

## COMMENTARY

# Sleep and Resilience—A Call for Prevention and Intervention

Commentary on Seelig et al. Sleep and health resilience metrics in a large military cohort. *SLEEP* 2016;39(5):1111–1120.

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In the last 15 years, there has been a marked growth in the number of publications focused on sleep and resilience in both civilians and military populations. A summary PubMed search on the term “resilience” in humans yielded a total of 6,850 articles published between 1966 and 2016 (retrieved March 23, 2016). The steady increase in publications each year focused on resilience coincides with the beginning of the Global War on Terror in 2001. Resilience can refer to (1) “the *capacity* of dynamic systems or organisms to withstand or recover from significant disturbances”<sup>1</sup>; or (2) the *process* of adaptation that follows such disturbance<sup>1</sup>; or (3) a broad range of *outcomes* used as indicators of the success of adaptation, which may be directly related with the inherent capacity for reacting to disturbances and establishing a new homeostasis.<sup>2</sup> In the article entitled, “Sleep and Health Resilience Metrics in a Large Military Cohort,” Seelig and colleagues<sup>3</sup> provide a broad definition that encompasses all of three aspects of resilience: (1) the ability to face and cope with challenges; (2) adapt to the changes created by these challenges; and (3) recover and even grow from these setbacks. One’s ability to adapt to changes is hard to measure in cohort studies, and the molecular, cellular, physiological, psychological, environmental, and social factors that support the coping, recovery, and growth processes are difficult to ascertain. However, different indicators of wealth, health, and functioning can be used as proxies to infer successful resilience following exposure to adversity.

In this study, Seelig and colleagues complement and expand their previous work on sleep in military service members of the Millennium Cohort Study<sup>4–6</sup> by focusing on physical health and functional outcomes. This work continues to be important for several reasons. First, this type of longitudinal and prospective study provides a unique opportunity to identify static and modifiable risk and protective factors that may contribute to health, fitness, and readiness in the US Armed Forces. In turn, these findings can guide the development and implementation of evidence-based, effective intervention strategies to mitigate risk and/or boost protective factors in order to reduce the occurrence of chronic diseases and conditions. Such findings are likely to be generalizable to the general civilian population, as is often the case for different areas of military medicine. This line of research also highlights specific functionally and operationally relevant domains and potential metrics by which the impact of resilience-promoting programs, or other prevention and intervention strategies aimed at promoting post-deployment adjustment and/or re-integration into civilian life, can be evaluated. Overall, such efforts clearly align with the US Armed Forces’ emphasis on promoting, sustaining, and restoring health and functioning through healthy sleep, nutrition, and physical fitness in order to optimize readiness.<sup>7</sup>

In this latest study, Seelig and colleagues leveraged the large, prospective data set cumulated by the Millennium Cohort Study to evaluate the relationship between insomnia, sleep duration, and physical and functional health outcomes as indicators of resilience. The Millennium Cohort Study is a Department of Defense prospective epidemiological research effort that was initiated after the first Gulf War, which aims to “evaluate the impact of military exposures, including deployment, on long-term health outcomes” (<https://www.millenniumcohort.org/about>; retrieved March 18, 2016). Data collected from a total of 52,021 individuals (including 22,774 Reserve/National Guard service members) who completed at least 2 surveys between 2001 and 2006 were included in the analytical plan. To estimate the presence of probable insomnia, items were extracted from two self-report measures—one measuring posttraumatic stress symptoms and the other measuring symptoms of anxiety. Total sleep duration was obtained from one item asking about total sleep time in increments of 1 h over a 24-h period for the past month. Indicators of resilience included self-report ratings of general physical health and lost work days over the past 3 years: military deployment (yes/no) and completion of service term based on data obtained from the Defense Manpower Data Center. For active duty service members only (n = 29,247), the number of outpatient visits and duration of hospitalizations were obtained from Military Health System Data Repository. After adjusting for demographic, military, and other health and behavioral variables (e.g., smoking, weight, drinking habits, and potential obstructive sleep apnea), the findings revealed that individuals who endorsed difficulty falling or staying asleep on both selected items represented approximately 10% of the total sample, and an additional 13% reported insomnia symptoms on one of the two items. Insomnia symptoms were related to poorer outcomes in all domains of interest. For total sleep time, the expected U-shaped relationship was found, whereby self-reported total sleep duration of 6 hours or less was associated with lower health ratings and more lost work days. This group was also more likely to deploy within 90 days of completing the survey. In the subsample of active duty personnel, those with insomnia symptoms on one or both self-report measures, as well as those who reported less than 6 hours or more than 8 hours of sleep over a 24-h period, were more likely to separate from the military before the completion of their term. In addition, these individuals had greater rates of health care utilization than those who reported no insomnia or 7 hours of sleep. The combination of insomnia and short sleep was associated with poorer outcomes in all domains of interest, with the exception of deployment. In this sample, only approximately 3% of the sample reported having been diagnosed with OSA, and OSA did not have a significant effect on these findings.

The Millennium Cohort Study is a rich, unique, and very large prospective project that provides a unique opportunity to assess the contribution of sleep into different domains of resilience. Although the sleep measures used in the survey have limitations and not standard for sleep research,<sup>8</sup> the findings are consistent with previous studies in demonstrating that insomnia and sleep duration are risk factors for poor health and functional outcomes above and beyond other risk factors such as sex, age, obesity, smoking, and alcohol use, and deployment-related factors. While there is rapidly growing evidence that sleep disturbance contributes to poor psychological health outcomes in post-9/11 service members and veterans,<sup>5,9,10</sup> this study extends these observations by showing similar adverse impacts of poor sleep on both service-related and physical health outcomes. Another notable strength of the study is the access to military personnel and health records to temporally link the completion of the surveys, separation, number of medical visits, and hospitalizations in relation to stages of deployment.

One important limitation of the study is the absence of well-validated sleep measures. Symptoms of insomnia, short and long sleep duration, and OSA can often masquerade as one another.<sup>11,12</sup> Although lengthy, validated questionnaires and clinical assessments that contain screening for sleep disordered breathing are impractical in such large, survey-based epidemiological studies, replication with validated sleep assessment methods is important. The current study's absence of a significant effect of OSA might be attributed to the small number of participants who reported a previous diagnosis of OSA, suggesting inflation of type II error rate. Another limitation is the absence of psychological health co-variables in the adjusted models tested here. The authors have previously shown that pre-deployment insomnia and short sleep duration contribute to increased risk for new-onset posttraumatic disorder, depression, and anxiety disorder,<sup>5</sup> which raise questions about the potential contribution of psychological and psychiatric symptoms to physical and functional outcomes, and vice versa. The persistent separation of mental and physical health outcomes may in fact mask synergistic adverse effects that compromise general fitness and readiness among service members, and may also contribute to the stigma associated with mental health. Investigating protective factors that can mitigate the adverse effects of sleep disturbances on mental and physical health outcomes is equally important in augmenting resilience-building strategies. Another consideration is that sleep metrics, in of themselves, might be predictive of trait-resilience. For example, how one copes to the stress associated with preparation for deployment might be measured by sleep duration. This could be due to a coping strategy that results in more sleep (> 8 hours) or anxiety inducing thoughts that result in less sleep (< 6 hours). As such, individuals within these ranges may be at greater risk for poor health-related and occupational outcomes, which seem to be reflected in the current study's findings.

Although insomnia and aberrant sleep duration are established risk factors for poor mental and physical health outcomes,<sup>13–20</sup> this study adds to the literature in three main ways. First, this study highlights that symptoms of insomnia and aberrant sleep duration are associated with reduced productivity and increased health care costs among service members.

Second, the presence of insomnia symptoms and aberrant sleep duration may contribute to early separation. Finally, the findings highlight health and occupational domains that should be considered in assessing the effectiveness of resilience-building training programs, including efforts targeting the prevention, detection, and treatment of insomnia.

This study is consistent with others in highlighting the high prevalence of clinically significant short sleep duration and insomnia among military service members. The findings from this very large, prospective study highlight the significant prevalence of clinically significant short sleep duration and insomnia among military service members, and lend further support for the importance of targeting sleep disturbances with evidence-based management and treatment strategies in order to enhance sleep resilience. The pervasive misconception that insomnia,<sup>21</sup> and more generally sleep disturbances, are secondary symptoms of underlying psychological and physical comorbidities may partially contribute to the slow pace of deploying efforts that aim to directly address short sleep duration and insomnia, not only to promote consolidated, restorative sleep, but also as a means to prevent or mitigate the risks of poor outcomes, including compromised fitness and readiness. As posited by the authors and others, sleep disturbance is a modifiable threat to mental and physical resilience, which can be mitigated by intervention strategies that promote consolidated, restorative, and sufficient sleep. The study also highlights that the pre-deployment period is characterized by short sleep duration, which may be related to the preparation required prior to deployment. Pre-deployment strategies to limit sleep curtailment may be challenging to design and implement, but promoting sleep as one of the essential measures to optimize fitness and readiness and performance should be considered. Unfortunately, resilience-enhancing training programs rarely include evidence-based sleep-focused components.<sup>22</sup> Hence, the field is ripe for longitudinal prevention and treatment studies that specifically examine the impact of evidence-based behavioral and pharmacological sleep treatments on short- and long-term physical and psychological health outcomes, operationally-relevant performance metrics, and readiness among military service members.

## CITATION

Germain A, Dretsch M. Sleep and resilience—a call for prevention and intervention. *SLEEP* 2016;39(5):963–965.

## REFERENCES

1. Masten AS. Resilience in developing systems: progress and promise as the fourth wave rises. *Dev Psychopathol* 2007;19:921–30.
2. Aburn G, Gott M, Hoare K. What is resilience? An integrative review of the empirical literature. *J Adv Nurs* 2016;72:980–1000.
3. Seelig AD, Jacobson IG, Donoho CJ, Trone DW, Crum-Cianflone NF, Balkin TJ. Sleep and health resilience metrics in a large military cohort. *Sleep* 2016;39:1111–20.
4. Seelig AD, Jacobson IG, Smith B, et al. Sleep patterns before, during, and after deployment to Iraq and Afghanistan. *Sleep* 2010;33:1615–22.
5. Gehrman P, Seelig AD, Jacobson IG, et al. Predeployment sleep duration and insomnia symptoms as risk factors for new-onset mental health disorders following military deployment. *Sleep* 2013;36:1009–18.

6. Boyko EJ, Seelig AD, Jacobson IG, et al. Sleep characteristics, mental health, and diabetes risk: a prospective study of U.S. military service members in the Millennium Cohort Study. *Diabetes Care* 2013;36:3154–61.
7. Office of the Surgeon General Public Affairs. Army medicine launches performance triad pilot program, Accessed September 22, 2014. [http://www.army.mil/article/111317/Army\\_Medicine\\_launches\\_Performance\\_Triad\\_Pilot\\_Program/](http://www.army.mil/article/111317/Army_Medicine_launches_Performance_Triad_Pilot_Program/)
8. Buysse DJ, Ancoli-Israel S, Edinger JD, Lichstein KL, Morin CM. Recommendations for a standard research assessment of insomnia. *Sleep* 2006;29:1155–73.
9. van LS, van ZM, Westenberg H, Super A, Vermetten E. Impact of impaired sleep on the development of PTSD symptoms in combat veterans: a prospective longitudinal cohort study. *Depress Anxiety* 2013;30:469–74.
10. Pigeon WR, Campbell CE, Possemato K, Ouimette P. Longitudinal relationships of insomnia, nightmares, and PTSD severity in recent combat veterans. *J Psychosom Res* 2013;75:546–50.
11. Mysliwiec V, Gill J, Lee H, et al. Sleep disorders in US Military Personnel: a high rate of comorbid insomnia and obstructive sleep apnea. *Chest* 2013;144:549–57.
12. Krakow B, Germain A, Tandberg D, et al. Sleep breathing and sleep movement disorders masquerading as insomnia in sexual-assault survivors. *Compr Psychiatry* 2000;41:49–56.
13. Baglioni C, Battagliese G, Feige B, et al. Insomnia as a predictor of depression: a meta-analytic evaluation of longitudinal epidemiological studies. *J Affect Disord* 2011;135:10–9.
14. Wright KM, Britt TW, Bliese PD, Adler AB, Picchioni D, Moore D. Insomnia as predictor versus outcome of PTSD and depression among Iraq combat veterans. *J Clin Psychol* 2011;67:1240–58.
15. Bryant RA, Creamer M, O'Donnell M, Silove D, McFarlane AC. Sleep disturbance immediately prior to trauma predicts subsequent psychiatric disorder. *Sleep* 2010;33:69–74.
16. Babson KA, Feldner MT. Temporal relations between sleep problems and both traumatic event exposure and PTSD: a critical review of the empirical literature. *J Anxiety Disord* 2010;24:1–15.
17. Wong MM, Brower KJ, Fitzgerald HE, Zucker RA. Sleep problems in early childhood and early onset of alcohol and other drug use in adolescence. *Alcohol Clin Exp Res* 2004;28:578–87.
18. Li Y, Zhang X, Winkelman JW, et al. Association between insomnia symptoms and mortality: a prospective study of U.S. men. *Circulation* 2014;129:737–46.
19. Worthington AD, Melia Y. Rehabilitation is compromised by arousal and sleep disorders: results of a survey of rehabilitation centres. *Brain Inj* 2006;20:327–32.
20. Swinkels CM, Ulmer CS, Beckham JC, Buse N, Calhoun PS. The association of sleep duration, mental health, and health risk behaviors among U.S. Afghanistan/Iraq Era Veterans. *Sleep* 2013;36:1019–25.
21. National Institute of Health. NIH state-of-the-science conference statement on manifestations and management of chronic insomnia in adults. *NIH Consensus Science Statements* 2005;22:1–30.
22. Rand Corporation, Meredith LS, Sherbourne CD, et al. Promoting psychological resilience in the U.S. military. Report No.: MG-996-OSD. RAND Corporation, 2011.

## SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication April, 2016

Accepted for publication April, 2016

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## DISCLOSURE STATEMENT

The views expressed in this article are those of the authors and do not reflect the official policy of the Department of Defense, U.S. military, or U.S. Government. Primary funding for this study was provided by the U.S. Army Medical Research and Materiel Command (provided to Dr. Michael Dretsch as the PI). The authors have indicated no financial conflicts of interest.