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Informing Evidence-Based Assessment of ADHD in Veterans and Service Members

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Attention-deficit/hyperactivity disorder (ADHD) is diagnosed in approximately 2.5% to 5% of the population, and though epidemiological studies of ADHD in veterans and service members are lacking, available evidence suggests that there may be a higher prevalence of ADHD in service members than in the general population. Assessment of ADHD in military populations is complicated by the higher prevalence rates of many other disorders with symptoms that overlap those of ADHD (e.g., posttraumatic stress disorder), making differential diagnosis an important aspect of the evaluation of ADHD. Although the diagnostic interview remains the gold standard for the evaluation and diagnosis of ADHD with adults, several different types of psychological measures have been developed and validated that can aid the evaluation. Future epidemiological research focused on prevalence and comorbidity rates in military samples is warranted to better understand the scope and complexity of the diagnosis. In addition, continued study of diagnostic assessment techniques, including validity testing and neurocognitive performance of veterans and service members with ADHD, particularly postdeployed veterans pursuing higher education, is warranted. This article reviews relevant findings and identifies initial recommendations for clinicians and researchers.

Keywords: veteran, military, ADHD, assessment

Attention-deficit/hyperactivity disorder (ADHD) has increased steadily in diagnosis, research attention, and academic debate since it was formally defined in the *Diagnostic and Statistical Manual of Mental Disorders*, 3rd ed. (*DSM-III*; American Psychiatric Association

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[APA], 1980). More recently, increasing attention has focused on ADHD in adulthood. Prevalence estimations of ADHD in adults range from 2.5% to 5%, and common correlates include being male, non-Hispanic White, unemployed, and previously married (Kessler et al., 2006; Simon, Czobor, Bálint, Mészáros, & Bitter, 2009; Willcutt, 2012). Epidemiological data on ADHD in veterans and service members have been less established. A self-report survey of nondeployed soldiers in the United States Army revealed that ADHD was the third most prevalent psychological disorder (7.0%; Kessler et al., 2014). Other studies of veterans and military personnel have reported ADHD in 10% to 62% of various types of samples (Adler, Kunz, Chua, Rotrosen, & Resnick, 2004; Hanson et al., 2012; Harrington et al., 2012; Kosasih, Hammeke, Graskamp, & Owsiany, 2015; Lomas & Gartside, 1997); however, those studies involved small sample sizes and commonly relied solely on screening measures to establish an ADHD diagnosis (see Table 1 for full list of studies).

The pathophysiology of symptoms in ADHD is not completely understood. Although ADHD is conceptualized as a central nervous system disorder, the literature has been inconsistent in elucidating the specific neuropsychological deficits and/or brain systems that may underlie observed symptoms. Most models have focused on the role of the prefrontal cortex and striatum in the development and maintenance of symptoms of ADHD due to the observed behavioral correlates of frontal lobe lesions and the efficacy of stimulant medications (Halperin & Schulz, 2006). Douglas and colleagues (1988, as cited in Barkley, 1997) described four major deficits in ADHD, including poor investment and maintenance of effort, deficient modulation of arousal to meet situational demands, strong inclination to seek immediate reinforcement, and difficulties with impulse control; she believed these arose from a general impairment in self-regulation. Barkley (1997) later described poor behavioral inhibition as the central deficiency in ADHD and proposed that inhibitory ability is necessary for normal working mem-

Table 1
ADHD Studies Using Veteran or Military Samples

Study	Sample	*n*	ADHD evaluation	ADHD prevalence	Study purpose	Analysis
Adler et al. (2004)	Veteran	47	K-SADS and "*DSM-IV* criteria"	17.0%	Relation between PTSD vs. panic and ADHD	χ^2
Hanson et al. (2012)	Military	260	ASRS	10.4%	ADHD comorbidities	Correlation, *t* tests
Harrington et al. (2012)	Veteran	222	ACDS v1.2	11.0%	Relation between PTSD and ADHD	Regression, CFA
Ivanov & Yehuda (2014)	Military and veteran	—	—	—	Review	Systematic review
Kessler et al. (2006)	Military	5,428	CIDI-SC	7.0%	Prevalence estimates	Epidemiological
Kosasih et al. (2015)	Military and veteran	690	History and problem list	10.6%	ADHD and comorbidities in TBI sample	χ^2, Fisher, *t*-tests
Lomas & Gartside (1997)	Veteran	81	4-Item screen	61.7%	ADHD in homeless veterans	Epidemiological
Lomas & Gartside (1999)	Outpatient with veterans	114	WURS, WURS-25, Hallowell-Ratey, WPRS	50.0%	Prevalence estimates	Epidemiological

Note. ADHD = Attention deficit/hyperactivity disorder; K-SADS = Kiddie SADS Present Episode Version; *DSM* = *Diagnostic and Statistical Manual of Mental Disorders*; PTSD = posttraumatic stress disorder; ASRS = Adult ADHD Self-Report Scale; ACDS = Adult ADHD Clinical Diagnostic Scale; CIDI-SC = Composite International Diagnostic Interview Screening Scale; WURS = Wender Utah Rating Scale; WPRS = Wender Parental Rating Scale, CFA = confirmatory factor analysis.

ory, internalization of speech, self-regulation of affect, motivation, arousal, reconstitution, and motor control. Others have noted slow and variable reaction time (RT), which many assume is linked to underlying neural dysfunction (Castellanos & Tannock, 2002). Due to frontal involvement reported in ADHD, assessment commonly focuses on executive function as much as attention abilities (see meta-analysis by Boonstra, Oosterlaan, Sergeant, & Buitelaar, 2005). In contrast, another meta-analysis suggested that although executive dysfunction is common in ADHD, "the magnitude of the effect sizes and the proportion of individuals demonstrating such impairments raise questions about the veracity of the hypothesis that executive function deficits are the root cause of ADHD for all or even most cases" (Halperin & Schulz, 2006, p. 562). Further, a meta-analysis looking at functional neuroimaging identified dysfunction in several areas of the motor inhibition network, with persistence of functional abnormalities of the caudate in adults (Lei et al., 2015). Thus, mechanisms of cerebral dysfunction in ADHD continue to be an active area of research, and the disorder remains a behavioral syndrome.

Prior to 2004, individuals with a preexisting diagnosis of ADHD were not eligible for military service (see *Medical Standards for Appointment, Enlistment, or Induction in the Military Services*; United States Department of Defense [DoD], 2004). Medical standards issued in 2004 permitted individuals with ADHD to enlist if they could demonstrate passing academic performance without the use of medication in the previous 12 months. In 2010, restrictions were tightened: An individual diagnosed with ADHD could enlist only if he or she met an additional six criteria (e.g., "no history of comorbid mental disorders;" DoD, 2010). In spite of changing standards, the prevalence of ADHD in veterans and active-duty soldiers is currently uncertain. ADHD in Afghanistan and Iraq veterans is of particular relevance as many service members use United States Veterans Affairs (VA) educational benefits, and ADHD is associated with poor educational outcomes (Biederman et al., 2008; Kuriyan et al., 2013). In fiscal year 2013, 1,091,044 individuals received veteran educational benefits, more than double the amount in 2008 and earlier (United States Department of Veterans Affairs, 2013), but between 2002 and 2010 only about half of those who initially used GI Bill benefits attained a degree (Cate, 2014). Additional considerations for assessment of ADHD in military populations are reviewed in Hess, Kennedy, Hardin, & Kupke's (2010) chapter and a review paper by Ivanov and Yehuda (2014). Of note, medical records in United States Veterans Affairs Medical Center (VAMC) facilities can typically access military records that might describe ADHD and military evaluations (e.g., psychological assessments); however, older records may not be available, and civilian records useful in diagnosis may not exist in the system.

Several issues may complicate the accurate diagnosis of ADHD in veteran and military cohorts. First, many ADHD symptoms are nonspecific and present in other psychological disorders common in military populations. For example, posttraumatic stress disorder (PTSD) includes the symptom of "problems with concentration" as one of the 20 inclusion criteria (APA, 2013). Second, the ADHD diagnosis is based on self-report of current and historical symptoms. Retrospective symptom report is susceptible to errors in memory, and the changing presentation of symptoms over the life span can make an accurate diagnosis difficult. Third, many who struggled in school might have improved functioning in the structured military environment, but find problems reemerging in the transition out of military life. This variable course can further impede accurate diagnosis. Finally, although cognitive testing is not required for diagnosis, neuropsychologists are commonly asked to evaluate ADHD and make treatment recommendations; however, there is no distinct ADHD profile, and comorbid conditions common to veterans may complicate differential attribution of underlying deficits. Thus, the primary aim of this paper is to review ADHD research focusing on veterans and service members, and more broadly, adults and assessment, to integrate relevant research to provide tentative recommendations for evidence-based ADHD assessment with military populations.

ADHD in Adults

ADHD is considered a neurodevelopmental disorder; thus when evaluating adults for ADHD, several symptoms must have been present since childhood. The release of the *DSM–5*

in 2013 (APA, 2013) resulted in two notable changes to the diagnostic criteria for ADHD that apply specifically to adults. First, only five of the nine symptoms of inattention and/or five of nine symptoms of hyperactivity–impulsivity are required for diagnosis in adults (six were required previously and six are still required for children). Second, "several" symptoms must have been present before age 12 (compared with age 7 previously; APA, 2013, p. 60). As before, the symptoms must present in at least two settings and impair social, academic, and/or occupational functioning. Although ADHD in adults was not evaluated in either *DSM–IV* (APA, 2000) or *DSM–5* field trials, Matte and colleagues (2015) evaluated the criteria with a sample of 4,000 18- to 19-year-olds from the Pelotas Birth Cohort Study. Results suggested that a single, general factor underlies the disorder; however, both attention and hyperactive factors contributed additional unique variance, with attention symptoms predominating the adult presentations. In addition, the authors noted a 27% increase in prevalence of ADHD in their sample from *DSM–IV* criteria to *DSM–5* criteria. This increase was most strongly related to the changed age of onset requirement rather than the reduced number of required symptoms. There were no differences between groups diagnosed using *DSM–IV* or *DSM–5* in terms of gender, level of impairment, or prevalence of comorbid anxiety disorders; however, the *DSM–5* group had a higher level of comorbid mood disorders.

As individuals with ADHD age, motoric hyperactivity symptoms often remit, while symptoms related to restlessness, inattention, planning deficits, and impulsivity often remain (APA, 2013). Notably, academic difficulties persist into adulthood and result in fewer years of education and a reduced likelihood of attending college (Barkley, 2006; Kuriyan et al., 2013). A longitudinal study revealed that participants with ADHD completed 2.5 fewer years of education, had lower graduation rates, and were less likely to obtain a college degree (Klein et al., 2012). Biederman and colleagues (2008) found that adults with ADHD attained both lower levels of education than predicted based on intellectual abilities, and lower occupational levels than predicted based on educational attainment. Occupationally, adults with persisting symptoms of ADHD attain lower socioeconomic status (SES) and make on average $40,000 less than those without ADHD (Barkley, 2006; Klein et al., 2012). Adults with ADHD report higher levels of termination or lay-offs, and their supervisors rate their performances more poorly than those without ADHD (Barkley, 2006). It is unclear if these differences translate to military settings (e.g., lower rank attainment, poorer performance in trade schools, etc.), or if veterans with ADHD encounter similar issues following discharge.

Adults with a predominately hyperactive–impulsive presentation report increased difficulty maintaining friendships, difficulties in romantic relationships, and more risky sexual behavior, resulting in increased pregnancy rates, younger age at first sexual contact, more sexual partners, and higher rates of sexually transmitted infection (Barkley, 2006; Flory, Molina, Pelham, Gnagy, & Smith, 2006). They endorse higher levels of risky driving, including more speeding tickets, collisions and scrapes, vehicular or hit-and-run accidents; more incidents of reckless driving infractions, traffic citations, driving without a license, and suspended or revoked driving privileges; and poorer steering control and variability (Barkley, 2006; Jerome, Segal, & Habinski, 2006; Thompson, Molina, Pelham, & Gnagy, 2007). Research has consistently revealed increased risk of substance-use disorders, criminal activity, and antisocial personality disorder (Barkley, 2006; Klein et al., 2012). Despite these outcomes, evidence suggests that interventions help improve symptoms and functioning (Surman, Hammerness, Pion, & Faraone, 2013), further highlighting the need for thorough evaluation of ADHD, though again, these factors apply to adults more broadly and have not yet been elucidated in veteran samples specifically.

Comorbidities in Veterans

Traumatic Brain Injury (TBI)

A total of 347,962 TBIs were reported in United States service members between 2000 and the first quarter of 2016, 82.3% of which were mild in severity (U.S. Defense & Veterans Brain Injury Center, 2016). Processing speed, attention, and executive functions are often transiently impaired immediately following mild TBI and deficits may persist for longer

periods or indefinitely following moderate to severe TBI. Kosasih and colleagues (2015) found that 10.6% of 690 VA Polytrauma Clinic referrals had evidence of an ADHD diagnosis in the medical records. Of note, veterans with ADHD history were no more likely to have a history of premilitary or military TBI than those without ADHD. It is possible that persisting effects following TBI could interact with premorbid neurodevelopmental deficits in attention, but this has not been investigated empirically. Moreover, diagnostic criteria for ADHD are nonspecific. For example, distractibility, difficulty sustaining attention, and forgetfulness may be present in ADHD or anyone with disrupted cerebral function, including TBI, rendering differential diagnosis difficult. Key differential factors involve onset and course: ADHD would not be expected to begin only following an injury, and TBI symptoms typically improve over time, whereas ADHD symptoms would be expected to remain relatively stable. In addition, TBI may be accompanied by neurological signs, especially temporal to the injury, that are not part of ADHD criteria (e.g., vision issues, headache, balance problems, alterations in consciousness).

PTSD

In a recent study of over 5,000 soldiers, 8.6% met criteria for PTSD, which was the most common internalizing disorder (Kessler et al., 2014). Adults with ADHD have significantly higher rates of PTSD than those without ADHD (Kessler et al., 2006; Antshel et al., 2013), and conversely, adults with PTSD have significantly higher rates of ADHD (Kessler et al., 2006). Similar to TBI, there is significant overlap between ADHD and PTSD. For example, carelessness or one's mind wandering, both inattentive symptoms, might also occur secondary to re-experiencing symptoms or hypervigilance. Key differential factors between ADHD and PTSD may include onset of symptoms (e.g., began following a trauma), relationship to triggers or traumatic material, or association with hypervigilance. Symptoms of ADHD have been shown to be significantly related to severity of PTSD in veterans (Hanson et al., 2012; Harrington et al., 2012). One small study ($n = 47$) found that 36% of veterans with PTSD met childhood criteria for ADHD, compared with only 9% of the veterans with panic disorder, suggesting that ADHD may be a risk factor for the subsequent development of PTSD (Adler et al., 2004).

Mood, Anxiety, and Substance-Use Disorders

A survey of adults in the United States found that individuals with ADHD had higher rates of anxiety (47.1% vs. 19.5%), mood (38.3% vs. 11.1%), and substance-use disorders (15.2% vs. 5.6%) than those without ADHD (Kessler et al., 2006). Prevalence rates from a cross national study of adults with ADHD showed similar rates of comorbid anxiety (38.1%), mood (24.8%), and substance-use (11.1%) disorders (Fayyad et al., 2007). In studies of adults with bipolar disorder, 9.5 to 21.2% had comorbid ADHD (Wingo & Ghaemi, 2007). Several symptoms of ADHD and (hypo)mania are similar (e.g., more talkative than usual, distractibility, restlessness, decreased social inhibitions), and symptoms of ADHD may be mistakenly attributed to (hypo)manic symptoms leading to underdiagnosis of comorbid ADHD (Klassen, Katzman, & Chokka, 2010). Diagnostic differentiation can be complicated, and the diagnoses are best distinguished by symptom onset and duration (e.g., symptoms present only during a hypo/manic episode; Wingo & Ghaemi, 2007). The course of bipolar disorder is distinct when a comorbid ADHD diagnosis is present, and is related to a higher proportion of Bipolar I classifications, higher incidence of manic episodes, and lower compliance with treatment (Klassen et al., 2010). ADHD generally differs from major mood disorders in that mood disorders are episodic compared with the relatively consistent nature of symptom presentation in ADHD.

Research findings have suggested that a diagnosis of ADHD in childhood or adolescence increases the risk of developing major depressive disorder through early adulthood (Meinzer et al., 2013), and this relationship appears to continue into older adulthood (Michielsen et al., 2013). Reports have suggested that approximately 13.7% of veterans deployed to Iraq or Afghanistan met criteria for probable major depressive disorder (Schell & Marshall, 2008). Depressive disorders may have overlap with ADHD predominantly due to inattentive symptoms; however, inattention in depression is likely to be accompanied by rumination and

negative cognitions. Again, symptoms associated with ADHD would be expected to remain following remission of the depressive episode.

Adult ADHD is also highly comorbid with anxiety disorders (Kessler et al., 2006). Anxiety disorders such as generalized anxiety disorder may present with impaired concentration and restlessness similar to ADHD; however they are often characterized by excessive worry and result in somatic symptoms (e.g., muscle tension, sleep disturbance, fatigue; Mao & Findling, 2014). As with depressive symptoms, there is evidence that the relationship between ADHD diagnosis and comorbid anxiety symptoms persists into older adulthood (Michielsen et al., 2013). In addition, veterans returning from war zones may experience a transient period of readjustment during the initial transition from theater to garrison or civilian life. These problems may appear similar to or compound preexisting ADHD symptoms. Anxiety disorders may overlap with ADHD in both inattentive and hyperactive/impulsive domains, but worry (generalized anxiety), intensity with time-limited course (panic), and focus of anxiety (phobia) might best differentiate anxiety disorders from symptoms attributable to ADHD.

Substance-use disorders are found in a disproportionately high number of veterans (Kessler et al., 2014), and also have a high incidence of comorbidity with ADHD (Kessler et al., 2006). Lifetime substance-use disorder rates were higher in those diagnosed with ADHD as children (43.3%) than those without a diagnosis (25.0%; Nogueira et al., 2014). ADHD is associated with alcohol-use disorders, and nicotine use and dependence in all three ADHD subtypes (De Alwis, Lynskey, Reiersen, & Agrawal, 2014). In addition, subthreshold ADHD was correlated with substance-use and substance-dependence disorders (De Alwis et al., 2014). Temporality of symptoms related to substance use would best differentiate effects of substance intoxication or withdrawal from longer-standing developmental difficulties.

Sleep Disruption

Disturbances in sleep are common among service members, especially when deployed to combat zones. Hoge and colleagues (2008) reported sleep disturbance in 24% to 54% of soldiers returning from Iraq, and another cross-sectional study found that 56% of Afghanistan veterans were sleep deficient (Taylor et al., 2014). Sleep disruption was also related to increased risk of psychiatric disorders. Sleep problems are reportedly prevalent across diagnostic groups, and may extend beyond the effects of specific psychiatric diagnoses (e.g., sleep problems beyond nightmares in PTSD; Capaldi, Guerrero, & Killgore, 2011). Reduced sleep time and quality has been associated with cognitive deficits, including problems with simple attention and vigilance tasks (Wickens, Hutchins, Laux, & Sebok, 2015). It is thus possible that effects of chronic sleep disruption common to combat deployments may mimic ADHD in returning veterans. Chronic sleep disruption, as well as the effects on apnea, reflect key differentials in the diagnosis of ADHD in veterans and service members. Future research might include evaluations of long-term interactive effects of ADHD and sleep disruption in military samples.

ADHD-Specific Measures for Adults

Gold-standard evaluation of ADHD in children typically includes a thorough clinical interview, collateral interviews, review of medical and academic records, symptom questionnaires, and behavioral observations (Handler & DuPaul, 2005); similar multimethod approaches might inform evaluation of ADHD in adults. Symptoms associated with adult ADHD are commonly assessed using inventories completed by the patient, parent, family member, or spouse. A systematic review of available measures concluded that the Wender Utah Rating Scale–Short Form (WURS; Ward, Wender, & Reimherr, 1993) and the Conners Adult ADHD Rating Scale (CAARS; Conners, Erhardt, & Sparrow, 1999) demonstrated the strongest psychometric properties and were the most frequently researched (Taylor, Deb, & Unwin, 2011). Although the WURS has a long form available, the short version containing the 25 items with the best discriminative validity is often used. The Adult ADHD Self-Report Scale, Version 1.1 Symptom Checklist (ASRS; Adler et al., 2006) is available through the World Health Organization in multiple languages in a six-item screening version (Part A) and a full-length, 18-item version (Part B). Preliminary research has sug-

gested good psychometrics for both Part A and Part B (Taylor et al., 2011). The Caterino Scale (Caterino, Gómez-Benito, Balluerka, Amador-Campos, & Stock, 2009) has two parallel forms and assesses current symptoms across the home, work/school, and social settings. More recently, the Barkley Adult ADHD Rating Scale–IV has also been released (BAARS-IV; Barkley, 2011; see Becker et al., 2014 for a confirmatory factor analysis). The BAARS-IV is available as a brief screening or a long form. In addition to classic ADHD symptoms, the BAARS-IV assesses symptoms of sluggish cognitive tempo. Table 2 provides information comparing commonly used adult inventories. Of note, none of these scales has been systematically studied in veterans or service members, and wording in these inventories might not reflect the types of situations for which ADHD symptoms are problematic for military personnel.

Neuropsychological Assessment of Adult ADHD

The *DSM–5* ADHD diagnostic criteria (APA, 2013, p. 61) are based solely on symptom report, and APA specifically states that cognitive tests "are not sufficiently sensitive or specific to

Table 2
Select ADHD Symptom Scales for Adults

Scale	Items and Likert-scale range	Score	α	Reporter	Symptom period	Criteria used
Wender Utah Rating Scale (WURS)	61 item long form, 25 item short form; 0 (*not at all*) to 4 (*very much*)	Raw score	.69–.92	Self Informant	Childhood	Utah criteria
Conners Adult ADHD Rating Scale (CAARS)	66 item long version, 26 item short version; 0 (*not at all, never*) to 3 (*very much, very frequently*)	Sex and age normed *t* scores	.74–.92	Self Informant	Current	*DSM-IV* and Utah criteria
Adult ADHD Self-Report Scale-v1.1 Symptom Checklist (ASRS)	Part A 6 items, Part B 12 items; 0 (*never*) to 4 (*very often*)	Number of items rated above item-specific threshold	.63–89	Self	Current	*DSM-IV-TR*
Symptom Inventory (SI)	18 items; 0 (*not at all*) to 3 (*almost always*)	Cut-off score of 6 or more inattention or hyperactive/impulsive items	.91	Self	Past week	*DSM-IV*
Caterino Scale	18 items; 0 (*a little*) to 2 (*a lot*)	Inattention, impulsivity, hyperactivity, total scores	.81–.91	Self	Childhood–current	*DSM-IV*
Barkley Adult ADHD Rating Scale-IV (BAARS-IV)	Long form 18 questions rated from 0 (*never or rarely*) to 3 (*very often*), 10 impairment questions, 1 age of onset	Inattention, hyperactivity, impulsivity, total, SCT, ADHD symptom count	.91	Self	Childhood–past 6 months	*DSM-IV*

Note. ADHD = attention deficit/hyperactivity disorder; *DSM* = *Diagnostic and Statistical Manual of Mental Disorders*; SCT = sluggish cognitive tempo. Utah criteria from Wender, Reimherr, and Wood (1981). Cronbach's reliabilities from Table 4 in Taylor, Deb, and Unwin (2011), except for the BAARS-IV, which is from the manual (Barkley, 2011).

serve as diagnostic indices" (APA, 2013, p. 61). Many studies of ADHD describe disruption in normal brain function, and researchers have attempted to characterize this disruption using neuropsychological tests. Schneider and colleagues (2015) found a weak association between two self-report ADHD Symptom Checklists (the WURS; Ward et al., 1993 and the ASRS; Adler et al., 2006) and a number of objective neuropsychological measures, further suggesting limited utility of objective measures in diagnosis compared with self-report. Nonetheless, although a number of professionals are qualified to evaluate and diagnose ADHD, neuropsychologists are frequently asked to evaluate it. One survey mailed to members of neuropsychology-practice organizations in the United States found that ADHD was the sixth most frequent diagnostic group encountered, with 46.5% of neuropsychologists reporting that they frequently work with patients with that diagnosis (Rabin, Barr, & Burton, 2005).

A meta-analysis of 33 studies examining neuropsychological performance of adults with ADHD categorized cognitive domains into attention, response inhibition, other executive functions, memory, processing and motor speed, intelligence, and "other" (Hervey, Epstein, & Curry, 2004). Participants with ADHD performed more poorly across all domains, contrary to the theory that ADHD reflects executive dysfunction specifically. Two patterns were noted. First, those with ADHD performed poorer on verbal tests (e.g., California Verbal Learning Test) compared with visual tests (e.g., Wechsler Memory Scale–Revised, Visual Reproduction; Hervey et al., 2004). Second, effect sizes were larger for complex tasks (e.g., Trail Making Test Part B) than for simpler ones (e.g., RT tests; Hervey et al., 2004). Although the results of the meta-analysis ultimately support the lack of a distinct cognitive profile in ADHD, they also suggest that certain common neuropsychological tests might be useful in clinical practice and research, including tests of working memory, list learning, continuous performance, and executive functioning.

A different meta-analysis of 13 studies evaluating adults with ADHD revealed medium effect sizes for tests of both executive and nonexecutive functioning, again suggesting that impairments are not exclusive to executive functions (Boonstra et al., 2005). Due to the high rates of comorbidities in ADHD, the observed cognitive impairments could be attributable to other diagnoses. However, Silva et al. (2012) found that subjects with ADHD (N = 352) performed worse than those without ADHD (n = 94) after controlling for psychiatric comorbidities (mood disorders, anxiety disorders, and substance-use disorders). Therefore, individuals with ADHD appear to perform more poorly than those without ADHD on a wide range of neurocognitive measures, even after accounting for comorbid disorders.

In contrast, other research has challenged the presence of objective cognitive impairments in ADHD. A review by Woods and colleagues (2002) noted numerous methodological flaws in studies demonstrating differences in cognitive testing. In a small study (N = 90), subjects with ADHD performed more poorly than controls across a number of cognitive domains, but there were no significant differences between the ADHD and psychiatric groups (Walker, Shores, Troller, Lee, & Sachdev, 2000). A meta-analysis of 18 studies found that adults with ADHD performed worse than controls by an average of 2.94 IQ points, which was not clinically significant (Bridgett & Walker, 2006). In sum, there is mixed evidence that individuals with ADHD demonstrate any particular cognitive profile, but no studies were found examining neurocognitive functioning in veteran or military samples with ADHD.

Validity Assessment

Thorough validity assessment during neuropsychological evaluation is considered medically necessary and part of a gold-standard evaluation, even outside of the forensic context (Bush et al., 2005; Heilbronner et al., 2009). Validity tests have been delineated into symptom validity tests (SVT; measures exaggeration of symptom report) and performance validity tests (PVT; measures exaggeration of impairment on objective cognitive tests), and these measures have been found to be independent though not mutually exclusive (Van Dyke, Millis, Axelrod, & Hanks, 2013). There are many reasons for test invalidation including malingering, defined as the intentional exaggeration or feigning of symptoms for external incentive (APA, 2013). Evaluation of ADHD is potentially contextualized within the realm of sec-

ondary gain, as the diagnosis is often the basis for academic accommodations or treatment via Schedule-II stimulants (e.g., methylphenidate). In addition, many who are neurologically healthy pursue stimulant medications for use as cognitive enhancers. Current practice is not to prescribe stimulant medications without the presence of a neurological disorder, thus some may malinger for stimulants to use as nontherapeutic enhancers (see Allen & Strand, 2015; Smith & Farah, 2011). Therefore, validity assessment as part of an ADHD evaluation is especially crucial. It must be noted that an individual can both have ADHD and an invalid test performance: A diagnosis of malingering does not necessarily exclude the existence of ADHD symptomatology. No studies were found evaluating symptom or performance validity with veterans presenting for ADHD evaluation.

Although checklists are sensitive to number and severity of symptoms, they inadequately detect feigned ADHD (see Musso & Gouvier, 2014 for a review). Several studies have employed multiscale, self-report inventories instead. One simulation study used the Minnesota Multiphasic Personality Inventory–2 (MMPI-2) validity scales with a sample of college students (research volunteers and a clinical ADHD group; total $N = 103$; Young & Gross, 2011). A raw cut-off score of Infrequency – Psychopathology (Fp) ≥ 5 showed the best diagnostic accuracy (sensitivity = 59.4, specificity = 94.4). Another simulation study using college students ($n = 88$) found that the MMPI-2-Restructured Form (MMPI-2-RF) Infrequent Psychopathology Responses (Fp-r) was most sensitive to detecting feigned ADHD using a modified cut-off score of ≥ 77 T (sensitivity = 63.6, specificity = 90.0; Harp, Jasinski, Shandera-Ochsner, Mason, & Berry, 2011). Infrequent Responses (F-r) and Infrequent Somatic Responses (Fs) also showed modest sensitivity, though Symptom Validity (FBS-r) was not significantly different across groups and Response Bias (RBS) was not evaluated (Harp et al., 2011). A third study evaluated the use of Personality Assessment Inventory (PAI) validity indices (Negative Impression [NIM], Malingering Index [MAL], and Rogers Discriminant Function [RDF]) to identify feigned ADHD in a retrospective clinical sample ($N = 66$), with the feigned group identified by those who failed the Word Memory Test (WMT; Sullivan, May, & Galbally, 2007). None of the PAI indices displayed adequate sensitivity for detecting those in the feigned condition; however, as noted by Van Dyke et al. (2013), symptom and performance validity are independent constructs, which limits the applicability of these findings. In sum, symptom validity scales have shown promise in detecting feigned ADHD, but results are limited by small samples, methodological issues, lack of replication, and no studies with veterans or military personnel.

Because an ADHD diagnosis does not require objective cognitive impairment, PVTs may be less useful in evaluations for diagnostic clarity, but should be included if cognitive tests are used (Bush et al., 2005; Heilbronner et al., 2009). Studies on PVT use for ADHD in adults typically use college samples. For example, a retrospective study (Suhr, Hammers, Dobbins-Buckland, Zimak, & Hughes, 2008) found that college students who failed the WMT performed significantly poorer on measures of memory and executive functioning, compared with ADHD and psychological control groups. One simulation study (Sollman, Ranseen, & Berry, 2010) found that Trial 1 of the Test of Memory Malingering Trial (TOMM) was most sensitive (sensitivity = 86.7) to feigned ADHD, though other PVTs (e.g., Digit Memory Test, Letter Memory Test, and Non-Verbal Medical Symptom Validity Test) also showed promise. In summary, there are few studies on validity in the assessment of ADHD, and additional information is needed, despite some promise of various indicators (Musso & Gouvier, 2014; Tucha, Fuermaier, Koerts, Groen, & Thome, 2014); no studies were found on PVT use with veterans or service members presenting for ADHD evaluation.

Conclusion

Recommendations

Following are some initial recommendations for clinical work and research on ADHD with veterans and service members.

1. The diagnosis of ADHD continues to rely on behavioral symptom report. The *DSM–5* provides a number of adult-focused examples for inclusion criteria

(APA, 2013). Although multiple symptom questionnaires are available and can inform an evaluation, the psychiatric interview remains the basis for diagnosis. Use of additional examples pertinent to military environments (e.g., inattention when studying for advancement exams, infractions related to forgetfulness or carelessness) might be useful when interviewing veterans or service members.

2. Collateral information may be particularly useful in retrospectively assessing symptoms during childhood, and particularly if prior evaluations (especially from childhood), academic records, work performance measures, military medical records, and so forth are not available.
3. ADHD is commonly comorbid with other conditions. Impaired attention and concentration are nonspecific symptoms of many conditions; therefore, careful consideration of the effect of comorbid conditions on symptom presentation is essential. Specific to veterans and service members, key differential diagnoses include PTSD, effects of moderate to severe TBI, substance-use disorders, sleep disorders, anxiety, and depression.
4. Cognitive testing is not required as part of an ADHD diagnostic evaluation. However, if cognitive testing is included, tests of attention, executive functioning, and memory will likely provide the most relevant information. Results from cognitive tests will be most helpful in determining the effects of ADHD on functioning (i.e., strengths and weaknesses for treatment planning), but by definition should not be used as the basis for diagnosis.
5. Due to the potential presence of secondary gain (i.e., stimulant medications or academic accommodations), symptom and performance validity must be thoroughly evaluated. Validity measures have yet to be researched specifically in veteran or military samples with ADHD; test and cutoff selection must be inferred from research on adults and veterans more generally.

Limitations and Future Directions

In conclusion, although research on adults with ADHD is increasing, veterans and service members represent unique populations in which ADHD is not well understood. The best epidemiological data published reported a 30-day ADHD prevalence of 7% in nondeployed Army soldiers (Kessler et al., 2014); however, that estimate does not necessarily apply to service members of other branches, other cohorts, or those returning from recent conflicts. Future research might establish broader prevalence rates, as well as elucidate factors that might drive the veteran/military prevalence to be higher than the estimated adult prevalence of 2.5% in the *DSM–5* (APA, 2013). In addition, the effects of ADHD on military performance are not known at this time. Current research suggests an interaction between ADHD and PTSD (Adler et al., 2004; Harrington et al., 2012), and future studies should further evaluate this relationship and whether ADHD is a risk factor for developing PTSD later in life or if a third factor underlies both disorders. Self-report measures including problems unique to adult ADHD populations have been created (e.g., ASRS); however, parallel measures for military have not been produced and interviews might adjust wording of questions to be more relevant to the experiences of veterans and service members. Last, neuropsychological tests and validity measures specific to ADHD have not been validated in veteran or military samples, reflecting an important gap in current data. Additional research is warranted to elucidate prevalence, comorbidity issues, and assessment of ADHD with veterans and service members.

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