The National Sleep Foundation's Sleep Health Index

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ABSTRACT

Objectives: A validated survey instrument to assess general sleep health would be a useful research tool, particularly when objective measures of sleep are not feasible. Thus, the National Sleep Foundation spearheaded the development of the Sleep Health Index (SHI).

Design: The development of the SHI began with a task force of experts who identified key sleep domains and questions. An initial draft of the survey was created and questions were refined using cognitive testing and pretesting. The resulting 28-question survey was administered via random-sample telephone interviews to nationally representative samples of adults in 2014 (n = 1253) and 2015 (n = 1250). These data were combined to create the index. A factor analysis linked 14 questions to 3 discrete domains: sleep quality, sleep duration, and disordered sleep. These were assembled as sub-indices, then combined to form the overall SHI, with scores ranging from 0 to 100 (higher score reflects better sleep health).

Results: Americans earned an overall SHI score of 76/100, with sub-index scores of 81/100 in disordered sleep, 79/100 in sleep duration, and 68/100 in sleep quality. In regression analyses, the strongest independent predictors of sleep health were self-reported stress ($\beta = -0.26$) and overall health ($\beta = 0.26$), which were also the strongest predictors of sleep quality ($\beta = -0.32$ and $\beta = 0.27$ respectively).

Conclusions: The current 12-item SHI is a valid, reliable research tool that robustly measures 3 separate but related elements of sleep health—duration, quality, and disorders—and assesses the sleep health status of adults in the United States.

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Introduction

Sleep is essential for optimal cognitive performance, physiological processes, emotional regulation, and quality of life.[1–6] Research consistently demonstrates that sleep is a significant component of physical and mental health, as well as overall well-being. Therefore, a comprehensive evaluation of an individual's health and wellness necessitates an assessment of sleep health. Unfortunately, objective measures of sleep, such as the gold-standard polysomnography, can be impractical and expensive and therefore infeasible for many large-scale studies, especially when the research is not primarily focused on sleep. A valid and reliable self-reported sleep health measure would therefore be a useful research tool, benefiting ongoing and future research studies across multiple fields of health.

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Sleep surveys and questions certainly have been used previously. Several large research studies of sleep and health relied on subjective reports of sleep; however, substantial heterogeneity exists in the questions asked to assess sleep duration and quality, which limits the ability to compare results. Moreover, many existing questionnaires that assess sleep focus on the clinical and sleep-disturbance dimensions of sleep health. This includes widely used instruments such as the Pittsburgh Sleep Quality Index (PSQI),[7] whose goal was to measure sleep quality in clinical populations, the Epworth Sleepiness Scale,[8] which assesses only daytime sleepiness, and the National Institutes of Health Patient-Reported Outcomes Measurement Information System (PROMIS) Sleep Disturbance scale, which focuses on disturbed sleep and is part of the set of patient-centered measures developed by the National Institutes of Health.[9] Currently, no uniform definition of "sleep health" exists, although the National Sleep Foundation (NSF) is working on developing its own definition. Sleep health is not merely the absence of a sleep disorder or problem, and therefore, to adequately assess general sleep health, multiple dimensions of sleep should be assessed.[10] For example, overall sleep health may include the quantity, quality, and impact of sleep, which are all essential, especially for the large proportion of the population that does not suffer from sleep pathologies.

The National Sleep Foundation (NSF) set out to develop a single survey to gauge "sleep health" among adults in the United States.[11] A critical mission of the NSF is to improve health and well-being through improving sleep health in the United States and abroad; consequently, it was important for the instrument to assess sleep health in the general population. Historically, the NSF conducted annual polls on sleep-related topics; however, the polls' topics and samples varied each year, which did not allow for analysis of trends across time. Thus, the NSF developed a poll to benchmark sleep health trends longitudinally. This poll, the Sleep Health Index (SHI), was developed and validated so that researchers and the public alike will better understand sleep health in the general population. The ultimate goal is to extend sleep health research, improve well-being, and empower individuals to understand the importance of sleep.

Methods

Development of the Sleep Health Index

The SHI was developed as a poll to assess multiple dimensions of sleep health to generate an overall SHI score. The development of the SHI, over the course of 4 years, included assembling a task force, identifying specific topic areas, developing and testing the questions, surveying a beta version of the instrument, refining the instrument, and developing and testing the index.

First, a task force was established in October 2013 as an initial step in this process. This task force included experts in sleep, polling, and survey methodology, as well as members of the polling firm, Princeton Survey Research Associates International. The task force members were initially asked to provide questions to address several domains related to sleep and health: general health, sleep habits, sleep schedules, sleep quality, sleep problems, sleep environment, sleep knowledge, and sleep beliefs. From an extensive list of suggested questions, a first draft of the poll was created and questions were subsequently refined between December 2013 and June 2014 using an iterative process involving conference calls and refining poll questions among task force members. Per best-practice guidelines,[12] an important goal was to minimize respondent burden by retaining the minimum number of questions necessary to achieve our goals. One significant area of discussion among the task force was appropriate recall period. To minimize error due to poor recall, the task force selected a period of 7 days. Another decision was to use time in bed instead of "actual sleep" to minimize cognitive burden due to the amount of mental calculations and estimation the respondent would need to complete.[13] Recalling a clock time requires a smaller cognitive burden than calculating time in bed and adjusting for sleeplessness. The instrument was further refined after cognitive testing and pretesting in July 2014. Ten (4 women/6 men) cognitive interviews were conducted in-person using the verbal probing technique.[14] The cognitive interviews were used to determine if respondents understood the questions, both consistently across subjects and in the way intended. Next, a pilot test of the questionnaire was fielded to an online convenience sample of 167 respondents to test question wording alternatives and to inform questionnaire reduction. After the cognitive testing and initial online pilot test, a pretest of the revised poll was conducted in August 2014 over the telephone with 24 subjects to determine the length of the questionnaire administration and to further identify questions that needed refinement. This led to a penultimate version of the sleep health survey with 28 substantive questions addressing all the topics listed above.

The penultimate version of the instrument was administered via random-sample telephone interviews to a nationally representative sample of adults in 2014 (n = 1253) and 2015 (n = 1250). The basic disclosure elements per the American Association for Public Opinion Research[12] are provided in Table 1. These 2 surveys were used to further refine the instrument and create the SHI score. We eliminated questions that did not pertain directly to individual sleep health based on conceptual grounds because they were less directly related to the experience of sleep. For example, the questions about general health and quality of life were eliminated because although sleep is associated with general health and quality of life, it is not a direct measure of sleep itself. Similarly, questions about the sleep environment, electronic use, beliefs, and knowledge about sleep were eliminated because although they likely impact sleep, they, too, are not direct measures of the experience of sleep itself. We also excluded a question about napping behavior because it is not clear whether a nap is an indicator of good or poor sleep health, and indeed the answer likely varies. Finally, because our goal was to create a score for each response, we wanted to compare the time

Table 1
Basic disclosure elements details

	2014 SHI	2015 SHI
Survey sponsor	National Sleep Foundation	National Sleep Foundation
Survey/data collection supplier	Princeton Survey Research Associates International (PSRAI)	PSRAI
Population represented	US adults	US adults
Sample size	1253	1250
Mode of data collection	Telephone (RDD landline and cell)	Telephone (RDD landline and cell)
Type of sample	Probability	Probability
Start and end dates of data collection	September 8-29, 2014	April 27-May 17, 2015
Margin of sampling error for total sample	±3.1 percentage points	±3.1 percentage points
Data weighting	Weighted to correct known demographic discrepancies	Weighted to correct known demographic discrepancies

SHI, Sleep Health Index.