Personality Processes and Sleep: An Overview and a Leitmotif for a Research Agenda

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Personality Traits and Processes are Relevant to Understanding Sleep and Social Behavior

Social psychology and social processes are traditionally concerned with whether, when, how, and why individuals are shaped by their real, perceived, and imagined social environments (that is, by the presence of others). However, an account of how individuals interact with their social worlds is not complete without an understanding of whether, when, how and why individuals behave consistently or similarly *across* situations and time, and in turn, how they select into, shape, and reinforce their social environments. Insights into these enduring patterns of thoughts, feelings, and behaviors that make people uniquely themselves across situations require an appreciation of personality and personality processes.

Preparation of this chapter was supported in part by funding to K. A. Duggan from the National Heart, Lung, and Blood Institute at the National Institutes of Health (T32HL007560, L30HL143741) and funding to Z. Križan from the National Science Foundation (Award No. 1525390).

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Z. Križan (ed.), *Sleep, Personality, and Social Behavior*,
https://doi.org/10.1007/978-3-030-30628-1_12

Personality Traits and States

These relatively enduring patterns of thoughts, feelings, and behaviors (or traits) are hierarchically-organized, with the focus typically on the Five Factor Model (John, Naumann, & Soto, 2008), which includes five personality traits: conscientiousness, agreeableness, neuroticism, openness, and extraversion (though see the HEXACO model for an alternative; Ashton & Lee, 2007). Each of these traits is in turn made up of hierarchically-organized facets (or components of each trait). For example, trait conscientiousness is defined by facets or collections of items which tap persistence, planfulness, organization, and self-control *in general* (i.e., across long periods of time; Roberts, Lejuez, Krueger, Richards, & Hill, 2014). Agreeableness taps facets of altruism, trust, compliance, and straightforwardness; neuroticism taps facets of anxiety, hostility, depression, and emotional lability; openness taps facets of curiosity, imagination, and the preference for novel activities; and extraversion taps facets sociability, dominance, activity, and positive emotions (John & Srivastava, 1999). These same traits can also be organized hierarchically at the higher level into meta-traits, with meta-trait stability (conscientiousness, agreeableness, and low neuroticism) and plasticity (openness and extraversion) forming one replicable higher-order structure with relevance to sleep and health (Dermody et al., 2016; DeYoung, Hasher, Djikic, Criger, & Peterson, 2007; Wilmot, DeYoung, Stillwell, & Kosinski, 2015).

Each of these facets within traits can be further differentiated by specific sets of thoughts, feelings, and behaviors which indeed fluctuate across situations and time, partially due to changes in the features of the situation (Rauthmann, Horstmann, & Sherman, 2018), changes in affect (Wilson, Thompson, & Vazire, 2017), and changes in goal pursuit (McCabe & Fleeson, 2016). This within-person variability in particular thoughts, feelings, and behaviors corresponds to personality *states*, which vary around a stable mean tendency reflecting the higher order trait (Fleeson, 2001). Considering personality traits as amalgamations of personality states across time is useful for (1) reflecting variability in individual behavior across time and situations (i.e., social processes; Fleeson, 2004; Funder, 2006); (2) linking personality traits with consequential outcomes via personality processes (Hampson, 2012); and (3) understanding factors that shape personality stability and change across time (Wrzus & Roberts, 2017).

Personality Processes

Broadly, personality processes describe *how* traits manifest in real, observable behavior (Hampson, 2012; Wrzus & Mehl, 2015), ultimately shaping important outcomes. These processes are thought to occur once a situation triggers a particular expectancy (or goal), leading to a state-like expression of personality, followed by the individual reacting to their own behaviors or interpreting the reactions of others

in their social environments (Wrzus & Roberts, 2017). For example, if a woman has a goal of getting a raise or promotion at work, this may translate to specific conscientiousness-like behaviors: using planners to schedule her day, showing up early, systematically organizing her work files and materials, setting timelines for getting projects done, and persisting at tasks after meeting setbacks or failures (Jackson et al., 2010). In the long-term, as her colleagues and supervisors notice her efforts, they may perceive her as more organized, planful, punctual, and persistent, which may result in the pay raise or promotion she desired. In this way, her goals shaped her behavior (*states*) in ways that were consistent with her personality (i.e., her high *trait* conscientiousness), leading to a meaningful outcome (i.e., raise or promotion) in her life. The interpersonal and social rewards for behaving in this way may also reinforce her high trait conscientiousness, ultimately making her more likely to think, feel, and behave in ways consistent with high conscientiousness in the future (DeYoung, 2015).

As these transactions can repeatedly occur over time, personality processes therefore tell us about both stability and change in behavior—which, given amalgamations of personality states into traits, describes how personality stability is maintained and suggests mechanisms which may lead to lasting personality change. To the extent that individuals repeatedly select into situations consistent with their personalities (or are reinforced for their behaviors), personality should become more stable (as similar levels of that particular trait will be reinforced). On the other hand, if people are repeatedly exposed to novel situations or are not reinforced for their behaviors, their personality is more likely to change.

These processes are important features of theories emerging from both personality and developmental psychology. Situational selection (sometimes called cumulative continuity in the developmental literature; Caspi, Bem, & Elder, 1989; Hampson, 2012; Scarr & McCartney, 1983) is a process of niche-picking (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007) through which people select into environments or may be recruited into environments. They can also alter their social milieu through person-situation transactions or situation evocation (termed interactional continuity in the developmental literature). People attend to and learn from the evoked reactions in and features of these environments (Buss, 1987; Funder, 2008), and sometimes are removed from (or selected out of) certain environments through attrition. Environments that are repeatedly selected into are often consistent with and reinforce the person's existing personality traits, while simultaneously promoting trait-outcome associations (such as in the work example above; Roberts, Caspi, & Moffitt, 2003) across long periods of time. In other words, person-situation transactions produce personality stability and change, and behavioral stability and change produce long-term consequential outcomes. In this way, personality processes impact personality development (stability and change) as well as consequential outcomes (Deary, Weiss, & Batty, 2010), including health behaviors and longevity (Strickhouser, Zell, & Krizan, 2017). Thus, personality traits and processes are relevant to understanding how healthy sleep is promoted and sustained over time.

Personality and Sleep are Associated with Each Other

Because both personality and sleep are associated with consequential outcomes (e.g., occupational success, relationship satisfaction, psychological well-being, and physical health; Barrick & Mount, 1991; DeNeve & Cooper, 1998; Friedman & Kern, 2014; Litwiller, Snyder, Taylor, & Steele, 2016; Luyster, Strollo, Zee, & Walsh, 2012; Malouff, Thorsteinsson, Schutte, Bhullar, & Rooke, 2009; Slavish et al., 2018; Troxel, Robles, Hall, & Buysse, 2007), it is surprising that research on personality and multiple dimensions of subjectively-, behaviorally-, and objectively-assessed sleep is still relatively nascent. Historically, there has been relatively little overlap or cross-talk between researchers interested in personality or sleep, likely due to differences in publication outlets (personality, social psychology, and developmental journals versus medical, psychiatric, neuroscience, and public health journals). Some differences may also emerge due to training. For example, personality psychologists may not be aware of multidimensional, reliable, and valid self-reports of sleep (as they are often published in specialized sleep journals), or may not have the training, funding, or personnel required for the collection, interpretation, and analysis of behavioral (actigraphy) and physiological (polysomnographic) sleep data (Hall, 2010). Similarly, sleep researchers may lack awareness of hierarchical models of personality and individual differences which may subsume some of the measures they are often interested in (e.g., positive and negative affect, impulsivity, motivation, and creativity), or they may not collect the large sample sizes that are more typical in personality psychology and necessary for precise analyses of individual differences. Despite this, sleep researchers are beginning to recognize that in intervention studies focused on improving consequential outcomes such as mental and physical health, personality traits may help identify individuals at-risk for poor sleep and individuals more or less amenable to intervention. Similarly, personality researchers are beginning to recognize that sleep may be a missing psychological, behavioral, and physiological mechanism implicated in personality processes across the lifespan. Thus, research at the intersection of sleep and personality is exponentially increasing (see Fig. 1).

Circadian Preference and Chronotype

Personality and chronotype is the most well-established and most frequently-researched area in personality and sleep (see Randler, chapter "Chronotype and Social Behavior", this volume, for review of chronotype research). Because chronotype is conceptualized as a relatively stable (trait-like) individual differences measure of sleep timing and preferences for activity during different times of day

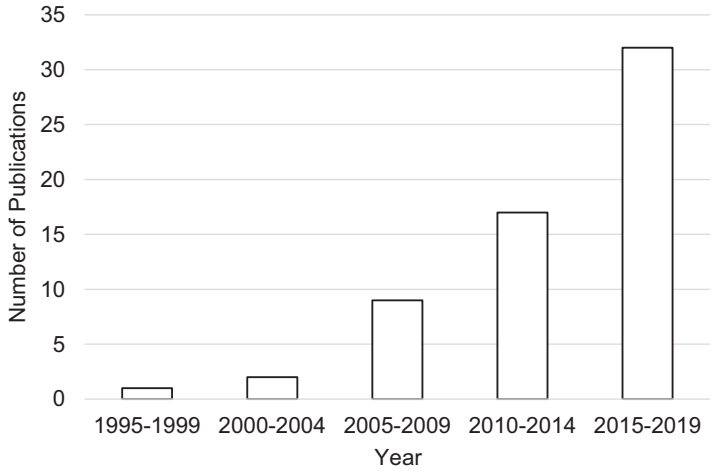

Fig. 1 Number of publications in SCOPUS with "Big Five" and sleep or circadian listed in the title, abstract, or keywords. We believe this to be an underestimate of the total published literature

(Randler, Schredl, & Göritz, 2017), there has been a rich tradition of distinguishing it from other individual difference characteristics (such as personality), and researchers interested in chronotype often publish in personality journals. A recent meta-analysis of the work in this area demonstrates conscientiousness is robustly correlated with chronotype, regardless of whether it is assessed by separate types (i.e., morningness or eveningness) or continuously (Lipnevich et al., 2017). Extraversion, openness, and low neuroticism also correlate with morningness, though to less of an extent than conscientiousness (Adan et al., 2012; DeYoung et al., 2007; Lipnevich et al., 2017; Randler, 2008). Part of the reason for overlap between personality and chronotype may be due to common genetic bases (Duggan, Friedman, McDevitt, & Mednick, 2014), including CLOCK and PER3 (Jiménez, Pereira-Morales, & Forero, 2017; Terracciano et al., 2010).

The majority of research in this area has used self-report measures of circadian preference and has not included behavioral or physiologic indices of the circadian system, such as circadian phase angles, dim light melatonin onset, or the timing and periodicity of biological rhythms (e.g., temperature, Frank et al., 2013; Skene & Arendt, 2006, though see Hasler, Buysse, Kupfer, & Germain, 2010 and Terracciano et al., 2014, for exceptions). Associations between personality and behavioral or physiologic measures of circadian rhythms are a ripe area for future research. It will also be important to disentangle biological (genetic) contributions to both personality and chronotype, relative to daily behaviors linking stable individual differences (i.e., personality traits) to chronotype and circadian preference across development (see also Tutek et al., chapter "Daily Rhythmicity in Social Activity", this volume).

Sleep Quality, Sleep Complaints, and Insomnia

Following chronotype, self-reports of poor sleep quality, sleep complaints, daytime sleepiness, and insomnia are the most commonly investigated. Sleep quality (e.g., Buysse et al., 2017; Buysse, Reynolds III, Monk, Berman, & Kupfer, 1989; Hays, Martin, Sesti, & Spritzer, 2005; Yu et al., 2011) includes not just self-reported global assessments, but also multidimensional indices tapping trouble falling asleep and staying asleep, the restorativeness and length of sleep, and daytime dysfunction and sleepiness. Self-report measures of insomnia (e.g., Levine et al., 2003; Morin, Belleville, Bélanger, & Ivers, 2011; Soldatos, Dikeos, & Paparrigopoulos, 2000) also capture several of these dimensions. Thus, measures of poor sleep quality and insomnia are highly correlated as they tap similar complaints. However, *clinical diagnoses* of insomnia are more than just reports of poor sleep quality: insomnia diagnoses require complaints about sleep quality *or* duration, with difficulties falling asleep or maintaining sleep *despite adequate opportunity for sleep*, resulting in clinically-significant daytime distress or impairment for at least three nights per week for over 3 months. These complaints must not be better explained by other health behaviors (substance use), medications, or other physical and mental health problems (Buysse, Rush, & Reynolds, 2017; Morin et al., 2015). Thus, although personality correlates of poor sleep quality and insomnia are similar due to their high conceptual overlap, it is important to note mechanisms linking personality and each of these dimensions of sleep may vary.

Personality traits are robustly correlated with self-reported poor sleep quality and insomnia symptoms. The strongest and most consistent associations are for high neuroticism, followed by low conscientiousness, low extraversion, and then agreeableness. Openness is not consistently associated with better sleep quality (Bertelson & Monroe, 1979; Calkins, Hearon, Capozzoli, & Otto, 2013; Duggan et al., 2014; Hintsanen et al., 2014; Križan & Hisler, 2019; Stephan, Sutin, Bayard, Križan, & Terracciano, 2018; van de Laar, Verbeek, Pevernagie, Aldenkamp, & Overeem, 2010). While there is no "objective" physiological or biological test for insomnia (it is completely dependent on self-reports), some research in insomnia has focused on sleep-state misperceptions (Vela-Bueno et al., 2010) or differences between perceived sleep and objective sleep on polysomnographic indicators (Dorsey & Bootzin, 1997). These differences may be linked to neuroticism (Costa & McCrae, 1987; Watson & Pennebaker, 1989). That is, in addition to functioning as a predictor or correlate of sleep quality, personality traits (particularly neuroticism and negative affectivity) may also moderate associations between subjective and behavioral or objective indices of sleep (as subjective reports are influenced by negative response styles; Watson & Pennebaker, 1989).

Though this area of research is smaller than that of personality and chronotype, more work has been done to disentangle pathways linking personality and sleep quality. Neuroticism may be a particularly important correlate of poor sleep quality because it is associated with stress (Williams & Moroz, 2009), poorer emotion regulation (Mauss, Troy, & LeBourgeois, 2012; Vantieghem, Marcoen, Mairesse, &

Vandekerckhove, 2016), problematic internet use (Herlache, Lang, & Krizan, 2018), and hyperarousal and rumination before bed (Cellini, Duggan, & Sarlo, 2017). On the other hand, conscientiousness likely promotes better sleep quality indirectly through better health behaviors related to sleep (i.e., sleep hygiene) as well as maintaining a more consistent bedtime routine and schedule (Duggan et al., 2014; Križan & Hisler, 2019). Extraversion may play a role via positive affectivity and sociability (Stephan et al., 2018), and agreeableness may promote sleep via feelings of trust and safety, as well as reduced interpersonal distress (Dahl & Lewin, 2002; Gunn, Troxel, Hall, & Buysse, 2014). Yet bidirectional associations are also possible, and poor sleep quality may also reliably predict personality change over time. One analysis of both Japanese and United States participants found poor sleep quality to be prospectively related to decreases in conscientiousness, agreeableness, and extraversion, and increases in neuroticism (Stephan et al., 2018), perhaps because chronically-poor sleep quality may deplete the psychosocial and physiological resources required for maintaining motivation, self-control, trust, positive affect, and emotion regulation. Genetic influences may also play an important role for tying personality traits to sleep quality. Both personality and sleep quality show substantive heritability (Bleidorn, Kandler, & Caspi, 2014; Lind & Gehrman, 2016), so it is important to evaluate whether shared genetic influences contribute to their phenotypic links. To this end, Krizan, Hisler, Krueger, and McGue (2019), estimated genetic correlations between sleep quality and personality traits in a large sample of twins, finding strong genetic overlap with neuroticism, extraversion, and aggression. Multivariate analyses indicated that unique genetic influences shape the overlap of sleep quality with different traits.

Finally, recent work has focused on sleep quality as an intervening variable linking personality and consequential health outcomes. One study found sleep latency, disturbance, and quality mediated associations between neuroticism and depressive symptoms, and sleep latency and daytime dysfunction mediated associations between conscientiousness and depressive symptoms. Although data were cross-sectional, alternative models exploring depression as a mediator of personality-sleep associations were not supported (Huang, Peck, Mallya, Lupien, & Fiocco, 2016). In another cross-sectional study, associations between neuroticism (the only trait measured) and depressive symptoms were mediated by daytime dysfunction and alertness upon waking (i.e., sleep inertia; Wong, Zhang, Wing, & Lau, 2017). In the first study to examine sleep as a potential reasons that personality traits predict mortality, recent work using a large longitudinal sample found that self-reported daytime dysfunction (rather than sleep problems) mediated the personality-mortality association, with higher neuroticism, lower conscientiousness, and lower extraversion predicting increased mortality risk via daytime dysfunction (Spears, Montgomery-Downs, Steinman, Duggan, & Turiano, 2019). Together, these three studies suggest the daytime consequences of poor nocturnal sleep may be especially important to understanding links between personality and health outcomes.

Like work on personality and chronotype, work on personality and sleep quality could profitably incorporate multiple methods, including partner-ratings of personality and dimensions of sleep quality to test actor-partner (i.e., participant and spouse) effects

on sleep and personality dynamics. Additionally, studies incorporating physiological measures of sleep and laboratory-based correlates of poor sleep quality and daytime dysfunction (e.g., the Psychomotor Vigilance Test; Killgore, Richards, Killgore, Kamimori, & Balkin, 2007) would be useful for testing sleep state misperception hypotheses, which may be particularly relevant to neuroticism. Additional work should delve into associations at the facet level, which may provide finer-grained insight into psychosocial mechanisms linking personality and sleep quality, and thus, targets for intervention.

Sleep Duration

The majority of research on associations between personality and sleep duration finds null associations (Calkins et al., 2013; Duggan et al., 2014; Gray & Watson, 2002; Randler, 2009; Soehner, Kennedy, & Monk, 2007), though there is scattered evidence for weak correlations between short sleep duration and neuroticism (Gau, 2000; Vincent, Cox, & Clara, 2009), impulsivity (Grano et al., 2007), effortful control (Diaz et al., 2017), conscientiousness (Randler, 2008), extraversion (Randler et al., 2017), openness (Križan & Hisler, 2019), and agreeableness (Hintsanen et al., 2014; Randler, 2008). Furthermore, neuroticism and low extraversion may predispose individuals to the negative sequelae associated with acute sleep deprivation (i.e., they may function as moderators; Mastin, Peszka, Poling, Phillips, & Duke, 2005).

It is possible that associations between personality and sleep duration are truly trivial. However, there are several limitations in this area that are critical to address. First, most studies are cross-sectional in nature and utilize self-reports of both personality and sleep, often testing only one or a few traits. Additionally, secondary data analyses relying on single-item questions assessing sleep duration are common, with questionable reliability and validity relative to questions tapping sleep schedules, daily diary measures, or behavioral or physiologic measures of sleep duration (Hall, 2010; Matthews et al., 2018). This makes small associations across traits difficult to interpret. Second, given the importance of both short *and* long sleep durations to physical health (Cappuccio, D'Elia, Strazzullo, & Miller, 2010; Gallicchio & Kalesan, 2009), it may be that absence of linear associations masks curvilinear patterns between personality and sleep duration. In support of this, one study examining U-shaped associations between personality and sleep duration found neuroticism was associated with both short and long sleep durations (Allen, Magee, & Vella, 2016), and recent work in a large, longitudinal sample found associations between low conscientiousness, high neuroticism, and mortality risk were mediated by both short and long sleep durations (Spears et al., 2019). Third, associations may vary across developmental stage, but most research has been conducted on adult samples. Sleep duration may be more robustly associated with temperament—the developmental precursor to personality—in children (Moore, Slane, Mindell, Burt, & Klump, 2011; Sadeh, 2007; see Williams, chapter "Sleep and Temperament in

Early Childhood", this volume, for review). Fourth, personality and sleep duration may be more intricately linked at the *state* level, with acute bouts of sleep deprivation depleting resources required for emotion regulation, self-control, social competence, and activity (see Engle-Friedmann, chapter "Sleep's Role in Effortful Performance and Sociability", this volume; Goldschmied, chapter "How Sleep Shapes Emotion Regulation", this volume; Hisler & Križan, "Dynamics between Sleep and Self-Control", this volume). Similarly, days characterized by reduced self-control, inactivity, difficulties in emotion regulation, and increases in negative affect may lead to nights of shorter sleep (Slavish et al., 2018). Additional multimethod research on personality and sleep duration is required before firm conclusions can be drawn.

Sleep Regularity, Variability, and Social Jetlag A final possibility for research on sleep duration and personality may be to focus on sleep *deficiency* (the difference between typical and preferred sleep duration), which is sometimes indexed using sleep *variability,* or differences in weekday and weekend sleep duration. In a large analysis of Australians and Finns, neuroticism, extraversion, low agreeableness, and low conscientiousness were related to more sleep deficiency (the difference between typical and preferred sleep duration). Thus, in terms of sleep length, personality traits may more correlate more robustly with (at least perceived) *discrepancies* between preferred and usual sleep (and associated daytime consequences) rather than actual sleep duration or length.

It will also be important to examine associations between personality and social jetlag, which indexes the misalignment between biological and social timing (Wittmann, Dinich, Merrow, & Roenneberg, 2006). To the extent that individuals are consistently unable to meet their sleep need (voluntarily or otherwise) and occasionally engage in attempts to "catch up" on sleep on free days or weekends, this mismatch may be indexed both by sleep variability (i.e., low stability) or social jetlag (undersleeping on weekdays and oversleeping on weekends). Additionally, individuals advance or delay their preferred (biological) sleep schedules due to school and work schedules, as well as social engagements. Personality may be related to social jetlag or variability because personality processes link traits to selection into these educational, occupational, and social environments.

Three cross-sectional studies speak to this possibility. One found agreeableness and low conscientiousness are related to oversleeping on weekends, and extraversion, low agreeableness, and low conscientiousness are related to misalignment and social jetlag (Randler, 2008). A second found delayed sleep-wake phase disorder patients (characterized by delayed timing of circadian rhythms) were characterized high agreeableness, conscientiousness, and extraversion, and low neuroticism relative to controls, although samples were very small (Micic, Lovato, Gradisar, & Lack, 2017). Finally, recent work in the a large, longitudinal cohort also found that variability in sleep duration was related to neuroticism; variability in sleep continuity (latency, fragmentation, and wake after sleep onset as indexed using actigraphy) was related to low conscientiousness and high neuroticism; and variability in sleep quality was related to neuroticism and low extraversion (Križan & Hisler, 2019).

Thus, future research should continue to examine associations between personality and social jetlag as well as sleep variability, using both self-reported and behavioral measures of sleep. Because sleep variability and social jetlag are of increasing interest as predictors of cardiometabolic risk, particularly fasting glucose and insulin resistance (Scheer, Hilton, Mantzoros, & Shea, 2009; Wong, Hasler, Kamarck, Muldoon, & Manuck, 2015), personality traits may provide a unique window towards identifying individuals who might be well-suited for behavioral sleep interventions focused on reducing social jetlag, sleep variability, or circadian misalignment (see Tutek et al., chapter "Daily Rhythmicity in Social Activity", this volume).

Research on Sleep Hygiene, Behaviorally-Assessed Sleep, and Objectively-Assessed Sleep Is Ripe for Future Personality Research

Though personality traits have been extensively linked to *daytime* health behaviors (Turiano, Chapman, Gruenewald, & Mroczek, 2015), it is surprising that little research has examined links between personality and health behaviors that promote sleep. Poor sleep hygiene involves long daytime naps; irregular wake schedules; doing cognitively- or emotionally-stimulating activities, exercising, or using tobacco, alcohol, or caffeine before going to bed; sleeping in an uncomfortable bedroom; and thinking, planning, or worrying before bed (Mastin, Bryson, & Corwyn, 2006). To our knowledge, only one study (Duggan et al., 2014) has examined associations between personality and sleep hygiene, with conscientiousness, agreeableness and low neuroticism emerging as predictors. Another did not look at sleep hygiene per se but found that non-restorative daytime nap habits were related to low conscientiousness and high neuroticism (Duggan, McDevitt, Whitehurst, & Mednick, 2018), and a third found more conscientious individuals are less likely to procrastinate their bed time, which should improve sleep (Kroese, De Ridder, Evers, & Adriaanse, 2014). Given that a portion of the association between personality and mortality risk is unexplained by daytime health behaviors (Booth et al., 2014; Hagger-Johnson et al., 2012; Hampson, Goldberg, Vogt, & Dubanoski, 2006), sleep hygiene (as well as the other characteristics of sleep described above) may be a missing link in models of personality and health.

There is also very little research on behaviorally-assessed sleep using actigraphy. One notable exception in adults (Križan & Hisler, 2019) found conscientiousness and low neuroticism were associated with lower actigraphically-assessed sleep latency, lower wake after sleep onset, and lower fragmentation indices, as well as reduced variability in these variables. In children, Diaz et al. (2017) found actigraphically-assessed longer sleep duration (but not variability in sleep duration, sleep onset, sleep latency, or sleep efficiency) was associated with more effortful control in children. Other analyses in children have linked less actigraphy-assessed sleep duration with greater depression, anxiety, and externalizing symptoms (Kelly

& El-Sheikh, 2014), and better sleep efficiency to lower behavioral dysregulation and emotional arousal (El-Sheikh, Buckhalt, Cummings, & Keller, 2007), though another analysis found null results (El-Sheikh, Kelly, Buckhalt, & Benjamin Hinnant, 2010). These results are promising and suggest that personality (and temperament) may be associated with behaviorally-assessed sleep throughout the lifespan (see Williams, chapter "Sleep and Temperament in Early Childhood", this volume). We encourage researchers to continue to examine sleep using actigraphy, focusing on both long-term (trait-like) and short-term (daily, state-like) associations.

At the time of publication of this chapter, there are (to our knowledge) no published reports on personality and objectively-assessed sleep using polysomnography (PSG). While both actigraphy and PSG provide estimates of total sleep time and sleep continuity, only PSG can generate measures of sleep architecture and depth. Additionally, while actigraphy relies solely on movements (and sometimes light) in its scoring, PSG is a more comprehensive record of the physiological changes that occur during sleep, including electrical activity in the brain (electroencephalography; EEG), eye movements (electrooculography; EOG), muscle movements (electromyography; EMG), heart rate (electrocardiography; EKG), respiration, and airflow. PSG is therefore the gold standard for assessment of sleep (Hall, 2010). While studies using PSG could determine whether personality is related to objectively-assessed sleep duration, continuity, timing, and regularity, they importantly might also provide a window linking personality and physiological functioning in the brain using sleep architecture, staging, and depth using EEG. Studies of this type could allow comparison of self-reported sleep against objective measures, to examine the role of personality in sleep-state misperception. Although polysomnography studies are time-consuming, expensive, and require specialized training, we hope that researchers will soon begin work of this type. Even small pilot studies would be informative for securing grant funding to examine personality and polysomnographically-assessed sleep using the sample sizes typical of personality research. Moreover, advances in at-home EEG assessment could provide less costly, yet more naturalistic measures of sleep behavior and architecture relative to laboratory-based PSG assessments (e.g., Wang, Loparo, Kelly, & Kaplan, 2015).

Future Research on Personality and Sleep Should Focus on Interactions Among Sleep and Personality Traits, States, and Processes Across Time

In addition to the suggestions noted above for specific dimensions of sleep, there are also several areas of research that could profitably integrate or translate across multiple dimensions of sleep. First, future research should determine why conscientiousness and neuroticism are particularly important to sleep. Duggan et al. (2014)

proposed that conscientiousness likely promotes healthy sleep through habitual sleep behaviors, such as an earlier sleep timing and waking routines, a regular sleep schedule, and salubrious sleep hygiene. On the other hand, low neuroticism might promote healthy sleep via positive emotions and reduced hyperarousal (Cellini et al., 2017) which ultimately promote better subjective sleep experiences, including perceptions of better sleep quality and reduced daytime sleepiness. The extent to which these associations are direct or bidirectional (via a possible feedback loop or *personality process* through which personality stability is achieved via sleep habits) may vary across development and nature of phenomena (e.g., the trait versus state level). Longitudinal research with multiple assessments of personality and sleep are required to disentangle these pathways. Second, additional work using observer reports of personality and behavioral or objective assessments of sleep will be necessary to determine to what extent are personality and sleep are correlated due to common method bias, and whether personality is also associated with *behavioral* or *physiologic* indices of sleep. Finally, more research is needed on habitual sleep behaviors (e.g., sleep regularity and sleep hygiene) as well as subjective sleep experiences (e.g., sleep quality, sleepiness, and daytime dysfunction) for adequate comparison of the strength of conscientiousness and neuroticism with each sleep domain, ideally via meta-analysis or meta-regression.

A second open question involves the directionality of trait-like versus state-like measures of personality and sleep. Is personality *causally* associated with healthy sleep? Can sleep reliably *change* personality? Answers to these questions likely vary by age. Trait-dependent processes for sleep assume the individual has some *direct, volitional control* over their sleep hygiene, timing, and length which is relatively stable and enduring (see Conceptual Fig. 2 for a hypothetical model). In young children, temperament is more plastic and biologically-determined (Rothbart,

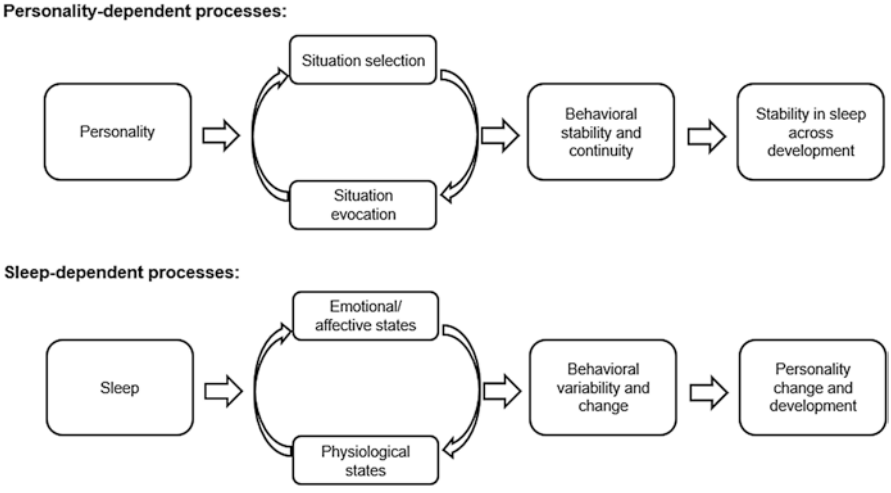

Fig. 2 A conceptual figure illustrating models linking personality and sleep at different levels of measurement across the lifespan

Ahadi, & Evans, 2000; Shiner & Caspi, 2003), and sleep is somewhat more variable and determined largely by family socioeconomic status, parent personality and behaviors, family conflict, parental sleep schedules (and occupations), school schedules, and culture (Adam, Snell, & Pendry, 2007; El-Sheikh, Buckhalt, Mize, Acebo, & El-sheikh, 2006; Jenni & LeBourgeois, 2006; Jenni & O'Connor, 2005; Owens, 2004; Zhang, Li, Fok, & Wing, 2010; see Williams, chapter "Sleep and Temperament in Early Childhood", this volume for review). For example, children whose sleep is relatively short, of variable timing and length, and frequently interrupted (perhaps due to family or neighborhood stress) may feel angry, frustrated, impulsive, or sad; to the extent that this process is repeated across development, these children may experience increases in neuroticism and decreases in conscientiousness, extraversion, and agreeableness. Infancy, childhood, and adolescence may therefore be a sensitive period in which sleep may influence temperament and thus, later personality. However, in adulthood personality is relatively enduring and sleep is more variable (Knutson, Rathouz, Yan, Liu, & Lauderdale, 2006; Roberts, Walton, & Viechtbauer, 2006), and individuals have more personal control over their sleep schedules and timing. For example, adults who have salubrious sleep hygiene and daytime health behaviors (i.e., they regularly exercise; avoid alcohol, tobacco, and drug use; and get in and out of bed at the same time each day), who also experience more stability and positivity in their emotions and interpersonal interactions, may report better sleep quality, less social jetlag, and better sleep continuity. Thus, adulthood may be a window of time when personality may be more likely to influence sleep.

A third substantial open question is the extent to which results vary by time span or developmental period. In experimental, daily dairy, or actigraphy studies, sleep *states* may impact affect and cognition, therefore changing personality *states* (e.g., impulsivity, Hisler & Krizan, 2017), assuming little underlying trait change. In contrast, studies using trait-like measures (or averages) collected prospectively years or decades apart may find that personality *traits* may be more likely to prospectively predict *trait-like* or averaged measures of sleep (including within-person variability), although this is an open question (Duggan et al., 2014; Križan & Hisler, 2019). We see possibly conflicting results at different units of analysis as mutually supportive rather than exclusive, since results cannot be extrapolated from the trait level to the state level and vice versa (ecological fallacy; Wilson et al. 2017). In other words, when changing units of analysis, associations may be absent or even in the opposite direction, because different phenomena are at play. Work integrating sleep and personality at multiple levels of measurement (e.g., integrating state and trait across days and across years via burst designs; Sliwinski, 2008) using multiple methods of personality and sleep (e.g., self-reports, observer reports, actigraphy, and polysomnography), will all be important. Such studies will be informative for understanding the role of personality *processes* in sleep as well as considering *variability* in both personality and sleep states. Additional experimental manipulations of personality and sleep could provide causal evidence of associations, and also inform intervention development aimed at improving sleep and public health.

Finally, given the importance of sleep for public health (Luyster et al., 2012), a fourth need includes applied mediational research on personality and health in service of public health interventions. For example, personality could be used to (1) identify individuals in the population who may have the greatest need for sleep interventions; (2) develop personality-informed interventions targeted to work synergistically with their personality profile; and (3) to use sleep interventions to shift problematic personality expressions, ultimately producing better health. Importantly, experimental research in this area would provide support for or against hypothetical causal models linking personality traits to future sleep, and sleep to changing personality traits.

The depth and breadth of associations between personality and sleep with consequential outcomes like health suggests the need for development and refinement of the theoretically-plausible causal models noted in the four substantial open questions above. For example, does personality lead to these consequential outcomes via sleep? Does sleep promote these consequential outcomes via personality development and change? To what extent are associations bidirectional? How and why do associations vary across different dimensions of personality and sleep, and across development? These questions still await answers, and we hope that researchers will continue to leverage increasingly sophisticated measurement tools to tackle them.

References

Adam, E. K., Snell, E. K., & Pendry, P. (2007). Sleep timing and quantity in ecological and family context: A nationally representative time-diary study. *Journal of Family Psychology, 21*(1), 4–19. https://doi.org/10.1037/0893-3200.21.1.4

Adan, A., Archer, S. N., Hidalgo, M. P., Di Milia, L., Natale, V., & Randler, C. (2012). Circadian typology: A comprehensive review. *Chronobiology International, 29*(9), 1153–1175. https://doi.org/10.3109/07420528.2012.719971

Allen, M. S., Magee, C. A., & Vella, S. A. (2016). Personality, hedonic balance, and the quality and quantity of sleep in adulthood. *Psychology and Health, 31*(9), 1091–1107. https://doi.org/10.1080/08870446.2016.1178745

Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the HEXACO model of personality structure. *Personality and Social Psychology Review, 11*(2), 150–166. https://doi.org/10.1177/1088868306294907

Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta analysis. *Personnel Psychology, 44*(1), 1–26. https://doi.org/10.1111/j.1744-6570.1991.tb00688.x

Bertelson, A. D., & Monroe, L. J. (1979). Personality patterns of adolescent poor and good sleepers. *Journal of Abnormal Child Psychology, 7*(2), 191–197.

Bleidorn, W., Kandler, C., & Caspi, A. (2014). The behavioural genetics of personality development in adulthood-classic, contemporary, and future trends. *European Journal of Personality, 28*, 244–255.

Booth, T., Mõttus, R., Corley, J., Gow, A. J., Henderson, R. D., Muñoz Maniega, S., … Deary, I. J. (2014). Personality, health, and brain integrity: The Lothian birth cohort study 1936. *Health Psychology, 33*(12), 1477–1486. https://doi.org/10.1037/hea0000012

Buss, D. M. (1987). Selection, evocation, and manipulation. *Journal of Personality and Social Psychology, 53*(6), 1214–1221.

Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*, 193–213.

Buysse, D. J., Rush, A. J., & Reynolds, C. F. (2017). Clinical management of insomnia disorder. *Journal of the American Medical Association, 318*(20), 1973–1974. https://doi.org/10.1001/jama.2017.15683

Buysse, D. J., Yu, L., Moul, D. E., Germain, A., Stover, A., Dodds, N. E., … Pilkonis, P. A. (2017). Development and validation of patient-reported outcome measures for sleep disturbance and sleep-related impairments. *Sleep, 33*(6), 781–792. https://doi.org/10.1093/sleep/33.6.781

Calkins, A. W., Hearon, B. A., Capozzoli, M. C., & Otto, M. W. (2013). Psychosocial predictors of sleep dysfunction: The role of anxiety sensitivity, dysfunctional beliefs, and neuroticism. *Behavioral Sleep Medicine, 11*(2), 133–143. https://doi.org/10.1080/15402002.2011.643968

Cappuccio, F. P., D'Elia, L., Strazzullo, P., & Miller, M. A. (2010). Sleep duration and all-cause mortality: A systematic review and meta-analysis of prospective studies. *Sleep, 33*(5), 585–592.

Caspi, A., Bem, D. J., & Elder, G. H. (1989). Continuities and consequences of interactional styles across the life course. *Journal of Personality, 57*(2), 375–406.

Cellini, N., Duggan, K. A., & Sarlo, M. (2017). Perceived sleep quality: The interplay of neuroticism, affect, and hyperarousal. *Sleep Health, 3*(3), 184–189. https://doi.org/10.1016/j.sleh.2017.03.001

Costa, P., & McCrae, R. (1987). Neuroticism, somatic complaints, and disease: Is the bark worse than the bite? *Journal of Personality, 55*(2), 299–316.

Dahl, R. E., & Lewin, D. S. (2002). Pathways to adolescent health: Sleep regulation and behavior. *Journal of Adolescent Health, 31*, 175–184.

Deary, I. J., Weiss, A., & Batty, G. D. (2010). Intelligence and personality as predictors of illness and death: How researchers in differential psychology and chronic disease epidemiology are collaborating to understand and address health inequalities. *Psychological Science in the Public Interest, 11*(2), 53–79. https://doi.org/10.1177/1529100610387081

DeNeve, K. M., & Cooper, H. (1998). The happy personality: A meta-analysis of 137 personality traits and subjective Well-being. *Psychological Bulletin, 124*(2), 197–229. https://doi.org/10.1037/0033-2909.124.2.197

Dermody, S. S., Wright, A. G. C., Cheong, J., Miller, K. G., Muldoon, M. F., Flory, J. D., … Manuck, S. B. (2016). Personality correlates of midlife cardiometabolic risk: The explanatory role of higher-order factors of the five-factor model. *Journal of Personality, 84*(6), 765–776. https://doi.org/10.1111/jopy.12216

DeYoung, C. G. (2015). Cybernetic big five theory. *Journal of Research in Personality, 56*, 33–58. https://doi.org/10.1016/j.jrp.2014.07.004

DeYoung, C. G., Hasher, L., Djikic, M., Criger, B., & Peterson, J. B. (2007). Morning people are stable people: Circadian rhythm and the higher-order factors of the big five. *Personality and Individual Differences, 43*, 267–276. https://doi.org/10.1016/j.paid.2006.11.030

Diaz, A., Berger, R., Valiente, C., Eisenberg, N., VanSchyndel, S. K., Tao, C., … Southworth, J. (2017). Children's sleep and academic achievement: The moderating role of effortful control. *International Journal of Behavioral Development, 41*(2), 275–284. https://doi.org/10.1177/0165025416635284

Dorsey, C. M., & Bootzin, R. R. (1997). Subjective and psychophysiologic insomnia: An examination of sleep tendency and personality. *Biological Psychiatry, 41*, 209–216. https://doi.org/10.1016/0006-3223(95)00659-1

Duggan, K. A., Friedman, H. S., McDevitt, E. A., & Mednick, S. C. (2014). Personality and healthy sleep: The importance of conscientiousness and neuroticism. *PLoS One, 9*(3), e90628. https://doi.org/10.1371/journal.pone.0090628

Duggan, K. A., McDevitt, E. A., Whitehurst, L. N., & Mednick, S. C. (2018). To nap, perchance to DREAM: A factor analysis of college students' self-reported reasons for napping. *Behavioral Sleep Medicine, 16*(2), 135–153. https://doi.org/10.1080/15402002.2016.1178115

El-sheikh, A. M., Buckhalt, J. A., Mize, J., Acebo, C., & El-sheikh, M. (2006). Marital conflict and disruption of children's sleep. *Child Development, 77*(1), 31–43.

El-Sheikh, M., Buckhalt, J. A., Cummings, E. M., & Keller, P. (2007). Sleep disruptions and emotional insecurity are pathways of risk for children. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 48*(1), 88–96. https://doi.org/10.1111/j.1469-7610.2006.01604.x

El-Sheikh, M., Kelly, R. J., Buckhalt, J. A., & Benjamin Hinnant, J. (2010). Children's sleep and adjustment over time: The role of socioeconomic context. *Child Development, 81*(3), 870–883. https://doi.org/10.1111/j.1467-8624.2010.01439.x

Fleeson, W. (2001). Toward a structure- and process-integrated view of personality: Traits as density distributions of states. *Journal of Personality and Social Psychology, 80*(6), 1011–1027. https://doi.org/10.1037//0022-3514.80.6.1011

Fleeson, W. (2004). Moving personality beyond the person-situation debate. *Current Directions in Psychological Science, 13*(2), 83–87. https://doi.org/10.1111/j.0963-7214.2004.00280.x

Frank, E., Sidor, M. M., Gamble, K. L., Cirelli, C., Sharkey, K. M., Hoyle, N., … Hasler, B. P. (2013). Circadian clocks, brain function, and development. *Annals of the New York Academy of Sciences, 1306*(1), 43–67. https://doi.org/10.1111/nyas.12335

Friedman, H. S., & Kern, M. L. (2014). Personality, Well-being, and health. *Annual Review of Psychology, 65*(18), 719–742. https://doi.org/10.1146/annurev-psych-010213-115123

Funder, D. C. (2006). Towards a resolution of the personality triad: Persons, situations, and behaviors. *Journal of Research in Personality, 40*(1), 21–34. https://doi.org/10.1016/j.jrp.2005.08.003

Funder, D. C. (2008). Persons, situations, and person-situation interactons. In P. Oliver, R. W. R. John, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 568–580). New York: The Guilford Press.

Gallicchio, L., & Kalesan, B. (2009). Sleep duration and mortality: A systematic review and meta-analysis. *Journal of Sleep Research, 18*, 148–158. https://doi.org/10.1111/j.1365-2869.2008.00732.x

Gau, S.-F. (2000). Neuroticism and sleep-related problems in adolescence. *Sleep, 23*(4), 1–8. https://doi.org/10.1093/sleep/23.4.1c

Grano, N., Keltikangas-Järvinen, L., Kouvonen, A., Puttonen, S., Virtanen, M., Vahtera, J., … Kivimäki, M. (2007). Association of impulsivity with sleep duration and insomnia in an employee population. *Personality and Individual Differences, 43*, 307–318. https://doi.org/10.1016/j.paid.2006.11.022

Gray, E. K., & Watson, D. (2002). General and specific traits of personality and their relation to sleep and academic performance. *Journal of Personality, 70*(2), 177–206.

Gunn, H. E., Troxel, W. M., Hall, M. H., & Buysse, D. J. (2014). Interpersonal distress is associated with sleep and arousal in insomnia and good sleepers. *Journal of Psychosomatic Research, 76*(3), 242–248. https://doi.org/10.1016/j.jpsychores.2013.11.010

Hagger-Johnson, G., Sabia, S., Nabi, H., Brunner, E., Kivimaki, M., Shipley, M., & Singh, A. (2012). Low conscientiousness and risk of all-cause, cardiovascular and cancer mortality over 17 years: Whitehall II cohort study. *Journal of Psychosomatic Research, 73*(2), 98–103. https://doi.org/10.1016/j.jpsychores.2012.05.007

Hall, M. H. (2010). Behavioral medicine and sleep: Concepts, measures, and methods. In A. Steptoe (Ed.), *Handbook of behavioral medicine* (pp. 749–765). New York: Springer. https://doi.org/10.1007/978-0-387-09488-5

Hampson, S. (2012). Personality processes: Mechanisms by which personality traits "get outside the skin". *Annual Review of Psychology, 63*, 315–339. https://doi.org/10.1146/annurev-psych-120710-100419.Personality

Hampson, S. E., Goldberg, L. R., Vogt, T. M., & Dubanoski, J. P. (2006). Forty years on: Teachers' assessments of children's personality traits predict self-reported health behaviors and outcomes at midlife. *Health Psychology, 25*(1), 57–64.

Hasler, B. P., Buysse, D. J., Kupfer, D. J., & Germain, A. (2010). Phase relationships between core body temperature, melatonin, and sleep are associated with depression severity: Further

evidence for circadian misalignment in non-seasonal depression. *Psychiatry Research, 178*(1), 205–207. https://doi.org/10.1016/j.psychres.2010.04.027

Hays, R. D., Martin, S. A., Sesti, A. M., & Spritzer, K. L. (2005). Psychometric properties of the medical outcomes study sleep measure. *Sleep Medicine, 6*(1), 41–44. https://doi.org/10.1016/j.sleep.2004.07.006

Herlache, A. D., Lang, K. M., & Krizan, Z. (2018). Withdrawn and wired: Problematic internet use accounts for the link of neurotic withdrawal to sleep disturbances. *Sleep Science, 11*(2), 69–73. https://doi.org/10.5935/1984-0063.20180015

Hintsanen, M., Puttonen, S., Smith, K., Törnroos, M., Jokela, M., Pulkki-råback, L., … Keltikangas-Järvinen, L. (2014). Five-factor personality traits and sleep: Evidence from two population-based cohort studies. *Health Psychology, 33*(10), 1214–1223.

Hisler, G., & Krizan, Z. (2017). Anger tendencies and sleep: Poor anger control is associated with objectively measured sleep disruption. *Journal of Research in Personality, 71*, 17–26. https://doi.org/10.1016/j.jrp.2017.08.009

Hisler, G. C., Krizan, Z., & DeHart, T. (2018). Does stress explain the effect of sleep on self-control difficulties? A month-long daily diary study. *Personality and Social Psychology Bulletin*. https://doi.org/10.1177/0146167218798823.

Huang, V., Peck, K., Mallya, S., Lupien, S. J., & Fiocco, A. J. (2016). Subjective sleep quality as a possible mediator in the relationship between personality traits and depressive symptoms in middle-aged adults. *PLoS One, 11*(6), e0157238. https://doi.org/10.1371/journal.pone.0157238

Jackson, J. J., Wood, D., Bogg, T., Walton, K. E., Harms, P. D., & Roberts, B. W. (2010). What do conscientious people do? Development and validation of the behavioral indicators of conscientiousness (BIC). *Journal of Research in Personality, 44*(4), 501–511. https://doi.org/10.1016/j.jrp.2010.06.005

Jenni, O. G., & LeBourgeois, M. K. (2006). Understanding sleep-wake behavior and sleep disorders in children: The value of a model. *Current Opinion in Psychiatry, 19*(3), 282–287. https://doi.org/10.1097/01.yco.0000218599.32969.03

Jenni, O. G., & O'Connor, B. B. (2005). Children's sleep: An interplay between culture and biology. *Pediatrics, 115*(1), 204–216. https://doi.org/10.1542/peds.2004-0815B

Jiménez, K. M., Pereira-Morales, A. J., & Forero, D. A. (2017). Higher scores in the extraversion personality trait are associated with a functional polymorphism in the PER3 gene in healthy subjects. *Chronobiology International, 34*(2), 1–7. https://doi.org/10.1080/07420528.2016.1268149

John, O. P., & Srivastava, S. (1999). The big five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality, theory and research* (2nd ed., pp. 102–138). New York: Guilford Press.

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative big five trait taxonomy: History, measurement, and conceptual issues. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 114–158). New York: Guilford Press.

Kelly, R. J., & El-Sheikh, M. (2014). Reciprocal relations between children's sleep and their adjustment over time. *Developmental Psychology, 50*(4), 1137–1147. https://doi.org/10.1037/a0034501

Killgore, W. D. S., Richards, J. M., Killgore, D. B., Kamimori, G. H., & Balkin, T. J. (2007). The trait of introversion-extraversion predicts vulnerability to sleep deprivation. *Journal of Sleep Research, 16*(4), 354–363. https://doi.org/10.1111/j.1365-2869.2007.00611.x

Knutson, K. L., Rathouz, P. J., Yan, L. L., Liu, K., & Lauderdale, D. S. (2006). Stability of the Pittsburgh sleep quality index and the Epworth sleepiness questionnaires over 1 year in early middle-aged adults: The CARDIA study. *Sleep, 29*, 1503–1506.

Križan, Z., & Hisler, G. (2019). Personality and sleep: Neuroticism and conscientiousness predict Behaviourally recorded sleep years later. *European Journal of Personality*, in press. https://doi.org/10.1002/per.2191

Krizan, Z., Hisler, G., Kruger, R. F., & McGure, M. C. (2019). Why is personality tied to sleep quality? A biometric analysis of aging twins. Manuscript submitted for publication.

Kroese, F. M., De Ridder, D. T., Evers, C., & Adriaanse, M. A. (2014). Bedtime procrastination: Introducing a new area of procrastination. *Frontiers in Psychology, 5*, 611.

Levine, D. W., Kaplan, R. M., Kripke, D. F., Bowen, D. J., Naughton, M. J., & Shumaker, S. A. (2003). Factor structure and measurement invariance of the Women's health initiative insomnia rating scale. *Psychological Assessment, 15*(2), 123–136. https://doi.org/10.1037/1040-3590.15.2.123

Lind, M., & Gehrman, P. (2016). Genetic pathways to insomnia. *Brain Sciences, 6*, 64.

Lipnevich, A. A., Credè, M., Hahn, E., Spinath, F. M., Roberts, R. D., & Preckel, F. (2017). How distinctive are morningness and eveningness from the big five factors of personality? A meta-analytic investigation. *Journal of Personality and Social Psychology, 112*(3), 491–509. https://doi.org/10.1037/pspp0000099

Litwiller, B., Snyder, L. A., Taylor, W. D., & Steele, L. M. (2016). The relationship between sleep and work: A meta-analysis. *Journal of Applied Psychology, 102*(4), 682–699. https://doi.org/10.1037/apl0000169.supp

Luyster, F. S., Strollo, P. J., Zee, P. C., & Walsh, J. K. (2012). Sleep: A health imperative. *Sleep, 35*(6), 727–734. https://doi.org/10.5665/sleep.1846

Malouff, J. M., Thorsteinsson, E. B., Schutte, N. S., Bhullar, N., & Rooke, S. E. (2009). The five-factor model of personality and relationship satisfaction of intimate partners: A meta-analysis. *Journal of Research in Personality, 44*(1), 124–127. https://doi.org/10.1016/j.jrp.2009.09.004

Mastin, D. F., Peszka, J., Poling, T., Phillips, R., & Duke, J. (2005). Personality as a predictor of the objective and subjective impact of sleep deprivation. *Personality and Individual Differences, 39*, 1471–1482. https://doi.org/10.1016/j.paid.2005.08.007

Mastin, D. F., Bryson, J., & Corwyn, R. (2006). Assessment of sleep hygiene using the sleep hygiene index. *Journal of Behavioral Medicine, 29*(3), 223–227. https://doi.org/10.1007/s10865-006-9047-6

Matthews, K. A., Patel, S. R., Pantesco, E. J., Buysse, D. J., Kamarck, T. W., Lee, L., & Hall, M. H. (2018). Similarities and differences in estimates of sleep duration by polysomnography, actigraphy, diary, and self-reported habitual sleep in a community sample. *Sleep Health, 4*(1), 96–103. https://doi.org/10.1016/j.sleh.2017.10.011

Mauss, I. B., Troy, A. S., & LeBourgeois, M. K. (2012). Poorer sleep quality is associated with lower emotion-regulation ability in a laboratory paradigm. *Cognition & Emotion, 27*(3), 1–10. https://doi.org/10.1080/02699931.2012.727783

McCabe, K. O., & Fleeson, W. (2016). Are traits useful? Explaining trait manifestations as tools in the pursuit of goals. *Journal of Personality and Social Psychology, 110*(2), 287–301. https://doi.org/10.1037/a0039490

Micic, G., Lovato, N., Gradisar, M., & Lack, L. C. (2017). Personality differences in patients with delayed sleep–wake phase disorder and non-24-h sleep–wake rhythm disorder relative to healthy sleepers. *Sleep Medicine, 30*, 128–135. https://doi.org/10.1016/j.sleep.2016.04.002

Moore, M., Slane, J., Mindell, J. A., Burt, S. A., & Klump, K. L. (2011). Sleep problems and temperament in adolescents. *Child: Care, Health and Development, 37*(4), 559–562. https://doi.org/10.1111/j.1365-2214.2010.01157.x

Morin, C. M., Belleville, G., Bélanger, L., & Ivers, H. (2011). The insomnia severity index: Psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep, 34*(5), 601–608.

Morin, C. M., Drake, C. L., Harvey, A. G., Krystal, A. D., Manber, R., Riemann, D., & Spiegelhalder, K. (2015). Insomnia disorder. *Nature Reviews Disease Primers, 1*, 1–18. https://doi.org/10.1038/nrdp.2015.26

Owens, J. A. (2004). Sleep in children: Cross-cultural perspectives. *Sleep and Biological Rhythms, 2*, 165–173.

Randler, C. (2008). Morningness–eveningness, sleep–wake variables and big five personality factors. *Personality and Individual Differences, 45*(2), 191–196. https://doi.org/10.1016/j.paid.2008.03.007

Randler, C. (2009). Proactive people are morning people. *Journal of Applied Social Psychology, 39*(12), 2787–2797. https://doi.org/10.1111/j.1559-1816.2009.00549.x

Randler, C., Schredl, M., & Göritz, A. S. (2017). Chronotype, sleep behavior, and the big five personality factors. *SAGE Open, 7*(3), 215824401772832. https://doi.org/10.1177/2158244017728321

Rauthmann, J. F., Horstmann, K. T., & Sherman, R. A. (2018). Do self-reported traits and aggregated states capture the same thing? A nomological perspective on trait-state homomorphy. *Social Psychological and Personality Science*. https://doi.org/10.1177/1948550618774772

Roberts, B. W., Caspi, A., & Moffitt, T. E. (2003). Work experiences and personality development in young adulthood. *Journal of Personality and Social Psychology, 84*(3), 582–593. https://doi.org/10.1037/0022-3514.84.3.582

Roberts, B. W., Kuncel, N. R., Shiner, R., Caspi, A., & Goldberg, L. R. (2007). The power of personality. *Perspectives on Psychological Science, 2*(4), 313–345. https://doi.org/10.1111/j.1745-6916.2007.00047.x

Roberts, B. W., Lejuez, C., Krueger, R. F., Richards, J. M., & Hill, P. L. (2014). What is conscientiousness and how can it be assessed? *Developmental Psychology, 50*(5), 1315–1330. https://doi.org/10.1037/a0031109

Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin, 132*(1), 1–25. https://doi.org/10.1037/0033-2909.132.1.1

Rothbart, M., Ahadi, S., & Evans, D. (2000). Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology, 78*(1), 122–135.

Sadeh, A. (2007). Consequences of sleep loss or sleep disruption in children. *Sleep Medicine Clinics, 2*(3), 513–520. https://doi.org/10.1016/j.jsmc.2007.05.012

Scarr, S., & McCartney, K. (1983). How people make their own environments: A theory of genotype --> environment effects. *Child Development, 54*(2), 424–435.

Scheer, F. A. J. L., Hilton, M. F., Mantzoros, C. S., & Shea, S. A. (2009). Adverse metabolic and cardiovascular consequences of circadian misalignment. *Proceedings of the National Academy of Sciences, 106*(11), 4453–4458. https://doi.org/10.1073/pnas.0808180106

Shiner, R., & Caspi, A. (2003). Personality differences in childhood and adolescence: Measurement, development, and consequences. *Journal of Child Psychology and Psychiatry, 44*(1), 2–32.

Skene, D. J., & Arendt, J. (2006). Human circadian rhythms: Physiological and therapeutic relevance of light and melatonin. *Annals of Clinical Biochemistry, 43,* 344–353. Review Article Human circadian rhythms: physiological and therapeutic relevance of light and melatonin, (OCTOBER), 344–353. https://doi.org/10.1258/000456306778520142

Slavish, D. C., Sliwinski, M. J., Smyth, J. M., Almeida, D. M., Lipton, R. B., Katz, M. J., & Graham-Engeland, J. E. (2018). Neuroticism, rumination, negative affect, and sleep: Examining between- and within-person associations. *Personality and Individual Differences, 123*(May 2017), 217–222. https://doi.org/10.1016/j.paid.2017.11.023

Sliwinski, M. J. (2008). Measurement-burst designs for social health research. *Social and Personality Psychology Compass, 2*(1), 245–261. https://doi.org/10.1111/j.1751-9004.2007.00043.x

Soehner, A. M., Kennedy, K. S., & Monk, T. H. (2007). Personality correlates with sleep-wake variables. *Chronobiology International, 24*(5), 889–903. https://doi.org/10.1080/07420520701648317

Soldatos, C. R., Dikeos, D. G., & Paparrigopoulos, T. J. (2000). Athens insomnia scale: Validation of an instrument based on ICD-10 criteria. *Journal of Psychosomatic Research, 48*(6), 555–560. https://doi.org/10.1016/S0022-3999(00)00095-7

Spears, S. K., Montgomery-Downs, H. E., Steinman, S., Duggan, K., & Turiano, N. A. (2019). Sleep: A pathway linking personality to mortality risk. *Journal of Research in Personality, 81*, 11–24. https://doi.org/10.1016/j.jrp.2019.04.007

Stephan, Y., Sutin, A. R., Bayard, S., Križan, Z., & Terracciano, A. (2018). Personality and sleep quality: Evidence from four prospective studies. *Health Psychology, 37*(3), 271–281. https://doi.org/10.1037/hea0000577

Strickhouser, J. E., Zell, E., & Krizan, Z. (2017). Does personality predict health and Well-being? A meta-synthesis. *Health Psychology, 36*(8), 797–810. https://doi.org/10.1037/hea0000475.supp

Terracciano, A., Sanna, S., Uda, M., Deiana, B., Usala, G., Busonero, F., … Costa, P. T., Jr. (2010). Genome-wide association scan for five major dimensions of personality. *Molecular Psychiatry, 15*, 646–656.

Terracciano, A., Strait, J., Scuteri, A., Meirelles, O., Sutin, A. R., Tarasov, K., … Schlessinger, D. (2014). Personality traits and circadian blood pressure patterns: A 7-year prospective study. *Psychosomatic Medicine, 76*(3), 237–243. https://doi.org/10.1097/PSY.0000000000000035

Troxel, W. M., Robles, T. F., Hall, M., & Buysse, D. J. (2007). Marital quality and the marital bed: Examining the covariation between relationship quality and sleep. *Sleep Medicine Reviews, 11*(5), 389–404. https://doi.org/10.1016/j.smrv.2007.05.002

Turiano, N. A., Chapman, B. P., Gruenewald, T. L., & Mroczek, D. K. (2015). Personality and the leading behavioral contributors of mortality. *Health Psychology, 34*(1), 51–60. https://doi.org/10.1037/hea0000038

van de Laar, M., Verbeek, I., Pevernagie, D., Aldenkamp, A., & Overeem, S. (2010). The role of personality traits in insomnia. *Sleep Medicine Reviews, 14*(1), 61–68. https://doi.org/10.1016/j.smrv.2009.07.007

Vantieghem, I., Marcoen, N., Mairesse, O., & Vandekerckhove, M. (2016). Emotion regulation mediates the relationship between personality and sleep quality. *Psychology and Health, 31*(9), 1064–1079. https://doi.org/10.1080/08870446.2016.1171866

Vela-Bueno, A., Bixler, E. O., Calhoun, S. L., Fernandez-Mendoza, J., Vgontzas, A. N., Basta, M., … Jose Ramos-Platon, M. (2010). Sleep misperception and chronic insomnia in the general population: Role of objective sleep duration and psychological profiles. *Psychosomatic Medicine, 73*(1), 88–97. https://doi.org/10.1097/psy.0b013e3181fe365a

Vincent, N., Cox, B., & Clara, I. (2009). Are personality dimensions associated with sleep length in a large nationally representative sample? *Comprehensive Psychiatry, 50*(2), 158–163. https://doi.org/10.1016/j.comppsych.2008.07.007

Wang, Y., Loparo, K. A., Kelly, M. R., & Kaplan, R. F. (2015). Evaluation of an automated single-channel sleep staging algorithm. *Nature and Science of Sleep, 7*, 101–111. https://doi.org/10.2147/nss.s77888

Watson, D., & Pennebaker, J. W. (1989). Health complaints, stress, and distress: Exploring the central role of negative affectivity. *Psychological Review, 96*(2), 234–254.

Williams, P. G., & Moroz, T. L. (2009). Personality vulnerability to stress-related sleep disruption: Pathways to adverse mental and physical health outcomes. *Personality and Individual Differences, 46*, 598–603. https://doi.org/10.1016/j.paid.2008.12.017

Wilmot, M. P., DeYoung, C. G., Stillwell, D., & Kosinski, M. (2015). Self-monitoring and the metatraits. *Journal of Personality, 84*(3), 335–347. https://doi.org/10.1111/jopy.12162

Wilson, R. E., Thompson, R. J., & Vazire, S. (2017). Are fluctuations in personality states more than fluctuations in affect? *Journal of Research in Personality, 69*, 110–123. https://doi.org/10.1016/j.jrp.2016.06.006

Wittmann, M., Dinich, J., Merrow, M., & Roenneberg, T. (2006). Social jetlag: Misalignment of biological and social time. *Chronobiology International, 23*(1–2), 497–509. https://doi.org/10.1080/07420520500545979

Wong, M. L., Zhang, J., Wing, Y. K., & Lau, E. Y. Y. (2017). Sleep-related daytime consequences mediated the neuroticism–depression link. *Sleep and Biological Rhythms, 15*(1), 21–30. https://doi.org/10.1007/s41105-016-0074-6

Wong, P. M., Hasler, B. P., Kamarck, T. W., Muldoon, M. F., & Manuck, S. B. (2015). Social Jetlag, chronotype, and cardiometabolic risk. *Journal of Clinical Endocrinology and Metabolism, 100*(12), 4612–4620. https://doi.org/10.1210/jc.2015-2923

Wrzus, C., & Mehl, M. R. (2015). Lab and/or field? Measuring personality processes and their social consequences. *European Journal of Personality, 29*(2), 250–271. https://doi.org/10.1002/per.1986

Wrzus, C., & Roberts, B. W. (2017). Processes of personality development in adulthood: The TESSERA framework. *Personality and Social Psychology Review, 21*(3), 253–277. https://doi.org/10.1177/1088868316652279

Yu, L., Buysse, D. J., Germain, A., Moul, D. E., Stover, A., Dodds, N. E., … Pilkonis, P. A. (2011). Development of short forms from the PROMIS™ sleep disturbance and sleep-related impairment item banks. *Behavioral Sleep Medicine, 10*(1), 6–24. https://doi.org/10.1080/15402002.2012.636266

Zhang, J., Li, A. M., Fok, T. F., & Wing, Y. K. (2010). Roles of parental sleep/wake patterns, socioeconomic status, and daytime activities in the sleep/wake patterns of children. *Journal of Pediatrics, 156*(4), 606–612.e5. https://doi.org/10.1016/j.jpeds.2009.10.036