/11, positive screens for depression, WTC-related PTSD symptoms, functional impairment, and problematic alcohol use were positively associated with SI, while male gender, higher income, greater number of WTC exposures and number of supportive family members while working at the WTC site were negatively associated with SI.

As shown in Fig. 1, in police WTC responders, symptom-level analyses revealed that feeling bad about oneself—or that you are a failure or that you have let yourself or your family down (OR = 2.52, 95%CI = 2.11–3.00; 30.2% relative variance explained [RVE]); feeling down, depressed, or hopeless (OR = 1.73, 95%CI = 1.41–2.12; 24.0% RVE); and sense of foreshortened future (OR = 1.27, 95%CI = 1.13–1.43; 16.8%) explained more than 70% of the variance in SI. None of the other assessed symptoms were significant. The remainder of the variance in SI was explained by functional impairment (13.2%), number of supportive family members while working at the WTC site (4.0%), problematic alcohol use (4.0%), marital status (3.8%), age (3.6%), and Hispanic ethnicity (0.4%).

As shown in Fig. 2, in non-traditional WTC responders, symptom-level analyses revealed that feeling bad about oneself—or that you are a failure or that you have let yourself or your family down (OR = 1.93, 95%CI = 1.79–2.09; 19.7% RVE); feeling down, depressed, or hopeless (OR = 1.44, 95%CI = 1.32–1.58; 14.3% RVE); psychomotor disturbance (moving or speaking so slowly that that other people could have noticed, or the opposite—being so fidgety or restless that other people could have noticed; OR = 1.40, 95%CI = 1.30–1.50; 12.3% RVE); sense of foreshortened future (OR = 1.20, 95%CI = 1.13–1.27; 10.7% RVE); WTC trauma-related emotional numbing (i.e. feeling emotionally numb or being unable to have loving feelings for those close to you; OR = 1.17, 95%CI = 1.10–1.24; 10.2% RVE) explained nearly 70% of the variance in SI. Irritability/anger (OR = 1.13, 1.06–1.20) and WTC trauma-related physiological reactivity (i.e., having a physical reaction such as heart pounding, trouble breathing, or sweating when reminded of the stressful experience or event; OR = 1.15, 95%CI = 1.09–1.22) explained an additional 9.0% and 6.4% of the variance in SI, respectively. None of the other symptoms were significant. The remainder of the variance in SI was explained by functional impairment (6.6%), life stressors post 9/11 (4.4%), number of supportive family members while working at the WTC site (3.0%), problematic alcohol use (2.2%), income (0.9%), WTC exposures (0.2%), and gender (0.1%).

Table 2
Results of multivariable logistic regression analyses evaluating factors associated with suicidal ideation in WTC disaster responders.

		Police responders n = 14,314			Non-traditional responders n = 16,389		
		Step 1 (R^2 = 0.104)			Step 1 (R^2 = 0.093)		
		Step 2 (R^2 = 0.121)			Step 2 (R^2 = 0.109)		
		Step 3 (R^2 = 0.320)			Step 3 (R^2 = 0.360)		
		OR	95% CI	Wald X^2	OR	95% CI	Wald X^2
Pre-event variables (Step 1)							
Age	Number of years	**1.03**	**1.01–1.05**	**11.54*****	1.00	0.99–1.00	2.05
Gender	Male	0.92	0.64–1.31	0.24	**0.83**	**0.70–0.97**	**5.30***
Race/ethnicity	Non-Hispanic White			REF			REF
	Non-Hispanic Black	0.75	0.49–1.15	1.75	0.81	0.65–1.01	3.59
	Hispanic	**0.70**	**0.50–0.99**	**4.05***	1.14	0.99–1.31	3.45
	Bi/multiracial or other	1.07	0.66–1.74	0.07	1.03	0.80–1.32	0.04
Education	Some college or higher	0.98	0.75–1.29	0.02	1.09	0.96–1.24	1.61
	Single/never married			REF			REF
Marital status	Married/partnered	**0.53**	**0.36–0.78**	**10.61*****	1.04	0.88–1.23	0.23
	Widowed/sep/dvrcd	**0.66**	**0.43–0.99**	**4.02***	1.10	0.92–1.32	1.04
Income	>$80,000/year	0.78	0.58–1.04	2.81	**0.85**	**0.72–1.00**	**3.88***
History of mental health disorder		0.89	0.64–1.23	0.53	1.14	0.99–1.31	3.29
Life stressors prior to 9/11		0.99	0.93–1.06	0.10	1.01	0.99–1.04	0.95
Peri-event variables (Step 2)							
WTC exposures		0.99	0.92–1.06	0.14	**0.95**	**0.92–0.98**	**12.76*****
Social support - family		**0.90**	**0.81–1.00**	**4.04***	**0.86**	**0.82–0.91**	**34.97*****
Social support - work		0.95	0.78–1.16	0.24	0.95	0.86–1.04	1.28
Post-event variables (Step 3)							
Life stressors post 9/11		1.04	0.99–1.10	2.21	**1.04**	**1.02–1.06**	**11.24*****
WTC-related medical conditions		0.82	0.63–1.08	1.98	0.91	0.80–1.02	2.50
Depression (PHQ-8)		**2.25**	**1.97–2.57**	**142.12*****	**2.39**	**2.20–2.59**	**446.35*****
WTC-related PTSD (PCL-S)		1.14	0.99–1.31	3.16	**1.60**	**1.48–1.74**	**123.48*****
Functional impairment (SDS)		**1.25**	**1.11–1.42**	**12.78*****	**1.25**	**1.16–3.34**	**35.48*****
Problematic alcohol use (CAGE)		**1.15**	**1.05–1.25**	**9.51****	**1.14**	**1.08–1.19**	**26.44*****

Note. OR = odds ratio; significant predictors are bolded; *p < .05, **p < .01, ***p < .001; suicidal ideation was operationalized as a score of ≥1 on the two-part suicide question from the Patient Health Questionnaire (PHQ)-9. Depression was measured by a score ≥ 10 on the PHQ-8. WTC-related Posttraumatic Stress Disorder (PTSD) was measured by a score ≥ 44 on the PTSD Checklist Specific-Stressor Version (PCL-S). Functional impairment was measured by a mean score ≥ 5 on the Sheehan Disability Scale (SDS). Problematic alcohol use was operationalized as a score ≥ 2 on the CAGE Questionnaire.

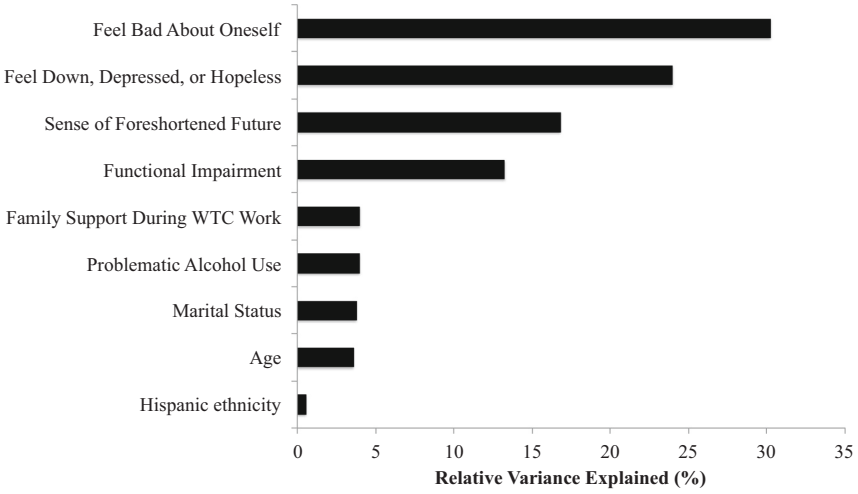

Fig. 1. Relative variance in suicidal ideation explained by individual depression and PTSD symptoms and other risk factors in police World Trade Center responders.

4. Discussion

To our knowledge, this study is the first to examine the prevalence and correlates of suicidal ideation (SI) in two diverse occupational groups that participated in rescue, recovery and clean-up efforts following the 9/11/2001 terrorist attacks on the World Trade Center. Results revealed that non-traditional responders reported markedly higher prevalence of SI (12.5% overall [16.3% of females and 11.8% of males]) relative to police responders (2.2% overall [2.6% of females and 2.1% of males]). The prevalence of SI reported by non-traditional responders was higher than those found in the general population (Substance Abuse and Mental Health Services Administration, 2018).

Several possible factors may account for the higher prevalence of SI in non-traditional disaster responders. For example, non-traditional

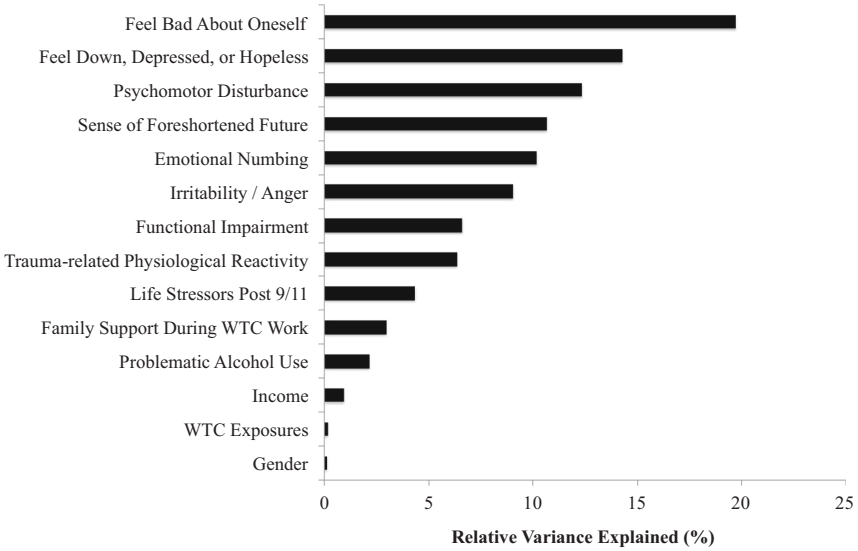

Fig. 2. Relative variance in suicidal ideation explained by individual depression and PTSD symptoms and other risk factors in non-traditional World Trade Center responders.

responder occupations—workers in utility, abatement, construction, transportation and sanitation occupations—are less likely than police responders to have had formal training to prepare them for the extraordinarily stressful conditions encountered at the WTC disaster site, such as seeing human remains and navigating hazardous environments for days or months at a time. Our findings align with prior research indicating that workers who lack disaster preparedness training and/or who perform tasks outside of their training during disaster recovery efforts may be more vulnerable to developing PTSD (Brooks et al., 2015, 2016; Perrin et al., 2007; Stellman et al., 2008), which is a known risk factor for SI in emergency responder populations such as police (Chopko et al., 2014; di Nota et al., 2020), as well as the general population (Nock et al., 2009). Furthermore, prior work from our group (DePierro et al., 2021) revealed that non-traditional responders reported more barriers to mental health care than did police, such as preferring to handle problems on their own, being too busy, and not knowing how or where to access care. These mental health-related beliefs, practices and access barriers may play a role in contributing to SI risk over time.

Whereas prior disaster preparedness training may have bolstered resilience to SI in police responders, concerns about stigma or other professional consequences (i.e., forced surrender of firearms) may have, at least in part, dissuaded self-reports of SI, as has been observed in prior studies (Stuart, 2017; Williams et al., 2010). Our previous work (DePierro et al., 2021) revealed that the only barrier to mental health care police endorsed at higher rates than non-traditional responders was fear of negative job consequences. Collectively, these findings underscore the importance of tailored intervention approaches for different WTC responder occupational subgroups, as well as confidential mental health screening and referral for police officers (e.g., Dowling et al., 2006; Newell et al., 2021).

Of note, the prevalence of SI among police responders in the current study was markedly lower than those found in both the general population and other disaster responder groups (Abbot et al., 2015; Kessler et al., 1999; Nock et al., 2008a; Stanley et al., 2016, 2015; Substance Abuse and Mental Health Services Administration, 2018). For example, one study of 193 U.S. A study in Midwestern police officers found that 8.8% (8.9% of males, 7.7% of females) reported SI within the prior two weeks. One possibility for a higher SI prevalence in this Midwestern sample (Chopko et al., 2014) is that participants completed survey items anonymously. In contrast, police responders in the present study completed survey items in a clinic, and responses (when used for clinical purposes) were paired with responders names.

Our large samples allowed us to examine a broad range of pre-, peri-, and post-9/11 factors associated with SI in police and non-traditional responders. We found that three variables explained the majority of variance in SI in both occupational groups. These variables, all of which were categorized as post-event variables, included greater severity of depressive symptoms of feeling bad about oneself or that one has let down oneself or family, and feeling down, depressed, or hopeless; and the PTSD symptom of sense of foreshortened future. Among non-traditional responders, four additional depressive and PTSD symptoms explained incremental variance in SI. Specifically, psychomotor disturbance accounted for 12.3% of the variance in SI, and WTC trauma-related emotional numbing, physiological reactivity and irritability/anger accounted for additional variance (ranging from 6.4% to 10.2%). Consistent with previous research (e.g., Russell et al., 2009), we also found that having functional impairment impacting one's work, family and/or social life was associated with a greater risk of SI in both groups of responders, accounting for 13.2% and 6.6% of the explained variance in police and non-traditional responders, respectively. Collectively, these findings extend prior 'symptomics' literature (Fried and Nesse, 2014; Kachadourian et al., 2021, 2019) to highlight the importance of a more nuanced, symptom-level approach to assessment, monitoring, and treatment of depression and PTSD in WTC responders at heightened risk for suicide. They further underscore the importance of functional impairment as a potential risk factor for SI in this population.

In addition to training, having a greater number of family members who provided support to responders while working at the WTC site provided a small potentially protective effect for both police (4.0%) and non-traditional responders (3.0%). This finding is consistent with a previous study of firefighters (e.g., Carpenter et al., 2015), but contrasts with studies of disaster responders and police, which found that organizational support helped mitigate mental health problems (Brooks et al., 2015, 2016; Violanti et al., 2016). In the current study, work support was unrelated to SI, though this variable had a restricted range. Collectively, our findings suggest that while organizational support may not incrementally contribute to SI risk above and beyond factors such as post-event depressive and PTSD symptoms and functional impairment.

Results of this study have several clinical implications for the assessment, monitoring, and treatment of suicide risk in WTC and other disaster responders. First, a single item—feeling bad about oneself/letting others down—explained nearly a third (30.2%) of the variance in SI in police and a fifth (19.7%) of this variance in non-traditional responders. Guilt related to a specific event, if left untreated, has

previously been linked to heightened risk of subsequent psychopathology (Kim et al., 2011; Kubany et al., 2004, 2000; Murray et al., 2021; Norman et al., 2014). Research-based interventions that focus on guilt following extreme stressors such as man-made disasters are available (Kubany et al., 2004; Norman et al., 2014; Litz et al., 2009). Additionally, group interventions such as Psychological First Aid may help provide specific knowledge of what to do during and following a disaster (Brucia et al., 2020; Brooks et al., 2016). Second, findings suggest that interventions should be tailored to the individual needs of diverse occupational groups. For example, given possible underreporting of SI in police responders, interventions addressing stigma also exist and may help improve disclosure of suicidal thoughts and adaptive help-seeking behaviors (Caine et al., 2018). Third, results of the current study also speak to the importance of a symptom-level approach to identifying mental health symptoms associated with SI in disaster responders, with particular attention to symptoms of feeling bad about oneself/guilt, depressed mood, and sense of foreshortened future, as well as related functional impairment. Fourth, in disaster responders who may underreport SI due to professional concerns, confidential screenings administered by a third party—rather than by an employer—and allowing for non-disclosure of SI may help improve identification of those most at risk (Kyron et al., 2020; Marshall et al., 2021). Because suicide is a low-incidence phenomenon, community-based preventive interventions and state-level public-private partnerships may help support a multifaceted approach to suicide prevention, including education, policy development, individual assessment, and preventive interventions (Knox et al., 2004). Further research is needed to evaluate the effectiveness of individual guilt- and stigma-reduction interventions, as well as broader, community-based efforts in mitigating suicidal thoughts and behaviors in WTC and other disaster response populations.

Results of this study should be considered within the context of the study's limitations. First, the study sample was comprised of individuals who responded to the WTC disaster and thus findings may not generalize to other populations. Second, data were obtained using self-report scales and so results may differ if clinician-administered scales were employed, and may be impacted by retrospective recall bias. Also, the median time from 9/11/2001 until survey completion was 5.5 years. The prevalence and severity of SI and its correlates may have fluctuated during this period, especially given that the PHQ-9 assessment of SI is limited to prevalence over the past two weeks. Longitudinal studies are needed to evaluate the nature and determinants of predominant longer-term trajectories of SI and suicidal behaviors over time, as well as predictors of completed suicide in WTC and other disaster responder populations. Lastly, the high incremental R^2 values in the third steps of our regression models are largely attributable to a strong association between positive screens for depression and SI. While depression was modeled as a risk correlate of SI, it is also possible that these measures, both of which were drawn from the PHQ-9, collectively reflect a common entity of more severe depressive symptoms with SI.

Notwithstanding these limitations, results of this study underscore the burden of SI in WTC responders, particularly non-traditional responders, and the role of pre-, peri-, and post-event factors as correlates of SI in this population. They further suggest that a symptom-based or 'symptomic' approach to identifying individual PTSD and MDD symptoms linked to SI may provide more nuanced targets for suicide risk assessment, monitoring, and treatment efforts. Further research is needed to examine the longitudinal interrelationships between PTSD and MDD symptoms, and the course of suicidal ideation and attempts, and to evaluate the efficacy of individual- and community-focused suicide prevention and treatment efforts to mitigate suicide risk in WTC and other disaster responder populations.

CRediT authorship contribution statement

R. Gibson, J. M. Whealin, and R. H. Pietrzak conceptualized this study and drafted the first version of the manuscript. R. H. Pietrzak conducted the analyses. C. R. Dasaro, I. G. Udasin, M. Crane, J. M. Moline, D. J. Harrison, B. J. Luft, A. C. Todd, C. Schechter, S. Lowe, and A. Feder coordinated data collection and provided critical revisions to the manuscript.

Role of the funding source

This work was supported in part by the CDC/National Institute for Occupational Safety and Health (NIOSH) Research Contract #200-2011-41919. The CDC/NIOSH did not contribute to study design; data collection; analysis or interpretation of data; writing of the report; or decision to submit the manuscript for publication.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors express their gratitude to all WTC responders for their courageous service and participation in this study.

References

Abbot, C., Barber, E., Burke, B., Harvey, J., Newland, C., Rose, M., Young, A., 2015. What's killing our medics? Ambulance Service Manager Program. Reviving Responders. http://www.revivingresponders.com/originalpaper. (Accessed 24 February 2021).

Beristianos, M.H., Maguen, S., Neylan, T.C., Byers, A.L., 2016a. Trauma exposure and risk of suicidal ideation among ethnically diverse adults. Depress Anxiety 33 (6), 495–501. https://doi.org/10.1002/da.22485.

Beristianos, M.H., Maguen, S., Neylan, T.C., Byers, A.L., 2016b. Trauma exposure and risk of suicidal ideation among older adults. Am. J. Geriatr. Psychiatry 24 (8), 639–643. https://doi.org/10.1016/j.jagp.2016.02.055.

Bishopp, S.A., Boots, D.P., 2014. General strain theory, exposure to violence, and suicide ideation among police officers: a gendered approach. J. Crim. Justice 42 (6), 538–548. https://doi.org/10.1016/j.jcrimjus.2014.09.007.

Blanchard, E.B., Jones-Alexander, J., Buckley, T.C., Forneris, C.A., 1996. Psychometric properties of the PTSD checklist (PCL). Behav. Res. Ther. 34 (8), 669–673. https://doi.org/10.1016/0005-7967(96)00033-2.

Borges, G., Orozco, R., Rafful, C., Miller, E., Breslau, J., 2012. Suicidality, ethnicity and immigration in the USA. Psychol. Med. 42 (6), 1175–1184. https://doi.org/10.1017/S0033291711002340.

Brooks, S.K., Dunn, R., Sage, C.A., Amlôt, R., Greenberg, N., Rubin, G.J., 2015. Risk and resilience factors affecting the psychological wellbeing of individuals deployed in humanitarian relief roles after a disaster. J. Ment. Health 24 (6), 385–413. https://doi.org/10.3109/09638237.2015.1057334.

Brooks, S.K., Dunn, R., Amlôt, R., Greenberg, N., Rubin, G.J., 2016. Social and occupational factors associated with psychological distress and disorder among disaster responders: a systematic review. BMC Psychol. 4, 18. https://doi.org/10.1186/s40359-016-0120-9.

Brown, L.A., Fernandez, C.A., Kohn, R., Saldivia, S., Vicente, B., 2018. Pre-disaster PTSD as a moderator of the relationship between natural disaster and suicidal ideation over time. J. Affect. Disord. 230, 7–14. https://doi.org/10.1016/j.jad.2017.12.096.

Brucia, E.F., Cordova, M.J., Finestone, A., Ruzek, J.I., 2020. Application and integration of psychological first aid in first responder organizations. In: Bowers, C.A., Beidel, D. C., Marks, M.R. (Eds.), Mental Health Intervention And Treatment of First Responders And Emergency Workers. Medical Information Science Reference/IGI Global, pp. 129–153. https://doi.org/10.4018/978-1-5225-9803-9.ch008.

Caine, E.D., Reed, J., Hindman, J., Quinlan, K., 2018. Comprehensive, integrated approaches to suicide prevention: practical guidance. Inj. Prev. 24 (Suppl. 1), i38–i45. https://doi.org/10.1136/injuryprev-2017-042366.

Carleton, N.R., Afifi, T.O., Turner, S., Taillieu, T., LeBouthillier, D.M., Duranceau, S., Sareen, J., Ricciardelli, R., MacPhee, R.S., Groll, D., Hozempa, K., Brunet, A., Weekes, J.R., Griffiths, C.T., Abrams, K.J., Jones, N.A., Beshai, S., Cramm, H.A., Dobson, K.S., Hatcher, S., Keane, T.M., Stewart, S.H., Asmundson, G.J.G., 2018. Suicidal ideation, plans, and attempts among public safety personnel in Canada. Can. Psychol. 59 (3), 220–231. https://doi.org/10.1037/cap0000136.

Carpenter, G.S.J., Carpenter, T.P., Kimbrel, N.A., Flynn, E.J., Pennington, M.L., Cammarata, C., Zimering, R.T., Kamholz, B.W., Gulliver, S.B., 2015. Social support, stress, and suicidal ideation in professional firefighters. Am. J. Health Behav. 39 (2), 191–196. https://doi.org/10.5993/AJHB.39.2.5.

Centers for Disease Control, 2019. Leading Causes of Death Reports. Web-based injury statistics query and reporting system. URL. https://www.cdc.gov/injury/wisqars/LeadingCauses.html (accessed 6.20.21).

Chopko, B.A., Palmieri, P.A., Facemire, V.C., 2014. Prevalence and predictors of suicidal ideation among U.S. law enforcement officers. J. Police Crim. Psychol. 29 (1), 1–9. https://doi.org/10.1007/s11896-013-9116-z.

DePierro, J., Lowe, S.M., Haugen, P.T., Cancelmo, L., Schaffer, J., Schechter, C.B., Dasaro, C.R., Todd, A.C., Crane, M., Luft, B.J., Moline, J.M., Harrison, D., Udasin, I. G., Feder, A., Southwick, S.M., Pietrzak, R.H., 2021. Mental health stigma and barriers to care in World Trade Center responders: results from a large, population-based health monitoring cohort. Am. J. Ind. Med. 64 (3), 208–216. https://doi.org/10.1002/ajim.23204.

DeWolfe, D.J., 2000. Training manual for mental health and human service workers in major disasters. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services. DHHS Publication No. ADM 90-538. https://store.samhsa.gov/product/field-manual-mental-health-and-human-service-workers-major-disasters/adm90-0537.

di Nota, P.M., Anderson, G.S., Ricciardelli, R., Carleton, R.N., Groll, D., 2020. Mental disorders, suicidal ideation, plans and attempts among Canadian police. Occup. Med. (Lond.) 70 (3), 183–190. https://doi.org/10.1093/OCCMED/KQAA026.

Dowling, F.G., Moynihan, G., Genet, B., Lewis, J., 2006. A peer-based assistance program for officers with the New York City Police Department: Report of the effects of Sept. 11, 2001. Am. J. Psychiatry 163 (1), 151–153. https://doi.org/10.1176/appi.ajp.163.1.151.

Fried, E.I., Nesse, R.M., 2014. The impact of individual depressive symptoms on impairment of psychosocial functioning. PLoS ONE 9 (2), e90311. https://doi.org/10.1371/journal.pone.0090311.

Hedegaard, H., Curtin, S.C., Warner, M., 2020. Increase in suicide mortality in the United States, 1999–2018. NCHS Data Brief 362, 1–8.

Jafari, H., Heidari, M., Heidari, S., Sayfouri, N., 2020. Risk factors for suicidal behaviours after natural disasters: a systematic review. Malays. J. Med. Sci. 27 (3), 20–33. https://doi.org/10.21315/mjms2020.27.3.3.

Kachadourian, L.K., Harpaz-Rotem, I., Tsai, J., Southwick, S.M., Pietrzak, R.H., 2019. Posttraumatic stress disorder symptoms, functioning, and suicidal ideation in US military veterans: a symptomics approach. Prim. Care Companion CNS Disord. 21 (2) https://doi.org/10.4088/PCC.18m02402.

Kachadourian, L.K., Feder, A., Murrough, J.W., Feingold, J.H., Kaye-Kauderer, H., Charney, D., Southwick, S.M., Peccoralo, L., Ripp, J., Pietrzak, R.H., 2021. Transdiagnostic psychiatric symptoms, burnout, and functioning in frontline health care workers responding to the COVID-19 pandemic. J. Clin. Psychiatry 82 (3), 20m13766. https://doi.org/10.4088/jcp.20m13766.

Kessler, R.C., Borges, G., Walters, E.E., 1999. Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. Arch. Gen. Psychiatry 56 (7), 617–626. https://doi.org/10.1001/archpsyc.56.7.617.

Kessler, R.C., Galea, S., Gruber, M.J., Sampson, N.A., Ursano, R.J., Wessely, S., 2008. Trends in mental illness and suicidality after Hurricane Katrina. Mol. Psychiatry 13 (4), 374–384. https://doi.org/10.1038/sj.mp.4002119.

Kim, S., Thibodeau, R., Jorgensen, R.S., 2011. Shame, guilt, and depressive symptoms: a meta-analytic review. Psychol. Bull. 137 (1), 68–96. https://doi.org/10.1037/a0021466.

King, M., 1986. At risk drinking among general practice attenders: validation of the CAGE questionnaire. Psychol. Med. 16 (1), 213–217. https://doi.org/10.1017/S0033291700002658.

Knox, K.L., Conwell, Y., Caine, E.D., 2004. If suicide is a public health problem, what are we doing to prevent it? Am. J. Public Health 93 (1), 37–45. https://doi.org/10.2105/AJPH.94.1.37.

Kölves, K., Kölves, K.E., de Leo, D., 2013. Natural disasters and suicidal behaviours: a systematic literature review. J. Affect. Disord. 146, 1–14. https://doi.org/10.1016/j.jad.2012.07.037.

Kroenke, K., Spitzer, R.L., 2002. The PHQ-9: a new depression diagnostic and severity measure. Psychiatr. Ann. 32 (9), 509–515. https://doi.org/10.3928/0048-5713-20020901-06.

Kroenke, K., Spitzer, R., Williams, J.B.W., 2001. The PHQ-9: validity of a brief depression severity measure. Gen. Intern. Med. 16 (9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x.

Kubany, E.S., Haynes, S.N., Leisen, M.B., Owens, J.A., Kaplan, A.S., Watson, S.B., Burns, K., 2000. Development and preliminary validation of a brief broad-spectrum measure of trauma exposure: the traumatic life events questionnaire. Psychol. Assess. 12 (2), 210–224. https://doi.org/10.1037/1040-3590.12.2.210.

Kubany, E.S., Hill, E.E., Owens, J.A., Iannce-Spencer, C., McCaig, M.A., Tremayne, K.J., Williams, P.L., 2004. Cognitive trauma therapy for battered women with PTSD (CTT-BW). J. Consult. Clin. Psychol. 72 (1), 3–18. https://doi.org/10.1037/0022-006X.72.1.3.

Kyron, M.J., Podlogar, M.C., Joiner, T.E., McEvoy, P.M., Page, A.C., Lawrence, D., 2020. Allowing nondisclosure in surveys with suicide content: characteristics of nondisclosure in a national survey of emergency services personnel. Psychol. Assess. 32 (12), 1106–1117. https://doi.org/10.1037/pas0000949.

Litz, B.T., Stein, N., Delaney, E., Lebowitz, L., Nash, W.P., Silva, C., Maguen, S., 2009. Moral injury and moral repair in war veterans: a preliminary model and intervention strategy. Clin. Psychol. Rev. 29 (8), 695–706. https://doi.org/10.1016/j.cpr.2009.07.003.

Liu, R.T., Miller, I., 2014. Life events and suicidal ideation and behavior: a systematic review. Clin. Psychol. Rev. 34 (3), 181–192. https://doi.org/10.1016/j.cpr.2014.01.006.

Marshall, R.E., Milligan-Saville, J., Petrie, K., Bryant, R., Mitchell, P., Harvey, S., 2021. Mental health screening amongst police officers: factors associated with under-reporting of symptoms. BMC Psychiatry 21 (1). https://doi.org/10.1186/s12888-021-03125-1.

Murray, H., Pethania, Y., Medin, E., 2021. Survivor guilt: a cognitive approach. Cogn. Behav. Therap. 14, e28 https://doi.org/10.1017/S1754470X21000246.

Newell, C.J., Ricciardelli, R., Czarnuch, S.M., Martin, K., 2021. Police staff and mental health: barriers and recommendations for improving help-seeking. Police Pract. Res. https://doi.org/10.1080/15614263.2021.1979398.

Nock, M.K., Borges, G., Bromet, E.J., Alonso, J., Angermeyer, M., Beautrais, A., Bruffaerts, R., Wai, T.C., de Girolamo, G., Gluzman, S., de Graaf, R., Gureje, O., Haro, J.M., Huang, Y., Karam, E., Kessler, R.C., Lepine, J.P., Levinson, D., Medina-Mora, M.E., Ono, Y., Posada-Villa, J., Williams, D., 2008a. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. Br. J. Psychiatry 192 (2), 98–105. https://doi.org/10.1192/bjp.bp.107.040113.

Nock, M.K., Borges, G., Bromet, E.J., Cha, C.B., Kessler, R.C., Lee, S., 2008b. Suicide and suicidal behavior. Epidemiol. Rev. 30 (1), 133–154. https://doi.org/10.1093/epirev/mxn002.

Nock, M.K., Hwang, I., Sampson, N., Kessler, R.C., Angermeyer, M., Beautrais, A., Borges, G., Bromet, E., Bruffaerts, R., de Girolamo, G., de Graaf, R., Florescu, S., Gureje, O., Haro, J.M., Hu, C., Huang, Y., Karam, E.G., Kawakami, N., Kovess, V., Levinson, D., Williams, D.R., 2009. Cross-national analysis of the associations among mental disorders and suicidal behavior: findings from the WHO World Mental Health Surveys. PLoS Med. 6 (8), e1000123 https://doi.org/10.1371/journal.pmed.1000123.

Nock, M.K., Hwang, I., Sampson, N.A., Kessler, R.C., 2010. Mental disorders, comorbidity and suicidal behavior: results from the national comorbidity survey replication. Mol. Psychiatry 15 (8), 868–876. https://doi.org/10.1038/mp.2009.29.

Norman, S.B., Wilkins, K.C., Myers, U.S., Allard, C.B., 2014. Trauma informed guilt reduction therapy with combat veterans. Cogn. Behav. Pract. 2 (1), 78–88. https://doi.org/10.1016/j.cbpra.2013.08.001.

O'Connor, R.C., Portzky, G., 2018. Looking to the future: a synthesis of new developments and challenges in suicide research and prevention. Front. Psychol. 9 (2139) https://doi.org/10.3389/fpsyg.2018.02139.

Perrin, M.A., DiGrande, L., Wheeler, K., Thorpe, L., Farfel, M., Brackbill, R., 2007. Differences in PTSD prevalence and associated risk factors among World Trade Center disaster rescue and recovery workers. Am. J. Psychiatry 164, 13851394. https://doi.org/10.1176/appi.ajp.2007.06101645.

Pietrzak, R.H., Schechter, C.B., Bromet, E.J., Katz, C.L., Reissman, D.B., Ozbay, F., Sharma, V., Crane, M., Harrison, D., Herbert, R., Levin, S.M., Luft, B.J., Moline, J.M., Stellman, J.M., Udasin, I.G., Landrigan, P.J., Southwick, S.M., 2012a. The burden of full and subsyndromal posttraumatic stress disorder among police involved in the World Trade Center rescue and recovery effort. J. Psychiatr. Res. 46 (7), 835–842. https://doi.org/10.1016/j.jpsychires.2012.03.011.

Pietrzak, R.H., Tracy, M., Galea, S., Kilpatrick, D.G., Ruggiero, K.J., Hamblen, J.L., Southwick, S.M., Norris, F.H., 2012b. Resilience in the face of disaster: prevalence and longitudinal course of mental disorders following Hurricane Ike. PLoS One 7 (6), e38964. https://doi.org/10.1371/journal.pone.0038964.

Pietrzak, R.H., Feder, A., Singh, R., Schechter, C.B., Bromet, E.J., Katz, C.L., Reissman, D. B., Ozbay, F., Sharma, V., Crane, M., Harrison, D., Herbert, R., Levin, S.M., Luft, B.J., Moline, J.M., Stellman, J.M., Udasin, I.G., Landrigan, P.J., Southwick, S.M., 2014. Trajectories of PTSD risk and resilience in World Trade Center responders: an 8-year prospective cohort study. Psychol. Med. 44 (1), 205–219. https://doi.org/10.1017/S0033291713000597.

Reifels, L., Spittal, M.J., Dückers, M.L.A., Mills, K., Pirkis, J., 2018. Suicidality risk and (repeat) disaster exposure: findings from a nationally representative population survey. Psychiatry 81 (2), 158–172. https://doi.org/10.1080/00332747.2017.1385049.

Robin, L.N., Smith, E.M., 1983. The Diagnostic Interview Schedule/Disaster Supplement. Washington University School of Medicine, St. Louis, Missouri.

Russell, D., Turner, R.J., Joiner, T.E., 2009. Physical disability and suicidal ideation: a community-based study of risk/protective factors for suicidal thoughts. Suicide Life Threat Behav. 39 (4), 440–451. https://doi.org/10.1521/suli.2009.39.4.440.

Sheehan, D., Harnett-Sheehan, K., Raj, B.A., 1996. The measurement of disability. Int. Clin. Psychopharmacol. 11 (Suppl. 3), 89–95. https://doi.org/10.1097/00004850-199606003-00015.

Stanley, I.H., Hom, M.A., Hagan, C.R., Joiner, T.E., 2015. Career prevalence and correlates of suicidal thoughts and behaviors among firefighters. J. Affect. Disord. 187, 163–171. https://doi.org/10.1016/j.jad.2015.08.007.

Stanley, I.H., Hom, M.A., Joiner, T.E., 2016. A systematic review of suicidal thoughts and behaviors among police officers, firefighters, EMTs, and paramedics. Clin. Psychol. Rev. 44, 25–44. https://doi.org/10.1016/j.cpr.2015.12.002.

Stein, D.J., Chiu, W.T., Hwang, I., Kessler, R.C., Sampson, N., Alonso, J., Borges, G., Bromet, E., Bruffaerts, R., de Girolamo, G., Florescu, S., Gureje, O., He, Y., Kovess-Masfety, V., Levinson, D., Matschinger, H., Mneimneh, Z., Nakamura, Y., Ormel, J., Posada-Villa, J., Sagar, R., Scott, K.M., Tomov, T., Viana, M.C., Williams, D.R., Nock, M.K., 2010. Cross-national analysis of the associations between traumatic events and suicidal behavior: findings from the who world mental health surveys. PLoS One. 5 (5), e10574 https://doi.org/10.1371/journal.pone.0010574.

Stellman, J.M., Smith, R.P., Katz, C.L., Sharma, V., Charney, D.S., Herbert, R., Moline, J., Luft, B.J., Markowitz, S., Udasin, I., Harrison, D., Baron, S., Landrigan, P.J., Levin, S. M., Southwick, S., 2008. 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. Environ. Health Perspect. 116 (9), 1248–1253. https://doi.org/10.1289/ehp.11164.

Stuart, H., 2017. Mental illness stigma expressed by police to police. Isr. J. Psychiatry Relat. Sci. 54 (1), 18–23.

Substance Abuse and Mental Health Services Administration, 2015. Traumatic stress and suicide after disasters. Supplemental Research Bulletin. https://www.samhsa.gov/sites/default/files/dtac/srb_sept2015.pdf. (Accessed 8 March 2021).

Substance Abuse and Mental Health Services Administration, 2018. Key substance use and mental health indicators in the United States: Results from the 2019 National Survey on Drug Use and Health. HHS Publication No. PEP20-07-01-001, NSDUH Series H-55. https://www.samhsa.gov/data/sites/default/files/cbhsq-reports/NSDUHNationalFindingsReport2018/NSDUHNationalFindingsReport2018.pdf. (Accessed 7 July 2021).

Syed, S., Ashwick, R., Schlosser, M., Jones, R., Rowe, S., Billings, J., 2020. Global prevalence and risk factors for mental health problems in police personnel: a systematic review and meta-analysis. Occup. Environ. Med. 77 (11), 737–747. https://doi.org/10.1136/oemed-2020-106498.

Tonidandel, S., LeBreton, J.M., 2010. Determining the relative importance of predictors in logistic regression: an extension of relative weight analysis. Organ. Res. Methods 13 (4), 767–781. https://doi.org/10.1177/1094428109341993.

US Department of Health and Human Services, 2021. The surgeon general's call to action to implement the national strategy for suicide prevention. https://www.hhs.gov/sites/default/files/sprc-call-to-action.pdf. (Accessed 11 June 2021).

Violanti, J.M., 2004. Predictors of police suicide ideation. Suicide Life Threat Behav. 34 (3), 277–283. https://doi.org/10.1521/suli.34.3.277.42775.

Violanti, J.M., Fekedulegn, D., Charles, L.E., Andrew, M.E., Hartley, T.A., Mnatsakanova, A., Burchfiel, C.M., 2009. Suicide in police work: exploring potential contributing influences. Am. J. Crim. Justice 34 (41), 41–53. https://doi.org/10.1007/s12103-008-9049-8.

Violanti, J.M., Andrew, M.E., Mnatsakanova, A., Hartley, T.A., Fekedulegn, D., Burchfiel, C.M., 2016. Correlates of hopelessness in the high suicide risk police occupation. Police Pract. Res. 17 (5), 408–419. https://doi.org/10.1080/15614263.2015.1015125.

Violanti, J.M., Owens, S., McCanlies, E., Fekedulegn, D., Andrew, M., 2019. Law enforcement suicide: a review. Policing 42 (2), 141–164. https://doi.org/10.1108/PIJPSM-05-2017-0061.

Weathers, F., Litz, B., Herman, D., Huska, J., Keane, T., 1993. The PTSD checklist (PCL): Reliability, validity, and diagnostic utility. In: Paper Presented at the Annual Convention of the International Society for Traumatic Stress Studies, San Antonio, TX.

Williams, J.B.W., 2000. Mental health status, functioning and disabilities measures. In: Handbook of Psychiatric Measures. American Psychiatric Association, Washington, DC, USA.

Williams, D.R., Mohammed, S.A., Leavell, J., Collins, C., 2010. Race, socioeconomic status, and health: complexities, ongoing challenges, and research opportunities. Ann. N. Y. Acad. Sci. 1186, 69–101. https://doi.org/10.1111/j.1749-6632.2009.05339.x.