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## Personality Traits and the Subjective and Objective Experience of Sleep

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### Abstract

**Background:** There is growing evidence that Five-Factor Model personality traits are associated with self-reported sleep. We test whether these associations extend to objective sleep measures in older adulthood and whether measures of objective sleep mediate the relation between personality and subjective sleep.

**Methods:** A random subsample of participants in the National Social Life and Aging Project (NSHAP) wore an accelerometer for up to three nights and had information on FFM personality traits ( $N=620$ ). Participants also reported on their feelings of being rested.

**Results:** Higher Neuroticism and lower Extraversion and Conscientiousness were associated with more frequent wake after sleep onset, greater fragmentation, and feeling less rested. Concurrent body mass index, disease burden, perceived stress, and depressive symptoms accounted for these associations. Personality was unrelated to total time spent asleep but Conscientiousness was associated with earlier and more consistent bedtimes. None of the objective sleep metrics mediated the relation between personality and subjective sleep.

**Conclusions:** The present research indicates that the associations typically found for personality and subjective sleep extend to objective sleep fragmentation. These objective measures, however, do not account for the relation between personality and feeling rested.

### Keywords

Personality Traits; Conscientiousness; Sleep; Fragmentation; Accelerometer

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**Research involving human participants:** “All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.”

**Informed consent:** Informed consent was obtained from all individual participants as part of the NSHAP assessment. The authors only had access to deidentified public data.

As defined by the Five Factor Model of personality [1], an individual's characteristic ways of thinking, feeling, and behaving are operationalized along five dimensions: Neuroticism (the tendency to feel negative emotions), Extraversion (the tendency to be outgoing and social), Openness (the tendency to be creative and unconventional), Agreeableness (the tendency to be trusting and cooperative), and Conscientiousness (the tendency to be organized, disciplined, and responsible). There is growing evidence that these traits are associated with self-reported sleep quality [2–5]. Individuals who are higher in Neuroticism and lower in Extraversion and Conscientiousness, for example, tend to report worse sleep [6], including more difficulties with staying asleep and feeling less rested [7]. These traits also predict declines in sleep quality over time; Openness and Agreeableness are not associated consistently with sleep quality [2].

This literature suggests that the association between traits and sleep is replicable and apparent across diverse samples [2, 3, 5]. This work, however, has relied on self-reports of sleep quality with less work on the association between personality and objective sleep measures [8]. We address this relation in a relatively large sample of older adults with objective markers of sleep derived from actigraphy over up to three nights of sleep. Consistent with the self-report literature, we expect that higher Neuroticism and lower Extraversion and Conscientiousness will be associated with worse sleep. We also test whether the association between personality and the objective sleep markers are mediated by concurrent body mass index (BMI), disease burden, perceived stress, and depressive symptoms. Finally, we test whether the relation between personality and subjective sleep is mediated by objective markers of sleep.

## Method

### Participants and Procedure

Participants were from the National Social Life, Health, and Aging Project (NSHAP) collected in 2010–2011 [9]. NSHAP started as a population-based study of how social factors contribute to health in older adulthood. Personality and objective sleep measures were first included in the second wave (see below). Participants completed the personality measure as part of the leave-behind questionnaire. A random one-third of Wave 2 participants were invited to participate in the Sleep Module, which involved wearing an accelerometer for 72 hours [10]. A total of 620 participants had complete data with valid personality and accelerometer assessments. Participants with sleep data but no information on personality ( $n=107$ ) had fewer years of education ( $d=.32$ ,  $p<.01$ ), were less likely to be white ( $\chi^2=15.05$ ,  $p<.01$ ) and more likely to be Latinx ( $\chi^2=7.22$ ,  $p<.05$ ); there were no differences by gender or age. And, compared with rest of the NSHAP sample at Wave 2 ( $n=2576$ ), participants in the analytic sample ( $n=620$ ) were younger ( $d=-.09$ ,  $p=.04$ ), had more years of education ( $d=.10$ ,  $p=.03$ ), and were more likely to be white ( $\chi^2=19.15$ ,  $p<.01$ ). There were no differences by gender or Latinx ethnicity.

### Measures

**Personality.**—Personality was assessed with a 21-item version of the Midlife Development Inventory (MIDI) [11] that measured Neuroticism (e.g., moody;  $\alpha=.65$ ), Extraversion

(e.g., talkative;  $\alpha=.76$ ), Openness (e.g., creative;  $\alpha=.75$ ), Agreeableness (e.g., helpful;  $\alpha=.75$ ), and Conscientiousness (e.g., organized;  $\alpha=.69$ ). Items were rated from 1 (*a lot*) to 4 (*not at all*) and reverse scored in the direction of the trait label when necessary.

**Subjective sleep.**—Subjective sleep was measured with the single item, “How often do you feel really rested when you wake up in the morning?” Participants responded on a scale from 1 (rarely) to 4 (most of the time). Although not ideal, single-item sleep scales have been found to be reliable and valid [12].

**Objective sleep.**—Administration of objective sleep assessments and scoring were based on Lauderdale and colleagues [10]. Participants wore an Actiwatch Spectrum from Phillips Respironics for 72 hours. Three nights of wear has been shown to provide valid estimates of sleep with theoretically meaningful associations [13]. Activity was counted at prespecified 15-second epochs. Five dimensions were derived from the epoch data: *Assumed Sleep* was the total length of the sleep interval measured from the first to the last epoch detected as sleep and recorded in hours. *Actual sleep* was the total minutes detected as sleep and recorded in hours. *Percent Sleep* was the ratio of actual sleep to assumed sleep. *Wake After Sleep Onset* (WASO) was the number of minutes awake after sleep had begun. *Fragmentation* was the sum of the percent of sleep spent moving and the percent of periods of immobility that were only 1 minute long. Actiwatch data were scored for each of three nights and the mean across the three nights was taken for each measure. In addition, the time each participant fell asleep was coded from the start of the sleep interval. Time was recorded on a 24-hour timescale. Hours after midnight were recoded to maintain a scale that indicates later time fell asleep (e.g., 12 am midnight was recoded to 24, 1 am to 25, etc.). Variability in time to fall asleep was taken as the standard deviation divided by the mean across the three nights.

**Mediators.**—BMI ( $\text{kg}/\text{m}^2$ ) was derived from staff-assessed weight and height. Disease burden was the sum of seven reported diagnoses (hypertension, diabetes, heart condition, lung disease, stroke, cancer other than skin, arthritis). Perceived stress was measured with a 4-item ( $\alpha=.56$ ) version of the Perceived Stress Scale [14]. Depressive symptoms were measured with an 11-item ( $\alpha=.79$ ) version of the Center for Epidemiologic Studies Depression (CESD) Scale [15].

**Covariates.**—Sociodemographic covariates included self-reported age in years, gender (female=1, male=0), race (African American=1 [dummy variable 1], other/unknown=1 [dummy variable 2] both compared to white=0), Latinx ethnicity (1=yes, 0=no), and education (from 1=less than high school to 4=Bachelor’s degree or higher).

## Statistical Approach

Linear regression was used to examine the association between personality traits and the subjective and objective markers of sleep. Each trait was entered separately controlling for sociodemographic covariates and then entered simultaneously. We tested BMI, disease burden, perceived stress, and depressive symptoms as simultaneous mediators of the relation

between personality and sleep markers using PROCESS 3.1 [16]. We likewise used PROCESS to test the objective sleep markers as mediators of the relation between personality and subjective sleep.

## Results

Table 1 shows the descriptive statistics for the study variables; bivariate correlations among all study variables are in Table S1. Table 2 shows the standardized regression coefficients for the association between personality and the sleep measures. Consistent with the self-report literature, higher Neuroticism was associated with feeling less rested, whereas higher Extraversion and Conscientiousness were associated with feeling more rested; higher Openness was also associated with feeling more rested. As measured by actigraphy, personality was unrelated to the total amount of time spent asleep, measured as either assumed sleep or actual sleep. It was, however, associated with quality of sleep: Higher Neuroticism was associated with more waking after sleep onset and greater fragmentation, whereas the opposite pattern emerged for Extraversion and Conscientiousness. There was a similar pattern for the percent of time spent asleep, although only the association with Conscientiousness was significant. Conscientiousness was also associated with falling asleep earlier and with less variability in time fell asleep over the three nights. Openness and Agreeableness were unrelated to the objective sleep measures. As a measure of effect size, Table S2 reports Cohen's *d* for the difference in the top versus bottom 25% of each trait and the corresponding bivariate correlation. Effect sizes were generally in the small range but similar to other risk factors. Indeed, the zero-order correlations in Table S1 suggest that the associations for personality are generally similar in magnitude to BMI, disease burden, stress, and depressive symptoms. Neither race nor ethnicity moderated any of the associations.

Depressive symptoms mediated the association between personality and feeling rested for the four traits associated with subjective sleep (Supplemental Table S3). None of the mediators explained the association between the traits and the objective sleep markers, and most associations were reduced to non-significance with the inclusion of the mediators. The exception was for time fell asleep and variability in this time: Conscientiousness remained a significant predictor of both markers and none of the potential mediators were significant. Finally, the objective sleep markers did not mediate the association between personality and subjective sleep (Supplemental Table S4). Of note, the relations between personality and subjective sleep were virtually identical accounting for the objective measures.

## Discussion

The present research provides new evidence for the association between personality and objective sleep measures among older adults: Higher Neuroticism is associated with more wake after sleep onset and greater sleep fragmentation, whereas higher Extraversion and Conscientiousness are associated with less waking and fragmentation. These findings replicate the literature on personality and subjective sleep that indicates that higher Neuroticism is associated with worse self-reported sleep quality, whereas higher Extraversion and Conscientiousness are associated with better sleep [2]. Although the effect

sizes are in the small range, they are consistent with effect sizes for other objective health measures [17] and for sleep in particular [8], which indicates the effects are reliable. Objectively-assessed fragmented sleep, however, did not mediate the relation between personality and subjective feelings of being rested. This finding is consistent with related literatures that find subjective and objective measures of sleep may have distinct correlates [18].

There are several characteristics inherent to each personality trait that may contribute to the association with sleep. Individuals higher in Neuroticism, for example, are prone to rumination and anxiety, which can interfere with the ability to sleep deeply [19]. Individuals higher in Extraversion, in contrast, are less likely to experience depression [20] and tend to engage in more physical activity [21] that may contribute to better sleep. Individuals higher in Conscientiousness tend to lead very organized lives with regular sleep-wake schedules and good sleep hygiene routines [7]. These traits are further associated with substance use that also may interfere with sleep [22]. The present research suggests that these associations are not just apparent with subjective assessments of feeling rested but extend to objective sleep markers, which supports emerging evidence found in younger populations [8]. This finding is also consistent with research in related domains that suggests the associations between personality and health behaviors, such as physical activity, are similar across objective [23] and subjective [21] measures. Interestingly, even though none of the tested mediators were associated with the objective sleep markers, most of the associations with personality were not significant when the indirect effects were accounted for in the model.

It is of note that personality was related to the quality of sleep rather than the overall quantity of sleep. That is, personality was unrelated to measures of the total time spent asleep. And, further, accounting for the objective sleep metrics had negligible effects on the relation between personality and subjective feelings of being rested. This pattern suggests that the psychological processes associated with the traits may contribute to how rested individuals feel, regardless of their actual amount and quality of sleep. Individuals higher in Neuroticism, for example, tend to hold negative perceptions in general [24], a tendency that likely extends to feelings of being rested. They may also have trouble getting themselves going in the morning. Individuals higher in Extraversion have more vigor [25] and may wake ready to start the day regardless of how many hours they slept. Individuals higher in Conscientiousness are goal-driven and may look forward to the start of each new day as an opportunity to achieve their goals. Depressive symptoms accounted for most of the association between personality and feeling rested. Personality traits, particularly Neuroticism, Extraversion, and Conscientiousness, are associated with concurrent symptoms and greater symptoms over time [26]. Such symptoms may be one mechanism through which these traits lead to feeling less rested.

Models of personality and health indicate that there are behavioral and physiological pathways that explain how traits are related to important health outcomes [27]. Sleep is a critical behavior that may be one mechanism between personality and consequential outcomes. The emotional and behavioral patterns associated with the traits may disrupt sleep, which in turn has both physiological (e.g., increased inflammation [28]) and behavioral (e.g., increased engagement in health-risk behaviors [29]) consequences that

contribute to poor health outcomes. The present research suggests that this disruption can be detected by objective measurements, in addition to subjective evaluations, and may thus be one pathway to worse health outcomes.

This research had several strengths, including a relatively large sample and actigraphy-measured sleep metrics. Limitations include the cross-sectional design and lack of sleep metrics (e.g., duration in slow wave sleep) that would be available from a sleep study. In addition, the brevity of the measures (single-item measure of rest, three nights of sleep) is a limitation that could be addressed with more comprehensive measures in future research. Despite these limitations, the present research indicates that personality traits are associated with objective measures of sleep in ways that are consistent with the literature on subjective sleep.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Discussion

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**Table 1**

## Descriptive Statistics for Study Variables

	Mean (SD) or %
Sociodemographic	
Age (year)	72.63 (7.35)
Sex (female)	54%
Race (African American)	10%
Race (Others or unknown)	8%
Race (white)	82%
Hispanic ethnicity (yes)	10%
Education <sup>a</sup>	2.68 (1.01)
Personality <sup>b</sup>	
Neuroticism	1.19 (.59)
Extraversion	2.17 (.57)
Openness	1.89 (.64)
Agreeableness	2.44 (.51)
Conscientiousness	2.33 (.55)
Subjective sleep	
Feel rested <sup>c</sup>	2.49 (.79)
Objective sleep	
Assumed sleep (hours)	7.86 (1.33)
Actual sleep (hours)	7.20 (1.26)
Percent sleep	91.74 (4.88)
Wake after sleep onset (hours)	.65 (.40)
Fragmentation	14.68 (6.29)
Time fell asleep (24 hour time)	22.97 (1.39)
Variation in time fell asleep <sup>d</sup>	.03 (.03)

Note.  $N=620$ ;  $n=618$  for feel rested.

<sup>a</sup>Education is on a scale from 1 (less than high school) to 4 (Bachelor's degree or more).

<sup>b</sup>Personality is scored on a scale from 1 (not at all) to 4 (a lot).

<sup>c</sup>Feel rested is scored on a scale from 1 (rarely) to 4 (most of the time).

<sup>d</sup>Variation in time fell asleep is the standard deviation divided by the mean across the up to three nights.



**Table 2**  
 Linear Regression Predicting Subjective and Objective Markers of Sleep from Personality Traits

Trait	Objective							
	Subjective	Assumed Sleep	Actigraph Sleep	Percent Sleep	Wake After Sleep Onset	Fragmentation	Time Fell Asleep	Variability in Time Fell Asleep
Neuroticism	-.24 <sup>***a,b</sup>	.01	-.02	-.07	.08 <sup>*</sup>	.08 <sup>*</sup>	.07	.02
Extraversion	.16 <sup>***b</sup>	-.05	-.03	.07	-.09 <sup>*</sup>	-.09 <sup>*</sup>	.01	.00
Openness	.09 <sup>sb</sup>	-.04	-.04	-.02	.00	.01	.01	.02
Agreeableness	.00	-.02	.00	.04	-.05	-.05	.02	-.01
Conscientiousness	.08 <sup>*</sup>	-.03	.00	.08 <sup>*</sup>	-.10 <sup>sb</sup>	-.09 <sup>*</sup>	-.14 <sup>***a,b</sup>	-.10 <sup>***a,b</sup>

*Note.* N=620; n=618 for feel rested. Standardized beta coefficients from linear regression controlling for age, sex, race, Hispanic ethnicity, and education.

<sup>a</sup> Significant controlling for the mediators.

<sup>b</sup> Significant when all traits are included in the model.

\* p<.05.

\*\* p<.01.