Published in final edited form as:
Behav Sleep Med. 2014 March 4; 12(2): 123–142. doi:10.1080/15402002.2013.764530.

The Development of a Questionnaire to Assess Sleep-Related Practices, Beliefs, and Attitudes

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Abstract

There are no established questionnaires that evaluate habitual sleep practices in the context of beliefs and attitudes about sleep. This study describes an effort to develop and evaluate a questionnaire that assesses habitual sleep; behaviors associated with sleep and potential sleep problems; sleep hygiene; social and environmental determinants of sleep; beliefs and attitudes about sleep as it relates to health, safety, and functioning; and knowledge about sleep. A total of 124 participants completed the final questionnaire. Overall, the questionnaire and subscales demonstrated moderate internal consistency, and concurrent and divergent validity were demonstrated by comparing various subscales to existing measures. Future studies may utilize the descriptive data to determine the role of behavioral, social, and environmental determinants of healthy sleep.

Modifiable behavioral factors play an important role in many of the leading causes of morbidity and mortality. In particular, the leading "actual" causes of death in the United States (e.g., poor diet, physical inactivity, tobacco use, and alcohol consumption) are strongly influenced by factors proximal to the execution of the behavior (Mokdad, Marks, Stroup, & Gerberding, 2004). Understanding the factors associated with healthy, protective behaviors (e.g., healthy diet, physical activity, abstention from smoking, and limited alcohol use) is critical so that targeted health programs can implement successful interventions grounded in factors known to influence behaviors. These programs can then be applied on a macrolevel to improve population health and longevity (DiClemente, Crosby, & Kegler, 2002; Sallis, Owen, & Fisher, 2008).

The field of health behavior theory has emerged in response to this public health issue, and several approaches have proven particularly useful in the understanding of healthy behaviors in the pursuit of successful interventions. Three theoretical frameworks that fit this description include the Health Belief Model (Rosenstock, 1966), the Theory of Reasoned Action (Montano & Kasprzyk, 2008), and the Transtheoretical Model of Behavior Change (Prochaska, Redding, & Evers, 2008). The Health Belief Model posits that individuals will

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take health-related action when they believe that (a) negative health outcomes are avoidable, (b) taking an action will avoid the negative outcome, and (c) they are able to take the action. The construct of self-efficacy (confidence in one's ability to perform the action) was later added to the model. The Theory of Reasoned Action describes a behavioral intention to perform an action as being influenced by attitudes (i.e., beliefs weighted by evaluations of those beliefs) and subjective norms (i.e., beliefs and actions of others weighted by evaluations of those others). The Transtheoretical Model of Behavior Change describes an individual's readiness to engage in a new health behavior, relative to whether they have contemplated change, decided to take action, or have taken action (i.e., stages of change). Overall, the current understanding of the driving forces behind healthy behavior acknowledges that many health behaviors (and any health behavior change) are largely driven by psychological factors including knowledge, beliefs, and attitudes regarding those behaviors.

Healthy sleep is a domain of healthy behavior (Grandner, Patel, Gehrman, Perlis, & Pack, 2010) that is largely overlooked by the existing health behavior literature. The view that sleep is not an integral part of healthy behavior, however, is beginning to change. Recently, the Institute of Medicine has released two separate reports acknowledging the public health impact of sleep deprivation and sleep disorders (Colten et al., 2006; Ulmer et al., 2009). Adequate sleep has been included as a national health priority in *Healthy People 2020* (Office of Disease Prevention, 2011), and assessment and surveillance of sleep health is increasingly recognized by the Centers for Disease Control and Prevention (McKnight-Eily et al., 2011; Wheaton, Liu, Perry, & Croft, 2011). These developments occur in response to the large amount of evidence that unhealthy sleep is associated with increased morbidity and mortality.

Dozens of studies, spanning several decades and several continents, have documented that short or long habitual sleep durations are associated with increased mortality risk (Grandner, Patel, Hale, & Moore, 2010). These data are complemented by other studies showing that sleep disorders, particularly sleep apnea, are also associated with increased mortality risk (Gooneratne et al., 2011). Evidence from laboratory and epidemiologic studies implicate sleep loss (in various forms) in weight gain and obesity (Nielsen, Danielsen, & Sorensen, 2010), diabetes (Zizi et al., 2010), cardiovascular disease (Knutson, 2010), hypertension (Friedman, Bradley, Ruttanaumpawan, & Logan, 2010), dyslipidemia (Gangwisch et al., 2010), heart attack (Magee, Iverson, & Caputi, 2009), stroke (Cappuccio, Cooper, D'Elia, Strazzullo, & Miller, 2011), accidents (Miyata et al., 2010), depression (Nakata, 2011), stress (Meerlo, Sgoifo, & Suchecki, 2008), alcohol use (Brower, Krentzman, & Robinson, 2011), smoking (Sabanayagam & Shankar, 2011), and a number of other adverse health outcomes.

Taken together, the existing evidence strongly supports sleep behavior as an important aspect of population health. Because sleep, like diet, represents a biological imperative met by engaging in sets of behaviors, there is a large volitional component that can potentially be intervened on to improve sleep of the population. A comprehensive exploration of factors proximal to the execution of sleep behavior is needed to help develop sleep health programs. This should include factors beyond the individual level, as we know that behavior is influenced by social environmental factors at many different levels. Furthermore, we believe particular focus on factors that are modifiable is warranted. Race and socioeconomic factors may facilitate identification of higher risk groups, but are not readily modifiable.

Relatively little is known about knowledge, beliefs, and attitudes about sleep in the population. Sell et al. (2009) assessed knowledge about sleep disorders among Mexican Americans, compared to non-Hispanic Whites. They found that the non-Hispanic White

group was more familiar with sleep disorders by name, and these differences were largely maintained when the disorders were described. Further, when the Mexican Americans were divided by levels of acculturation, similar differences were found across groups: The more "Americanized" Mexican Americans responded similarly to the non-Hispanic White group. Pandey et al. (2011) assessed dysfunctional beliefs and attitudes about sleep in a population of African Americans recruited in barber shops. They found that those men who were at higher risk of obstructive sleep apnea were more likely to endorse unhelpful beliefs and attitudes about sleep.

To advance the field of sleep behavioral determinants, a comprehensive standardized instrument is needed to capture the gamut of proximal factors that lead to eventual sleep behavior. Based on health behavioral theory principles (discussed earlier), it would be critical to capture knowledge, beliefs, and attitudes in connection with habitual sleep behavioral practices. Two scales currently exist that examine beliefs about sleep. The Dysfunctional Beliefs and Attitudes about Sleep (DBAS) scale (Edinger & Wohlgemuth, 2001) was developed as an instrument that specifically assesses beliefs about sleep that are consistent with insomnia. This scale addresses sleep beliefs, but constrained to insomnia only. Likewise, the Sleep Beliefs Scale (Adan, Fabbri, Natale, & Prat, 2006) was developed to assess beliefs about factors that may improve or worsen sleep relative to circadian typology, but this scale captures a narrow set of beliefs, which represent aspects of sleep hygiene or are otherwise associated with disordered sleep. Neither of these scales was designed to holistically assess aspects of sleep as a health behavior outside of the context of specific sleep disorders, and neither were developed with an iterative strategy or grounded in health behavior theory.

Accordingly, this study describes the development and initial evaluation of the Sleep Practices and Attitudes Questionnaire (SPAQ). The SPAQ was specifically designed to meet the need for a standardized instrument that captured aspects of sleep relevant to health behavior theory, representing the habitual behaviors associated with sleep, as well as beliefs and attitudes about sleep that may be useful in identifying potential targets for intervention. The scale was developed by generating a pool of items and organizing these items by theme. The initial draft of the questionnaire underwent a four-step process of iterative refinement:

1. Obtaining the input of experts in the sleep field.
2. Obtaining feedback from members of the community.
3. Further testing and refining the measure in a series of community-based focus groups. 4. Field-testing the measure in an ongoing research study.

A final questionnaire was developed to assess 16 domains:

1. Sleep duration.
2. Sleep debt.
3. Sleep quality.
4. Sleepiness/tiredness.
5. Coping with sleepiness.
6. Coping with acute insomnia.
7. Coping with chronic insomnia.
8. Activities in bed.
9. Sleep environment.

10. Knowledge.
11. Importance.
12. Impact on sleep.
13. Impact of sleep.
14. Self-efficacy.
15. Sleep and health.
16. Social norms.

METHOD

Scale Development

Item generation and initial questionnaire development—Item generation was grounded by health behavior theory and conceptualized along these lines: (a) knowledge about sleep, (b) importance of sleep, (c) impact of other factors on sleep, (d) impact of sleep on functioning, (e) self-efficacy, (f) importance of sleep for health, and (g) subjective norms. Regarding habitual sleep practices, items were written to capture habitual sleep duration and need (to assess insufficient sleep), as well as overall subjective experience of poor sleep at night or upon awakening (to assess inadequate sleep quality). These items are justified by the literature documenting the impact of these on health (Grandner, Patel, Gehrman, Perlis, & Pack, 2010; Grandner, Patel, Hale, & Moore, 2010), and were specifically written to reflect common wording used in sleep diaries (Smith, Nowakowski, Soeffing, Orff, & Perlis, 2003), as well as existing scales (discussed later). Items regarding sleep-related practices were derived from Spielman's three-factor model of insomnia (see Perlis, Shaw, Cano, & Espie, 2010), which describes the chronic inability to initiate or maintain sleep as a result of maladaptive coping behaviors that perpetuate these difficulties. These behaviors include poor sleep hygiene, engaging in non-sleep activities in bed, and staying in bed while unable to sleep, despite efforts. Additional items were written to assess bed-sharing, which is known to affect sleep (Thoman, 2006). Thus, habitual sleep-related practices were conceptualized as including (a) sleep duration, (b) sleep debt (discrepancy between needed sleep and obtained sleep), (c) sleep quality, (d) sleepiness/tiredness, (e) coping with sleepiness, (f) coping with acute insomnia, (g) coping with chronic insomnia, (h) behaviors in bed, and (i) sleep environment.

Initial development and validation—Our evaluation of the SPAQ encompassed elements of reliability and validity. Face validity was determined by a panel of community members, focus groups, and research participants. These individuals were solicited for feedback on the items or contributed to group conversations about the questionnaire content and asked questions about specific items. Content validity was maximized by deriving items from a theoretical framework, guided by input from a panel of sleep clinicians and input from the focus groups, to ascertain whether the comprehensiveness and representativeness of potential items was appropriate. Concurrent and discriminative validity were assessed by comparing SPAQ results to other, established questionnaires (discussed later).

An initial pool of potential items was generated, which was subsequently refined into a preliminary questionnaire. This initial version of the questionnaire was further refined based on input from a panel of experts otherwise unaffiliated with the project (including 2 board-certified sleep physicians and 1 psychologist certified in behavioral sleep medicine). This version was then presented to a panel of three African American members of the community (aged ≥ 25). The questionnaire was then administered to four focus groups in the

Philadelphia region, who gave feedback on the questionnaire and its items. Results are published elsewhere (Grandner et al., in press). As this questionnaire was intended for research, it was deployed as part of an ongoing research study examining habitual short- and normal-duration sleepers in the community. Based on feedback from study participants, a final version of the questionnaire was produced for evaluation in this study. The multiple levels of feedback on items were intended to maximize face validity, such that many individuals were able to ask questions and weigh-in on the specific wording of items. Content validity is established by comparison to relevant literature, representativeness, and experts (Burns & Grove, 1993). Although true content validity could only be demonstrated by evaluating the chosen items against all possible items, we posit that the method of item generation and subsequent evaluation by external subject-matter experts speaks to content validity.

The final version of the questionnaire contains 16 subscales:

1. Sleep duration.
2. Sleep debt.
3. Sleep quality.
4. Sleepiness/tiredness.
5. Coping with sleepiness.
6. Coping with acute insomnia.
7. Coping with chronic insomnia.
8. Activities in bed.
9. Sleep environment.
10. Knowledge.
11. Importance.
12. Impact on sleep.
13. Impact of sleep.
14. Self-efficacy.
15. Sleep and health.
16. Social norms.

The sleep duration subscale is represented in number of hours of habitual sleep, and the sleep debt subscale is represented as the percentage of difference between need and habitual sleep duration (with values < 0 reflecting more obtained than needed and values > 0 reflecting less obtained than needed). All other subscales scores range from 0 to 1, reflecting the degree of endorsement of items reflecting good sleep quality, increased sleepiness/tiredness, more coping with sleepiness, more coping with acute insomnia, more coping with chronic insomnia, more activities in bed, more restful sleep environment, more knowledge, greater importance, more impact on sleep by internal and external factors, greater impact of sleep on functioning, higher self-efficacy, stronger relation between sleep and health, and social norms that reflect increased importance of sleep. Although the questionnaire is intended to be descriptively interpreted, subscale scores can be computed. There are a total of 151 individual items.

Final Scale Evaluation

The final version of the SPAQ was administered as part of an online survey. This sample was recruited from the general population. Eligibility criteria were broad (aged 18–65 years, not pregnant, and no major medical problems). Recruitment utilized online classifieds and other social media.

The online survey included other previously validated measures collected to demonstrate validity and characterize the sample. Several existing measures of sleep duration and sleep quality were used. General sleep disturbance was assessed using the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). We used the global score and a cutoff of 5 to determine good versus poor sleepers. In addition, the PSQI includes a sleep duration item, which was separately evaluated. Daytime sleepiness was assessed using the Epworth Sleepiness Scale (ESS; Johns, 1991). As the SPAQ assesses aspects of sleep hygiene, responses were compared to those on an existing measure of sleep hygiene: the Sleep Hygiene Index (SHI; Mastin, Bryson, & Corwyn, 2006). No questionnaires exist that assess sleep-related attitudes and behaviors addressed in the SPAQ. Despite this, it would be expected that responses would be somewhat related to sleep-related beliefs as measured using scales developed to assess maladaptive beliefs that frequently exist in the context of insomnia. The most well-known scale in this domain is the DBAS, of which a validated short form was used in this study (Morin, Vallieres, & Ivers, 2007). Finally, the following demographic information was collected: age, gender, education, height, weight (for calculation of body mass index), and race and ethnicity. Currently, there is no “gold standard” instrument that exists to capture many of the constructs included in SPAQ subscales. Evaluation of the questionnaire is largely descriptive; however, several quantitative assessments were conducted.

Although the items within each subscale were not specifically designed to correlate with each other (e.g., using coffee to combat sleepiness likely does not relate to making sleep more of a priority), assessment of internal consistency using Cronbach’s alpha for all subscales was undertaken. To assess the degree to which independent subscales assess overlapping constructs, all scales were examined relative to correlation with each other.

To demonstrate concurrent validity, several subscales were assessed relative to established measures, such as the ESS and the PSQI. Subscale 1 (sleep duration) and its components (average, weekday, and weekend sleep duration) were evaluated relative to the PSQI sleep duration item, which assesses sleep duration in a similar way. Subscale 3 (sleep quality) was related to the PSQI global score, as well as the ability to distinguish between PSQI subtypes. Subscale 4 (sleepiness/tiredness) was evaluated relative to the ESS total score and the ability to distinguish between ESS subtypes. Subscales 6 (coping with acute insomnia), 8 (activities in bed), and 9 (sleep environment) address issues related to sleep hygiene and were, thus, evaluated relative to SHI scores. Subscales 12 (impact of external factors on sleep), 13 (impact of sleep on daytime functioning), and 14 (self-efficacy) are thought to capture aspects of overall sleep quality, so these were evaluated relative to their ability to distinguish good from poor sleepers on the PSQI. All subscales were assessed relative to the DBAS to evaluate the degree to which they represent dysfunctional beliefs about sleep as measured using this questionnaire.

RESULTS

Sample Characteristics

A total of 124 participants provided data for the initial validation (final iteration). The sample ranged in age from 18 to 80 years old and represented a diverse set of demographics (see Table 1). The SPAQ took approximately 10 min to complete, and all questionnaires

were completed in one sitting. The median completion time was 638.5 sec, with an interquartile range of 523 sec to 786 sec. Only four individuals who started the SPAQ did not complete it; of those, one came from an Internet Protocol (IP) address that later showed a complete questionnaire, and one came from an IP address that did not qualify for the study (outside the United States).

Subscale 1: Sleep Duration—The sample reported a mean weekday sleep duration of 6.96 hr (*SD = 1.34* hr) and a mean weekend sleep duration of 7.87 hr (*SD = 1.49* hr). The average sleep duration, computed as (5*weekday + 2*weekend)/7, was 7.21 hr (*SD = 1.20* hr). The correlation between PSQI sleep duration and average sleep duration was $r = .53$, $p < .001$.

Subscale 2: Sleep Debt—The sample reported a mean sleep need of 8.01 hr. When sleep need was subtracted from average sleep time, the mean sleep debt was 0.14 hr (8.4 min), with a range of −60 min (60 min more than needed) to 150 min of sleep debt.

Subscale 3: Sleep Quality—When asked to rate their overall sleep quality on a 5-point scale ranging from 1 (*least restful*) to 5 (*most restful*), scores were distributed as follows: 1 (2.4%), 2 (8.9%), 3 (25.0%), 4 (36.3%), and 5 (26.6%). When asked whether they agree with the statement, “I have difficulty with my sleep,” 15.3% responded “strongly disagree,” 31.5% responded “disagree,” 13.7% responded “unsure,” 25.8% responded “agree,” and 13.7% responded “strongly agree.” This resulted in a mean sleep quality score (after transforming the items so that higher scores indicate worse sleep) of 0.59 (*SD = 0.15*). This subscale correlates moderately well with the PSQI global score ($\rho = 0.36$, $p < .001$) and distinguishes between good and poor sleepers ($p = .001$).

Subscale 4: Sleepiness/Tiredness—Among respondents, 41.9% reported that they typically feel sleepy during the day, 58.1% reported usually feeling tired, and 50.0% reported feeling un-refreshed when waking. For the item, “I never feel sleepy,” 43.9% indicated that they “strongly disagree,” 46.3% indicated that they “disagree,” 4.9% indicated that they were “unsure,” 4.9% indicated that they “agree,” and no respondents indicated that they “strongly agree.” This pattern was reflected in a mean subscale score of 0.68 (*SD = 0.17*). This subscale correlated moderately well with the ESS ($\rho = 0.39$, $p < .001$) and significantly differentiated ESS scores indicative of excessive sleepiness ($p = .003$).

Subscale 5: Coping With Sleepiness—Reports of activities endorsed as likely methods for coping with sleepiness are reported in Table 2. The most commonly endorsed behaviors include getting more or better sleep, drinking caffeine, and getting more exercise. This pattern of responding was associated with a mean subscale score of 0.66 (*SD = 0.15*). Higher scores indicate that the individual engaged in more strategies. It should be noted that this does not indicate better or more effective strategies.

Subscale 6: Coping With Acute Insomnia—Reports of activities endorsed as likely methods for coping with acute insomnia are reported in Table 2. The most commonly endorsed behaviors include staying in bed in an attempt to get more sleep and doing something in bed (like reading or watching TV). This pattern of responding was associated with a mean subscale score of 0.38 (*SD = 0.10*). Higher scores indicate more active coping. As these items assess some domains of sleep hygiene, a correlation with the SHI (higher scores indicating worse sleep hygiene) was moderate ($r = .29$, $p < .001$).

Subscale 7: Coping With Chronic Insomnia—Reports of activities endorsed as likely methods for coping with chronic insomnia are reported in Table 2. The most commonly

endorsed behaviors include making more time for sleep and adjusting the temperature or lighting. This pattern of responding was associated with a mean subscale score of 0.37 (*SD = 0.11*). Higher scores indicate more active coping.

Subscale 8: Activities in Bed—Likelihood of various activities performed in bed is reported in Table 2. Most respondents either agreed or strongly agreed to statements suggesting that they read, watch TV, and worry in bed. This was reflected in a mean subscale score of 0.43 (*SD = 0.20*). Higher scores indicate more activities in bed. As this reflects aspects of sleep hygiene, this subscale moderately correlated with the SHI ($r = .53$, $p < .001$).

Subscale 9: Sleep Environment—Responses to items describing the general comfort, light, noise, and temperature are reported in Table 2. Overall, most respondents reported their sleeping environments to be generally comfortable, resulting in a mean subscale score of 0.79 (*SD = 0.13*). As this reflects some aspects of sleep hygiene, this subscale was negatively correlated with SHI ($r = -.34$, $p < .001$).

Subscale 10: Sleep Knowledge—Respondents reported receiving information about sleep from a mean of 3.18 (*SD = 2.07*) trusted sources. Responses to items assessing knowledge about sleep and discussing sleep with a doctor are reported in Table 3. Overall, nearly all respondents strongly agreed that dozing while driving a vehicle is serious. Less than one-half of the respondents disagreed or strongly disagreed with inaccurate statements, including assertions that boredom can cause sleepiness, turning up the volume or lowering a car window is an effective countermeasure to sleepiness, and that individuals can accurately tell when they are sleepy. Less than one-half of the respondents agreed or strongly agreed with statements asserting that their doctor had discussed the importance of sleep and daily schedules. This pattern of responding was reflected in an overall subscale score of 0.54 (*SD = 0.10*). Higher scores indicate more access to knowledge and more factual statements.

Subscale 11: Importance of Sleep—Responses to items characterizing the general sense of importance of sleep are reported in Table 3. Overall, most respondents indicated that their parents stressed the importance of sleep, and this was reflected in responses to an item asking whether sleep was important for children, to which > 90% of respondents indicated that they “strongly agree.” Respondents were less likely, however, to “strongly agree” with the statement that sleep is important for adults or older adults. This was consistent with other items, where the majority of respondents did not indicate that they “strongly agree” that a consistent bedtime is important or that it is important to make time for sleep. Despite this, > 70% indicated that they “strongly agree” that sleep is important. This pattern of responding was reflected in an overall subscale score of 0.83 (*SD = 0.12*). Higher scores indicate increased importance of sleep.

Subscale 12: Impact of External Factors on Sleep—Responses to items characterizing the impact of external factors on sleep are reported in Table 4. Overall, the most common factor that respondents indicated influenced their sleep was stress, followed by home responsibilities, work responsibilities, mood and depression, commute to work, medical status, and feeling unsafe. This pattern of responding was reflected in an overall subscale score of 0.57 (*SD = 0.15*). Higher scores indicate an increased number of factors that impact on sleep. Scores on this subscale significantly differed between good and poor sleepers on the PSQI ($p = .004$).

Subscale 13: Impact of Sleep on Daytime Functioning—Responses to items characterizing the impact of sleep on daytime factors are also reported in Table 4. The

majority of respondents (> 90%) indicated that they “agree” or “strongly agree” that sleep affects quality of life. This was consistent with other items, where > 80% of respondents indicated that lack of sleep affects their ability to enjoy the daytime and can lead to serious consequences. In addition, respondents generally believed that sleep was important for safety in a number of occupations, with a mean response score of 3.69 out of 4.00 (*SD = 0.37*). This pattern of responding was reflected in an overall subscale score of 0.84 (*SD = 0.12*). Higher scores indicate an increased relevance of sleep regarding daytime functioning. Scores on this subscale did not significantly differ between good and poor sleepers on the PSQI ($p = .414$).

Subscale 14: Sleep Self-Efficacy—This subscale item asked whether respondents believed they had control over their sleep. Few respondents indicated that they “strongly disagree” (4.8%), 20.2% indicated that they “disagree,” 12.9% indicated that they were “unsure,” 50.0% indicated that they “agree,” and 12.1% indicated that they “strongly agree.” This pattern of responding was reflected in an overall subscale score of 0.69 (*SD = 0.19*). Higher scores indicate increased self-efficacy. Those with higher self-efficacy were more likely to be good sleepers on the PSQI ($p = .005$).

Subscale 15: Sleep and Health—Responses to items characterizing the importance of sleep for health are reported in Table 5. Overall, > 95% of respondents indicated that they “agree” or “strongly agree” that sleep is important for health. Regarding specific health consequences, respondents were most likely to “agree” or “strongly agree” that lack of sleep could lead to decreased energy (98.4%), followed by increased tiredness (97.5%), increased moodiness (96.8%), increased sleepiness (92.8%), decreased ability to concentrate (89.5%), decreased performance (83.9%), decreased sex drive (61.3%), and increased weight (51.6%). These represented the items for which > 50% of the respondents indicated general agreement. A large number of respondents “disagreed” or “strongly disagreed” that lack of sleep could lead to increased missed days at work (46.8%) or falling asleep while driving (40.3%). Items relating to cardio-metabolic health were very likely to elicit a response of “unsure,” with ≥50% of respondents not agreeing or disagreeing with statements suggesting that a lack of sleep can lead to adverse outcomes regarding diabetes, cholesterol, blood pressure, and heart disease. This pattern of responding was reflected in an overall subscale score of 0.79 (*SD = 0.11*). Higher scores indicate increased perceived importance of sleep for health.

Subscale 16: Social Norms—Table 5 shows responses to items characterizing perceived social norms regarding the importance of sleep for health. Responses to these items were very similar to those of Subscale 15 (sleep and health). Over 50% of respondents stated that they “agree” or “strongly agree” that their social group believes that a lack of sleep can lead to sleepiness, tiredness, lack of energy, difficulty concentrating, decreased performance, moodiness, and falling asleep while driving. Also, generally consistent with self-reported beliefs, ≥50% of respondents were “unsure” whether their social group agreed or disagreed with statements associating a lack of sleep with cholesterol, diabetes, heart disease, blood pressure, sex drive, and weight. When items relating to respondents’ beliefs (included in Subscale 15) were compared to perceived beliefs of their social group, there was a great deal of variability at the individual level. This pattern was reflected in an overall subscale score of 0.67 (*SD = 0.11*). Higher scores indicate increased perceived importance of sleep for health. On average, when ratings of others’ beliefs were subtracted from self-rated beliefs (maximum score of 56 for both), the mean difference in scores was 1.19 (*SD = 6.17*). This reflected a wide range, from −21 to +17. This value represents the difference between an individual’s appraisal and the appraisal of the social group. A negative score, for example, would indicate that the individual perceived sleep being less important than those around

that individual, with a more extreme score indicating a stronger deviation from the social norm.

Internal Consistency

Cronbach's alpha values for individual subscales are reported in Table 6. (Values could not be calculated for Subscales 1, 2, and 14 because they represent single-item or single-calculation subscales.) These values ranged from low (0.251, Subscale 5) to high (0.864, Subscale 16). Most values were in the moderate range (*Mdn = 0.629*, Subscale 7). Correlations among subscales are reported in Table 6. Overall, these subscales measure relatively distinct constructs, as evidenced by a moderate number of significant correlations.

Associations With the DBAS Scale

Several subscales were significantly correlated with the DBAS, including Subscales 2 ($r = .18$, $p < .05$), 3 ($r = .28$, $p < .01$), 4 ($r = .31$, $p < .001$), 8 ($r = .23$, $p < .05$), 12 ($r = .30$, $p < .001$), 13 ($r = .45$, $p < .001$), 15 ($r = .30$, $p < .001$), and 16 ($r = .26$, $p < .01$). The following subscales were not significantly correlated with DBAS scores: Subscales 1, 5, 6, 7, 9, 10, 11, and 14.

DISCUSSION

This study describes the development and initial evaluation of a questionnaire designed to assess habitual sleep-related practices, beliefs, and attitudes. This questionnaire was developed in the context of principles of health behavior theory to maximize its potential to assess sleep as a domain of healthy behavior. Further, we employed accepted methods to determine multiple domains of validity, leveraging a varied, iterative process.

To our knowledge, the SPAQ is the first comprehensive instrument to investigate factors proximal to sleep behavior. Two existing instruments examine beliefs and attitudes toward sleep behaviors (the DBAS and the Sleep Beliefs Scale); however, these are limited in their application to insomnia and circadian type. The measurements of factors that determine sleep behavior were also somewhat limited, and have not been based on health behavior theory, whereas the SPAQ addresses both typical sleep metrics and a number of new domains.

The SPAQ includes factors at the individual level, but also at the community level, which may influence an individual to engage in a particular sleep behavior on a habitual basis. This approach has been employed in other public health arenas (e.g., diet, physical activity, and tobacco) and represents a socio-ecological approach to health issues on a macrolevel. Such a model acknowledges that an individual's health behavior is subject to a range of social and environmental factors at multiple, interactive levels. A person's sleep behavior may be influenced by personal behavioral and biological traits, but also by community or health policy factors. The SPAQ includes components of social norm, sleep knowledge, and attitudes and beliefs—all of which can be concurrently influenced from a variety of venues.

The SPAQ also recognizes the importance of understanding behavioral determinants that are modifiable. Epidemiological sleep research studies are extremely helpful in identifying groups at higher risk for insufficient sleep duration or inadequate sleep quality. Historically, such groups have been identified in lower socioeconomic strata (a situation not readily modifiable). This common research finding can be advanced upon by indentifying factors within these groups that can be intervened upon. We believe the SPAQ can begin the operationalization of current epidemiological findings to assist in identifying factors that predict a behavioral change in habitual practice. This can then help form effective sleep

health programs on a broader scale. Evidence that supports the social-ecological approach exists from broad-scale campaigns in tobacco health, breast cancer screening, physical activity, and diet, which have all embraced models founded in behavioral theory (Sallis et al., 2008).

Most subscales in the SPAQ demonstrated moderate to high internal consistency, which is consistent with the intended purpose of the items. All of the subscales assessed overlapping, but separate, domains; although many of the subscales correlated with each other, these correlations were predominantly in the moderate range. It is likely that the questionnaire has high face validity and construct validity. Criterion validity was not able to be ascertained for most subscales, but was demonstrated for those subscales for which similar measures exist. It is important to note that there were relatively few correlations with sleep debt or other manifestations of "unhealthy sleep." These correlations were based on subscale scores; it may be the case that the subscale score itself is less useful than the responses to individual items. The subscale scores may provide a global indicator in a domain, but they may not be useful in relation to clinical outcomes.

The SPAQ may prove to be a useful instrument in clinic. Although its utility for screening for sleep disorders may be limited, its strengths may lie in its ability to characterize how an individual relates to sleep and sleep-related behavior. It may uncover potential therapeutic targets (e.g., excessive time awake in bed) or avenues (e.g., beliefs about the importance of sleep). Clinical use may also be limited by other factors as well, such as age and chronotype, which could influence responses.

Limitations

There are a number of limitations with this study and the questionnaire. An important limitation with the study could be sample bias. This sample may not reflect the general population. The sample was predominantly White, female, and college-educated. Therefore, further validation in broader samples is required. A major limitation of the questionnaire is its length. The investigators were sensitive to the need to be comprehensive but also to elicit accurate feedback from respondents. Although the questionnaire is long, the 10-min completion time shows that many of the items can be completed quickly. For example, 28 of the items are "yes/no" questions regarding potential sources of information about sleep and whether those sources are trusted. Also, an additional 42 items are repeated versions of the same 14 consequences of sleep loss, under the items, "If I don't get enough sleep, it can cause me to …," "My friends and family believe that not enough sleep can cause them to …," and "How important is it to you that by not sleeping enough, you will …" These sections are also usually completed quickly.

Also, particular domains could be better represented with more items. For example, the subscale measuring knowledge about sleep does not assess (as was done by Sell et al., 2009) knowledge about specific sleep disorders. The chosen length represents the combined influence of input from focus groups and others. Furthermore, despite the large number of items, the questionnaire was designed to be completed relatively quickly, and the average completion time for the questionnaire was approximately 10 min. It is unclear, however, if other samples (e.g., less educated) or formats (e.g., not online) would show similar completion times. Another limitation of the questionnaire is that, although the subscale scores are continuous in nature, they represent a composite of items that are primarily ordinal in nature. Furthermore, the items in each subscale were not designed to necessarily covary with each other, resulting in lower internal consistency. For example, whether an individual copes with sleepiness by drinking caffeine might only be loosely related to whether that same individual copes with sleepiness by getting more exercise. Also, some items reflect behaviors or beliefs that are known to be either conducive to sleep or unhelpful,

whereas other items reflect behaviors or beliefs that may or may not be helpful or unhelpful —either this may depend on the context, or it may not be known at the present time. The items were designed to capture the majority of possible responses, rather than specific types of responses. In this way, information at the individual item level may be more useful than at the subscale level, depending on the application.

There were also some important limitations to the sample studied. Participants were recruited from the general population, and may have limited generalizability due to volunteer biases. For example, the sample reported more difficulties with sleep (e.g., higher ESS and PSQI scores) than are typically seen in non-clinical samples. Perhaps those who elected to complete a survey about their sleep habits might have been more willing to do so if they were experiencing difficulties with sleep. Therefore, results should be interpreted with appropriate caution.

CONCLUSION

Sleep is an important domain of health behavior, but no standardized instruments exist to capture, in a comprehensive way, habitual practices, attitudes, and beliefs about sleep that may be useful targets for future interventions and may vary by race, ethnicity, and culture. Accordingly, the SPAQ was developed to meet the need for a socio-ecological, health behavior-based instrument that may inform broader sleep health programs. Future studies will better ascertain the utility of this questionnaire in identifying useful targets for health-promotion interventions and assess response differences across socioeconomic groups.

Acknowledgments

This work was performed at the University of Pennsylvania, and was supported by grant number T32HL007713 and a National Institute of Health, Resource Center for Minority Aging Research pilot grant. Individuals interested in obtaining a copy of the SPAQ may contact Dr. Grandner.

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TABLE 1

Participant Characteristics

Variable	Distribution[a]
Age: = (SD)	38.8 (13.8)
Gender	
Female	103 (83.1)
Education	
High school	4 (3.23)
Some college	25 (20.2)
College	95 (76.6)
Marital status	
Married	58 (47.2)
Partnered	20 (16.3)
Never married	35 (28.5)
Divorced, widowed, or separated	10 (8.1)
Employment	
Employed (day shift)	84 (67.7)
Employed (other shift)	6 (4.8)
Retired	3 (2.4)
Homemaker	8 (6.5)
Student	20 (16.1)
Unemployed	3 (2.4)
BMI: = (SD)	26.5 (6.0)
Obesity (BMI = 30)	27 (21.8)
Race or ethnicity	
Non-Hispanic White	95 (80.5)
Black/African American	3 (2.5)
Hispanic/Latino	10 (8.47)
Asian	9 (7.6)
Other	1 (0.9)
PSQI score: = (SD)	7.7 (3.5)
Poor sleep (PSQI = 5)	99 (79.84)
PSQI sleep duration (in hours): = (SD)	7.1 (1.1)
ESS score: = (SD)	7.5 (4.3)
Excessive sleepiness (ESS > 9)	47 (37.9)

Note. BMI = body mass index; PSQI = Pittsburgh Sleep Quality Index; ESS = Epworth Sleepiness Scale.

[a]Values are *n* (%), unless otherwise noted.

TABLE 2

Sleep Practices (Coping With Sleepiness, Acute Insomnia, Chronic Insomnia, and Activities in Bed) and the Sleep Environment

Variable	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
If I am feeling sleepy during the day:					
Sleep more or better	0.8%	4.9%	4.9%	53.7%	35.8%
Take a nap	11.4%	22.8%	13.0%	37.4%	15.4%
Increase caffeine	8.9%	17.1%	7.3%	49.6%	17.1%
Increase exercise	2.4%	11.4%	14.6%	55.3%	16.3%
I never feel sleepy	43.9%	46.3%	4.9%	4.9%	0.0%
If I were having trouble sleeping tonight:					
Stay in bed	1.6%	17.9%	13.8%	15.4%	26.8%
Do something in bed	13.8%	29.3%	4.1%	39.8%	13.0%
Get up and do something	15.4%	37.4%	9.8%	30.9%	6.5%
Eat/drink	26.8%	43.9%	11.4%	14.6%	3.3%
Drink alcohol	56.9%	29.3%	6.5%	7.3%	0.0%
Smoke	86.2%	8.9%	1.6%	3.3%	0.0%
Increase caffeine	80.5%	15.4%	0.8%	3.3%	0.0%
Get up and start the day	23.6%	37.4%	19.5%	17.9%	1.6%
If I were having trouble sleeping over a period of time:					
Medications	21.1%	23.6%	18.7%	26.0%	10.6%
Mattress	1.6%	19.5%	24.4%	47.2%	7.3%
Prioritize bedtime	0.0%	1.6%	8.9%	59.3%	30.1%
Lighting	1.6%	16.3%	11.4%	48.8%	22.0%
Temperature	0.8%	5.7%	2.4%	61.8%	29.3%
Change sleep schedule	4.1%	19.5%	25.2%	38.2%	13.0%
Reduce caffeine	5.7%	17.9%	18.7%	39.0%	18.7%
Prioritize sleep	2.4%	13.0%	26.0%	44.7%	13.8%
I do the following in bed:					
Read	5.6%	10.5%	4.0%	50.0%	29.8%
TV	30.6%	16.9%	2.4%	31.5%	18.5%
Eat/drink	46.8%	33.1%	1.6%	15.3%	3.2%
Worry/thinking	10.5%	8.9%	10.5%	49.2%	21.0%

Variable	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Argue/angry	41.1%	41.9%	3.2%	12.1%	1.6%
Work	48.4%	25.0%	0.8%	21.8%	4.0%
Physical environment:					
Physically comfortable	0.0%	0.0%	1.6%	61.3%	37.1%
Dark	1.6%	8.9%	2.4%	54.0%	33.1%
Comfortable temperature	0.8%	4.0%	4.0%	64.5%	26.6%
Quiet	0.0%	6.5%	8.1%	58.1%	27.4%

TABLE 3

Knowledge About Sleep and Importance of Sleep

Variable	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Sleep knowledge					
Dozing while driving a vehicle is serious	0.0%	0.0%	0.8%	5.6%	93.5%
My doctor has discussed the importance of a regular sleep schedule	21.0%	39.5%	12.9%	18.5%	8.1%
My doctor has discussed the importance of getting enough sleep	19.4%	37.9%	10.5%	22.6%	9.7%
If you are really bored, you might fall asleep, even if you slept well the night before	13.7%	29.8%	13.7%	32.3%	10.5%
Lying in bed with your eyes shut is as good as sleeping	32.3%	55.6%	8.1%	3.2%	0.8%
I can tell when I am sleepy	0.0%	0.0%	4.8%	58.9%	36.3%
Opening the car window is a good way to wake me up if I am drowsy while driving	4.0%	20.2%	18.5%	51.6%	5.6%
Turning up the volume of the radio or music is a good way to wake me up if I am drowsy while driving	5.6%	23.4%	16.9%	48.4%	5.6%
People who fall asleep at work or school are lazy or have bad habits	29.0%	45.2%	16.1%	8.1%	1.6%
Importance of sleep					
As you were growing up, did your parents emphasize the importance of sleep?	29.0% (“no”)			71.0% (“yes”)	
How important is getting healthy sleep for children growing up?	0.0%	0.8%	0.0%	8.9%	90.3%
How important is getting healthy sleep for adults?	0.0%	8.9%	0.0%	41.9%	49.2%
How important is getting healthy sleep for older adults/seniors?	0.0%	12.1%	0.0%	29.8%	58.1%
Going to bed at a good time is important to me	1.6%	16.1%	8.1%	46.8%	27.4%
I think my sleep is important	0.0%	0.0%	1.6%	27.4%	71.0%
I care about making sure that I have enough time to sleep	0.0%	6.5%	9.7%	52.4%	31.5%

TABLE 4

Effects of External Factors on Sleep and Effects of Sleep on Functioning

Variable	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Effects of external factors on sleep					
My work affects when and how much I sleep	1.6%	17.7%	8.1%	36.3%	36.3%
Home responsibilities affect when and how much I sleep	0.0%	17.7%	2.4%	45.2%	34.7%
My commute affects when and how much I sleep	19.4%	33.9%	7.3%	25.8%	13.7%
My sleep is affected by medical conditions (like heart, breathing, or pain)	29.8%	34.7%	5.6%	21.8%	8.1%
Sometimes when I am feeling down or depressed, it affects my sleep	4.8%	16.9%	9.7%	47.6%	21.0%
Sometimes my sleep is affected because I feel unsafe at night	35.5%	40.3%	4.8%	13.7%	5.6%
My sleep is affected by stress and/or worrying	0.8%	12.9%	4.0%	39.5%	42.7%
Effects of sleep on daytime functioning					
Getting enough sleep is important for me to be able to enjoy the day	1.6%	5.6%	8.9%	42.7%	41.1%
Not enough sleep can lead to serious consequences	0.0%	2.4%	7.3%	47.6%	42.7%
Poor sleep affects the quality of my life	0.0%	4.0%	5.6%	48.4%	41.9%

Behav Sleep Med. Author manuscript; available in PMC 2015 March 04.

TABLE 5

Consequences of Insufficient Sleep: Self-Rated Beliefs and Perceived Social Norms

Variable	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
My sleep is important to my health	0.0%	0.8%	2.4%	37.1%	59.7%
If I don't get enough sleep, it can cause me to:					
Feel sleepy during the day	1.6%	3.2%	2.4%	36.3%	56.5%
Fall asleep while driving	16.1%	24.2%	12.1%	36.3%	11.3%
Gain weight	1.6%	14.5%	32.3%	36.3%	15.3%
Develop heart disease	0.8%	11.3%	50.0%	27.4%	10.5%
Raise cholesterol	1.6%	11.3%	60.5%	19.4%	7.3%
Develop hypertension (high blood pressure)	0.8%	7.3%	50.8%	30.6%	10.5%
Be more moody	0.0%	1.6%	1.6%	50.8%	46.0%
Have less energy	0.0%	0.8%	0.8%	37.1%	61.3%
Have a lower sex drive	3.2%	8.9%	26.6%	37.9%	23.4%
Miss more days of work or school	6.5%	40.3%	10.5%	26.6%	16.1%
Perform worse at work or school	0.8%	8.1%	7.3%	56.5%	27.4%
Have problems remembering things or concentrating	0.8%	3.2%	6.5%	46.0%	43.5%
Develop diabetes	3.2%	9.7%	66.9%	16.9%	3.2%
Feel tired	0.0%	1.6%	0.8%	30.6%	66.9%
My friends and family believe that not enough sleep can cause them to:					
Feel sleepy during the day	0.0%	0.8%	8.9%	50.0%	40.3%
Fall asleep while driving	1.6%	4.0%	25.0%	47.6%	21.8%
Gain weight	0.8%	9.7%	56.5%	24.2%	8.9%
Develop heart disease	0.8%	10.5%	66.9%	16.1%	5.6%
Raise cholesterol	0.8%	12.9%	71.0%	12.9%	2.4%
Develop hypertension (high blood pressure)	0.8%	10.5%	66.9%	16.9%	4.8%
Be more moody	0.0%	1.6%	18.5%	52.4%	27.4%
Have less energy	0.0%	0.0%	11.3%	47.6%	41.1%
Have a lower sex drive	0.0%	4.0%	58.9%	27.4%	9.7%
Miss more days of work or school	1.6%	9.7%	42.7%	36.3%	9.7%
Perform worse at work or school	0.0%	3.2%	16.9%	59.7%	20.2%
Have problems remembering things or concentrating	0.0%	1.6%	15.3%	58.9%	24.2%

Variable	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Develop diabetes	3.2%	9.7%	69.4%	14.5%	3.2%
Feel tired	0.0%	0.0%	9.7%	38.7%	51.6%

TABLE 6

Internal Consistency (Cronbach's Alpha) and Correlations Among Subscales

		Spearman Correlations With Other Subscales														
Subscale	**α**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
2		−0.62***														
3	.675	0.04	0.01													
4	.567	−0.04	0.22*	0.16†												
5	.251	0.05	0.00	−0.07	0.09											
6	.549	−0.08	0.05	0.13	−0.01	0.02										
7	.629	−0.02	0.02	0.17†	0.02	−0.06	0.08									
8	.687	0.03	−0.02	0.38***	0.09	0.04	0.28**	0.10								
9	.675	−0.07	−0.04	−0.11	0.05	0.03	−0.15	−0.22*	−0.22*							
10	.508	0.06	0.12	0.03	0.14	−0.06	0.00	0.05	0.00	−0.01						
11	.639	−0.08	0.14	−0.04	0.04	0.20*	−0.22*	−0.36***	−0.10	0.38***	0.05					
12	.552	−0.02	0.12	0.17†	0.13	0.06	0.13	−0.09	0.28**	−0.06	0.16†	0.03				
13	.618	0.02	0.19*	0.08	0.14	0.16†	−0.10	−0.31***	0.01	0.26**	0.04	0.54***	0.29**			
14		0.24**	−0.18*	−0.19*	−0.15	−0.05	−0.17†	−0.37***	0.00	0.09	0.09	0.35***	−0.04	0.27**		
15	.808	−0.09	0.30***	−0.03	0.13	0.21*	−0.05	−0.21*	−0.06	0.31***	0.15†	0.55***	0.15†	0.61***	0.21*	
16	.864	−0.10	0.16†	0.12	0.09	0.15	−0.06	−0.07	0.09	0.13	0.13	0.21*	0.18*	0.30***	−0.05	0.46***

*$p < .05$.

**$p < .01$.

***$p < .001$.

†$p < .10$.