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Review

A systematic review of sleep disturbance in anxiety and related disorders

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ABSTRACT

Recent research suggests that sleep disturbance may be a transdiagnostic process, and there is increasing interest in examining how sleep disturbance may contribute to anxiety and related disorders. The current review summarizes and synthesizes the extant research assessing sleep in anxiety and related disorders. The findings suggest that sleep disturbance exacerbates symptom severity in the majority of anxiety and related disorders. However, the nature of sleep disturbance often varies as a function of objective versus subjective assessment. Although sleep disturbance is a correlate of most anxiety and related disorders, a causal role for sleep disturbance is less clear. A model of potential mechanisms by which sleep disturbance may confer risk for the development of anxiety and related disorders is discussed. Future research integrating findings from basic sleep research with current knowledge of anxiety and related disorders may facilitate the development of novel treatments for comorbid sleep disturbance and clinical anxiety.

Contents

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Sleep is a vital process linked to neural restoration and physiological maintenance across multiple systems (Siegel, 2005; Xie et al., 2013). For example, healthy sleep is linked to clearance of metabolic waste from the brain (Xie et al., 2013) and enhancement of cognitive function, including the consolidation of memory (Diekelmann, 2014; Inostroza & Born, 2013). Conversely, sleep loss is linked to a diverse range of adverse effects, including deficits in cognitive function (Goel, Rao, Durmer, & Dinges, 2009; Harrison & Horne, 2000) and dysregulation of circadian processes, such as cortisol secretion (Omisade, Buxton, & Rusak, 2010; Spiegel, Leproult, & van Cauter, 1999). Further, poor sleep is implicated in impaired emotional function (Goldstein & Walker, 2014; Zohar, Tzichinsky, Epstein, & Lavie, 2005), including deficits in emotion regulatory abilities (Baum et al., 2014; Mauss, Troy, & LeBourgeois, 2013). Likewise, sleep disturbance is highly prevalent in psychopathology, and sleep impairments are found in almost every major psychiatric disorder (Benca, Obermeyer, Thisted, & Gillin, 1992). While the majority of extant research has focused on impaired sleep in affective disorders (Armitage, 2007; Benca et al., 1992; Krystal, Thakur, & Roth, 2008), a small body of developing research is addressing the role of sleep disturbance in the anxiety and related disorders.

The present paper aims to review the existing literature on sleep disturbance in the anxiety and related disorders, including generalized anxiety disorder (GAD), obsessive-compulsive disorder (OCD), panic disorder (PD), phobias, posttraumatic stress disorder (PTSD), and social anxiety disorder (SAD). For the purposes of this review, the term "sleep disturbances" will be used to refer to self-reported poor sleep quality, clinical insomnia, and/or alterations or deficits in sleep parameters compared to a control group. Reviewed studies include those utilizing single sample and controlled comparison methods, as well as studies employing subjective and objective measurement of sleep. Additionally, the review includes studies of both adult and child samples. This paper will begin with a brief overview of definitions regarding the physiology and measurement of sleep, followed by a review of sleep disturbance in anxiety and related disorders. The literature review will be followed by a comparison of subjective versus objective differences in sleep disturbances, as these methods yield discrepant results in some cases and are both critical for the assessment of sleep (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006). Additionally, potential mechanisms by which sleep disturbance may confer risk for the development of anxiety and related disorders will be proposed. Finally, treatment implications and future directions for the study of sleep disturbance in the anxiety and related disorders will be discussed.

1. Sleep measurement: terminology and methods

The assessment of sleep can be grouped into two broad categories: objective sleep assessment and subjective sleep assessment. While objective assessment offers an unbiased measure of sleep parameters and increased precision, subjective measures are also critical for the assessment of sleep disturbance, as subjective sleep complaints are linked to dsyregulated emotional processes (Takano, Iijima, & Tanno, 2012) and are necessary for diagnosing insomnia (Buysse, 2008).

There have been significant advancements in sleep methodology in recent decades, including advances in sleep-related technology and recommendations for standard assessment of sleep and insomnia (see Buysse et al., 2006 for review). The most commonly measured sleep parameters assessed with both subjective and objective methods include the following (see Table 1): total sleep time (TST), or amount of time spent asleep during the night; sleep onset latency (SOL), or the amount of time it takes to fall asleep; sleep efficiency (SE), or the percentage of time asleep while in bed; and wake after sleep onset (WASO), or the amount of time awake during the night after initiating sleep. Polysomnography, an objective sleep methodology, provides data on these indices and also provides information on progression through stages of sleep, or sleep architecture (Bastien, 2011). Sleep architecture can be divided into non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. Within NREM sleep, there are 3 stages of sleep with increasing delta wave frequency and decreasing alpha wave frequency (Iber, Ancoli-Israel, Chesson, & Quan, 2007). However, as previous sleep scoring methods included 4 stages of sleep, the present paper will include results dividing Stage 3 into Stages 3 and 4 sleep, which were also considered slow-wave sleep (SWS). NREM stages and SWS are typically assessed as percentage of time spent in each stage during the night. REM sleep is characterized by a mixture of theta and beta waves, rapid eye movements, and muscle atonia (Iber et al., 2007). Common REM sleep parameters include REM onset latency, or the amount of time before the first REM period, REM percentage, or time spent in REM sleep during the night, and REM density, or the frequency of rapid eye movements.

1.1. Objective sleep measurement

Polysomnography (PSG): PSG is the most comprehensive objective measure of sleep and provides data on multiple indices that are used to delineate sleep parameters, including four electroencephalogram recordings (EEG) to assess electrical brain activity, vertical and horizontal electrooculogram recordings (EOG) to assess eye movements, and electromyogram recordings (EMG) to assess muscle tone (Bastien, 2011). PSG is considered the gold-standard method for sleep measurement and is the only method that allows for assessment of sleep stages (Bastien, 2011). However, PSG is limited by its relative expense, burden to the participant (Miller, Kyle, Melehan, & Bartlett, 2015; Ancoli-Israel et al., 2003), and lack of ecological validity (Buysse et al., 2006).

Actigraphy: Actigraphy measures movement using accelerometers typically worn on the wrist (Ancoli-Israel et al., 2003). Actigraph data can be scored by hand or by algorithms that differentiate sleep from wake (Buysse et al., 2006). Studies indicate that actigraphy correlates highly with PSG (Cellini, Buman, McDevitt, Ricker, & Mednick, 2013; Kushida et al., 2001). Further, actigraphy has the advantage of allowing for data collection across multiple days in the participants' natural sleeping environment, is relatively inexpensive, and is less invasive than PSG (Ancoli-Israel et al., 2003; Buysse et al., 2006). However, actigraph recordings are less reliable at detecting wakefulness compared to PSG (Paquet, Kawinska, & Carrier, 2007) and should be used in conjunction with a sleep diary in order to differentiate sleep from other times of stillness, such as when watching TV or reading (Buysse et al., 2006).

1.2. Subjective sleep measurement

Sleep diary: A sleep diary is a form of experience sampling that captures the subjective perception of the previous nights sleep across an extended period of time, typically one week (Carney et al., 2012). Sleep diaries typically include self-reported TST, SOL, sleep efficiency, time in bed, WASO, and a rating of perceived sleep quality (Buysse et al., 2006), and sleep diaries are considered the gold-standard for subjective sleep assessment (Carney et al., 2012). Relative to PSG, sleep diaries are more ecologically valid and are able to capture sleep data over a longer period of time; however, sleep diaries are limited by the inability to verify whether data were actually collected at the indicated times (though this problem can be addressed by using electronic sleep diaries) and rely on the participants ability to accurately estimate their own sleep (Buysse et al., 2006).