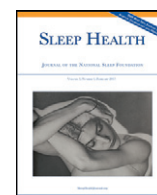




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# Sleep Health

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## National Sleep Foundation's sleep quality recommendations: first report<sup>☆</sup>



Maurice Ohayon, MD, DSc, PhD<sup>a,\*</sup>, Emerson M. Wickwire, PhD<sup>b,c</sup>, Max Hirshkowitz, PhD<sup>d,e</sup>, Steven M. Albert, PhD, MS<sup>f</sup>, Alon Avidan, MD, MPH<sup>g</sup>, Frank J. Daly, PhD<sup>h</sup>, Yves Dauvilliers, MD, PhD<sup>i</sup>, Raffaele Ferri, MD<sup>j</sup>, Constance Fung, MD, MSHS<sup>k</sup>, David Gozal, MD<sup>l</sup>, Nancy Hazen, PhD<sup>m</sup>, Andrew Krystal, MD<sup>n</sup>, Kenneth Lichstein, PhD<sup>o</sup>, Monica Mallampalli, PhD, MSC<sup>p</sup>, Giuseppe Plazzi, MD<sup>q,r</sup>, Robert Rawding, PhD<sup>s</sup>, Frank A. Scheer, PhD<sup>t</sup>, Virend Somers, MD, PhD<sup>u</sup>, Michael V. Vitiello, PhD<sup>v</sup>

<sup>a</sup> Stanford Sleep Epidemiology Research Center, Division of Public Mental Health and Population Sciences, Stanford University School of Medicine, Palo Alto, CA, USA

<sup>b</sup> Department of Psychiatry, University of Maryland School of Medicine, Baltimore, MD, USA

<sup>c</sup> Sleep Disorders Center, Division of Pulmonary and Critical Care Medicine, University of Maryland School of Medicine, Baltimore, MD, USA

<sup>d</sup> Division of Public Mental Health and Population Sciences, School of Medicine, Stanford University, Stanford, CA, USA

<sup>e</sup> Department of Medicine, Baylor College of Medicine, Houston, TX, USA

<sup>f</sup> Department of Behavioral and Community Health Sciences, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA

<sup>g</sup> UCLA Sleep Disorders Center, UCLA Neurology Clinic, Department of Neurology, UCLA, Los Angeles, CA, USA

<sup>h</sup> Department of Biomedical Sciences, College of Osteopathic Medicine, University of New England, Biddeford, ME, USA

<sup>i</sup> Sleep Disorders Center, Department of Neurology, Gui-de-Chauliac Hospital, CHU Montpellier, Montpellier, France

<sup>j</sup> Department of Neurology I.C., Oasi Institute for Research on Mental Retardation and Brain Aging (IRCCS), Troina, Italy

<sup>k</sup> David Geffen School of Medicine at UCLA, VA Greater Los Angeles Healthcare System, Los Angeles, CA, USA

<sup>l</sup> Department of Pediatrics, The University of Chicago Medicine Comer Children's Hospital, University of Chicago, Chicago, IL, USA

<sup>m</sup> Human Development and Family Sciences, University of Texas at Austin, Austin, TX, USA

<sup>n</sup> Neurosciences Medicine, Duke Clinical Research Institute, Durham, NC, USA

<sup>o</sup> Sleep Research Project, Department of Psychology, The University of Alabama, Tuscaloosa, AL, USA

<sup>p</sup> Scientific Affairs, Society for Women's Health Research, Washington, DC, USA

<sup>q</sup> Department of Biomedical and Neuromotor Sciences, University of Bologna, Bologna, Italy

<sup>r</sup> IRCCS Istituto delle Scienze Neurologiche di Bologna, Bologna, Italy

<sup>s</sup> Department of Biology, Gannon University, Erie, PA, USA

<sup>t</sup> Medical Chronobiology Program, Division of Sleep and Circadian Disorders, Brigham & Women's Hospital, Boston, MA, USA

<sup>u</sup> Department of Internal Medicine, Mayo Clinic, Rochester, MN, USA

<sup>v</sup> Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, USA

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### ABSTRACT

**Objectives:** To provide evidence-based recommendations and guidance to the public regarding indicators of good sleep quality across the life-span.

**Methods:** The National Sleep Foundation assembled a panel of experts from the sleep community and representatives appointed by stakeholder organizations (Sleep Quality Consensus Panel). A systematic literature review identified 277 studies meeting inclusion criteria. Abstracts and full-text articles were provided to the panelists for review and discussion. A modified Delphi RAND/UCLA Appropriateness Method with 3 rounds of voting was used to determine agreement.

**Results:** For most of the sleep continuity variables (sleep latency, number of awakenings >5 minutes, wake after sleep onset, and sleep efficiency), the panel members agreed that these measures were appropriate indicators of good sleep quality across the life-span. However, overall, there was less or no consensus regarding sleep architecture or nap-related variables as elements of good sleep quality.

**Conclusions:** There is consensus among experts regarding some indicators of sleep quality among otherwise healthy individuals. Education and public health initiatives regarding good sleep quality will require

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\* Corresponding author.

E-mail address: [research@sleepfoundation.org](mailto:research@sleepfoundation.org) (M. Ohayon).

sustained and collaborative efforts from multiple stakeholders. Future research should explore how sleep architecture and naps relate to sleep quality. Implications and limitations of the consensus recommendations are discussed.

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## Introduction

Good sleep quality is a well-recognized predictor of physical and mental health, wellness, and overall vitality. Although, the term “sleep quality” is widely used by researchers, clinicians, and the public, this expression lacks definitional consensus. To date, no consistent guidance is available from the scientific community regarding what constitutes normal or optimal, healthy sleep and good sleep quality.

The Webster dictionary’s simple definition of quality is “how good or bad something is.”<sup>1</sup> Thus, a global approach for indexing sleep quality often involves soliciting a self-rating. Such indices likely reflect an individual’s satisfaction with his or her sleep. An extension of this approach involves correlating self-rated sleep quality against other measures such as environmental factors, the timing of sleep, physiologically derived indices, polysomnographic parameters, behavior, pharmacologic interventions, and/or the presence of sleep disorders. One obvious limitation of relying on self-report when assessing sleep quality is the loss of consciousness during sleep, which makes individuals poor self-observers of this particular behavior.

An alternative approach to defining sleep quality involves deconstructing it into its particular objective components. Within this paradigm, “quality” is defined as a combination of constituent elements or processes judged as valuable. It is this approach that guided the current investigation. The purpose of this study was to search for a composite of objectively identifiable sleep features underlying sleep quality. Many questions related to sleep quality and its potential outcomes on health (eg, mood and cognitive performance) exist; however, those questions are outside the scope of this article.

The need for such clarity on sleep quality is of particular and timely importance given the rapid increase in public awareness of sleep as an important component of health and overall well-being. Millions of individuals are using commercially available sleep tracking devices. These devices purport to measure sleep quality and quantity. Therefore, there exists a need to define clearly both sleep quantity and quality using the best scientific evidence available. Sleep quantity recommendations were previously addressed by a National Sleep Foundation (NSF) Sleep Duration Recommendation consensus panel.<sup>2</sup> Continuing this process, the NSF assembled a panel of experts to answer the question, “What is good sleep quality?” The overall objectives of this Sleep Quality Consensus Panel (SQCP) were to provide scientifically sound recommendations regarding indicators of good sleep quality at different ages across the life-span.

## Methods

### Participants

To ensure a wide range of perspectives regarding indicators of sleep quality, the NSF assembled an expert panel comprising sleep experts as well as experts in other areas of science and medicine. Because one objective of the SQCP was to provide interpretable recommendations to the public, it was important to include non-sleep experts from related scientific domains. The 18-member panel included representatives selected by stakeholder

organizations (n = 10) as well as sleep experts selected by the NSF (n = 8). Stakeholder organizations that appointed representatives included the *American Academy of Neurology*, *American Geriatrics Society*, *American Physiological Society*, *American Association of Anatomists*, *Gerontological Society of America*, *Human Anatomy and Physiology Society*, *Sleep Research Society*, *Society for Research on Biological Rhythms*, *Society for Research of Human Development*, and the *Society for Women’s Health Research*.

### Procedures

#### Literature review

To ensure that all panelists had access to the same body of evidence, the NSF performed a systematic review of peer-reviewed literature encompassing the years 2005–2015 using PubMed, Web of Science, CINAHL Plus, EBSCO, and MEDLINE databases. Search terms were developed, reviewed, and agreed upon by the panel (see Table 1). Inclusion criteria for individual studies were the following:

- Published in English language
- Published in peer-reviewed scientific journal
- Studied human subjects
- Used objective measures of sleep quality.

A total of 3928 unique articles were identified, 386 articles were selected for full-text review, and 277 studies met the final inclusion criteria. A flowchart of literature search results is depicted in Fig. 1. Study data (ie, sample characteristics, country, study type, measures, and results) were extracted and summarized in alphabetical tables. Separate summary tables were developed for each age group. These tables and the corresponding full-text articles were distributed to panelists for review to inform their ratings. Key articles are summarized in Supplementary table (Appendix A).

#### Panel deliberations and consensus voting

Panelists were initially tasked with defining age categories and possible indicators of good sleep quality. Based on the literature

**Table 1**  
Search terms used in the systematic review

Sleep terms	Indicators
Sleep quality	Awakenings
Sleep efficiency	Arousals
Restorative sleep	Movement
Sleep consolidation	Restlessness
Restful sleep	Architecture
Efficient sleep	Spindle activity
Refreshing sleep	Duration
High-value sleep	Time in bed
High-grade sleep	Environmental factors
Satisfactory sleep	Stages of sleep
Sleep depth	Sleep cycles
Deep sleep	Phases of sleep
	Perceptions
	Restorative

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