

# ORIGINAL RESEARCH

## Coping Behavior and Risk of Post-Traumatic Stress Disorder Among Federal Disaster Responders

George T. Loo, MPA, MPH, DrPH; Charles J. DiMaggio, PhD, MPH, PA-C;  
Robyn R. Gershon, DrPH, MHS; David B. Canton, DO, JD, MPH, USPHS(ret);  
Stephen S. Morse, PhD; Sandro Galea, MD, DrPH, MPH

### ABSTRACT

**Background:** Our knowledge about the impact of coping behavior styles in people exposed to stressful disaster events is limited. Effective coping behavior has been shown to be a psychosocial stress modifier in both occupational and nonoccupational settings.

**Methods:** Data were collected by using a web-based survey that administered the Post-Traumatic Stress Disorder (PTSD) Checklist–Civilian, General Coping Questionnaire-30, and a supplementary questionnaire assessing various risk factors. Logistic regression models were used to test for the association of the 3 coping styles with probable PTSD following disaster exposure among federal disaster responders.

**Results:** In this sample of 549 study subjects, avoidant coping behavior was most associated with probable PTSD. In tested regression models, the odds ratios ranged from 1.19 to 1.26 and 95% confidence intervals ranged from 1.08 to 1.35. With control for various predictors, emotion-based coping behavior was also found to be associated with probable PTSD (odds ratio = 1.11; 95% confidence interval: 1.01-1.22).

**Conclusion:** This study found that in disaster responders exposed to traumatic disaster events, the likelihood of probable PTSD can be influenced by individual coping behavior style and other covariates. The continued probability of disasters underscores the critical importance of these findings both in terms of guiding mental health practitioners in treating exposed disaster responders and in stimulating future research. (*Disaster Med Public Health Preparedness*. 2016;10:108-117)

**Key Words:** stress disorders, post-traumatic, mental health, emergency responders, coping behavior, disaster medicine

Exposure to traumatic events may adversely affect the mental well-being of disaster responders and rescue workers,<sup>1-3</sup> with post-traumatic stress disorder (PTSD) being the most frequently studied outcome.<sup>2,3</sup> The reported prevalence of PTSD ranges from 5% to 29% in this population.<sup>4-18</sup> In one study, PTSD prevalence among all types of disaster workers was 12.4%; for rescue/recovery workers without prior disaster training or expertise, the prevalence was 21.2%.<sup>19</sup> The evidence on associated factors is conflicting. Factors such as the presence of social support, leadership, training, and rituals have been found to reduce stress levels in firefighters.<sup>20</sup> Studies comparing professional responders and laypersons suggest that long-term professional experience is protective against developing adverse psychological sequelae.<sup>21,22</sup> By contrast, other studies<sup>23,24</sup> that report prevalence rates of 16.7% and 21.4% for general psychiatric morbidity and post-traumatic morbidity<sup>23</sup> found that longer job experience was highly associated with greater psychiatric and post-traumatic

morbidity.<sup>23</sup> The number of traumatic exposures may also affect stress. In one longitudinal study,<sup>25</sup> shipwreck participants who had only a single exposure demonstrated consistent reductions in stress reactions over a 12-month period, whereas those who experienced repeated traumatic exposures incurred increased stress reactions over the same period. Similarly, a study<sup>26</sup> on police officers found that PTSD was nearly 7 times as likely to occur in exposed disaster workers who had a prior history of disaster exposure.

Coping behavior styles may mediate mental health sequelae following exposure to traumatic events.<sup>27,28</sup> The role of coping, which is known to affect perceived or “felt” stress, on the subsequent development of mental health disorders has not been well characterized in disaster responders. Coping styles have been categorized into 3 major groups: avoidant, emotion, and task-oriented behavior. Avoidance-based coping is characterized by attempts to displace oneself either mentally or physically from the stressor.

Emotion-based coping is typified by attempts to mitigate emotional anguish through self-reflection or self-blame. Task-oriented or problem-based coping utilizes behaviors that solve, alter, or mentally transform the distress.<sup>29</sup> Studies have consistently shown that people who make an action plan and seek out trusted advice for dealing with stressors have better mental health outcomes than do persons who rely solely on avoidance or emotion-focused coping behaviors.<sup>30</sup> Additionally, coping behavior mechanisms have been linked with the social and cultural values of specific population groups. For example, similar prevalence rates of PTSD and major depression were observed between victims of terrorist bombings in 2 different countries where different coping mechanisms were used; one group depended on their religious faith, whereas the other group relied on medical treatment, drugs, and alcohol.<sup>31</sup>

Confrontive coping behavior was found to be a predictor of psychiatric morbidity, leading to the speculation of an association between coping and psychological symptoms.<sup>23</sup> Distancing and escape-avoidance are also significant predictors of post-traumatic morbidity, but positive reappraisal is significantly protective against post-traumatic morbidity.<sup>23</sup> Evidence about resiliency is conflicting. Some studies have found that the ability to cope with and gain from the event is protective against adverse mental health outcomes.<sup>8,32,33</sup> Evidence from other studies has at best been neutral, finding rescue workers unaffected by disaster events.<sup>24,32,34</sup> Still other studies found that rescue workers were more susceptible or symptomatic than were victims who were directly exposed.<sup>35,36</sup>

The coping process embodies cognitive and behavior attitudes that are employed to deal with traumatic circumstances and the related adverse feelings. This is an obscure process and prospective studies evaluating 81 Israeli college students exposed to a terrorist bus explosion demonstrates this complexity. This study found that direct exposure to the attack, indirect exposure to the attack, pre-attack harm avoidance personality dimension, avoidance coping style, and perceived threat were factors associated with increased risk for PTSD.<sup>37,38</sup> These findings are similarly consistent with the findings of other retrospective studies.<sup>28,39</sup>

In light of this conflicting and contradictory evidence, the main objective of this study was to explore the role of various coping behavior styles on probable PTSD and to determine the role of other covariates such as demographics, premorbidity and comorbidity, terrorism, traumatic life events, and military experience in a sample of disaster rescue and recovery workers who were exposed to one or more disaster events.

## METHODS

The target population for this study was federal disaster responders from the National Disaster Medical System

(NDMS). The disaster response function of the NDMS consists of disaster medical assistance teams (DMATs), disaster mortuary assistance teams (DMORTs), national veterinarian response teams (NVRTs), and other specialized medical assistance teams such as the international medical surgical team (IMSURT). These response teams include physicians, nurses, veterinarians, paramedics, emergency medical technicians, other medical specialties, police and fire professionals, and other nonmedical personnel who provide emergency medical services in a disaster situation. No federal funding or incentives were used and notification was conducted through publicly available means. The study protocol was approved by the Columbia University Institutional Review Board.

Study subjects voluntarily participated in an Internet-based electronic self-report survey. Periodic e-mails (approximately 6-week intervals) were sent to remind potential respondents about the study for a period of 12 months. The best estimate for the total population of both active and inactive NDMS responders is approximately 4900 responders (TE Davis, personal communication, 2007). Of those responders, the number who were eligible for deployment and at risk for exposure was substantially lower (D Diamond, personal communication, 2005). In total, 1600 responders were active, eligible for deployment, and potentially at risk of exposure to disaster during the recruitment period for this study. On the basis of this denominator, the 568 completed surveys we received potentially represent an overall response rate of 35.5%.

Outcomes were defined by *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition, criteria, and constructs included in the survey were as follows: anxiety was measured by using the Generalized Anxiety Disorder Scale (GAD-7),<sup>40,41</sup> alcohol use disorders were assessed by using only the core questions from the Alcohol Use Disorders Identification Test (AUDIT) questionnaire,<sup>42,43</sup> depression was evaluated by using the Patient Health Questionnaire (PHQ-9),<sup>44-46</sup> PTSD was identified by using the PTSD Checklist Civilian Version (PCL-C),<sup>47</sup> and coping behaviors were determined by use of the General Coping Questionnaire (GCQ-30).<sup>48,49</sup> Participants were asked whether they deployed to one or more disaster events, such as Hurricanes Katrina, Rita, and Wilma and the terrorist attacks of September 11, 2001. Deployments were defined as responders being notified, responding to the mission, and performing their assigned duties. In addition, exposure to traumatic life events was also assessed and was defined as experiencing an event where there was the threat of actual death or serious injury to oneself, family, or friends or responding to an event with a perception of fear, helplessness, or horror. Information was also collected on additional covariates such as age, gender, race, marital status, education, team type, team role, unit type, medical or professional responder training, years of service, and civilian occupation.

Descriptive statistics were performed and the relationship between each of the coping styles was stratified by PTSD

symptoms and evaluated by using Pearson's correlation statistic. For each coping behavior style, the differences between the group means for those with and without PTSD symptoms were tested by Student's *t*-test. Bivariate analysis was conducted by using two-way contingency tables to examine the association between probable PTSD and covariates and to identify predictor variables for regression model fitting. Odds ratios (ORs) and 95% confidence intervals (CIs) with two-tailed significance levels set at  $P \leq 0.05$  were used in the bivariate analysis. Several logistic regression models were tested to assess the association between PTSD, coping behavior, and exposures while controlling for covariates. Premorbid and comorbid outcomes, such as alcohol use, anxiety, and depression were adjusted in the models because depression is often comorbid with PTSD.<sup>26</sup> This study reported the regression coefficients as ORs with 95% CIs and a two-tailed significance level of  $P < 0.05$ . All data analyses were conducted by using SAS 9.2 (SAS Institute, Inc., Cary, NC).

### RESULTS

A total of 568 participants were enrolled in the study, with 19 observations removed for missing data. Among the 549 responses in the analysis, 60% were from men with a mean age of 48.0 years (range: 19 to 76 years). Female subjects averaged 48.4 years of age (range: 27 to 72 years). The largest group of study participants (93%) identified as Caucasian, and the next largest group (2.8%) identified as "other." Only 3.8% of participants identified themselves as Hispanic in ethnicity, and 66.5% of study participants reported that they were married. As expected, the study sample was highly educated: 18.7% reported completing an associate's degree, 24.3% completing a bachelor's degree, 17.7% a master's degree, and 18.8% a doctoral degree. The overwhelming majority of respondents (76.3%) served in medical units, whereas 12% of respondents reported serving in mortuary units and 7.3% belonged to veterinary units. In terms of deployment roles, 55.4% reported that they performed a medical function while deployed and 13.8% were in command/leadership positions. Respondents came from various civilian occupations; the largest occupational group was the emergency medical services sector (33.9%), followed by academia/education/research and fire services at 25.7% and 11.0%, respectively. Over two-thirds (65.1%) of the sample earned more than \$55,000 per year, whereas 34.9% reported incomes below \$55,000. Most participants (88.9%) reported having served as federal disaster responders for more than 3 years.

### Prevalence of Mental Health Outcomes

Fifty respondents (9.1%) screened positive for probable PTSD (Table 1) as defined by a score of 44 or higher on the PCL-C. Evaluation of the PTSD subscales (intrusion, avoidance, or arousal) revealed that 35.3% of respondents

screened positive for at least one of the PTSD symptoms: intrusion (8.0%,  $n = 44$ ), avoidance (0.9%,  $n = 5$ ), arousal (5.3%,  $n = 29$ ), intrusion and avoidance (2.0%,  $n = 11$ ), intrusion and arousal (6.2%,  $n = 34$ ), and avoidance and arousal (2.7%,  $n = 15$ ). Furthermore, 10.2% ( $n = 56$ ) of respondents screened positive for all 3 symptoms.

The AUDIT scale identified (total score of 8 points or higher) 5.7% of respondents ( $n = 31$ ) who screened positive for alcohol use (Table 1). Of the 31 respondents who scored above 8 points, 27 (4.9%) exhibited harmful alcohol consumption levels and 4 (0.7%) were identified as being alcohol dependent. Generalized anxiety disorder, defined by a score of 5 or higher on the GAD-7, was identified in 25.5% ( $n = 140$ ) of study respondents (Table 1). Of the respondents who screened positive on the GAD-7, 18.4% reported mild anxiety, 5.7% had moderate anxiety, and 1.5% screened high enough for severe anxiety.

As noted in Table 1, of the 148 respondents (27.0%) who reported some degree of depression by scoring 5 points or greater on the PHQ-9, a total of 93 respondents (16.9%) reported having mild depression, 40 (7.3%) had moderate depression, 11 (2.0%) had major depression, and 4 (0.7%) scored highly for severe depression. The alternative PHQ-9 scoring method identified 3.5% of the respondents ( $n = 19$ ) as having "major depressive" symptoms and 6.9% ( $n = 38$ ) as having "other depressive" symptoms.

### Bivariate Analysis

Bivariate analysis of the covariates indicated that age, gender, education, team type, team role, and years in service were not significantly associated with probable PTSD in this group of disaster responders. Bivariate analysis of the exposures did not demonstrate any notable relationship for hurricane exposures, the 9/11 attacks, military service, or combat with probable PTSD. However, exposure to traumatic life events significantly increased the likelihood for probable PTSD (OR = 1.87; 95% CI: 1.07-3.28). One protective factor was observed: being married was associated with a 49% reduction in probable PTSD among disaster responders (OR = 0.51; 95% CI: 0.29-0.89). In contrast, being single/never married significantly elevated the odds for probable PTSD among disaster responders (OR = 2.60; 95% CI: 1.34-5.06). Examining preexisting or coexisting mental health conditions showed that premorbid anxiety (OR = 4.30; 95% CI: 2.22-8.31), premorbid depression (OR = 4.54; 95% CI: 2.55-8.09), comorbid anxiety (OR = 22.46; 95% CI: 10.63-47.45), and comorbid depression (OR = 33.59; 95% CI: 14.00-80.59) were all highly associated with increased risk of probable PTSD among disaster responders.

### General Coping Questionnaire Scores

For the 3 GCQ-30 coping-style subscales, descriptive statistics were conducted to characterize the score range, mean,

TABLE 1

Prevalence of Mental Health Disorder Outcomes <sup>a</sup>		
Outcome	No.	%
<b>PTSD (PCL <math>\geq</math> 44)<sup>b</sup></b>		
Yes	50	9.1
No	499	90.9
<b>PTSD differential</b>		
No symptoms	355	64.7
Intrusion only	44	8.0
Avoidance only	5	0.9
Arousal only	29	5.3
Intrusion + avoidance	11	2.0
Intrusion + arousal	34	6.2
Avoidance + arousal	15	2.7
Intrusion + avoidance + arousal <sup>c</sup>	56	10.2
<b>Alcohol Use (Audit <math>\geq</math> 8)<sup>d</sup></b>		
Yes	31	5.7
No	518	94.4
<b>Audit differential</b>		
Harmful	27	87.1
Dependence	4	12.9
<b>Anxiety<sup>e</sup></b>		
None	409	74.5
Mild (5 $\leq$ GAD < 10)	101	18.4
Moderate (10 $\leq$ GAD < 15)	31	5.7
Severe (15 $\leq$ GAD)	8	1.5
<b>Depression<sup>f</sup></b>		
None	401	73.0
Mild (5 $\leq$ PHQ < 10)	93	16.9
Moderate (10 $\leq$ PHQ < 15)	40	7.3
Major (15 $\leq$ PHQ < 20)	11	2.0
Severe (20 $\leq$ PHQ)	4	0.7
<b>By symptomology</b>		
Major depressive symptoms		
Yes	19	3.5
No	530	96.5
Other depressive symptoms		
Yes	38	6.9
No	511	93.1

<sup>a</sup>Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; GAD, Generalized Anxiety Disorder Scale; PCL, PTSD Checklist Civilian Version; PHQ, Patient Health Questionnaire; PTSD, post-traumatic stress disorder.

<sup>b</sup>Prevalence calculated by cut point and by symptomology. Percentage is based on total respondent population.

<sup>c</sup>Diagnostic and Statistical Manual of Mental Disorders, 4th edition, criteria for PTSD.

<sup>d</sup>Alcohol use disorder percentage is out of total respondent population. AUDIT differential percentage calculated from respondents who scored 8 or above on the AUDIT.

<sup>e</sup>Anxiety severity is defined as respondents who scored a certain cut point on the GAD-7 instrument.

<sup>f</sup>Severity differential based on cut point scores as indicated. Percentages are based on the total respondent population. Symptoms were assessed by meeting criteria as specified in the alternative PHQ scoring method.

median, and standard deviation for each of the 3 coping behavior styles and for each of the 3 coping behavior styles by PCL-C subscales (Table 2).

Welch's *t*-test was conducted to test the group means of each of the GCQ-30 coping style subscales stratified by PTSD

symptoms (PCL-C subscales). The study found that disaster responders who had no PTSD symptoms versus those who had at least one PTSD symptom had significantly different group mean scores when cross-tabulated with avoidance coping behavior. Similarly, the group means for the avoidance coping subscale were significantly different between disaster responders who screened positive for all 3 PTSD symptoms (intrusion, avoidance, and arousal) when compared with all others who had less than 3 symptoms. This suggests that disaster responders who screened for PTSD (all 3 symptoms) answered avoidant coping behavior questions significantly differently than did disaster responders who were not identified with probable PTSD.

The association between probable PTSD by PCL-C scores or by PTSD subscale and GCQ-30 coping style was evaluated by using the Pearson correlation (Table 3). For total PCL-C scores (PTSDSCORE), a significant correlation existed between avoidant coping behavior (AVOIDANTCOPE;  $r = 0.42$ ,  $P < 0.0001$ ) and increasing PCL-C scores, suggesting that disaster responders in our study who manifested avoidant coping behavior were more likely to score higher on the PCL-C. Disaster responders in this study who screened positive for all 3 PTSD symptoms (intrusion, avoidance, and arousal) were more likely to have avoidant coping behavior styles ( $r = 0.30$ ,  $P < 0.0001$ ). In contrast, disaster responders who screened for none of the PTSD symptoms were observed to have a significantly inverse correlation with avoidance behavior ( $r = -0.41$ ,  $P < 0.0001$ ). These results clearly indicate that avoidant coping behavior style was a key factor for probable PTSD in this group of disaster responders.

### Regression Models of Coping Styles

Logistic regression models examining the relationship between probable PTSD and coping behavior styles (avoidant, emotion, task-oriented) consistently revealed that avoidant-focused coping was significantly associated with probable PTSD among disaster responders (Table 4). In the simple, unadjusted regression model, avoidant-focused coping was found to have an association with probable PTSD (OR = 1.25; 95% CI: 1.16-1.34). With adjustment for disaster/traumatic exposures only, avoidant coping behavior remained significantly associated (OR = 1.25; 95% CI: 1.16-1.34) and exposure to traumatic life events disclosed a nearly two-fold increase in the risk (OR = 1.91; 95% CI: 1.04-3.50) for probable PTSD among exposed disaster responders. The other exposures (2005 hurricanes and the 9/11 attack), although not statistically significant, suggest a resiliency effect in this model. We further adjusted the model by fitting gender and marital status and found that avoidant-based coping behavior remained indicative with a 26% increase (OR = 1.26; 95% CI: 1.17-1.35). Exposure to traumatic life events was no longer a risk factor in this adjusted model, but exposure to one hurricane event appeared to have a mitigating effect (OR = 0.43;

TABLE 2

Descriptive Statistics: PCL-C score and GCQ-30 Coping Behavior Styles by PTSD Symptoms <sup>a</sup>							
	No. Obs	Variable	Minimum	Maximum	Median	Mean	SD
<b>All</b>	549	PTSDSCORE	17	74	23	26.81	11.30
		TASKCOPE	10	40	27	27.05	4.66
		EMOTIONCOPE	10	37	24	23.72	4.78
		AVOIDANTCOPE	10	38	16	16.73	3.87
<b>PTSD symptoms</b> None	355	PTSDSCORE	17	33	20	20.65	3.64
		TASKCOPE	10	40	27	27.11	4.80
		EMOTIONCOPE	10	37	24	23.71	4.93
		AVOIDANTCOPE	10	38	15	15.57	3.24
Intrusion	44	PTSDSCORE	21	38	27	27.50	4.07
		TASKCOPE	18	38	27	27.70	4.23
		EMOTIONCOPE	15	35	24	24.16	4.31
		AVOIDANTCOPE	11	35	16.5	17.11	3.87
Avoidant	5	PTSDSCORE	27	34	30	30.40	2.70
		TASKCOPE	16	30	25	23.60	6.35
		EMOTIONCOPE	19	27	24	23.00	3.81
		AVOIDANTCOPE	15	25	18	19.60	3.91
Arousal	29	PTSDSCORE	22	35	29	28.79	3.92
		TASKCOPE	22	32	26	26.66	2.84
		EMOTIONCOPE	17	30	22	23.10	4.16
		AVOIDANTCOPE	11	30	17	17.93	3.84
Intrusion + Avoidant	11	PTSDSCORE	32	48	39	39.27	4.98
		TASKCOPE	19	31	25	24.82	3.03
		EMOTIONCOPE	12	26	22	20.73	3.95
		AVOIDANTCOPE	17	26	19	20.27	3.35
Intrusion + Arousal	34	PTSDSCORE	27	50	36	36.50	4.97
		TASKCOPE	10	35	27.5	26.62	5.33
		EMOTIONCOPE	15	31	24	23.50	4.86
		AVOIDANTCOPE	13	28	19	19.21	3.73
Avoidant + Arousal	15	PTSDSCORE	31	46	40	39.67	4.51
		TASKCOPE	21	31	27	26.00	3.12
		EMOTIONCOPE	13	29	22	22.53	4.41
		AVOIDANTCOPE	15	25	20	18.80	2.81
Intrusion + Avoidant + Arousal	56	PTSDSCORE	35	74	51	52.20	10.08
		TASKCOPE	16	37	27	27.61	4.72
		EMOTIONCOPE	14	34	25	24.82	4.56
		AVOIDANTCOPE	13	32	20	20.18	4.38

<sup>a</sup>Abbreviations: GCQ-30, General Coping Questionnaire; PCL-C, PTSD Checklist Civilian Version; PTSD, post-traumatic stress disorder. The PTSDSCORE range from the PCL-C was from 17 to 85 points. The 3 coping behavior scores (TASK, EMOTION, and AVOIDANT) from the GCQ-30 ranged from 10 to 40 points for each style.

95% CI: 0.18-1.35), and being married significantly reduced the likelihood for probable PTSD by 57% (OR = 0.43; 95% CI: 0.20-0.92).

The saturated model included premorbid and comorbid mental health conditions (anxiety, alcohol use, depression) and demonstrated that avoidant coping behavior remained a significant predictor for probable PTSD in exposed disaster responders (OR = 1.19; 95% CI: 1.08-1.30). There was a slight decrease in the effect estimate that may be explained by an 11% increase in PTSD by responders who expressed emotion-based coping behavior (OR = 1.11; 95% CI: 1.01-1.22). Resiliency was seen with a significant reduction in the likelihood for probable PTSD among married responders (OR = 0.33; 95% CI: 0.12-0.69) and among responders who

were exposed to one hurricane event (OR = 0.30; 95% CI: 0.10-0.91). Exposure to traumatic life events was highly predictive of probable PTSD among exposed disaster responders with a more than two-fold increase in the odds (OR = 2.31; 95% CI: 1.04-5.14). Gender was not statistically associated with coping behavior and probable PTSD, although males were observed to have an OR of 2.11 and confidence interval between 0.88 and 5.94. Premorbid mental health conditions were not indicative of probable PTSD. However, comorbid anxiety (OR = 7.90; 95% CI: 2.85-21.90) and comorbid depression (OR = 11.52; 95% CI: 3.76-35.26) significantly elevated the odds of probable PTSD in exposed disaster responders. These results suggest that comorbidity may have a considerable effect on probable PTSD and coping behavior in this study sample.

TABLE 3

Pearson Correlation Between PTSD Symptoms and Coping Styles<sup>a</sup>

	TASKCOPE	EMOTIONCOPE	AVOIDANTCOPE
PTSDSCORE	-0.0105	0.0178	0.4219
None	0.8060	0.6781	<.0001
Intrusion	0.0190	-0.0014	-0.4063
Avoidant	0.6572	0.9736	<.0001
Arousal	0.0417	0.0273	0.0290
Intrusion + Avoidant	0.3297	0.5233	0.4984
Intrusion + Arousal	-0.0710	-0.0144	0.0710
Avoidant + Arousal	0.0965	0.7361	0.0965
Intrusion + Avoidant + Arousal	-0.0199	-0.0304	0.0731
None	0.6418	0.4773	0.0873
Intrusion	-0.0685	-0.0896	0.1308
Avoidant	0.1090	0.0358	0.0021
Arousal	-0.0237	-0.0117	0.1641
Intrusion + Avoidant	0.5791	0.7841	0.0001
Avoidant + Arousal	-0.0377	-0.0416	0.0895
Intrusion + Arousal	0.3778	0.3307	0.0361
Intrusion + Avoidant + Arousal	0.0405	0.0779	0.3000
	0.3431	0.0680	<.0001

<sup>a</sup>Pearson Correlation Coefficients, N = 549, for Prob > |r| under H<sub>0</sub>: Rho = 0. PTSDSCORE ranged from 17 to 85 points and was calculated from the PTSD Checklist Civilian Version (PCL-C) instrument. PTSD subscales/symptoms were ascertained by defined PCL-C scoring methodology. Coping styles (TASK, EMOTION, and AVOIDANT) originated from the General Coping Questionnaire and each style had a point range from 10 to 40 points.

## DISCUSSION

A central finding in this study was that federal disaster responders who utilize avoidant coping behaviors have a significant likelihood for probable PTSD. In this study, avoidant coping behavior remained a significant predictor in tested regression models even when the models were adjusted for various covariates. For our study population, the prevalence of probable PTSD after evaluating the PCL-C subscales was 10.2%. This result is comparable to the 10% pooled prevalence calculated in a meta-analysis study on rescue workers.<sup>50</sup> In our study, overall mean GCQ-30 subscale scores were analogous to findings reported by Joseph et al,<sup>48</sup> but they contrasted with results from other studies, one conducted on medical students following exposure to cadaver dissection<sup>49</sup> and the other focused on military personnel after exposure to an avalanche.<sup>25</sup> We attribute the variation in our study group's mean GCQ-30 scores to self-selection bias by participants who exhibit traits in common with individuals joining disaster-responder organizations. Avoidant coping behavior was significantly correlated with increased PCL-C scores and with responders who screened positive for the 3 PCL-C subscales. Avoidant coping behavior was also found in our sample to be inversely correlated with responders who reported no PTSD symptoms. We further examined the relationship between the PCL-C subscales and avoidant coping behavior to assess the risk of bias in the analysis, given the overlap between the subscales. Our evaluation found the individual PCL-C subscales and

avoidant coping behavior to be uncorrelated, thus reducing the chance for this bias to occur.

Regression modeling demonstrated that avoidant-focused coping behavior was consistently and significantly associated with probable PTSD; this "negative" coping style was similarly found in other studies to be associated with poorer outcomes.<sup>25,30,51</sup> In the adjusted regression models we found that a number of covariates partly explained the likelihood of coping behavior and probable PTSD among federal disaster responders. With adjustment for comorbid mental health sequelae in the saturated regression model, we found that comorbid anxiety and depression altered the model such that avoidant and emotion-based coping behaviors were significant predictors for probable PTSD prevalence among federal disaster responders. Specifically, in the saturated model we note that emotion-based coping behavior was associated with an 11% increase in the likelihood of probable PTSD among traumatically exposed responders, while avoidant coping behavior was associated with only a 19% increase in the effect estimate. In previous models, emotion-based coping was not a factor and avoidance coping exerted a consistent mid-20% increase in the likelihood of PTSD.

The effects of traumatic events on probable PTSD are well documented.<sup>1-5</sup> When we adjusted the regression model for disaster/traumatic exposures, we noted that exposure to traumatic life events was a significant predictor. In the model that included gender and marital status, exposure to traumatic life events was not a factor, but exposure to one hurricane and being married had protective effects. We postulate that being married provided an overarching contribution toward resiliency. The presence of a strong social network that mediates stress levels has been reported by other studies.<sup>20,52</sup> In the fully saturated model, exposure to traumatic life events was again a significant predictor of probable PTSD in the presence of comorbid mental health conditions. For our particular study population, the perceived threat to one's safety or well-being may be more elevated when exposed to traumatic life events than when exposed to disaster incidents or events. Studies have shown that the severity of the disaster exposure and the spatial proximity of the incident or event play a significant contributory effect on the developmental pathway of probable PTSD.<sup>51,52</sup>

Our analysis found that both comorbid anxiety and comorbid depression were significantly associated with probable PTSD in disaster/trauma-exposed responders in this study. Studies on samples of the general population, clinical population, and Vietnam veterans identified with probable PTSD found that these individuals have higher rates of anxiety disorders and major depression.<sup>53,54</sup> In one of our regression models the presence of emotion-based coping and avoidant coping suggests that comorbid mental health conditions may have a greater influence on the risk of probable PTSD in disaster responders exposed to traumatic events and requires further

TABLE 4

Logistic Regression Models Predicting the Association Between PTSD and Coping Styles With Adjustment for Covariates <sup>a</sup>									
Effect	Model 1			Model 3			Model 5		
	OR	95% CI	P value	OR	95% CI	P value	OR	95% CI	P value
<b>Coping style</b>									
Avoidant	1.25	1.16-1.34	<0.0001	1.26	1.17-1.35	<0.0001	1.19	1.08-1.30	0.00
Emotion	1.04	0.97-1.11	0.26	1.04	0.97-1.12	0.23	1.11	1.01-1.22	0.02
Task	1.04	0.97-1.11	0.27	1.05	0.98-1.13	0.20	1.09	0.99-1.20	0.07
<b>Exposures</b>									
HUREXP1				0.43	0.18-1.35	0.05	0.30	0.10-0.91	0.03
HUREXP2				0.62	0.29-1.12	0.22	0.54	0.19-1.50	0.24
HUREXP3				0.40	0.14-1.13	0.09	0.54	0.15-1.98	0.36
SEPT-11 WTC				0.71	0.33-1.52	0.37	0.51	0.19-1.33	0.17
Traumatic life event				1.66	0.90-3.09	0.11	2.31	1.04-5.14	0.04
Military service				1.42	0.62-3.27	0.41	1.26	0.42-3.85	0.68
Combat experience				0.78	0.17-3.51	0.75	1.36	0.17-10.59	0.77
<b>Gender</b>									
Male				1.39	0.70-2.76	0.35	2.11	0.88-5.04	0.09
<b>Marital status</b>									
Married				0.43	0.20-0.92	0.03	0.33	0.12-0.89	0.03
Partner				0.27	0.05-1.51	0.14	0.18	0.02-1.41	0.10
Separate				1.57	0.27-9.11	0.62	0.93	0.11-8.07	0.95
Divorced				1.12	0.40-3.08	0.83	0.50	0.13-1.84	0.29
<b>Premorbidity</b>									
Anxiety							1.40	0.49-3.98	0.53
Alcohol							0.64	0.07-5.60	0.69
Depression							1.93	0.79-4.70	0.15
<b>Comorbidity</b>									
Alcohol							0.45	0.11-1.79	0.26
Anxiety							7.90	2.85-21.90	<0.0001
Depression							11.52	3.76-35.26	<0.0001

<sup>a</sup>Abbreviations: CI, confidence interval; GCQ-30, General Coping Questionnaire; HUREXP, hurricane exposure; OR, odds ratio; PTSD, post-traumatic stress disorder; WTC, World Trade Center. PROC LOGISTICS was used to compute these models at a statistical significance of  $P < 0.05$ . Model 1 was the simple model regressing only coping styles as determined by the GCQ-30 on PTSD as defined by the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition. Models 3 and 5 were adjusted for additional covariates.

investigation. We speculate that the combined presence of traumatic life events, comorbid anxiety, and depression might have a synergistic effect on coping behaviors or probable PTSD. These findings are analogous to another study<sup>55</sup> that emphasized the significance of prevention, screening, and treatment for high-risk disaster responders with a prior mental health history and consistent traumatic event exposure.

We felt it was important to examine our findings in terms of gender. Men were found to have a greater likelihood for probable PTSD than women, although this was not a statistically significant predictor. This result contrasts with studies on the general population<sup>53,56-59</sup> and among police officers.<sup>60</sup> A 2-year follow-up study, however, of the police officers showed that the statistical significance had waned.<sup>18</sup> Further supporting our gender result is a study<sup>61</sup> on Iraq-Afghanistan veterans that found that female veterans were less likely to screen for PTSD than were male veterans (21% versus 33%). Some authors postulate<sup>62</sup> that the risk may be influenced more by frequency and intensity of combat exposure than by gender. Frequency and intensity have been analogized

to disaster exposure by the extant literature,<sup>25,37-39</sup> which could explain these findings. More in line with our results are the findings by Palgi et al<sup>63</sup>; in a group of rescue workers, they found that gender differences were not detected during the acute stress reaction phase. The authors explained that this result may have been due to the possibility that gender differences develop some time later or that female disaster responders are a unique self-selected group that do not represent the experience of women in the general population.

### Limitations

Several limitations of the study need to be addressed. The cross-sectional aspect of this study, while expedient and inexpensive, precludes the determination of causality. Another potential limitation was the lapse in time after exposure in surveying the disaster responders. The varying gap between the initial disaster exposure and the measurement of mental health symptoms is a concern. However, studies<sup>12,18,64,65</sup> have shown that the effects of disaster

exposure remain discernable even over a prolonged duration. Another potential concern with the protracted intervals is the possibility of capturing a larger proportion of responders who have chronic PTSD, and fewer people with acute PTSD, because acute cases would have been resolved. This could have affected the strength of association of our results and mental health outcomes. The issue of prolonged time was, however, unlikely to be an issue for the assessment of coping behaviors because the GCQ-30 measures lifetime coping style behavior. Studies<sup>39,52,66</sup> have reported that the distance and intensity of the traumatic exposure may have an underlying role in the manifestation of mental health outcomes. We were not able to decipher these data in our study but were able to assess exposure to traumatic life events.

Another potential study limitation was the difficulty in ascertaining an accurate target population size given that official records were unavailable. Thus, we were constrained in our estimation of our denominator. This resulted in some concern regarding the response rate and the potential for nonresponse bias. However, we examined the potential effects of this bias by comparing a known subset (complete team roster) with the study sample and found no significant demographic differences. Another concern was the possibility that some individuals in this study or in the target population were not willing to participate in the survey because of physical or psychological distress associated with recollecting the events, thereby leading to an underestimation of the associations. A final limitation is the convenience sampling of the study population, raising the issue regarding the generalizability of the study findings. Despite these limitations of the study design, this methodology is a valuable approach for investigating the association between these determinants. Clearly, additional research efforts are needed and future studies should be prospective in design to address the biases inherent in a cross-sectional design and convenience sample.

## CONCLUSION

This study found that avoidant coping behavior was significantly associated with an increased likelihood for probable PTSD. Exposure to traumatic life events, comorbid anxiety, and depression were significantly associated with probable PTSD and may influence or be influenced by expression of coping behavior style in exposed disaster responders. The finding that avoidant coping behavior was associated with an increased risk of probable PTSD contributes to our understanding of the negative effects of this coping style. The association of comorbid anxiety and depression with increased risk of probable PTSD and the protective effect of marriage are consistent with the extant literature. These findings provide a foundation to stimulate future research on the epidemiology of coping behavior style and PTSD across its life course. These results also underline the focal areas requiring development and implementation of effective interventions that temper stress or improve coping behavior abilities for disaster responders.

## About the Authors

Icahn School of Medicine at Mount Sinai, New York, New York (Dr Loo); New York University School of Medicine, New York, New York (Dr DiMaggio); University of California at San Francisco, Institute for Health Policy Studies, San Francisco, California (Dr Gershon); Shasta Community Health Center, Redding, California (Dr Canton); Columbia University, Mailman School of Public Health, New York, New York (Dr Morse); and Boston University School of Public Health, Boston, Massachusetts (Dr Galea).

Correspondence and reprint requests to George T. Loo, Icahn School of Medicine at Mount Sinai, Department of Emergency Medicine, Department of Population Health Science and Policy, 19 East 98 Street, Suite 3D, Box 1062, New York, New York 10029 (e-mail: [george.loo@mountsinai.org](mailto:george.loo@mountsinai.org)).

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## Disclaimer

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