Neuroticism, rumination, negative affect, and sleep: Examining between- and within-person associations

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ABSTRACT

Neuroticism is strongly implicated in the development of sleep impairment and sleep disorders such as insomnia. However, it is unclear if neuroticism is a direct predictor of sleep, and/or if it moderates associations between related psychological processes (e.g., rumination and negative affect, or NA) and sleep in daily life. We investigated: 1) neuroticism as a between-person predictor of reported sleep, 2) daily fluctuations in rumination and NA as predictors of reported sleep, and 3) neuroticism as a between-person moderator of the relationships in aim 2. A sample of racially and ethnically diverse adults (N = 242; 62% African-American, 24% Hispanic/Latina/o) completed a baseline assessment of neuroticism and then completed two weeks of daily reports, including bedtime assessments of daily rumination and NA and waking assessments of prior night's sleep. Individuals with higher neuroticism reported more impaired average sleep, but this relationship became non-significant after accounting for daily rumination and NA. Days with greater NA than one's individual average predicted more impaired sleep, regardless of average levels of NA, daily rumination, and neuroticism. Results suggest the importance of investigating both between- and within-person associations linking neuroticism, rumination, NA, and sleep and may help inform more targeted intervention efforts for improving sleep.

1. Introduction

Neuroticism is a personality trait characterized by a tendency to perceive one's environment as threatening and difficult to manage. It is strongly implicated in elevated risk for poor health outcomes, including cardiovascular disease, depression, anxiety, and in particular, disturbed sleep and insomnia (Gurtman, McNicol, & McGillivray, 2014; Lahey, 2009; van de Laar, Verbeek, Pevernagie, Aldenkamp, & Overeem, 2010). The connection between neuroticism and disturbed sleep seems intuitive yet needs further exploration. In cross-sectional and experimental sleep deprivation studies, neuroticism and cognitive-emotional hyperarousal have been shown to be some of the strongest vulnerability factors for poor or insufficient sleep (Calkins, Hearon, Capozzoli, & Otto, 2013; Duggan, Friedman, McDevitt, & Mednick, 2014; Gurtman et al., 2014; Mastin, Peszka, Poling, Phillips, & Duke, 2005). However, it is unclear if neuroticism is a direct predictor of sleep, and/or if it moderates associations between related psychological processes (e.g., cognition and emotion) and sleep. Moreover, because most previous

work has been cross-sectional, the daily, within-person psychological processes related to neuroticism and impaired sleep remain relatively unexplored. Daily psychological processes are important to investigate as they may be a proximal disruption to nightly sleep and may represent modifiable intervention targets. In the current research, we focus on the construct of neuroticism as both a direct predictor of reported sleep and as a potential moderator of daily associations between cognitive-emotional processes (i.e., rumination and negative affect) and reported sleep.

Rumination, or repetitive thinking about the causes and consequences of one's problems, and negative affect (NA), or emotions like anger, fear, and sadness, may each relate to impaired sleep in daily life. According to the response styles theory (Nolen-Hoeksema, 1991), when individuals fixate on their response to a stressful event as well as the causes and effects of this response (e.g., "Why do I get distressed when others don't?"), this can prolong and heighten distress. Elevated distress can lead to hyperarousal, which makes the act of falling and staying asleep more difficult (Brosschot, Gerin, & Thayer, 2006; Guastella &

Moulds, 2007). Cross-sectionally, both NA and rumination have been associated with poorer subjective sleep quality (Brummett et al., 2006; Norlander, Johansson, & Bood, 2005; Zawadzki, Graham, & Gerin, 2013). In studies in daily life, when examined separately, daily NA and rumination have been shown to predict impaired subjective and objective (i.e., actigraphy-determined) sleep quality (McCrae et al., 2008; Pillai, Steenburg, Ciesla, Roth, & Drake, 2014; Winzeler et al., 2014).

Despite some evidence of neuroticism, rumination, and NA each predicting impaired sleep, no studies have examined associations between these constructs simultaneously in daily life. Although they are likely related, neuroticism is a trait that is relatively stable over time (Lahey, 2009), whereas rumination and NA have been shown to fluctuate from day-to-day and moment-to-moment (Eid & Diener, 1999; Takano & Tanno, 2011). Neuroticism, rumination, and NA may each be unique predictors of sleep and/or may interact in daily life to predict sleep. For example, individuals higher in neuroticism may be particularly likely to suffer from the consequences of daily rumination and NA on impaired sleep. Neuroticism has been shown to moderate the link between daily stressors and NA reactivity (Bolger & Zuckerman, 1995), as well as the link between negative cognitions and depressive symptoms (Hankin, Fraley, & Abela, 2005); individuals higher in neuroticism exhibit stronger positive associations between these variables compared to those lower in neuroticism. Similarly, hostility, a trait with some overlap with neuroticism, exacerbated a connection between daily NA and subjective sleep quality (Brissette & Cohen, 2002). These studies suggest that neuroticism and related traits may predict stronger associations between negative psychological states and poor health behaviors. However, no studies have examined neuroticism as a moderator of the relationships between rumination, NA, and impaired sleep quality in daily life.

This lack of research examining both individual and daily predictors of sleep across time represents an important gap in the literature. It is helpful to understand what it means for a person to vary from day-to-day on repeated measures of sleep over time (i.e., within-person effects), in addition to what it means for some people to be higher or lower overall, relative to other people, on these same measures (i.e., between-person effects; Mroczek, Spiro, & Almeida, 2003; see Smyth & Heron, 2014 for a general discussion). Both approaches are useful, but answer very different questions: Between-person analyses can identify individuals at greatest risk for adverse sleep outcomes (e.g., those higher in trait neuroticism), whereas within-person analyses can identify specific daily processes related to sleep (e.g., days characterized by more rumination or NA than average). The separation of between- and within-person effects helps avoid the ecological fallacy, where inferences about associations at one level of analysis (e.g., day-level characteristics) are conflated with associations at another level of analysis (e.g., person-level characteristics; Kramer, 1983; Zawadzki, Smyth, Sliwinski, Ruiz, & Gerin, 2017).

To address gaps in the literature, we investigated associations between neuroticism, rumination, NA, and sleep across a 14-day repeated-measures study. At the between-person level, we examined neuroticism as a predictor of reported sleep, with the expectation that neuroticism would be associated with more impaired average sleep quality and greater difficulty falling asleep across the 14 days. At the within-person level, we examined associations between daily rumination and NA with reported sleep; we hypothesized that on days when individuals reported relatively greater (i.e., higher than their person-mean) rumination and NA, they also would report more impaired sleep quality and greater difficulty falling asleep that night. Finally, we tested neuroticism as a moderator of the associations between daily rumination, NA, nightly sleep quality, and difficulty falling asleep, with the expectation that these associations would be stronger for those higher in neuroticism.

2. Method

2.1. Overview

Data were drawn from the first burst of data collection from a longitudinal burst study. Participants were recruited from a housing development in the Bronx, New York using systematic probability sampling. Eligible participants were 25 to 65 years old, ambulatory, fluent in English. Exclusion criteria included inability to answer smartphone surveys throughout the day due to visual impairment or work requirements. Within each burst, participants completed a baseline assessment of neuroticism. Upon completion of a training session, participants completed two weeks of daily surveys in the morning and before bedtime via a customized smartphone interface (see below for more details). Informed consent was obtained from all participants.

2.2. Participants

The larger study consisted of 337 participants, but only participants who completed the baseline assessment at least one daily diary survey from the first burst of data collection were included in analyses. The final sample thus was comprised of 242 adults (M_{age} = 46.8 ± 10.9 years; 66.5% female; 62.4% African-American, 18.2% White Hispanic/Latina/o, 6.2% Black Hispanic/Latina/o, 9.1% Caucasian). There were no significant demographic differences between those who only completed the baseline survey and those who completed both the baseline survey and at least one daily survey.

2.3. Daily survey procedure

Participants first completed a training session for instruction on how to complete the surveys on the smartphone they were given to use as part of the study. Participants then completed a 2-day daily diary practice phase. For the actual 14-day daily diary protocol, each day participants completed two reports: one upon waking, in which they reported on their previous night's sleep, and another within an hour before bedtime, in which they reported their thoughts and emotions over the course of that day.

2.4. Measures

2.4.1. Neuroticism

Neuroticism was assessed at baseline using a 24-item scale derived from the International Personality Inventory Pool (DeYoung, Quilty, & Peterson, 2007; Goldberg et al., 2006; Johnson, 2011). This 24-item scale consists of six subscales that each demonstrate high internal consistency (α's = 0.77 to 0.88). The 24-item subscale also demonstrates good convergent validity with the Revised NEO-Personality Inventory (r = 0.87; Johnson, 2011). Participants rated how accurately each statement described themselves on a scale of 1 (very inaccurate) to 5 (very accurate). Example items included "Worry about things" and "Get irritated easily." Items were added together to create a composite measure. Possible scores ranged from 24 to 120, with higher scores indicating greater levels of neuroticism.

2.4.2. Daily negative affect

Daily negative affect (NA) was assessed in the evening survey. Participants rated how much they felt five NA items (tense, frustrated, angry, depressed, unhappy) over the past day on a scale of 0 (not at all) to 100 (very much). These particular items were chosen in alignment with previous research on daily negative affect (Diener & Emmons, 1984) and were derived from the Profile of Mood States, which has shown to be a reliable and valid measure of affect (McNair, Lorr, & Dropelman, 1981). Items were averaged to create a composite measure of NA. Possible scores ranged from 0 to 100, with higher scores indicating greater daily NA. (For psychometric quality, between and within-person variances were computed for all waking and bedtime repeated measures; see Table 1.)

2.4.3. Daily rumination

Daily rumination was assessed in the evening survey. Questions