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The role of sleep in adolescents' daily stress recovery: Negative affect spillover and positive affect bounce-back effects[☆]

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ABSTRACT

The present study examined the role of sleep in daily affective stress recovery processes in adolescents. Eighty-nine American adolescents recorded their emotions and stress through daily surveys and sleep with Fitbit devices for two weeks. Results show that objectively measured sleep (sleep onset latency and sleep debt) moderated negative affective responses to previous-day stress, such that stress-related negative affect spillover effects became more pronounced as amount of sleep decreased. Total sleep time and sleep debt moderated cross-day positive affect “bounce-back” effects. With more sleep, morning positive affect on days following high stress tended to bounce back to the levels that were common following low stress days. Conversely, if sleep was short following high stress days, positive affect remained low the next morning. No evidence for subjective sleep quality as a moderator of spillover/bounce-back effects was found. This research suggests that sleep quantity could relate to overnight affective stress recovery.

Adolescence is a developmental period that is notorious for insufficient sleep (Carskadon, 2011). Given the importance of sleep on virtually all aspects of emotional processing (Kahn, Sheppes, & Sadeh, 2013; Palmer & Alfano, 2017), it seems likely that sleep, either duration or quality, could play a part in emotional recovery from daily stress for adolescents. It is important to understand processes of stress recovery because stress is an inevitable aspect of life and the ability to “bounce back” (i.e., recover) from it has important implications for overall emotional well-being (Tugade & Fredrickson, 2004). Research on recovery from daily stressors has largely focused on negative affect spillover effects from one day to the next (Bolger & Zuckerman, 1995; Gunthert, Cohen, Butler, & Beck, 2007; Marco & Suls, 1993). However, few researchers have investigated daily-level processes that might relate to everyday fluctuations in stress recovery, such as sleep. In this study, we investigated the role of daily sleep on stress recovery among adolescents.

1. Sleep in adolescents

A majority of adolescents do not receive enough sleep (National Sleep Foundation, 2014). Although sleep experts recommend that adolescents sleep for 8–10 h a night, about 70% of adolescents sleep less than 8 h a night, and a large proportion get substantially less than 8 h. Average sleep duration decreases from 8.4 h per night in sixth grade to 6.9 h in 12th grade (Hirshkowitz et al., 2015; Paruthi et al., 2016).

To a large extent, inadequate sleep in teenagers can be attributed to a confluence of biological and social changes that delay

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circadian timing and sleep periods (Carskadon, Wolfson, Acebo, Tzischinsky, & Seifer, 1998; Taylor, Jenni, Acebo, & Carskadon, 2005). As a result, adolescents could accrue significant sleep debt, or the accumulation of multiple nights of shortened sleep, particularly during the school week, which might have negative ramifications for stress responses and emotion (Dinges et al., 1997; Hamilton et al., 2008; Motomura et al., 2013). Indeed, adolescents who underwent experimentally manipulated sleep deprivation reported less positive affect, more negative affect, and less ability to regulate emotion compared to rested adolescents (Baum et al., 2014; Dagsys et al., 2012; McMakin et al., 2016; Reddy, Palmer, Jackson, Farris, & Alfano, 2016). Moreover, adolescents who reported generally having more insomnia symptoms scored lower on an assessment of emotional competence and empathy (Brand et al., 2016). Studies of naturalistic sleep show similar emotional consequences related to sleep loss in adolescents. Not only do adolescents who tend to sleep less typically report higher negative affect and lower positive affect, but adolescents also reported increased levels of negative affect and decreased levels of positive affect following nights on which they had slept less and rated their sleep quality lower (Fuligni & Hardway, 2006; Galambos, Dalton, & Maggs, 2009; Kouros & El-Sheikh, 2015; van Zundert, van Roekel, Engles, & Scholte, 2015). Sleep disturbances in youth could also be related to downstream emotional well-being. There is some evidence that sleep problems in childhood can predict persistent emotional difficulties, including stable levels of high internalizing symptoms, in young adulthood (Touchette et al., 2012).

2. Role of sleep in stress and emotion processes

In addition to the link between decreased sleep and worsened mood, there is some evidence that sleep might impact emotional reactions to stress. One study found that sleep-deprived adolescents were more likely to rate their worries as being more threatening than rested adolescents (Talbot, McGlinchey, Kaplan, Dahl, & Harvey, 2010). In another study, adolescent friend pairs discussed a conflict following two nights of sleep restriction or normal sleep, and researchers found that sleep-restriction was related to more observed negative affect behaviors during the conflict discussion task compared to normal sleep (McMakin et al., 2016). Furthermore, on a daily level, Chiang et al. (2017) found that sleep efficiency, or the proportion of actual sleep time within the amount of time spent in bed, moderated the relationship between family stress and negative affect, such that the positive relationship between experiencing family stress and demands and reports of negative affect were stronger on days when sleep efficiency was lower than usual. This moderation effect of sleep efficiency was especially strong for adolescents of European descent as compared to those from Latino, Asian, and other backgrounds.

Studies on adult samples similarly show evidence of increased emotional reactions to stress. For example, in one study, subjective emotional reactivity to a mild experimental stressor was higher among sleep-deprived participants compared to controls, but equally high across groups when the stressor was severe. These findings suggest that poor sleep might lower the threshold for which an experience is perceived as stressful (Minkel et al., 2012). Sleep loss has also been linked to differences in neurological reactivity in adults. Sleep-deprived participants had greater amygdala reactivity to negative pictures and decreased connectivity between the amygdala and the medial prefrontal cortex, which is responsible for top-down inhibitory processes (Yoo, Gujar, Hu, Jolesz, & Walker, 2007). When examining everyday stress and sleep, researchers have routinely found that poor quality sleep and sleep loss are linked to increased negative affect in the face of a stressful event, whereas good quality and longer sleep are associated with lower negative affect stress reactivity (Hamilton, Catley, & Karlson, 2007; O'Leary, Small, Panaite, Bylsma, & Rottenberg, 2017; Zohar, Tzischinsky, Epstein, & Lavie, 2005).

3. Everyday stress recovery

While evidence that links sleep loss and increased emotional stress reactivity has significant implications on emotional well-being (Chiang et al., 2017; Hamilton et al., 2007; Talbot et al., 2010; Zohar et al., 2005), it might also be important to consider how long emotional reactions last as an indicator of stress recovery processes. Understanding stress recovery processes is important because the cumulative effect of emotional spillover from stress, over time, could erode resources and increase vulnerability to affective disorders. Adolescence is known to be a period of increased stress, frequency and intensity of emotions, and risk for psychopathology (Arnett, 1999; Cairns, Yap, Pilkington, & Jorm, 2014; Compas et al., 2017; Hankin et al., 1998).

One way that researchers have investigated daily stress recovery is through “spillover” effects, or when stress endorsed one day predicts emotional experiences in the next, even when controlling for previous-day emotion (Gable, Reis, & Elliot, 2000; Gunther et al., 2007; Kiang & Buchanan, 2014; Marco & Suls, 1993). Certainly, there are occasions when emotional responses to stress continue into the next day, but there is not much research on *when* spillover occurs. Sleep, either amount or quality, seems to be a good candidate for influencing recovery from the day's stress. The nightly sleep period, which separates the end of a stressful day and beginning of a new one, provides a “psychological break” that could promote emotional recovery (David, Green, Martin, & Suls, 1997; Williams, Suls, Alliger, Learner, & Wan, 1991). Surprisingly, few studies have investigated the role of sleep in daily stress recovery processes, despite an abundance of evidence that inadequate sleep negatively impacts mood and emotional reactivity processes (Chiang et al., 2017; Kahn et al., 2013; Palmer & Alfano, 2017; Talbot et al., 2010).

One published study (in adult women diagnosed with fibromyalgia) that has examined the relationship between stress, sleep, and next-day emotions used a 30-day daily diary design to illuminate overnight stress recovery processes (Hamilton et al., 2008). The researchers found that stress moderated the relationship between sleep and next-day emotions. When number of daily stressors was high, low sleep duration predicted increased negative affect and decreased positive the next day. Therefore, under conditions of less sleep and more stress, next-day spillover of negative affect, as well as a dampening of positive affect, was observed. However, when sleep was above average, stress did not predict affect the next day. It seems, then, that lower amounts of sleep might inhibit recovery

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