Published in final edited form as:

Soc Sci Med. 2015 April ; 130: 125–134. doi:10.1016/j.socscimed.2015.02.009.

Mental Health Service Use by Cleanup Workers in the Aftermath of the Deepwater Horizon Oil Spill

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Abstract

High rates of mental health (MH) problems have been documented among disaster relief workers. However, few workers utilize MH services, and predictors of service use among this group remain unexplored. The purpose of this study was to explore associations between predisposing, illness-related, and enabling factors from Andersen's behavioral model of treatment-seeking and patterns of service use among participants who completed at least one full day of cleanup work after the Deepwater Horizon oil spill and participated in home visits for the NIEHS GuLF STUDY ($N = 8,931$). Workers reported on MH symptoms and whether they had used counseling or medication for MH problems since the oil spill. Hierarchical logistic regression models explored associations between predictors and counseling and medication use in the full sample, and type of use (counseling only, medication only, both) among participants who used either service. Analyses were replicated for subsamples of participants with and without symptom inventory scores suggestive of probable post-disaster mental illness. Having a pre-spill MH diagnosis, pre-spill service use, more severe post-spill MH symptoms, and healthcare coverage were positively associated with counseling and medication use in the full sample. Among participants who used

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either service, non-Hispanic Black race, pre-spill counseling, lower depression, and not identifying a personal doctor or healthcare provider were predictive of counseling only, whereas older age, female gender and pre-spill medication were predictive of medication only. The results were generally consistent among participants with and without probable post-disaster mental illness. The results suggest variability in which factors within Andersen's behavioral model are predictive of different patterns of service use among disaster relief workers.

Keywords

Mental health service use; disasters; Deepwater Horizon oil spill; disaster relief workers

In the aftermath of disasters, relief workers take on responsibilities that expose them to the wide-ranging consequences of such events and to additional stressors and potentially life-threatening situations (e.g., McCaslin et al., 2005). Therefore, it is not surprising that high rates of mental health (MH) problems, including posttraumatic stress disorder (PTSD) and major depression (MD), have been documented among relief workers (e.g., Biggs et al., 2010; Fullerton et al., 2004). Despite their heightened risk, few disaster relief workers utilize MH services (Elhai et al., 2006; Fullerton et al., 2004).

Factors associated with disaster relief workers' service use are not well understood. Only two studies to date, both in the aftermath of the September 11, 2001 World Trade Center (WTC) terrorist attacks (9/11), explored predictors of use among this population. Participants in the first study were those who accepted a psychotherapy referral after a psychological screening that was given to all workers deployed to the WTC site (Jayasinghe et al., 2005). The majority (57.5%) did not subsequently use services, and racial/ethnic minority status and higher posttraumatic stress (PTS) were significant predictors of utilization. The second study investigated use among American Red Cross staff members who had participated in relief work after the attack (Elhai et al., 2006). Among this sample, 10.7% reported service use since the attack, and significant predictors of use included younger age, being divorced or widowed, no previous MH service use, and higher PTS.

Although these two studies provide evidence that demographic characteristics and PTS influence MH service use among disaster relief workers, there is clearly a dearth of literature on this topic. A significant limitation of the extant literature is that the predictors included have not adequately represented the full range of factors from Andersen's (1995) behavioral model of treatment-seeking, an influential model that has shaped much of the thinking in the field. According to this model, service use is influenced by three categories of factors: (1) *predisposing factors*, including demographic characteristics, history of psychiatric symptoms and service use, and the extent and severity of stress exposure; (2) *illness-related factors*, including psychiatric symptom severity; and (3) *enabling factors*, including resources that increase the possibility that services are accessed (e.g., healthcare coverage, knowledge of available services). The model as a whole has received support in the context of traumatic events, including natural disasters, yet there is variation in which characteristics are associated with post-trauma service use across studies (Elhai, North, & Frueh, 2005).

Variation in the strength of predictors from Andersen's behavioral model is likely due to at least four factors. First, the factors driving use are likely to vary based on the population under examination. As far as we are aware, no study has examined associations between predictors representing variability in stress exposure (e.g., the duration of relief work) or any enabling factors and service use among disaster relief workers, and it is therefore unclear whether they apply in this case.

Second, the specific context of the traumatic event is likely to influence the drivers of use among a given population. In the current study, we focus on cleanup workers after the Deepwater Horizon oil spill. The Deepwater Horizon drilling rig exploded on April 20, 2010 and led to the release of approximately 5 million barrels of crude oil into the Gulf of Mexico before being capped on July 15, 2010 – the largest-ever oil spill in U.S. waters (Ramseur, 2010). Cleanup workers were exposed to oil and petroleum products, dispersant chemicals, smoke from burning oil, odors and vapors, heat stress, and visible damage to wildlife, and shoreline and below-the-surface ecosystems, but unlike disaster relief workers in the aftermath of 9/11, were not exposed to mass human mortality and suffering directly linked to the disaster (Shultz, Walsh, Garfin, Wilson, & Neria, 2014). It is unclear whether the results of studies focusing on relief workers after 9/11 would generalize to the Deepwater Horizon oil spill context, given this variation in exposure, as well as differences in the geographic and cultural contexts in which the disasters took place.

Third, drivers of service use are likely to vary based on the type of service offered. Among MH service users, there could be systematic differences among those who use counseling services, psychotropic medication, or both. In this vein, descriptive analysis of data from a nationally representative sample of adults in the United States showed increasing proportions of participants using both counseling and medication, and decreasing proportions using medication only, as the level of depressive symptoms increased (Wittayanukorn, Qian, & Hansen, 2014). An improved understanding of the factors that influence different patterns of use is important given evidence that some conditions (e.g., PTS, chronic depression) are more effectively alleviated through a combination of psychotherapy and medication than either service alone (e.g., Craighead & Dunlop; Schneier et al., 2012).

Fourth, predictors of use might vary by the presence of absence of mental illness. Jayasinghe and colleagues (2005) found that race/ethnic minority status was significantly associated with MH service use only among those exceeding a cut-off for probable PTSD, providing support for this possibility among disaster relief workers. Evidence of predictors specific to workers with probable mental illness would inform efforts to increase use among the most severely affected workers. Alternatively, those specific to those without probable mental illness could provide insight into which workers might be receiving services despite not having a significant need for them.

Current Study

The purpose of this study was to explore predictors of MH service use among persons who completed at least one full day of cleanup work in the aftermath of the Deepwater Horizon

oil spill. As part of the \$7.8 billion settlement between BP and individuals and business affected by the spill, \$36 million was devoted toward meeting MH needs in affected communities (Levin, 2012). Despite this substantial investment, MH service use in the aftermath of the spill has remained unexplored. We investigated predisposing illness-related, and enabling factors from Andersen's behavioral model. We explored associations between these predictors and counseling and medication use in the full sample, and use of counseling only, medication only, or both services in the subsample of participants using either service. We then replicated the analyses with participants with and without a probable MH diagnosis after the spill.

Method

Participants and Procedures

Data were from the NIEHS Gulf Long-Term Follow-Up Study (GuLF STUDY), a prospective cohort study of cleanup workers from the Deepwater Horizon oil spill. Working from multiple lists of persons involved in the cleanup effort, 58,923 individuals who were presumed eligible (age 21 or over and capable of completing an interview in English, Spanish, or Vietnamese) and had reasonably good contact information were identified. A total of 32,608 participants (55% of potentially eligible participants; 90% of those contacted and confirmed to be eligible) completed a Telephone Enrollment Survey between March 2011 and March 2013 that assessed details of the participant's cleanup work, if any, as well as demographic and lifestyle factors, and medical history and symptoms. Participants were classified as workers if they participated in one full day cleanup work. Interviews averaged 30 minutes, except for Vietnamese-speaking participants who completed an abbreviated Telephone Enrollment Survey.

A subsample of 24,275 English- or Spanish-speaking participants residing in Gulf states was invited to participate in a Home Visit for collection of biological samples, clinical assessments, and additional questionnaire data collection, including structured mental health indices and items assessing mental health service use. Although 17,833 (73.5%) initially agreed to participate, 11,193 (62.3%), including 8,931 cleanup workers, completed a Home Visit between May 2011 and May 2013. Relative to the larger sample, Home Visit participants reported significantly lower socioeconomic status, more health problems, and were more likely to be racial/ethnic minorities.

The Institutional Review Board of the National Institute of Environmental Health Sciences approved the study procedures, and participants provided verbal consent in the Telephone Enrollment Survey and written consent in the Home Visit. Missing data for variables of interest ranged from 0.0% to 16.8%, with an average missing rate of 2.3% ($SD = 3.5\%$). Multiple imputation was used to handle missing data. Five complete datasets were imputed in Amelia 2.0 (Honaker, King, & Blackwell, 2008), and the results represent the average of the five analyses, with Rubin's (1987) correction of standard error. Demographic characteristics of the sample of 8,931 cleanup workers are shown in Table 1.

Measures

Post-Spill Mental Health Service Use—Two items in the Home Visit assessed post-spill mental health service use. First, participants indicated whether they had received “any sort of counseling for problems with [their] emotions, nerves, or mental health” (*counseling*). Second, they indicated whether they were “prescribed any medication for problems with [their] emotions, nerves, or mental health” (*medication*). Using these two items, we created a *type of use* variable indicating whether participants who used services used *counseling only* (1), *medication only* (2), or *both counseling and medication* (3).

Predisposing factors—Predisposing factors included demographic characteristics, and indices of pre-spill mental health and spill exposure.

Demographic characteristics: During the Telephone Enrollment Survey, participants provided their age in years, gender, number of children, immigrant status (whether they were born outside of the United States), marital status (married; divorced or separated; or single), and household income level (less than \$20,000; between \$20,000 and \$50,000; or greater than \$50,000). We also included variables indicating whether participants were employed for pay at the time of the Home Visit, and the number of weeks that had passed between the date the oil spill was capped (July 15, 2010) and both the Telephone Enrollment Survey and Home Visit.

Pre-spill mental health: Participants reported in Telephone Enrollment Survey whether they had ever been diagnosed with any of the following: acute stress disorder, anxiety or an anxiety disorder, panic disorder, PTSD, and depression. Participants who answered affirmatively indicated either the approximate date or their age at the time of first diagnosis, which determined whether the participant had a *pre-spill probable mental health diagnosis*. During the Home Visit, two items assessed whether participants had received counseling or were prescribed medication for their “emotions, nerves, or mental health” in the year prior to the oil spill. Those who answered affirmatively were classified as having *pre-spill counseling* and *pre-spill medication*, respectively.

Spill exposure: Four indices of spill exposure, all assessed during the Telephone Enrollment Survey, were included. Participants indicated start and end dates of their spill-related employment, and these were used to determine their *duration of cleanup work* in days. Second, participants’ initial start date determined whether they participated in *cleanup work before capping*, that is, whether they began work before July 15, 2010. Cleanup work before capping likely entailed more substantial exposure to oil and its effects than work afterwards. Third, participants’ baseline addresses were used to determine their *proximity to the spill* – whether they lived in a county with *direct contact* with the spill (counties on the Gulf Coast in Alabama, Louisiana, Mississippi, and the Florida Panhandle); *indirect contact* with the spill (counties adjacent to those with direct contact); or another county (elsewhere in Alabama, Louisiana, Mississippi, and Florida, or another state) – which was included as an indicator of exposure to the spill and its aftermath outside of cleanup activities. Lastly, participants completed a 30-item inventory indicating how often they experienced physical health symptoms (e.g., “cough,” “watery or itchy eyes”) while participating in cleanup work,

from *never* (0) to *all of the time* (4). Scale items were derived from standard inventories of respiratory symptoms (e.g., Ferris, 1978) as well research on the physical health effects of oil spills (e.g., Janjua et al., 2006). Responses were summed to create a *spill-related physical health symptoms* severity score (range: 0–120).

Illness-related factors—Illness-related factors included three mental health indices which participants completed during the Home Visit. First, they completed the four-item Primary Care PTSD Screen (*PC-PTSD*) (Prins et al., 2003), on which they indicated whether they experienced symptoms from each *DSM-IV* PTSD symptom cluster over the prior month, and the sum of affirmative responses was included (range: 0–4; $\alpha = .76$). Scores of 3 or greater are indicative of probable PTSD (Prins et al., 2003). Second, the seven-item Generalized Anxiety Disorder-7 (*GAD-7*) assessed how many days during the past two weeks participants were bothered by anxiety symptoms (e.g., “feeling nervous, anxious or on edge”). For each item, participants’ responses were classified into four levels (0 = 0–1 days; 1 = 2–6 days; 2 = 7–11 days; 3 = 12–14 days) and a sum of the responses was included (range: 0–21). The *GAD-7* has been shown to have excellent internal consistency and test-retest reliability, with scale scores of 10 or greater indicative of probable *GAD* (Spitzer et al., 2006) ($\alpha = .93$). Third, the Patient Health Questionnaire-8 (*PHQ-8*) assessed how many days over the past two weeks participants experienced eight symptoms of *MD* (e.g., “felt down, depressed, or hopeless”). The same categories for items were used as with the *GAD-7* (Kroenke et al., 2009), and the sum of items was included (range: 0–24). Previous studies have found the *PHQ-8* to have excellent internal consistency, test-retest reliability, and construct validity, with scores of 10 or greater indicative of probable *MD* (Kroenke, Spitzer, & Williams, 2001) ($\alpha = .90$).

Enabling factors—Three factors that could enable participants to access services were included. First, participants indicated whether they had *healthcare coverage*. Second, participants indicated whether they had one or more persons that they considered their “personal doctor or healthcare provider” (*identified provider*). Lastly, participants indicated whether they knew of a clinic or healthcare provider where they could go to get medical care (*knows of clinic*).

Data Analysis

We first computed frequencies of participants using counseling and medication among the full sample, and using counseling only, medication only, and both services among the subsample of participants using either service. Subsequently, we ran two hierarchical logistic regression analyses predicting *counseling* and *medication* use since the oil spill. Predictors were entered in three steps: 1) predisposing factors, 2) illness-related factors, and 3) enabling factors. Next, we ran a hierarchical multinomial logistic regression using the same set of predictors for the subsample of participants that reported use of either service, with *type of use* as dependent variable. Lastly, supplementary analyses replicated the models for participants who had any post-spill probable mental health diagnosis (*PC-PTSD* = 3, *GAD-7* = 10, and/or *PHQ-8* = 10). Data analyses were conducted in Mplus 7.1 (Muthén & Muthén, 1998–2012).

Results

Descriptive Statistics

Among the full sample, 8.2% of participants reported counseling use, and 9.2% reported medication use. A total of 971 participants (10.9%) reported use of either service and, among this subsample, 18.5% used counseling only, 28.1% used medication only, and 53.4% used both services. Descriptive information for predisposing, illness-related, and enabling factors is listed in Table 1.

Predictors of Counseling Use

Predisposing factors—Results of the logistic regression models predicting counseling use are listed in Table 2. Ten predisposing factors were significant predictors of counseling use in Step 1. Younger age and divorced or separated status were significantly associated with greater likelihood of counseling use. Each year younger was associated with 1.01 odds (95% confidence interval [CI] = 1.00–1.02) and each decade younger with 1.14 odds (95% CI = 1.03–1.26) of counseling use. Divorced or separated participants had 1.40 odds (95% CI = 1.12–1.74) of counseling use, relative to their counterparts. Non-Hispanic Black and “other” race, and employment were significantly associated with lower likelihood of counseling use. Non-Hispanic Black race was associated with .58 odds (95% CI = .46–.73) and “other” race with .66 odds (95% CI = .47–.93) of counseling use, relative to non-Hispanic Whites, and employed participants had .65 odds (95% CI = .54–.79) relative to unemployed participants.

Pre-spill probable MH diagnosis, pre-spill counseling, and pre-spill medication were significant predictors of counseling use. Having a pre-spill MH diagnosis was associated with 1.61 odds (95% CI = 1.25–2.08), pre-spill counseling with 9.23 odds (95% CI = 7.05–12.07), and pre-spill medication 2.44 odds (95% CI = 1.84–3.24) of counseling use, relative to not having these characteristics.

Longer duration of cleanup work was associated with a lower likelihood of counseling use, such that each month (defined as 30 days) of work was associated with .97 odds (95% CI = .97–.97) of use. Spill-related physical health symptoms were also associated with a greater likelihood of counseling use. Each unit increase on the spill-related physical health symptom inventory was associated with 1.01 odds (95% CI = 1.01–1.02) of counseling use. An increase on the inventory equivalent to the interquartile range (*IQR* = 31) was associated with 1.50 odds (95% CI = 1.33–1.69) of counseling.

Illness-related factors—The three illness-related factors entered were significantly associated with counseling in Step 2. Each unit increase on the PC-PTSD was associated with 1.21 odds (95% CI = 1.10–1.33), each unit increase on the GAD-7 1.04 odds (95% CI = 1.02–1.06) and each unit increase on the PHQ-8 with 1.04 odds (95% CI = 1.02–1.06) of counseling use.

Enabling factors—In Step 3, having healthcare and knowledge of a clinic were predictive of a greater likelihood of counseling use, associated with 1.68 odds (95% CI = 1.36–2.08)

and 1.80 odds (95% CI = 1.12–2.89) of counseling use, relative to not having these enabling factors.

Predictors of Medication Use

Predisposing factors—Table 3 lists the results of the logistic regression models predicting medication use. Eight predisposing factors were significant predictors of medication use in Step 1. Female gender was significantly associated with a higher likelihood of medication use, associated with 1.67 odds (95% CI = 1.37–2.02) of medication use, relative to male gender. Non-Hispanic Black race, immigrant status, and employment were significantly associated with a lower likelihood of medication use. Non-Hispanic Black race was associated with .43 odds (95% CI = .34–.54), immigrant status with .48 odds (95% CI = .27–.87), and employment with .63 odds (95% CI = .51–.76) of medication use, relative to their counterparts.

Pre-spill probable MH diagnosis, pre-spill counseling, and pre-spill medication were significantly associated with a greater likelihood of medication use. Having a pre-spill probable MH diagnosis was associated with 1.77 odds (95% CI = 1.39–2.25), pre-spill counseling with 2.01 odds (95% CI = 1.54–2.62), and pre-spill medication with 12.83 odds (95% CI = 9.95–16.56) of medication use, relative to their respective reference groups.

Spill-related physical health symptoms were significantly associated with a greater likelihood of medication use. Each unit increase on the spill-related physical health symptom index was associated with 1.02 odds (95% CI = 1.01–1.02) of medication use, and an increase equivalent to the IQR was associated with 1.69 odds (95% CI = 1.50–1.91) of medication use.

Illness-related factors—The PC-PTSD, GAD-7, and PHQ-8 were significant predictors of medication use in Step 2. Each unit increase on the PC-PTSD was associated with 1.19 odds (95% CI = 1.09–1.30), each unit increase on the GAD-7 with 1.02 odds (95% CI = 1.00–1.05), and each unit increase on the PHQ-8 with 1.06 odds (95% CI = 1.04–1.08) of medication use.

Enabling factors—In Step 3, having healthcare, an identified provider, and knowledge of a clinic were predictive of a greater likelihood of medication use, associated with 1.71 odds (95% CI = 1.39–2.11), 1.98 odds (95% CI = 1.55–2.53), and 1.73 odds (95% CI = 1.05–2.87) of medication use, relative to their respective reference groups.

Predictors of Type of Service Use

Predisposing factors—Table 4 lists the results of the multinomial logistic regression models predicting type of service use. For clarity of presentation, the reference groups used in the text are at times the opposite of the reference groups used the table. These values are labeled accordingly in the Table 4. Seven predisposing factors were significant predictors in Step 1. Older age was significantly associated with use of medication only, such that each year older was associated with 1.04 odds (95% CI = 1.02–1.06) relative to counseling only and 1.03 odds (95% CI = 1.02–1.05) relative to both services, and each decade older was

associated with 1.49 odds (95% CI = 1.20–1.85) relative to counseling only and 1.39 odds (95% CI: 1.19–1.63) relative to both services. Female gender was also significantly associated with greater likelihood of medication use only, increasing the odds relative to counseling only by 1.98 (95% CI = 1.21–3.24) and relative to both services by 1.57 (95% CI = 1.12–2.20). In contrast, non-Hispanic Black race was significantly predictive of counseling use only, associated with 2.62 odds (95% CI = 1.45–4.73) relative to medication only and 1.67 odds (95% CI = 1.04–2.70) relative to both services. Divorced or separated status was significantly associated with a lower likelihood of medication only, such that divorced or separated participants had .62 odds (95% CI = .42–.93) relative to both services. Employment was significantly associated with a decreased likelihood of both services. Being employed was associated with .63 odds (95% CI = .41–.96) of both services relative to counseling only, and .69 odds (95% CI = .48–.97) of both services relative to medication only.

Pre-spill counseling was associated with 24.34 greater odds (95% CI = 13.31–44.51) of counseling only relative to medication only, 3.45 greater odds (95% CI = 2.17–5.49) of counseling only relative to both services, and 7.06 greater odds (95% CI = 4.48–11.12) of both services relative to medication only. The opposite pattern was detected for pre-spill medication, which was associated with 38.63 odds (95% CI = 19.45–76.71) of medication only relative to counseling only, 2.41 odds (95% CI = 1.56–3.71) of medication only relative to both services, and 16.05 odds (8.99–28.68) of both services relative to counseling only.

Illness-related factors—In Step 2, greater PHQ-8 was significantly predictive of a lower likelihood of counseling only. Each unit increase on the PHQ-8 was associated with .94 odds (95% CI = .90–.99) of counseling only relative to both services.

Enabling factors—Having an identified provider was a significant negative predictor of counseling only in Step 3, associated with .27 odds (95% CI = .15–.48) relative to medication only, and .34 odds (95% CI = .21–.55) relative to both services.

Models for Participants With and Without a Probable Mental Health Diagnosis

Based on PC-PTSD, GAD-7, and PHQ-8 cut-off scores, 5.5% of the sample evidenced probable PTSD, 25.0% probable GAD, and 17.1% probable MD. A total of 2,475 participants (27.7%) were classified as having any probable post-spill mental illness. Among this subsample, 17.0% reported use of counseling, and 19.3% use of psychotropic medication. Of those reporting any MH service use ($n = 558$, 22.5%), 15.8% reported counseling use only, 26.0% medication use only, and 58.2% use of both services. Among the 6,456 participants (72.3%) without a probable post-spill mental health diagnosis, 4.8% reported counseling use, and 5.4% reported medication use. Of those reporting use of either service ($n = 413$, 6.4%), 22.3% reported counseling use only, 31.0% medication use only, and 46.7% use of both services.

The full set of results of supplementary models of subsamples with and without probable post-spill mental health diagnoses is available in Supplemental Tables 1–6. Here, we note the predictors that were significant in these subsamples, but not in the full sample.

Participants with probable post-spill mental health diagnoses—In the logistic regression model predicting counseling, female gender was an additional significant predisposing factor in Step 1, associated with 1.49 greater odds (95% CI = 1.12–1.96, $p < .01$) of use.

In the logistic regression model predicting medication, three additional predisposing factors were significant in Step 1. First, older age was a significant predictor, such that each year older was associated 1.01 odds (95% CI = 1.00–1.03) and each decade older with 1.14 odds (95% CI = 1.01–1.28) of use ($p < .05$). Second, other race was associated with .57 odds (95% CI = .37–.89, $p < .05$) of use. Third, having an annual income less than \$20,000 (versus over \$50,000) was associated with .69 odds (95% CI = .47–.99, $p < .05$) of use.

In the multinomial regression predicting type of use, single status (versus married) was an additional predisposing factor predictive of counseling only in Step 1, associated with .31 odds (95% CI = .11–.85, $p < .05$) relative to medication only, and .40 odds (95% CI = .17–.96, $p < .05$) relative to both services. In Step 2, greater PHQ-8 was an additional significant illness-related factor predictive of counseling only, versus medication only, associated with .91 odds (95% CI = .85, .98, $p < .05$).

Participants without a probable post-spill mental health diagnoses—In the logistic regression models predicting counseling and medication in this subsample, no additional variables reached statistical significance. However, two additional predisposing factors were significant in Step 1 of the multinomial logistic regression model predicting type of use. First, non-Hispanic Black race was associated with .39 odds (95% CI = .17–.89, $p < .05$) of medication only, relative to use of both services. Second, participation in cleanup work before the well was capped was a significant predictor of counseling only, associated with 6.94 odds (95% CI = 1.49–32.48, $p < .05$) relative to medication only, and 4.46 odds (95% CI = 1.15–17.24, $p < .05$) relative to both services..

Discussion

This study explored predictors of MH service use – counseling and medication – among cleanup workers in the aftermath of the Deepwater Horizon oil spill. Indicators of predisposing, illness-related, and enabling factors from Andersen’s (1995) behavioral model were examined as predictors of use. We found that similar sets of factors predicted counseling and medication use in the full sample. Having a pre-spill MH diagnosis, pre-spill medication and counseling use, more spill-related physical health symptoms, more severe PTS, anxiety, and depression, health care coverage, and having knowledge of a clinic were positively associated with each type of service use, whereas non-Hispanic Black race and employment were negatively associated with use. However, there were some factors that predicted one type of use and not the other. For example, younger age, divorced or separated marital status, and shorter duration of cleanup work were predictive of counseling use, whereas female gender, having been born in the United States, and identifying a personal doctor or healthcare provider were predictive of medication use. Additionally, despite the substantial overlap in predictors of counseling and medication use in the full sample, we found that predisposing, illness-related, and enabling factors were also predictive of *type* of

use among the subsample of participants who reported use of either service. Non-Hispanic Black race, pre-spill counseling, lower depression, and not having an identified medical provider were predictive of counseling only; older age, female gender and pre-spill medication were predictive of medication only; and unemployment was predictive of both services. Also notable was that pre-spill counseling was predictive of both services, relative to medication only, and pre-spill medication of both services, relative counseling only. The results were generally consistent among subsamples with and without probable post-spill mental health diagnoses.

The results generally aligned with the two previous studies of MH service use among disaster relief workers in the aftermath of 9/11 (Elhai et al., 2006; Jayasinghe et al., 2005). For example, they provide additional evidence that age, race, marital status, and PTS are factors that shape service use among relief workers across disaster contexts. They also provide novel evidence that indicators of exposure and enabling factors influence service use in this population.

The study also provides new evidence that the factors shaping service use among disaster relief workers differ by type of use, that is, the use of counseling only, medication only, or both services. First, there was clear variation in type of use by demographic characteristics, with women more likely than men to use medication only and non-Hispanic Blacks more likely than non-Hispanic Whites to use counseling only. Several factors might underlie these differences, including demographic variation in referral rates (e.g., Mott, Barrera, Hernandez, Graham, & Teng, 2014) and preferences for MH services (Ayalon & Alvidrez, 2007). Second, there was consistency in type of use over time, such that participants who had used one type of MH service prior to the spill were more likely to use that same type afterwards. This consistency could be a function of workers' general preferences for coping with mental health symptoms. It could also indicate a need for coordination among purveyors of the two services to more effectively treat workers' symptoms, particularly chronic depression and PTS, through a combination of medication and psychotherapy (e.g., Craighead & Dunlop, 2014; Schneier et al., 2012). Third, the finding that lower depressive symptoms was predictive of counseling only, versus both services, could reflect the effectiveness of psychotherapy alone in the treatment of mild, non-chronic depression (e.g., Craighead & Dunlop, 2014). Lastly, one possible explanation for the finding that participants reporting an identified health provider were significantly more likely to use medication only or both services, relative to counseling only, is that participants with ongoing symptoms were more likely to have a physician monitoring their medication use. Alternatively, this finding could reflect participants turning to their physical health providers for psychotropic medication, and then either not receiving psychotherapy referrals or not pursuing them.

Consistent with previous research (e.g., Jayasinghe et al., 2005), we found some variation in patterns of significance among participants with and without probable post-spill mental illness, compared to the full sample. For example, in the subsample of participants without a probable MH diagnosis, participation in cleanup work before the well was capped was predictive of counseling only, relative to medication only and both services. Although it is unclear why early work would be distinctly related to patterns of use among this subgroup,

potential explanations could be variation in the likelihood of this exposure between participants with and without probable MH diagnoses, in attitudes toward mental health services between participants who began work before versus after the capping, and in availability, accessibility and affordability of services over time.

Limitations

Several limitations to this study are worth noting. First, we lacked detail on the nature and extent of service use, for example, the class of medications, provider of services, and number of sessions attended. Second, our assessments of pre-spill MH diagnoses and post-spill MH symptoms did not include the full spectrum of psychiatric disorders, nor did it include clinical diagnoses. Third, we did not include indicators of exposure that could potentially affect workers' mental health and service use, such as the extent of their direct contact with oil, exhaust, and chemical dispersants, and witnessing damage to wildlife and ecosystems. Fourth, we did not include the type of healthcare coverage, for example whether mental health services were covered under participants' insurance plans, which could potentially influence patterns and predictors of use. Lastly, our findings might not generalize to other post-disaster contexts, including other oil spills. Replication is especially needed given the relatively low response and participation rates in the study, and systematic differences between participants who completed the Home Visit assessment and those who did not.

Despite these limitations, especially given the large number of participants, this study represents a significant step in understanding predictors of MH service utilization among disaster relief workers, a group that is especially vulnerable to post-disaster psychological adversity. Further investigation into the factors that facilitate or hinder service use is crucial to successful disaster response, particularly among those whose efforts provide a foundation for recovery.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This research was funded by the Intramural Research Program of the NIH, the National Institute of Environmental Health Sciences (Z01 ES 102945), and the NIH Common Fund.

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Research Highlights

- Disaster relief workers are at elevated risk for mental health problems.
- Predictors of workers' mental health service use remain unexplored.
- Cleanup workers after the Deepwater Horizon oil spill were surveyed ($N = 8,931$)
- Predictors of counseling and medication use were identified in the full sample.
- Predictors of patterns of use among service users ($N = 971$) were also explored.

Table 1Means, Standard Deviations, and Frequencies for Study Variables ($N = 8,931$)

	M (SD) / %
Predisposing factors	
<i>Demographic Characteristics</i>	
Age	43.19 (12.84)
Female	20.0%
Number of children	.88 (1.24)
Race/ethnicity	
Black	34.8%
Other race	11.8%
Hispanic	6.0%
Immigrant	5.6%
Marital status	
Divorced or separated	23.1%
Single	26.8%
Income	
< \$20,000	38.7%
\$20,000-\$49,999	33.7%
Employed	56.4%
Time	
Weeks to enrollment	89.58 (21.00)
Weeks to home visit	103.51 (22.52)
<i>Pre-Spill Mental Health</i>	
Pre-spill probable diagnosis	8.3%
Pre-spill counseling	9.5%
Pre-spill medication	8.0%
<i>Spill Exposure</i>	
Duration of cleanup work	128.33 (132.08)
Cleanup work before capping	85.1%
Residential proximity	
Direct contact with spill	72.9%
Indirect contact with spill	7.1%
Spill-related physical health symptoms	26.89 (20.22)
Illness-Related Factors	
PC-PTSD	.42 (.93)
GAD-7	5.43 (6.71)
PHQ-8	4.24 (6.07)
Enabling Factors	
Has healthcare	49.0%
Has an identified provider	67.8%
Knows of a clinic	93.8%

Note. Values represent the average of five imputed datasets. PC-PTSD = Primary Care PTSD Screen; GAD-7 = Generalized Anxiety Disorder-7; PHQ-8 = Patient Health Questionnaire-8.

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Table 2Results of Logistic Regression Analysis Predicting Post-Spill Counseling Use ($N = 8,931$)

	Model 1	Model 2	Model 3
Step 1. Predisposing Factors			
<i>Demographics Characteristics</i>			
Age	.99 (.98–.99)**	.99 (.98–1.00)*	.98 (.98–.99)***
Female	1.20 (.98–1.47)	1.24 (1.01–1.52)*	1.14 (.93–1.40)
Number of children	1.05 (.97–1.14)	1.04 (.96–1.12)	1.04 (.96–1.12)
Race/ethnicity			
Black	.58 (.46–.73)***	.61 (.48–.77)***	.60 (.47–.77)***
Other race	.66 (.47–.93)*	.65 (.46–.93)*	.65 (.46–.92)*
Hispanic	.73 (.41–1.30)	.74 (.42–1.32)	.77 (.43–1.36)
Immigrant	.67 (.38–1.21)	.80 (.44–1.44)	.88 (.48–1.59)
Marital status			
Divorced or separated	1.40 (1.12–1.74)**	1.37 (1.10–1.72)**	1.48 (1.18–1.87)**
Single	.93 (.71–1.23)	.93 (.70–1.23)	.98 (.74–1.30)
Income			
< \$20,000	1.02 (.77–1.35)	.96 (.72–1.28)	1.14 (.84–1.53)
\$20,000–\$49,999	.96 (.74–1.24)	.90 (.69–1.18)	1.02 (.78–1.34)
Employed	.65 (.54–.79)***	.76 (.63–.93)**	.71 (.59–.87)**
Time			
Weeks to enrollment	1.00 (.99–1.01)	1.00 (1.00–1.01)	1.00 (1.00–1.01)
Weeks to home visit	1.00 (1.00–1.01)	1.01 (1.00–1.01)*	1.01 (1.00–1.01)*
<i>Pre-Spill Mental Health</i>			
Pre-spill probable diagnosis	1.61 (1.25–2.08)***	1.58 (1.22–2.04)***	1.55 (1.20–2.01)**
Pre-spill counseling	9.23 (7.05–12.07)***	8.89 (6.78–11.65)***	8.90 (6.76–11.71)***
Pre-spill medication	2.44 (1.84–3.24)***	2.08 (1.56–2.79)***	2.06 (1.53–2.78)***
<i>Spill Exposure</i>			
Duration of cleanup work	1.00 (1.00–1.00)*	1.00 (1.00–1.00)*	1.00 (1.00–1.00)*
Cleanup work before capping	.98 (.71–1.34)	1.00 (.72–1.37)	1.00 (.73–1.37)
Residential proximity			
Direct contact with spill	1.06 (.82–1.36)	.96 (.73–1.24)	1.00 (.77–1.30)
Indirect contact with spill	1.10 (.74–1.63)	.89 (.58–1.35)	.88 (.58–1.35)
Spill-related physical health symptoms	1.01 (1.01–1.02)***	1.00 (.99–1.00)	1.00 (.99–1.01)
Step 2. Illness-Related Factors			
PC-PTSD		1.21 (1.10–1.33)***	1.22 (1.11–1.34)***
GAD-7		1.04 (1.02–1.06)***	1.04 (1.02–1.06)***
PHQ-8		1.04 (1.02–1.06)**	1.04 (1.02–1.07)***
Step 3. Enabling Factors			

	Model 1	Model 2	Model 3
Has healthcare		1.68 (1.36–2.08)***	
Has an identified provider		1.23 (.97–1.55)	
Knows of a clinic		1.80 (1.12–2.89)*	

Note. PC-PTSD = Primary Care PTSD Screen; GAD-7 = Generalized Anxiety Disorder-7; PHQ-8 = Patient Health Questionnaire-8.

*
 $p < .05$

**
 $p < .01$

 $p < .001$.

Table 3Results of Logistic Regression Analysis Predicting Post-Spill Medication Use ($N = 8,931$)

	Model 1	Model 2	Model 3
Step 1. Predisposing Factors			
<i>Demographics characteristics</i>			
Age	1.00 (.99–1.01)	1.01 (1.00–1.01)	1.00 (.99–1.00)
Female	1.67 (1.37–2.02) ***	1.73 (1.42–2.11) ***	1.54 (1.26–1.89) ***
Number of children	1.04 (.96–1.12)	1.03 (.96–1.12)	1.03 (.95–1.11)
Race/ethnicity			
Black	.43 (.34–.54) ***	.44 (.35–.57) ***	.43 (.33–.55) ***
Other race	.74 (.54–1.02)	.74 (.53–1.02)	.74 (.53–1.03)
Hispanic	.84 (.51–1.40)	.84 (.50–1.41)	.87 (.52–1.45)
Immigrant	.48 (.27–.87) *	.58 (.32–1.05)	.64 (.35–1.18)
Marital status			
Divorced or separated	1.09 (.88–1.35)	1.04 (.84–1.30)	1.16 (.93–1.45)
Single	.96 (.74–1.26)	.96 (.73–1.26)	1.03 (.78–1.36)
Income			
< \$20,000	.96 (.73–1.26)	.89 (.68–1.18)	1.12 (.84–1.49)
\$20,000–\$49,999	1.04 (.82–1.32)	.97 (.76–1.25)	1.13 (.87–1.45)
Employed	.63 (.51–.76) ***	.73 (.59–.89) **	.69 (.56–.84) ***
Time			
Weeks to enrollment	1.00 (.99–1.01)	1.00 (.99–1.01)	1.00 (.99–1.01)
Weeks to home visit	1.00 (1.00–1.01)	1.01 (1.00–1.01) *	1.01 (1.00–1.01) *
<i>Pre-Spill Mental Health</i>			
Pre-spill probable MH diagnosis	1.77 (1.39–2.25) ***	1.70 (1.33–2.17) ***	1.64 (1.28–2.11) ***
Pre-spill counseling	2.01 (1.54–2.62) ***	1.88 (1.44–2.46) ***	1.89 (1.43–2.49) ***
Pre-spill medication	12.83 (9.95–16.56) ***	11.53 (8.85–15.02) ***	11.72 (8.90–15.42) ***
<i>Spill Exposure</i>			
Duration of cleanup work	1.00 (1.00–1.00)	1.00 (1.00–1.00)	1.00 (1.00–1.00)
Cleanup work before capping	.95 (.74–1.22)	.97 (.75–1.25)	.96 (.74–1.24)
Residential proximity			
Direct contact with spill	1.13 (.89–1.44)	1.01 (.79–1.30)	1.08 (.84–1.38)
Indirect contact with spill	1.22 (.83–1.77)	.99 (.67–1.46)	.97 (.66–1.45)
Spill-related physical health symptoms	1.02 (1.01–1.02) ***	1.00 (1.00–1.01)	1.01 (1.00–1.01) *
Step 2. Illness-Related Factors			
PC-PTSD		1.19 (1.09–1.30) ***	1.21 (1.10–1.32) ***
GAD-7		1.02 (1.00–1.05) *	1.03 (1.00–1.05) *
PHQ-8		1.06 (1.04–1.08) ***	1.06 (1.04–1.09) ***
Step 3. Enabling Factors			
Has healthcare			1.71 (1.39–2.11) ***

	Model 1	Model 2	Model 3
Has an identified provider		1.98 (1.55–2.53) ***	
Knows of a clinic		1.73 (1.05–2.87) *	

Note. PC-PTSD = Primary Care PTSD Screen; GAD-7 = Generalized Anxiety Disorder-7; PHQ-8 = Patient Health Questionnaire-8.

*
 $p < .05$

**
 $p < .01$

 $p < .001$.

Table 4

Results of Multinomial Logistic Regression Analysis Predicting Type of Service Use among Service Users ($N = 972$)

	Model 1		
	<i>Counseling Only vs. Both</i>	<i>Medication Only vs. Both</i>	<i>Counseling Only vs. Medication Only</i>
Step 1. Predisposing Factors			
<i>Demographics Characteristics</i>			
Age	.99 (.97–1.01)	1.03 (1.02–1.05) ***	.96 (.94–.98) *** ^a
Female	.79 (.51–1.22)	1.57 (1.12–2.20) **	.51 (.31–.83) *** ^a
Number of children	1.08 (.91–1.28)	1.04 (.90–1.21)	1.04 (.85–1.26)
Race/ethnicity			
Black	1.67 (1.04–2.70) *	.64 (.40–1.02)	2.62 (1.45–4.73) **
Other race	.98 (.44–2.16)	1.42 (.81–2.49)	.69 (.29–1.61)
Hispanic	.93 (.24–3.61)	1.59 (.63–3.99)	.59 (.14–2.46)
Immigrant	2.43 (.59–9.99)	.86 (.27–2.73)	2.84 (.60–13.39)
Marital status			
Divorced or separated	.95 (.60, 1.52)	.62 (.42–.93) *	1.54 (.90–2.63)
Single	.73 (.42–1.29)	1.03 (.63–1.67)	.71 (.37–1.38)
Income			
< \$20,000	1.34 (.72–2.49)	1.08 (.67–1.75)	1.24 (.62–2.49)
\$20,000–\$49,999	.83 (.47–1.44)	1.09 (.69–1.71)	.76 (.41–1.41)
Employed	1.60 (1.04–2.46) * ^a	1.46 (1.03–2.07) * ^a	1.10 (.67–1.79)
Time			
Weeks to enrollment	1.00 (.98–1.01)	1.00 (.99–1.01)	1.00 (.98–1.01)
Weeks to home visit	1.00 (.99–1.01)	1.00 (.99–1.00)	1.00 (.99–1.02)
<i>Pre-Spill Mental Health</i>			
Pre-spill probable diagnosis	.67 (.40–1.12)	.85 (.57–1.28)	.78 (.43–1.44)
Pre-spill counseling	3.45 (2.17–5.49) ***	.14 (.09–.22) *** ^a	24.34 (13.31–44.51) ***
Pre-spill medication	.06 (.03–.11) *** ^a	2.41 (1.56–3.71) ***	.03 (.01–.05) *** ^a
<i>Spill Exposure</i>			
Duration of cleanup work	1.00 (1.00–1.00)	1.00 (1.00–1.00)	1.00 (1.00–1.00)
Cleanup work before capping	1.16 (.66–2.06)	1.08 (.66–1.77)	1.08 (.57–2.06)
Residential proximity			
Direct contact with spill	.96 (.55–1.66)	1.05 (.65–1.69)	.92 (.48–1.74)
Indirect contact with spill	1.18 (.52–2.65)	1.51 (.76–3.02)	.78 (.31–1.93)
Spill-related physical health symptoms	.99 (.98–1.00)	1.00 (1.00–1.01)	.99 (.98–1.00)
Step 2. Illness-Related Factors			
PC-PTSD			
GAD-7			
PHQ-8			
Step 3. Enabling Factors			

Model 1			
	<i>Counseling Only vs. Both</i>	<i>Medication Only vs. Both</i>	<i>Counseling Only vs. Medication Only</i>
Has healthcare			
Has an identified provider			
Knows of a clinic			
Model 2			
	<i>Counseling Only vs. Both</i>	<i>Medication Only vs. Both</i>	<i>Counseling Only vs. Medication Only</i>
Step 1. Predisposing Factors			
<i>Demographics Characteristics</i>			
Age	.99 (.97–1.01)	1.03 (1.01–1.05) ***	.96 (.94–.98) ***
Female	.78 (.50–1.22)	1.54 (1.09–2.17) *	.51 (.31–.84) **
Number of children	1.06 (.90–1.26)	1.04 (.89–1.20)	1.03 (.84–1.25)
Race/ethnicity			
Black	1.66 (1.03–2.69) *	.63 (.39–1.01)	2.64 (1.46–4.79) **
Other race	.89 (.39–2.02)	1.35 (.76–2.37)	.66 (.28–1.58)
Hispanic	.96 (.25–3.72)	1.64 (.65–4.16)	.59 (.14–2.44)
Immigrant	2.53 (.62–10.34)	.83 (.26–2.67)	3.07 (.65–14.40)
Marital status			
Divorced or separated	.94 (.59–1.51)	.61 (.41–.91) *	1.54 (.90–2.65)
Single	.73 (.42–1.30)	1.02 (.62–1.66)	.72 (.37–1.40)
Income			
< \$20,000	1.39 (.74–2.61)	1.11 (.68–1.81)	1.25 (.62–2.53)
\$20,000–\$49,999	.87 (.50–1.53)	1.11 (.71–1.75)	.78 (.42–1.46)
Employed	1.45 (.94–2.24)	1.38 (.97–1.97)	1.05 (.64–1.72)
Time			
Days to enrollment	1.00 (.98–1.01)	1.00 (.99–1.01)	1.00 (.98–1.01)
Days to home visit	1.00 (.98–1.01)	.99 (.98–1.00)	1.00 (.99–1.02)
<i>Pre-Spill Mental Health</i>			
Pre-spill probable diagnosis	.64 (.38–1.09)	.86 (.57–1.28)	.75 (.41–1.39)
Pre-spill counseling	3.32 (2.08–5.29) ***	.14 (.09–.22) ***	23.95 (.13.07–43.89) ***
Pre-spill medication	.07 (.04–.12) ***	2.49 (1.61–3.85) ***	.03 (.01–.05) ***
<i>Spill Exposure</i>			
Duration of cleanup work	1.00 (1.00–1.00)	1.00 (1.00–1.00)	1.00 (1.00–1.00)
Cleanup work before capping	1.12 (.63–2.00)	1.06 (.65–1.75)	1.06 (.55–2.04)
Residential proximity			
Direct contact with spill	1.01 (.58–1.76)	1.09 (.68–1.76)	.92 (.48–1.76)
Indirect contact with spill	1.26 (.56–2.86)	1.60 (.80–3.21)	.79 (.31–1.98)
Spill-related physical health symptoms	1.00 (.99–1.01)	1.01 (1.00–1.02)	.99 (.98–1.00)
Step 2. Illness-Related Factors			
PC-PTSD	.98 (.81–1.19)	.93 (.80–1.09)	1.05 (.84–1.32)
GAD-7	1.02 (.98–1.07)	.98 (.94–1.02)	1.04 (.99–1.10) *

Model 2			
	<i>Counseling Only vs. Both</i>	<i>Medication Only vs. Both</i>	<i>Counseling Only vs. Medication Only</i>
PHQ-8	.94 (.90–.99)*	1.00 (.96–1.03)	.95 (.90–1.00)*
Step 3. Enabling Factors			
Has healthcare			
Has an identified provider			
Knows of a clinic			
Model 3			
	<i>Counseling Only vs. Both</i>	<i>Medication Only vs. Both</i>	<i>Counseling Only vs. Medication Only</i>
Step 1. Predisposing Factors			
<i>Demographics Characteristics</i>			
Age	1.00 (.98–1.02)	1.03 (1.01–1.05)***	.97 (.95–.99)**
Female	.85 (.54–1.33)	1.53 (1.09–2.16)*	.55 (.33–.92)*
Number of children	1.04 (.87–1.25)	1.04 (.90–1.21)	1.00 (.82–1.23)
Race/ethnicity			
Black	1.66 (1.01–2.72)*	.63 (.39–1.01)	2.64 (1.44–4.84)**
Other race	.82 (.36–1.91)	1.37 (.78–2.43)	.60 (.25–1.46)
Hispanic	.92 (.23–3.60)	1.68 (.66–4.29)	.55 (.13–2.31)
Immigrant	2.83 (.68–11.82)	.79 (.24–2.58)	3.60 (.74–17.46)
Marital status			
Divorced or separated	.92 (.56–1.49)	.62 (.41–.92)*	1.49 (.86–2.58)
Single	.68 (.37–1.22)	1.02 (.63–1.67)	.66 (.33–1.31)
Income			
< \$20,000	1.14 (.60–2.16)	1.09 (.67–1.79)	1.04 (.51–2.12)
\$20,000–\$49,999	.73 (.40–1.32)	1.10 (.70–1.74)	.66 (.35–1.26)
Employed	1.42 (.90–2.22)	1.39 (.97–2.00)	1.02 (.61–1.69)
Time			
Days to enrollment	.99 (.98–1.01)	1.00 (.99–1.01)	1.00 (.98–1.01)
Days to home visit	1.00 (.98–1.01)	.99 (.98–1.00)	1.00 (.99–1.02)
<i>Pre-Spill Mental Health</i>			
Pre-spill probable diagnosis	.73 (.43–1.25)	.86 (.57–1.29)	.85 (.46–1.60)
Pre-spill counseling	3.27(2.02–5.28)***	.14 (.09–.22)***	23.71 (12.76–44.05)***
Pre-spill medication	.06 (.03–.11)***	2.49 (1.60–3.88)***	.02 (.01–.05)***
<i>Spill Exposure</i>			
Duration of cleanup work	1.00 (1.00–1.00)	1.00 (1.00–1.00)	1.00 (1.00–1.00)
Cleanup work before capping	1.11 (.61–2.00)	1.08 (.66–1.77)	1.02 (.52–2.00)
Residential proximity			
Direct contact with spill	.92 (.52–1.64)	1.10 (.68–1.78)	.84 (.43–1.63)
Indirect contact with spill	1.34 (.58–3.07)	1.60 (.80–3.22)	.83 (.33–2.12)
Spill-related physical health symptoms	1.00 (.99–1.01)	1.01 (1.00–1.02)	.99 (.98–1.00)
Step 2. Illness-Related Factors			
PC-PTSD	.98 (.79–1.20)	.93 (.79–1.09)	1.05 (.83–1.32)

	Model 3		
	<i>Counseling Only vs. Both</i>	<i>Medication Only vs. Both</i>	<i>Counseling Only vs. Medication Only</i>
GAD-7	1.02 (.97–1.07)	.98 (.94–1.02)	1.04 (.99–1.10)
PHQ-8	.94 (.89–.98)**	.99 (.96–1.03)	.94 (.89–.99)*
Step 3. Enabling Factors			
Has healthcare	.86 (.54–1.36)	.92 (.63–1.33)	.93 (.56–1.57)
Has an identified provider	.34 (.21–.55)***	1.26 (.79–2.02)	.27 (.15–.48)***
Knows of a clinic	.78 (.27–2.28)	.88 (.31–2.48)	.89 (.24–3.33)

Note. PC-PTSD = Primary Care PTSD Screen; GAD-7 = Generalized Anxiety Disorder-7; PHQ-8 = Patient Health Questionnaire-8. ^a The opposite reference group used in the text for clarity of presentation, and therefore the Odds Ratios and Confidence Intervals listed here do not match what is listed in the text.

*
 $p < .05$

**
 $p < .01$

 $p < .001$.