

Nighttime Sleep and Daytime Stress—Tangled Bedfellows: a Comment on Williams et al.

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The article by Williams and colleagues [1] aligns with growing evidence that although psychological stress and worry can result in less sleep, poor sleep quality may play a significant role in disturbing further stress adaptation. By examining associations between sleep and stress-related cognitive, affective, and physiological disturbances, the authors provide a snapshot of what likely represents an unhealthful, bidirectional cycle of poor sleep and maladaptive stress responses.

Elaborating on this cyclical pathway has the potential to inform models of chronic stress and health that could ultimately benefit prevention and intervention efforts. Inadequate sleep and poor adaptation to stressors each affect mental and emotional well-being. Williams and colleagues' findings hint at a key role for sleep in stress and health links, and future work should clarify this role. Poor sleep may be a causal factor for poor adaptation to stress, a moderator of the effects of stressors on well-being, and/or a phenotypic marker of risk for individuals most vulnerable to the health effects of stress.

In the realm of heart health, poor sleep quality may be integrally involved in mechanisms linking stress to cardiovascular morbidity and mortality. Blood pressure reactivity to acute laboratory stressors can predict future hypertension. Williams and colleagues' observation that lower sleep quality in healthy young adults was associated with atypical blood pressure reactivity to acute stress signals a possible role for poor sleep as a stimulus or catalyst for this pathway. Similarly, we found that compared to good sleepers, healthy

older adults who reported poor sleep had greater acute stress-provoked increases in a circulating marker of inflammation, interleukin-6 [2], a risk factor for poor cardiovascular morbidity and all-cause mortality. An important question for future study is whether sleep can help explain variability in the effects of stress on proximal physiological risk factors and poor cardiovascular health outcomes.

In addition to alterations in blood pressure reactivity, Williams and colleagues found that multiple indices of less continuous sleep were associated with increases in pre-sleep cognitive arousal from the night before to the night after the stressor and prolonged cognitive and affective activation in response to stress. These and other recent findings raise questions about the extent to which sleep directly or indirectly impacts individuals' physiological adaptation to stressors. For instance, poor sleep quality may indirectly influence psychophysiological stress responses by diminishing cognitive and emotional resources available to cope with stressors. Altered sleep, however, also appears to have direct effects on physiological systems that regulate stress responses. Chronic sleep disturbance alters activities of the autonomic and neuroendocrine systems during non-stressful, waking states. However, in response to acute stressors, lower levels of the regulatory hormone, adrenocorticotropin hormone, are necessary to stimulate the release of the key stress hormone cortisol following longer term sleep loss [3]. The tight knit between stress and sleep is also highlighted by evidence that exposure to stressors before sleep impinge upon autonomic regulation during sleep [4]. Future work should characterize more fully the nature of the stress–sleep relationship, clarifying how altered sleep may sensitize physiological stress pathways, as well as the extent to which psychosocial stressors alter physiological regulation during sleep.

In sum, Williams and colleagues' findings provoke a number of questions about the mechanistic role of sleep in self-regulation and health. Knowing how sleep quality

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affects cognitive, affective, and physiological adaptation to acute and chronic stressors, and vice versa, is likely to shed light on biobehavioral pathways to physical well-being. Epidemiological evidence continues to accumulate for the links between poor sleep and morbidity and mortality. Stress management for health promotion may well require explicit attention to behavioral sleep modification in order for public health prevention and intervention efforts to be successful.

Conflict of Interest The author has no conflict of interest to disclose.

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