



## Research paper

# Psychiatric disorders moderate the relationship between insomnia and cognitive problems in military soldiers



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## ABSTRACT

**Background:** There has been a great deal of research on the comorbidity of insomnia and psychiatric disorders, but much of the existing data is based on small samples and does not assess the full diagnostic criteria for each disorder. Further, the exact nature of the relationship between these conditions and their impact on cognitive problems are under-researched in military samples.

**Method:** Data were collected from the All Army Study of the Army Study to Assess Risk and Resilience in Service members (unweighted  $N = 21,449$ ; weighted  $N = 674,335$ ; 18–61 years; 13.5% female). Participants completed the Brief Insomnia Questionnaire to assess for insomnia disorder and a self-administered version of the Composite International Diagnostic Interview Screening Scales to assess for psychiatric disorders and cognitive problems.

**Results:** Military soldiers with current major depressive episode (MDE) had the highest prevalence of insomnia disorder (INS; 85.0%), followed by current generalized anxiety disorder (GAD; 82.6%) and current posttraumatic stress disorder (PTSD; 69.7%), respectively. Significant interactions were found between insomnia and psychiatric disorders; specifically, MDE, PTSD, and GAD status influenced the relationship between insomnia and memory/concentration problems. Limitations: Cross-sectional nature of the assessment and the absence of a comprehensive neurocognitive battery.

**Conclusion:** Psychiatric disorders moderated the relationship between insomnia and memory/concentration problems, suggesting that psychiatric disorders contribute unique variance to cognitive problems even though they are associated with insomnia disorder. Results highlight the importance of considering both insomnia and psychiatric disorders in the diagnosis and treatment of cognitive deficits in military soldiers.

## 1. Introduction

Insomnia is the most common sleep disorder, affecting 10.0–22.0% of the general adult population (Bramoweth and Germain, 2013). In the National Veteran Sleep Disorder Study, 26.0% of Veterans were diagnosed with insomnia disorder (Alexander et al., 2016). Insomnia is a growing public health concern that has a complex and likely cyclical relationship with psychiatric disorders. Insomnia can affect the development and maintenance of psychiatric disorders (Smith et al., 2005) and psychiatric disorders can, in turn, exacerbate insomnia symptoms. One study found that the odds of having at least one psychiatric diagnosis were 5.04 times greater in those with severe insomnia, 2.63 times

greater in those with moderate insomnia, and 1.70 times greater in those with subthreshold insomnia compared to those with no insomnia (Sarsour et al., 2010). This strong co-occurrence is particularly relevant for Veterans, who experience high rates of psychiatric diagnoses (55.7%; Department of Defense, 2014) that are frequently comorbid with insomnia symptomatology. For example, McLay et al. (2010) found that insomnia was the most frequent posttraumatic stress disorder (PTSD) symptom reported following deployment (33.0%), and Veterans who initially reported insomnia problems had significantly higher PTSD symptoms at 3 months follow-up. More recently, combat-related trauma and pre-deployment insomnia symptoms were shown to be significantly associated with higher odds of developing PTSD, depression, and anxiety disorder post-deployment, independent of other risk factors (Gehrman et al., 2013).

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The presence of comorbid psychiatric disorders may complicate diagnosis and assessment of insomnia. Individuals with insomnia, in the absence of psychiatric disorders, report worse daytime symptoms of alertness, positive and negative mood, and sleepiness/fatigue compared to good sleeper controls (Buysse et al., 2007). Additionally, about 10.0–15.0% of adults endorse insomnia symptoms associated with daytime consequences such as behavioral difficulties and mood disturbances (Morin and Benca, 2012). Indeed, impaired daytime functioning is a required criterion for a *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013) diagnosis of insomnia. Recently, a meta-analysis that pooled estimates of the effects of insomnia on cognitive function reported that individuals with insomnia exhibited small to moderate cognitive deficits for working memory, episodic memory and some aspects of executive functioning compared to healthy sleepers (Fortier-Brochu et al., 2012). More recently, one study found clinically significant changes in attention and episodic memory in individuals with insomnia (Fortier-Brochu and Morin, 2014).

However, the demonstrated high rates of psychiatric comorbidities in patients with insomnia may further contribute to these daytime impairments as well. For example, like insomnia, major depression, PTSD, and generalized anxiety disorder (GAD) have been associated with deficits in concentration, attention and memory (Millan et al., 2012; Morin and Benca, 2012). Furthermore, insomnia, major depression, and PTSD are each also associated with executive functioning deficits (Millan et al., 2012; Morin and Benca, 2012; Polak et al., 2012). In sum, although psychiatric disorders are associated with disease-specific patterns of cognitive impairment, there is significant overlap between domains of cognitive functioning impacted by insomnia and psychiatric disorders. This is important because cognitive dysfunction may be particularly exacerbated among those with both.

In military soldiers, insomnia is worsened during combat deployments when constant threat of harm is frequently present (Foster et al., 2016). In addition, insomnia is often the primary complaint among combat-exposed military soldiers and has been shown to negatively affect vigilance, moral reasoning, and decision-making, all of which are critical to maintaining performance during combat missions (Foster et al., 2016). Further, data suggest that 14.6% of military soldiers reported accidents or errors that affected mission performance, and of those, 51.0% reported that these accidents or errors were attributed to sleepiness (LoPresti et al., 2016).

The co-occurrence of insomnia, cognitive dysfunction, and psychiatric disorders among military soldiers suggest that these conditions are likely to be interrelated. Moreover, insomnia is a core feature and criterion of many psychiatric disorders that are relatively common in this population (e.g. major depression, PTSD, GAD). An understanding of the overlap of insomnia, depression/anxiety and cognitive problems has important clinical implications for treating military and Veteran patients, as well as the broader population of individuals with insomnia disorder. Differentiating the unique effects of insomnia and psychiatric disorders on cognitive problems will aid in the design of effective treatments and will inform treatment sequencing. Recently, studies have begun to explore the overlap of sleep and psychiatric disorders on cognition; however, these findings have been inconsistent. For example, Yu et al. (2016) found significant interactions with high sleep quality and cognitive performance in individuals with low levels of depressive symptoms, while no significant relationships were observed in individuals with high levels of depressive symptoms. In contrast, Sutter et al. (2012) showed that poorer sleep quality was associated with lower cognitive performance in individuals with high levels of sub-clinical depression versus those with low levels. The aforementioned studies suggest that individual differences in levels of depressive symptomatology may account for some of the inconsistent findings in the relationship between sleep and cognitive function. To date, no study has explored whether the presence of psychiatric disorders common among military soldiers moderate the relationship between insomnia

disorder and cognitive dysfunction. There are several reasons to examine the moderating effects of psychiatric disorders. First, a review by Waters and Bucks (2011) reports that the relationship between sleep loss and cognitive function might be stronger in some people than others; a possible explanation for these differences in cognitive susceptibility could be psychiatric disorders. Second, the interaction between insomnia and psychiatric disorders may be associated with cognitive function to a greater extent than either disorder alone. Finally, cognitive vulnerabilities of insomnia may be associated with disease-specific impairments in military soldiers with psychiatric disorders. Given these reasons, the purpose of this study was twofold: 1) to characterize the prevalence of psychiatric disorders comorbid with insomnia in military soldiers; and 2) to explore whether psychiatric disorders moderate the association between insomnia disorder and cognitive problems.

## 2. Method

The data source for the present study was the All Army Study (AAS) of the Army Study to Assess Risk and Resilience in Service members (STARRS). The AAS is a cross-sectional self-administered questionnaire administered between 2011 and 2013. For the current study, participants were a representative sample (unweighted  $N = 21,449$ ; weighted  $N = 674,335$ ; 13.5% female) of U.S. Army soldiers recruited in quarterly samples from active duty Army personnel. Each quarterly AAS replicate consisted of a stratified (by Army Command and location) probability sample of Army units (or, for large units, subunits), selected without replacement with sample sizes proportional to unit strength (Ursano et al., 2014, 2015). Units were excluded if they were civilian-only or had fewer than 30 soldiers.

Participants provided written informed consent to: (1) complete a self-administered questionnaire (SAQ), (2) allow linkage of their Army and Department of Defense (DoD) administrative records to their SAQ responses, and (3) be contacted regarding future data collection. All study procedures were approved by the Human Subjects Committees of the Uniformed Services University of the Health Sciences for the Henry M. Jackson Foundation (the primary grantee), the Institute for Social Research at the University of Michigan (the organization collecting the data), and all other collaborating organizations. For a complete description on the methodology of data collection, please see Kessler et al. (2013b).

### 2.1. Measures

#### 2.1.1. Insomnia

Insomnia status was measured with the Brief Insomnia Questionnaire (BIQ; Kessler et al., 2010; Roth et al., 2011), which assesses frequency (number of nights per week) of insomnia symptoms in the past 30 days (i.e., taking more than 30 min to fall asleep, waking three or more times during a single night, waking at night and taking more than 30 min to get back to sleep, waking more than 30 min too early in the morning, and feeling tired or unrested in the morning even after a full night of sleep). The measure also assesses the degree to which daytime functioning was impacted in the past 30 days by these sleep problems in the areas of daytime fatigue, somatic problems, moodiness, reduced performance at work/school, and accident-proneness on a Likert scale (1 = *extremely*, 2 = *a lot*, 3 = *some*, 4 = *a little*, 5 = *not at all*). DSM-5 criteria were applied to this measure to determine current insomnia (past 30 days) disorder (American Psychiatric Association, 2013). To be categorized as having current insomnia disorder, soldiers had to meet the following criteria: 1) insomnia symptoms 3 or more nights per week; 2) sleep problems that interfered with functioning at least “a lot”; and 3) sleep problems that occurred at least 3 months out of the past year.

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