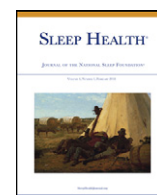




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# Sleep Health

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## A provisional tool for the measurement of sleep satisfaction



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### ABSTRACT

**Objectives:** The goal of this project was to provisionally identify the basic elements of sleep satisfaction within the general population.

**Methods:** The National Sleep Foundation conducted a systematic literature review and identified 495 published articles evaluating potential indicators of sleep satisfaction. The National Sleep Foundation then convened an expert panel (“Panel”), provided full-text articles and summaries, and used a modified RAND appropriateness method with three total rounds of voting to determine the appropriateness of indicators for sleep satisfaction.

**Results:** The literature review revealed no tools or measures of sleep satisfaction (not dissatisfaction) applied to the general population and directly associated with good health. Nonetheless, a variety of sleep factors were extracted from the extant sleep research literature. Panel members voted on these indicators: sleep environmental factors; and sleep initiation and maintenance parameters. Using these indicators, the Panel constructed provisional questions for measuring sleep satisfaction.

**Conclusions:** The Panel determined that appropriate sleep satisfaction elements include how an individual feels (a) about their sleep, (b) immediately after their sleep, and (c) during the subsequent day. Additionally, appropriate environmental elements include (a) bedding comfort, (b) bedroom temperature, and (c) noise and light in the bedroom. How one feels with (a) the time it takes to fall asleep, (b) the ease with which one falls back to sleep after awakening during a sleep period, (c) the amount of sleep on weekdays and weekends, as well as how undisturbed one's sleep is also were determined to be appropriate contributors to sleep satisfaction. Finally, the Panel agreed that whether an individual desired to change anything about their sleep, is a relevant question.

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### Introduction

Sleep health is the intersection of biological and cultural factors determining sleep quantity and quality, and how sleep contributes to an individual's well-being. Sleep is a critical component of human health; it affects and is affected by health, social wellbeing,

and economic stability. As with any human experience, individuals may have varying degrees of satisfaction with their sleep, and the elements contributing to that level of satisfaction likely differ between people. Furthermore, what constitutes a person's satisfaction may change with time. Regardless, identifiable elements contributing to sleep satisfaction do exist. To illustrate this point, consider for a moment the experience of dining; certainly, elements like the amount of the food and its quality contribute to satisfaction, as well as the preparation, ambiance, cost, and others. In the end, how satisfying

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the experience was, whether it be a meal or a night of sleep, represents a unique combination of factors. Thus, sleep satisfaction is tied to, but not wholly represented by just sleep quantity and quality.

Most studies in this general area focus on dissatisfaction associated with medical, neurological, psychiatric, and sleep disorders. Sleep satisfaction, on the other hand, represents a positive effect, not merely the absence of a negative effect. A satisfying meal does not just sate hunger, nor is it just a meal that is not unsatisfactory. The most basic questions about an individual's sleep is "how satisfied are you with your sleep?" However, to our knowledge, this has not been asked on any standardized sleep questionnaire in general use. Even the 863-item Sleep Questionnaire and Assessment of Wakefulness (SQAW) battery does not query the individual about sleep satisfaction.<sup>1,2</sup> Some instruments inquire about sleep quality (e.g., "During the past month, how would you rate your sleep quality overall?"), but not the person's satisfaction.<sup>3</sup> As a result, it is unknown how satisfied most people are with their sleep.

With advances in basic sleep neuroscience and epidemiology, there are many more links drawn between sleep and health. This incremental understanding of the importance of sleep to health and wellness, along with the pervasiveness of consumer sleep tracking devices, workplace policies, and other issues including school start times and transportation workers' sleep habits have all led to an increase in public awareness of aspects pertaining to sleep. Yet for the majority of individuals (who do not have pathological sleep disorders), there is currently no tool to understand sleep satisfaction. To better study sleep satisfaction, the National Sleep Foundation (NSF) assembled a Sleep Satisfaction Consensus Panel to examine the concept of sleep satisfaction. The Panel set out to review the existing literature, vote on the appropriateness of indicators of sleep satisfaction, and create a working draft of an instrument to measure sleep satisfaction in the general population. The result of this process is the provisional NSF Sleep Satisfaction Tool.

## Methods

### Literature review

The National Sleep Foundation performed a systematic review of the peer-reviewed literature addressing subjective assessment and evaluation of sleep. A search using the NCBI PubMed tool was conducted targeting peer-reviewed original scientific research published from January 1, 2007 to April 1, 2017, in English. Search terms were considered and affirmed by the Panel (Table 1). Inclusion criteria for papers included: subjective measures of sleep and sleep satisfaction or quality leading to different outcomes; ages 18–70 years; appropriate setting; comparing subjective sleep satisfaction and health outcomes or quantification of subjective sleep satisfaction indicators; outcomes ranging from academic performance, mental and physical health, cognitive functioning and daytime alertness (Table 1). Key exclusion criteria were: sole use of objective sleep assessment tool; care settings comprised of special population patients; animal studies and case reports.

An initial search of the literature identified 2982 articles, from which a final 495 were selected from a tiered examination of abstracts and full-texts (Supplementary Table 1). A flowchart of the search results and tiered exclusion is depicted in Fig. 1. From the included final papers, full-texts were reviewed and methodologies were extracted and assembled into tables for Panel review.

### Indicator list

From the tables developed through the literature review, which compiled methods and suggested indicators, a list of 38 indicators

**Table 1**  
Inclusion and exclusion criteria for sleep satisfaction papers

Category	Inclusion/Exclusion	Criteria
Populations	Include	1. Ages 18–70
	Exclude	1. Subset of the population—e.g., studies of patients with sleep or non-sleep diseases, mental illness, etc.
Condition-Definition	Include	2. Subjective measures of sleep Sleep satisfaction/quality leading to different outcomes
	Exclude	Objective sleep quality
Setting	Include	All settings that are not exclusion criteria
	Exclude	Care settings comprised of special population patients
Study Types	Include	1. Compare reported <b>subjective</b> sleep satisfaction/quality to different health outcomes
		2. Quantification of <b>subjective</b> sleep satisfaction/quality indicators (e.g., arousals, awakenings, etc.)
		3. Intervention studies
Outcomes	Include	Animal studies, abstracts, letters, case reports and reviews
		1. Academic Performance 2. Mental health 3. Daytime sleepiness/alertness 4. Cognitive functioning 5. All-cause mortality 6. Quality of life 7. Functional status 8. Medical Outcomes 9. Fatigue
	Exclude	-N/A-

for Panel consideration was assembled. The list presented each indicator in a standard question form for the Panel as follows:

*In a normal population, under normal circumstances, is [indicator] an appropriate indicator of sleep satisfaction?*

### Voting

#### Round 0

The list of indicators, presented in question form as detailed above, was programmed into Qualtrics (<http://www.qualtrics.com>; Provo, Utah; 2017). Each indicator was presented along with three response options as follows: 0 – accept, 3 – discuss, 6 – reject. The programmed list of indicators was sent out to the Panel for vote on June 28, 2017 in an attempt to reduce the number of indicators up for discussion at the in-person meeting in July. A conservative need for five out of the seven panelists to fully reject an indicator was established. Rejected indicators were not presented to the Panel at the in-person meeting.

#### Rounds 1 and 2 voting

An in-person Panel meeting was convened at the Stanford Sleep Epidemiology Research Center in Palo Alto, CA, USA, on July 15, 2017, to discuss the existing literature, the methodologies for measuring sleep satisfaction, and the Round 0 votes for the remaining indicators. The overall methodology has been used previously to update NSF recommendations for sleep duration.<sup>4,5</sup>

Due to the absence of a validated instrument on sleep satisfaction in the general population, Panel members were asked to reach a consensus on indicators to construct a novel instrument. Panel voting was conducted via a modified Delphi RAND method [10]. Briefly, Panel members considered each indicator, as presented in the question format above, and voted in successive rounds using a scale from 1 (extremely inappropriate) to 9 (extremely appropriate) on the appropriateness of the item as an indicator for sleep satisfaction. Panelists drew from the literature review as well as their own expertise in making these judgments. An indicator was recommended as

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