Posttraumatic Stress Disorder in Veterans and Military Personnel: Epidemiology, Screening, and Case Recognition

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Posttraumatic stress disorder (PTSD) is a psychiatric disorder that affects 7–8% of the general U.S. population at some point during their lifetime; however, the prevalence is much higher among certain subgroups, including active duty military personnel and veterans. In this article, we review the empirical literature on the epidemiology and screening of PTSD in military and veteran populations, including the availability of sensitive and reliable screening tools. Although estimates vary across studies, evidence suggests that the prevalence of PTSD in deployed U.S. military personnel may be as high as 14–16%. Prior studies have identified trauma characteristics and pre- and posttrauma factors that increase risk of PTSD among veterans and military personnel. This information may help to inform prevention and screening efforts, as screening programs could be targeted to high-risk populations. Large-scale screening efforts have recently been implemented by the U.S. Departments of Defense and Veterans Affairs. Given the prevalence and potential consequences of PTSD among veterans and active duty military personnel, development and continued evaluation of effective screening methods is an important public health need.

Keywords: epidemiology, military personnel, posttraumatic stress disorder, screening, veterans
Rona, & Wessely, 2010; Young, 1995), in part because of concerns over possible overdiagnosis related to patients seeking secondary gain (Department of Veterans Affairs Office of Inspector General, 2005; McHugh & Treisman, 2007). However, recent, large-scale studies indicate that PTSD may be a highly prevalent disorder among U.S. service men and women returning from current military deployments, with prevalence estimates as high as 14–16% (Hoge et al., 2004; Hoge, Terhakopian, Castro, Messer, & Engel, 2007; Milliken, Auchterlonie, & Hoge, 2007; Tanielian & Jaycox, 2008). Importantly, prior studies may actually underestimate the true number of military personnel and veterans suffering from PTSD and other trauma-related disorders, because of stigma and potential negative consequences associated with disclosing mental health difficulties (e.g., compromising one’s military career, delays in returning home) (Hoge et al., 2004). Nonetheless, on the basis of the available research findings, PTSD has been referred to as one of the “signature injuries” of active duty service men and women who are deployed to Afghanistan for Operation Enduring Freedom (OEF) or Iraq for Operation Iraqi Freedom (OIF) (Testimony of Jason Altmire, 2007).

PTSD is associated with numerous deleterious outcomes for veterans and active duty service personnel, and the costs of PTSD to the individual, their immediate family, and society at large are substantial. In addition to the emotional and cognitive symptoms of PTSD, individuals with PTSD are more likely to experience marital and family problems (Jordan et al., 1992), job instability (Smith, Schnurr, & Rosenheck, 2005), legal difficulties (Kulka et al., 1990), and physical health problems (Boscarino, 2004; O’Toole, Catts, Outram, Pierse, & Cockburn, 2009). Veterans with a history of PTSD have a higher risk of cardiovascular, respiratory, gastrointestinal, infectious, nervous system, and autoimmune disorders (Boscarino, 1997, 2004; Hoge et al., 2007; Kubzansky, Koenen, Spiro, Vokonas, & Sparrow, 2007) and are more likely to experience anxiety, depression, substance abuse, and other psychiatric disorders (Kulka et al., 1990; Long, MacDonald, & Chamberlain, 1996). Some studies also have reported a higher risk of suicidal ideation among veterans with PTSD (Jakupcak et al., 2009; Pietrzak, Goldstein et al., 2009). PTSD often occurs in combination with persistent postconcussive symptoms and chronic pain, complicating the diagnosis and treatment of PTSD (Lew et al., 2009). The economic costs of PTSD and major depression for all currently deployed service members could be more than 6.2 billion dollars during only the first two years after return from deployment (Tanielian & Jaycox, 2008). A large proportion of these costs are expected to be attributable to lost work productivity. Eibner and colleagues (Eibner, Ringel, Kilmer, Pacula, & Díaz, 2008) hypothesized that the economic burden of PTSD could be reduced through the proper identification of those with PTSD and use of evidence-based treatments within the first two years after an individual’s return from war zone deployment.

In response to the recent estimates of PTSD prevalence among military personnel deployed to OEF/OIF and the associated public health and economic consequences, the U.S. Department of Defense (DoD) and VA have increased the number of available mental health providers and instituted mandatory primary care screenings for PTSD and other associated disorders for military personnel and veterans. In addition, the VA has developed and implemented specialized programs for evidence-based treatment of PTSD, including Cognitive Processing Therapy (CPT) and Prolonged Exposure (PE) therapy (Karlin et al., 2010). However, the provision of adequate services depends upon the use of accurate and reliable screening procedures to identify individuals either at risk for or currently affected by the disorder. Continued evaluation of the current screening efforts is needed to assess their effectiveness in properly identifying individuals with PTSD and reducing the amount of PTSD-related suffering among veterans and active duty military personnel.

In considering the rationale for the development and implementation of PTSD screening programs for armed services personnel and veterans, we first provide an overview of the prevalence and etiology of PTSD in military and veteran populations, followed by a review of current screening initiatives within the DoD and VA and the available screening instruments. We conclude by discussing potential gaps and future research needs in the area of screening for PTSD in veteran and military populations. The primary goal of this article is to provide an overview of PTSD epidemiology and screening...
for clinicians and researchers, as well as to serve as a resource to guide clinicians in the selection of screening instruments and implementation of screening programs.

**Method**

We searched the U.S. National Library of Medicine’s PubMed database and the PsychINFO database for articles related to the prevalence, epidemiology, or screening of PTSD among armed forces personnel and veterans. We identified studies related to the prevalence or epidemiology of PTSD in veterans and military personnel by searching for references with the terms “posttraumatic stress disorder” or “PTSD” and “veterans,” “military,” or “combat” in the title or abstract, as well as “prevalence” (n = 229) or “epidemiology,” “risk factor,” or “predictor” (n = 101) in the title/abstract or subject heading. We reviewed the abstracts for the resulting articles to identify those relevant to our topic, and we also reviewed the references for the most relevant articles to identify additional studies of interest.

To identify articles related to screening for PTSD in veterans and active duty military personnel, we searched for articles with the terms “posttraumatic” or “PTSD” in the major subject heading, “veteran” or “military” in the subjects field, and “screen” in any field, which yielded 177 articles. We reviewed the results to determine whether the study addressed screening for PTSD and the screening measures used. After identifying relevant screening measures, we performed additional searches to locate articles about the measures in question, including original validation studies.

**Results**

**Prevalence of PTSD in Veterans and Military Personnel**

Figure 1 displays estimates of the prevalence of lifetime (any history) and current PTSD from studies of active duty military personnel and veterans of the Vietnam War (Boscarino, 1995; Eisen et al., 2004; Goldberg, True, Eisen & Henderson, 1990; Kulka et al., 1990; O’Toole et al., 2009; O’Toole et al., 1996; Stretch, 1985), Gulf War (Al-Turkait & Ohaeri, 2008; Department of National Defence, 2002; Gray, Reed, Kaiser, Smith & Gastanaga, 2002; Holmes, Tariot & Cox, 1998; Ikin et al., 2004; Jones, Rona, Hooper & Wesseley, 2006; Kang, Natelson, Mahan, Lee, & Murphy, 2003; Lee, Gabriel, Bolton, Bale & Jackson, 2002; Perconte, Wilson, Pontius, Dietrick, & Spiro, 1993; Pierce, 1997; Proctor et al., 1998; Stretch et al., 1996; The Iowa Persian Gulf Study Group, 1997; Toomey et al., 2007; Unwin et al., 1999; Wolfe, Erickson, Sharkansky, King & King, 1999), and OEF/OIF (Duma, Reger, Canning, McNeil, & Gahm, 2010; Fear et al., 2010; Haskell et al., 2010; Hoge & Castro, 2006; Hoge et al., 2004; Hoge et al., 2007; Hotopf et al., 2006; Milliken et al., 2007; Seal, Bententhal, Miner, Sen & Marmar, 2007; Seal et al., 2009; Smith et al., 2008; Tanielian & Jaycox, 2008; Vasterling et al., 2006; Vasterling et al., 2010). Although the prevalence estimates vary widely across studies, overall the data in Figure 1 suggest that a large proportion of military personnel and veterans are affected by PTSD. Several factors may contribute to differences in the prevalence estimates across studies, including the study design and methods, the diagnostic criteria used, and characteristics of the study population, such as the intensity of combat exposure or number of deployments (Ramchand et al., 2010). Two recent review articles summarized the data on the prevalence of combat-related PTSD (Richardson, Frueh, & Acierno, 2010; Sundin et al., 2010); we therefore briefly summarize the most recent prevalence data below and refer readers to specific publications for details of older studies.

**Prevalence of military-related PTSD in the United States.** The most recent prevalence estimates of deployment-related PTSD come from the ongoing military operations in Iraq and Afghanistan. In a review of the prevalence literature on combat-related PTSD, Richardson et al. reported estimates for current PTSD in U.S. OEF/OIF veterans ranging from 4% to 17% (Richardson et al., 2010). In a recent study not included in the reviews noted above, 21.8% of 289,328 OEF/OIF veterans who first received care at a VA facility between 2002 and 2008 were diagnosed with PTSD during the 6-year study period, based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes from inpatient and outpatient visits (Seal et al., 2009). However, this study population sought health care at VA
facilities and therefore may not be representative of the larger population of OEF/OIF veterans. In addition, PTSD diagnoses were based on electronic medical records and were not confirmed by other methods, likely resulting in false positive as well as false negative diagnoses. In contrast to the study by Seal et al., a study published by the RAND Corporation in 2008 reported that 14% of a representative sample of 1,965 OEF/OIF veterans interviewed by telephone met diagnostic criteria for PTSD (Tanielian & Jaycox, 2008). Extrapolating from these results, the authors estimated that 226,000 individuals who served in OEF/OIF through October 31, 2007 currently have PTSD.

**Prevalence of military-related PTSD internationally.** Studies of non-U.S. veteran populations generally report similar or lower prevalence estimates than studies of U.S. veterans (Richardson et al., 2010; Sundin et al., 2010). For example, prevalence estimates for U.K. veterans who served in Iraq and Afghanistan range from 3.4% to 6%, based on studies using self-administered questionnaires (Browne et al.,...
Risk Factors for PTSD in Veterans and Military Personnel

The majority of individuals exposed to trauma do not develop clinical PTSD, suggesting that other factors strongly influence the onset and course of this disorder (Keane, Marx, & Sloan, 2009). Risk factors for PTSD are commonly divided into three categories: individual-level (pretrauma) factors, characteristics of the trauma, and posttrauma factors (Keane, Marshall, & Taft, 2006). Knowledge of pretrauma factors and trauma characteristics that influence risk may help to identify populations at higher risk of developing PTSD and who are therefore more likely to benefit from screening, whereas posttrauma factors may help to inform prevention and treatment programs among men and women with trauma exposure.

Table 1 summarizes the epidemiologic factors shown in multiple studies to influence risk of PTSD in veterans and military personnel. Characteristics of the trauma (e.g., trauma severity, perceived life threat, and combat-related injury) and posttrauma factors (e.g., lack of social support and exposure to additional life stressors) have been strongly associated with risk of PTSD in multiple studies. In contrast, weak to moderate associations generally have been reported for pretrauma factors, such as younger age at trauma and prior psychiatric history.

Gender, race/ethnicity, and risk of PTSD.

In addition to the risk factors included in Table 1, some studies have suggested that gender and race/ethnicity may be important in the de-
development of military-related PTSD (Brewin, Andrews, & Valentine, 2000; Gahm, Lucenko, Retzlaff, & Fukuda, 2007; Koenen, Stellman, Stellman, & Sommer, 2003). In a meta-analysis of 25 studies, Brewin et al. (2000) observed a significantly higher risk of PTSD among women compared with men in civilian but not military populations, although only two military studies of gender and PTSD were included. More recent studies are mixed, with some reporting a higher risk among women and others reporting no association (Street, Vogt, & Dutra, 2009). Similarly, minority race/ethnicity was associated with an increased risk of PTSD in military populations in the meta-analysis by Brewin et al. (2000), but other studies do not support an association (Baker et al., 2009; Frueh et al., 1998). Several factors may contribute to differences in the associations with gender and race observed across studies, including premilitary trauma exposure or confounding by trauma characteristics, social support during deployment, or other stressors (Dohrenwend, Turner, Turse, Lewis-Fernandez, & Yager, 2008; Kienerling, Gima, Smith, Street, & Frayne, 2007; Loo et al., 2005; Street et al., 2009; Vogt, Pless, King, & King, 2005). For example, premilitary/military sexual trauma is an important cause of PTSD that disproportionately affects women (Himmelfarb, Yaeger, & Mintz, 2006; Kimmerling et al., 2007); however, studies of military and veteran populations that focus on PTSD resulting from combat, rather than all military-related trauma, may fail to report cases of PTSD that are primarily attributable to military sexual trauma.

**Complexity of PTSD etiology.** Multivariate and meta-analytic studies (Brewin et al.,

### Table 1

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Strength of association</th>
<th>References</th>
</tr>
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<tbody>
<tr>
<td>Pre-trauma factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Younger age at trauma</td>
<td>+</td>
<td>(Brewin et al., 2000; Nasky, Hines, &amp; Simmer, 2009)</td>
</tr>
<tr>
<td>Lower education</td>
<td>++</td>
<td>(Brewin et al., 2000; Iversen et al., 2008; Schnurr et al., 2004; Zohar et al., 2009)</td>
</tr>
<tr>
<td>Lower intelligence</td>
<td>++</td>
<td>(Brewin et al., 2000; Gale et al., 2008; Zohar et al., 2009)</td>
</tr>
<tr>
<td>Lower military rank</td>
<td>++</td>
<td>(Iversen et al., 2008; Nasky et al., 2009; Zohar et al., 2009)</td>
</tr>
<tr>
<td>Lower socioeconomic status</td>
<td>++</td>
<td>(Brewin et al., 2000; Schnurr et al., 2004)</td>
</tr>
<tr>
<td>Prior trauma</td>
<td>++</td>
<td>(Brewin et al., 2000; Ozer et al., 2003)</td>
</tr>
<tr>
<td>Prior psychiatric history/symptoms</td>
<td>++</td>
<td>(Brewin et al., 2000; Rona et al., 2009)</td>
</tr>
<tr>
<td>Family psychiatric history</td>
<td>+</td>
<td>(Brewin et al., 2000; Ozer et al., 2003)</td>
</tr>
<tr>
<td>Behavioral problems in childhood</td>
<td>+</td>
<td>(Helzer, Robins, &amp; McEvoy, 1987; King, King, Foy, &amp; Gudanowski, 1996; Koenen et al., 2005)</td>
</tr>
<tr>
<td>Childhood abuse or adversity</td>
<td>+</td>
<td>(Brewin et al., 2000; Cabrera, Hoge, Bliese, Castro, &amp; Messer, 2007; Gahm et al., 2007; Iversen et al., 2008)</td>
</tr>
<tr>
<td>Trauma characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trauma/combat exposure severity</td>
<td>+++</td>
<td>(Brewin et al., 2000; Cabrera et al., 2007; Gahm et al., 2007; Koenen et al., 2003; O'Toole et al., 1996; Rona et al., 2009; Schnurr et al., 2004)</td>
</tr>
<tr>
<td>Perceived life threat</td>
<td>++</td>
<td>(King et al., 1998; Schnurr et al., 2004)</td>
</tr>
<tr>
<td>Combat-related injury</td>
<td>++</td>
<td>(Koren, Norman, Cohen, Berman, &amp; Klein, 2005; MacGregor et al., 2009)</td>
</tr>
<tr>
<td>Exposure to death, killing, or abusive violence</td>
<td>+</td>
<td>(Gahm et al., 2007; Iversen et al., 2008; Maguen et al., 2010; Marx et al., 2010; McCarroll, Ursano, Fullerton, Liu, &amp; Lundy, 2001)</td>
</tr>
<tr>
<td>Peritraumatic distress or dissociation</td>
<td>+</td>
<td>(Ozer et al., 2003; Schnurr et al., 2004)</td>
</tr>
<tr>
<td>Post-trauma factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of social support</td>
<td>++</td>
<td>(Brewin et al., 2000; Ozer et al., 2003)</td>
</tr>
<tr>
<td>Negative homecoming experience</td>
<td>++</td>
<td>(Johnson et al., 1997; Koenen et al., 2003)</td>
</tr>
<tr>
<td>Exposure to additional life stressors</td>
<td>++</td>
<td>(Brewin et al., 2000)</td>
</tr>
</tbody>
</table>

* Weak effect (+), intermediate effect (++), or strong effect (+++).
2000; King, King, Foy, Keane, & Fairbank, 1999; Ozer, Best, Lipsey, & Weiss, 2003; Wolfe et al., 1999) highlight the complexity of predicting who will and will not develop chronic PTSD. Risk and resilience factors, including the quality of the family environment during childhood, age at trauma exposure, history of prior adversity, severity of trauma exposure, breadth and strength of the social support network, exposure to additional life stressors, and individual-level characteristics such as hardiness and neurobiology have consistently been found to influence the development of PTSD (King et al., 1999; King, King, Fairbank, Keane, & Adams, 1998; Pietrzak et al., 2010; Pietrzak, Johnson, Goldstein, Malley, & Southwick, 2009). This research suggests that vulnerability to PTSD is not simply a function of trauma exposure but a function of the interaction between trauma exposure, preexisting psychological and biological vulnerabilities, and the post-trauma environment. Other research indicates that the factors influencing development and maintenance of PTSD may differ (Schnurr, Lunney, & Sengupta, 2004).

Genetics of PTSD. Finally, although familial studies support a heritable component of PTSD, limited data are available on genetic polymorphisms that may influence risk in military and veteran populations (Afifi, Asmundson, Taylor, & Jang, 2010; Koenen, 2007). In a study of male twin pairs who served during the Vietnam era, True et al. observed that approximately 30% of the variability in PTSD symptoms was attributable to genetic factors, whereas shared family environment did not appear to influence the development of PTSD (True et al., 1993). Studies of specific genetic variants have focused on the dopaminergic, serotonergic, and other neurobiochemical pathways (Nugent, Amstadter, & Koenen, 2008). Polymorphisms in the dopamine receptor D2 (DRD2) gene have been associated with risk of PTSD in some but not all studies of combat-exposed populations (Nugent et al., 2008; Voisey et al., 2009), and one study reported lower dopamine beta-hydroxylase (DBH) activity among veterans with PTSD compared with those without PTSD, suggesting a possible role of the DBH gene in the development of PTSD (Mustapic et al., 2007). However, studies of genes in other pathways generally have been null in military and veteran populations, although the number of available studies is small (reviewed in Koenen, 2007; Nugent et al., 2008).

Large, genome-wide association studies would be helpful in identifying other chromosomal regions that may be important in PTSD. Although future genetic studies may help to elucidate the mechanisms involved in the development of PTSD and may be informative for risk prediction and screening or prevention, currently the evidence is too limited for widespread use of genetic data for screening purposes in military and veteran populations.

Screening Programs for PTSD in Veterans and Military Personnel

The high prevalence of PTSD in military and veteran populations and the potential seriousness of the symptoms and associated emotional/physical health consequences highlight the importance of effective screening and early intervention efforts for these groups. The goal of screening in this population is to identify trauma-exposed individuals with undiagnosed or sub-syndromal PTSD, or those at risk for developing the disorder, to intervene earlier in the course of disease than would occur in the absence of screening. Although screening for PTSD differs from screening for chronic diseases, such as cancer, in that symptoms often are present at the time of screening, the goal of reducing morbidity or mortality from disease is similar, as early intervention may result in a shorter course of disease and fewer negative outcomes related to PTSD (Bryant et al., 2008; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; O’Donnell, Bryant, Creamer, & Carty, 2008). Screening may also be of value in identifying subgroups of individuals or specific cohorts at increased risk for developing PTSD, tracking changes in prevalence over time, and assessing the degree of unmet need for services.

In 2003, the DoD instituted a military-wide screening program—the Post-Deployment Health Assessment (PDHA)—that assesses service members’ physical and mental health status after deployment. Specific mental health areas addressed include depression, suicidal ideation, aggression, and PTSD (Hoge et al., 2006). Screening occurs within 1–2 weeks of return from deployment and consists of a three-page self-report questionnaire followed by a brief interview with a health care professional, who documents any concerns, determines
whether additional evaluation is needed, and provides information on available resources for dealing with postdeployment issues (U.S. Department of Defense Deployment Health Clinical Center). Results of this large-scale screening program suggest that a substantial percentage of service members who served in Iraq and Afghanistan screen positive for probable PTSD; during the first year after implementation of the PHDA, 9.8% of Army soldiers and Marines returning from Iraq and 4.7% returning from Afghanistan screened positive for probable PTSD (Hoge et al., 2006). Although it is possible that these estimates overstate the prevalence of PTSD because of patients seeking secondary gain, it is also possible that these studies underestimate the prevalence of PTSD among active duty military personnel who may not report the presence of PTSD symptoms because of concerns that public knowledge of their symptoms may damage their personal or professional reputations. As part of this ongoing screening program, the DoD mandated in 2005 that service members be assessed again 3–6 months after return from deployment (Milliken et al., 2007). Screening at two time points yielded even higher positive screening rates for probable PTSD and other mental health concerns; at the reassessment, 16.7% of active soldiers and 24.5% of National Guard and Reserve soldiers screened positive for PTSD (Milliken et al., 2007). A second study found that the proportion of individuals screening positive for PTSD and other mental health conditions was higher when screening was delayed until several months postdeployment, indicating that screening soon after return from deployment may miss a large number of cases as a result of delayed onset or false negative screens (Bliese, Wright, Adler, Thomas, & Hoge, 2007).

Despite the apparent success of these screening efforts by the DoD, some researchers have voiced concerns, citing limited evidence of the effectiveness of screening in military populations (Rona, Hyams, & Wessely, 2005). Rona and colleagues argued that the number of positive screens requiring prompt psychological attention is small relative to the total number of individuals screening positive and that several factors may influence over- or underreporting of symptoms in military populations (Rona et al., 2005). However, in a study of 1,578 military personnel returning from a year-long deployment to Iraq, Bliese et al. reported a sensitivity of 0.73 and specificity of 0.88 for the four-item Primary Care PTSD Screen (PC-PTSD) used in the PDHA compared with a structured interview, indicating that the PDHA has reasonably good validity (Bliese, Wright, Thomas, Adler, & Hoge, 2004, December).

In 2004, the VA implemented the Afghan and Iraq Post-Deployment Screen, a 10–15 minute assessment for PTSD, depression, and high-risk alcohol use (Seal et al., 2008). Veterans seeking care at Veterans Health Administration (VHA) primary care and specialty clinics are routinely screened by their clinician, who is prompted to complete the assessment by an automatic reminder in the VHA’s computerized medical record system (Seal et al., 2008; Veterans Health Administration, 2004). PTSD symptoms are assessed using the four-item PC-PTSD, and clinicians are encouraged to refer veterans with a positive screen to a specialty mental health clinic (Seal et al., 2008). In a study by Seal and colleagues (2008), 45% of OEF/OIF veterans seen at a VHA Medical Center or associated clinic were screened, and 50% of those screened met the criteria for probable PTSD. This is consistent with a study of active duty military personnel seen at outpatient mental health clinics in which 44% screened positive for probable PTSD (Gahm & Lucenko, 2008). Although the prevalence of PTSD likely is elevated among active duty military personnel and veterans seen at VHA facilities, as this population includes individuals seeking care for symptoms of PTSD or related conditions, these studies highlight the importance of screening for PTSD in this setting. Beginning in 2010, the VA required that all OEF/OIF veterans being actively treated for PTSD at a VHA facility be evaluated for PTSD symptoms every 90 days using the PTSD Checklist (PCL), to monitor changes in PTSD symptoms and assess whether individuals previously diagnosed with PTSD continue to meet diagnostic criteria (Department of Veterans Affairs, 2009).

Ongoing evaluation of the efforts to screen active duty military personnel and veterans is needed to maximize the effectiveness of these screening programs. For example, studies of the optimal timing of the PDHA and the optimal frequency of the VA screen would help to ensure that cases are detected and treatment is
initiated early but that the number of cases missed because of delayed onset is minimized. In addition, validation studies should be conducted where none are available, to evaluate the effectiveness of the screening programs as well as to assess the psychometric properties and diagnostic accuracy of new screening measures in these populations.

**Overview of Screening Instruments for Identifying PTSD in Military and Veteran Populations**

Various methods have been used to assess the signs and symptoms of PTSD in military and veteran populations; however, the most common approach involves the use of self-report questionnaires. In a review of screening instruments for assessing symptoms of PTSD in the general population, Brewin noted that screening tools designed to assess *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV)* symptoms were superior to other instruments, and that measures with fewer items, simpler response scales, and simpler methods of scoring usually were superior (Brewin, 2005).

Some screening instruments, including those reviewed by Brewin (2005), more generally assess the presence of PTSD that may or may not be combat related. In contrast, other screening measures are specifically designed to assess combat-related PTSD. Combat-specific PTSD screening instruments may have higher sensitivity and specificity in military and veteran populations than screening tools designed for use in the general population. However, more focused screening tools may fail to identify PTSD cases that are unrelated to combat, such as PTSD resulting from military sexual trauma (Sturis & Lind, 2008); screening measures should therefore be broad enough to effectively screen for both combat-related PTSD and PTSD related to other trauma in military settings.

Screening instruments for PTSD assess some or all of the characteristic symptoms of PTSD and are typically validated against a “gold standard” of clinical diagnosis by a qualified clinician. Additional validation tests include discriminant or known groups validity (“does the test distinguish between individuals with and without the disorder?”), predictive validity (“does the test predict who will develop the disorder?”), and convergent validity (“do the test results correlate with other similar measures?”). Reliability assessment (test-retest, internal consistency) is also necessary. Ideally, PTSD screening tools should have a high degree of sensitivity and at least modest specificity, when compared with expert diagnosis. Although the negative consequences of a false positive screen for PTSD may be acceptable, because a positive screen should always be followed by in-depth diagnostic assessment by a qualified mental health professional, the number of false positives should not be so large as to overwhelm the available resources for diagnosing and treating PTSD. In contrast, false negative screens have potentially serious consequences and should be minimized, as individuals with PTSD who are not identified may not receive further assessment and could potentially be symptomatic for several years without receiving diagnosis or treatment.

**Review of self-report screening instruments.** In Table 2 we provide an overview of the self-report scales and screening instruments that have been used to detect probable PTSD in military and veteran populations (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Brewin, 2005; Carlson, 2001; Davidson et al., 1997; Foa, Cashman, Jaycox, & Perry, 1997; Gore, Engel, Freed, Liu, & Armstrong, 2008; Hammarberg, 1992; Horowitz, Wilner, & Alvarez, 1979; Hovens, Bramsen, & van der Ploeg, 2002; Keane, Caddell, & Taylor, 1988; Marx et al., 2008; Meltzer-Brody, Churchill, & Davidson, 1999; Neal et al., 1994; O’Donnell, Creamer et al., 2008; Prins et al., 2003; Weathers, Litz, Herman, Huska, & Keane, 1993; Weathers et al., 1996). In the interest of space we are unable to discuss all of the instruments included in Table 2, but additional information regarding some of the most widely used and/or innovative instruments is presented below.

Early studies, including the NVVRS, used two self-report instruments to screen for PTSD: the 15-item Impact of Events Scale (Horowitz et al., 1979) and the 35-item Mississippi Scale (Keane et al., 1988). The Mississippi Scale was ultimately the biggest contributor to the diagnostic algorithm developed to establish prevalence in the NVVRS. More recently, the PCL has emerged as the standard self-report instrument for screening military and veteran populations (Weathers et al., 1993). The PCL includes 17 items which align with *DSM-IV* criteria and assess symp-
<table>
<thead>
<tr>
<th>Name</th>
<th>No. of items</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Efficiency</th>
<th>Item structure and description</th>
<th>Cutoff score</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTSD Checklist (PCL) (Blanchard et al., 1996; Weathers et al., 1993)</td>
<td>17</td>
<td>0.78–0.94</td>
<td>0.83–0.86</td>
<td>0.83–0.90</td>
<td>Rate how much specific problems have bothered patient in the past month ranging from 1 (not at all) to 5 (extremely)</td>
<td>Varies</td>
</tr>
<tr>
<td>Primary Care Posttraumatic Stress Disorder Screen (PC-PTSD) (Prins et al., 2003)</td>
<td>4</td>
<td>0.78</td>
<td>0.87</td>
<td>0.85</td>
<td>Indicate presence/absence of nightmares, avoidance, hypervigilance, and numbness in the past month resulting from a traumatic event</td>
<td>3</td>
</tr>
<tr>
<td>Davidson Trauma Scale (DTS) (Davidson et al., 1997)</td>
<td>17</td>
<td>0.69</td>
<td>0.95</td>
<td>0.83</td>
<td>Rate frequency/severity of each symptom in the past week from 0 = not at all to 4 = every day/ extremely distressing. Reexperiencing symptoms are tied to a specific event.</td>
<td>40</td>
</tr>
<tr>
<td>Startle, Physiological arousal, Anger, and Numbness (SPAN) (Meltzer-Brody et al., 1999)</td>
<td>4</td>
<td>0.84</td>
<td>0.91</td>
<td>0.88</td>
<td>Rate frequency/severity of symptoms from 0–4</td>
<td>5</td>
</tr>
<tr>
<td>Screen for Posttraumatic Stress Disorder (SPTSS) (Carlson, 2001)</td>
<td>17</td>
<td>0.94</td>
<td>0.60</td>
<td></td>
<td>Rate frequency of symptoms over the past two weeks from 0 (never) to 10 (every day)</td>
<td>4</td>
</tr>
<tr>
<td>Impact of Event Scale (IES) (Horowitz et al., 1979; Neal et al., 1994)</td>
<td>15</td>
<td>0.89</td>
<td>0.88</td>
<td>0.88</td>
<td>Rate frequency of symptoms in past week (not at all, rarely, sometimes, and often) in response to a specific life event</td>
<td>35</td>
</tr>
<tr>
<td>Mississippi PTSD Scale (Keane et al., 1988)</td>
<td>35</td>
<td>0.93</td>
<td>0.89</td>
<td>0.90</td>
<td>Items rated on a five-point scale (responses vary by item), time period “since the event”</td>
<td>107</td>
</tr>
<tr>
<td>Single Item PTSD Screen (SIPS) (Gore et al., 2008)</td>
<td>1</td>
<td>0.76</td>
<td>0.79</td>
<td></td>
<td>“Not bothered at all,” “bothered a little,” or “bothered a lot” by a past traumatic experience</td>
<td></td>
</tr>
<tr>
<td>War-Zone Related PTSD Scale (WZ-PTSD) (Brewin, 2005; Weathers et al., 1996)</td>
<td>25</td>
<td>0.87–0.90</td>
<td>0.65–0.72</td>
<td>0.81–0.82</td>
<td>Rate current PTSD symptoms (occurring in the past 7 days) on a five-point scale</td>
<td>1.3</td>
</tr>
</tbody>
</table>
toms during the past month, using a scale from 1 (not at all) to 5 (extremely). A positive screen for PTSD is typically determined based on either a cutoff score (e.g., a score of 50 or higher) or DSM criteria (i.e., the presence of one reexperiencing symptom, three avoidance symptoms, and two arousal symptoms), or a combination of both criteria (Hoge et al., 2007).

In a sample of Vietnam veterans, the PCL demonstrated excellent test–retest reliability (0.96) and internal consistency (0.97), and adequate sensitivity (0.82) and specificity (0.83) using a cutoff score of 50 (Weathers et al., 1993). However, more recent studies in veteran populations support the use of a lower cutoff for the PCL (Bliese et al., 2008; Yeager, Magruder, Knapp, Nicholas, & Frueh, 2007); Yeager et al. (2007) reported a sensitivity and specificity of 0.81 using a cutoff of 31, versus a sensitivity of 0.53 and a specificity of 0.95 using a cutoff of 50, while a recent study by Dunn et al. (2011) reported an optimal cutoff of 44 based on a receiver operating characteristic curve, with a sensitivity of 0.81 and a specificity of 0.83. Differences in the sensitivity and specificity for a given cutoff score and the optimal cutoff score across studies may be attributable to population characteristics such as the severity of PTSD symptoms, the interrater reliability of the screening instrument, or differences in the “gold standard” diagnostic assessment to which the screening instrument is compared (Warner, 2004). Because it is a relatively brief measure, the PCL is easily implemented in survey studies and has been widely used in military (Hoge et al., 2004; Smith et al., 2008) and veteran populations (Hoge et al., 2007; Kline et al., 2010) as a measure of probable PTSD and PTSD symptom severity. In addition, a brief screening instrument has been derived from the PCL (Lang & Stein, 2005).

The Davidson Trauma Scale consists of 17 items, with self-ratings of both frequency and severity for each symptom on a five-point scale (Davidson et al., 1997). It has been validated for use in military and veteran populations (McDonald, Beckham, Morey, & Calhoun, 2009) and demonstrated adequate test–retest reliability (0.86) and internal consistency (0.97–0.99) in a mixed trauma sample of 353 individuals, including 110 male war veterans (Davidson et al., 1997). In a study of U.S. veterans who served after September 11, 2001,
a cutoff score of 32 resulted in a sensitivity of 0.97, a specificity of 0.91, and an overall efficiency of 0.94 (McDonald et al., 2009).

A general trend in screening instrument development is the drive to create measures that are as brief as possible but still retain excellent psychometric properties. This, coupled with the fact that PTSD is commonly unrecognized in primary care settings, led to the development of the PC-PTSD, a brief screening tool for PTSD that is easily administered and scored by non-mental health professionals (Prins et al., 2003). The PC-PTSD consists of four items that assess symptoms of reexperiencing, numbing, avoidance, and hyperarousal (Prins et al., 2003). In a validation study conducted among 352 postdeployment soldiers, Bliese et al. (2008) reported a weighted sensitivity and specificity of 0.76 and 0.92, respectively, using a cutoff score of 3.

The Startle, Physiological Arousal, Anger, and Numbness instrument is another four-item self-report measure developed from the severity items of the Davidson Trauma Scale (Meltzer-Brody et al., 1999). Among veterans seen in a VA primary care setting, the sensitivity and specificity were 0.74 and 0.82, respectively, using a cutoff score of 5 and comparing the results to the Clinician-Administered PTSD Scale (Yeager et al., 2007).

Gore and colleagues (2008) recently developed a single-item PTSD measure with a three-point response scale ranging from “not bothered” to “bothered a lot.” However, the psychometric properties of the single-item measure were inferior to the four-item PC-PTSD: the sensitivity and specificity in a military primary care setting were 0.76 and 0.79, respectively, for those who were “bothered a little” by a past traumatic experience. In contrast, the PC-PTSD had a sensitivity of 0.91 and a specificity of 0.84 in this population, based on a cutoff score of 2 (Gore et al., 2008).

Screening for PTSD resulting from pre-military or military sexual trauma. In addition to combat, PTSD symptoms among veterans and military personnel may originate from pre-military or military sexual trauma. VA surveillance data suggest that 22% of females and 1% of males experience sexual trauma while in the military (Suris & Lind, 2008); however, estimates vary across studies and the true prevalence may be even higher because of underreporting (Suris & Lind, 2008; Valente & Wight, 2007). Given the scope of the problem, specific screening measures have been developed to assess PTSD symptoms related to military sexual trauma. For example, the VHA implemented universal screening for military sexual trauma using a two-item instrument, which has been successful in identifying individuals for referral to mental health services (Kimerling et al., 2007; Kimerling, Street, Gima, & Smith, 2008). Both questions have high sensitivity (0.89 – 0.92) and specificity (0.89 – 0.90), compared with a clinical interview, and a positive screen has been associated with a significantly increased odds of PTSD (adjusted odds ratio = 8.83 for women and 3.00 for men) (Kimerling et al., 2007).

Screening for PTSD in women and racial/ethnic minorities. As noted above, military sexual trauma is an important consideration when screening women for PTSD. Screening instruments should be designed to accurately diagnose PTSD regardless of the gender or race/ethnicity of the individual being screened, and the reliability and validity of instruments should be assessed in diverse populations (Frueh et al., 1998). Because several studies have reported racial/ethnic differences and a high prevalence of PTSD among minority veterans (Frueh et al., 1998; Loo et al., 2005; Seal et al., 2007), validation studies of current and future screening instruments should include adequate numbers of minority participants to ensure the representativeness of relevant domains and items in minority respondents.

Predictive assessments for risk of developing PTSD. Although symptom-based PTSD screening instruments may help to reduce morbidity related to PTSD by allowing for earlier intervention, they are limited by their inability to prevent the onset of PTSD in individuals exposed to trauma. Recent research suggests that measures designed to quantify information about risk and resilience factors for PTSD can be used to identify asymptomatic, trauma-exposed individuals who are more likely to develop PTSD. O’Donnell and colleagues developed a screening tool that identifies hospitalized adults at high risk of PTSD or major depression (O’Donnell, Creamer et al., 2008). In this study, 527 civilians hospitalized with nonlethal injuries answered questions related to 13 risk factors for PTSD. Patients were assessed 12 months later for the presence of PTSD or major
depression. Responses from half of the participants were used in factor analyses to derive the 10-item Posttraumatic Adjustment Scale, which was then validated in the remaining participants. After 12 months, 8% of participants had developed PTSD, and the scale had moderate sensitivity (0.82) and specificity (0.84) when predicting PTSD diagnoses (O’Donnell, Creamer et al., 2008).

In another recent study, Marx et al. (2008) used data from 1,081 Vietnam era veterans to develop and test a similar screening instrument for combat-related PTSD. Participants completed self-report measures and structured interviews for PTSD and supplied information on risk and resilience variables. Participants were divided into three subsamples, two of which were used to identify variables that differentiated between individuals with and without PTSD. Twelve risk and resilience items were included in the resulting PTSD Statistical Prediction Instrument, which was validated using the remaining subsample. This instrument displayed adequate sensitivity (0.86) and moderate specificity (0.77) in the validation sample, using a cut-off score of 6, and strong internal consistency (0.84) (Marx et al., 2008). These results suggest that primary prevention of PTSD may be possible in military and veteran populations, which would be expected to result in improved outcomes and decreased health care utilization by PTSD patients.

Psychophysiological screening. In addition to traditional questionnaire-based assessments, some research suggests that psychophysiological testing, such as the acoustic startle response and heart rate variability, may have potential applications for PTSD screening. Several studies have reported that veterans with PTSD have decreased heart rate variability (Tan, Dao, Farmer, Sutherland, & Gervirtz, 2011; Tan et al., 2009) and a heightened acoustic startle response (Butler et al., 1990; Morgan, Grillon, Southwick, Davis, & Charney, 1996; Orr, Lasko, Shalev, & Pitman, 1995), raising the possibility that these measures could be used to identify individuals with undiagnosed or preclinical PTSD. However, the use of biological assays and psychophysiological methods for assessment and screening is still in the early developmental stages and additional research on the utility of these measures for screening purposes is needed.

Risks and limitations of screening instruments. Despite the intense effort and interest in developing methods to screen for symptoms of PTSD in military and veteran populations, all of the current methods have inherent limitations. For example, all self-report scales may be vulnerable to response bias from various sources (Elhai, Frueh, Davis, Jacobs, & Hammer, 2003). Concerns about the potential implications of positive (or negative) screening results may lead to over- or underreporting of symptoms, depending on the individual and circumstances of testing. In addition, reliance on a single measure or assessment methodology may lead to inaccurate diagnosis in many cases and a large number of false positives and negatives.

As a result of these limitations, it has become standard practice to use multiple methods and measures to better inform diagnostic decisions (Weathers, Keane, & Foa, 2009). Such multimethod assessment of PTSD takes advantage of each individual measure’s relative strengths, overcoming the potential psychometric limitations of any single instrument and maximizing correct diagnostic decisions. On the other hand, the use of multiple assessment methods reduces cost efficiency and increases the respondent and clinician burden in proportion to the number of instruments used. In determining cut points or criteria for further evaluation, it is generally preferable to err on the side of increased sensitivity, rather than specificity, in the use of such screeners. All other things being equal, a modest number of false positives may be acceptable on the initial shorter screening measure, followed by perhaps longer but increasingly accurate and specific measures. For instance, Felker and colleagues (Felker, Hawkins, Dobie, Gutierrez, & McFall, 2008) used the four-item PC-PTSD followed by the longer PCL. Other researchers found that using a composite measure, created from various self-report symptom-based measures, led to increased diagnostic accuracy, compared with the use of several individual measures (Wright et al., 2007).

Additional resources for clinicians. In addition to the references noted above and those included in Table 2, several resources related to PTSD screening are available through the VA. The VA/DoD Clinical Practice Guideline for the Management of Post-Traumatic Stress (Department of Veterans Affairs, 2004) includes information on PTSD screening and treatment,
as well as monitoring and follow-up of patients with potential PTSD. The VA National Center for PTSD website (Department of Veterans Affairs, 2011) includes extensive resources on PTSD for both clinicians and researchers, including an overview of PTSD screening instruments.

Discussion

Although numerous symptom checklists and self-administered questionnaires have been developed, there is no compelling evidence that one screening instrument outperforms the others in veteran and military populations. Several instruments have adequate psychometric properties and have been used successfully to screen for PTSD in active duty military personnel and veterans. In general, short measures seem to do as well as longer questionnaires and therefore should be used whenever possible to decrease the time and effort required to screen for PTSD. When appropriate, short screening instruments may be followed by longer measures with greater specificity to decrease the number of false positive screens. Continued evaluation of new and existing screening measures, and in particular validation against more rigorous diagnostic methods, is needed to ensure that the screening measures in use are detecting cases of probable PTSD while minimizing the number of missed diagnoses.

Screening programs such as those implemented by the DoD and VA have been successful in identifying individuals with presumptive or probable PTSD. Individuals who screen positive are then referred for further clinical assessment and diagnostic evaluation by a mental health professional, who might also provide treatment of the disorder as needed. By detecting and treating patients as soon as possible after the onset of symptoms, screening may contribute to a shorter duration of disease and more favorable outcomes (Kessler et al., 1995). In addition, screening instruments have been used in large-scale surveys to evaluate the prevalence of key symptoms of PTSD before and after deployment, and to identify subgroups of individuals at increased risk for PTSD and related conditions, such as substance abuse and depression. However, despite the potential benefits of screening, there are also several limitations. Current screening programs detect symptoms of PTSD in individuals who already show signs of the disorder; therefore, these programs may lead to earlier diagnosis and treatment, but may not prevent the onset of PTSD symptoms. Although some research has evaluated the effectiveness of predeployment screening, the question remains as to whether screening asymptomatic individuals can result in accurate identification of a sufficient number of military personnel at risk for future PTSD, and whether those who screen positive are more likely to obtain and benefit from services. Rona and colleagues found little benefit of predeployment screening for predicting subsequent onset of PTSD, in part because of the low prevalence of PTSD in the sample (Rona et al., 2006). Additional limitations of screening include the fact that individuals with symptoms of PTSD may be less likely to participate in screening programs (Rona, Jones, French, Hooper, & Wessely, 2004) or seek treatment (Sayer et al., 2009). These findings raise serious concerns, as the individuals with greatest need of diagnosis and treatment may be least likely to receive it.

Further, individuals exposed to military-related trauma may have multiple adverse effects, and PTSD may not be the most immediate concern after trauma exposure. For example, in a recent study of British troops deployed to Iraq or Afghanistan the prevalence of probable PTSD was only 4%, compared with 13% for alcohol abuse and 20% for symptoms of other psychiatric disorders (Fear et al., 2010). However, several studies have reported an increase in PTSD prevalence with increasing time since return from deployment (Bliese et al., 2007; Kang, Li, Mahan, Eisen, & Engel, 2009; Mil liken et al., 2007), suggesting that continued surveillance and screening for PTSD are needed.

In summary, PTSD is a potentially disabling mental disorder that is common among active duty military personnel and veterans. Prevalence studies and large scale screening programs have helped to define the scope of the problem in military and veteran populations, while epidemiologic studies have improved our understanding of the etiology of the disorder and the characteristics of those at highest risk. Although research and interest in this field has grown in recent years, there is still much to be learned about the risk, detection, natural history, and treatment of PTSD. In particular, prospec-
tive studies of military cohorts that begin before deployment and follow individuals for trauma exposure and its sequelae will help to improve our understanding of the epidemiology and detection of PTSD, while longitudinal registries of PTSD patients will help to elucidate the most effective treatment regimens and other factors influencing recovery. Given the debilitating nature of the symptoms of PTSD and the seriousness of the associated medical conditions, additional research on PTSD should be an area of high priority.

References


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