Review Article

The impact of sleep duration on self-rated health

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ABSTRACT

Purpose: To review the association between sleep duration and self-rated health.
Methods: A search for original and review articles focusing on sleep duration and self-rated health was performed in PubMed. The general search strategy was [("sleep duration" OR "total sleep time" OR "time in bed") AND "self-rated health"].
Results: We found 22 articles in the English language; 8 articles with no direct association between sleep duration and self-rated health were excluded. Of these articles, 14 were considered potentially relevant and examined in detail, and 9 were excluded for not having self-rated health as the primary outcome. This work was compounded by 5 papers. The extremes of sleep duration (short or long) exhibited an interaction with poor or worse self-rated health.
Conclusion: The sleep duration issue should be considered when inquiring about health conditions, as this factor can lead to adverse results in global health status.

1. Introduction

Sleep duration (SD) is a predictor of an individual's health status. Insufficient sleep is a common characteristic in our 24 h/7 days a week modern society and can lead to metabolic dysfunction, obesity, hypertension, heart attack, stroke [1] and coronary heart disease [2]. On the other hand, there is conflicting evidence that we are not as deprived of sleep as we think we are; because in some countries, people are sleeping more [3,4]. However, sleep duration figures as an important outcome, while its extremes (short or long sleep) may be hazardous and might result in type 2 diabetes mellitus [5,6], increased mortality hazard [7], coronary heart disease, cardiovascular disease, stroke [8], obesity [9] and other comorbidities/impairments. These problems are frequently associated with short and long sleepers. As one of the major problems in our society, shortened sleep, or insufficient sleep, is a public health concern. Currently, short and long sleepers exhibit increased mortality rates, independent of sleep duration [10,11]. Studies on sleep have traditionally examined the effects of perceived sleep duration and its impact on health.

Self-rated health (SRH) is a subjective perception and has become an increasingly common measure for public health monitoring. SRH is a strong independent predictor of mortality after accounting for objective health status, behavioral risk factors and socio-demographic characteristics, and it also provides a suitable and inexpensive method of assessing an individual's health [12]. Various socio-demographic, health and lifestyle determinants of SRH have been identified in different populations. Epidemiological studies from different societies and cultures have shown that SRH is a valid and consistent predictor of cardiovascular disease and overall mortality [13]. The incidences of chronic diseases such as obesity, hypertension, diabetes and dyslipidemia rise significantly as SRH decreases [14]. Variations in general SRH status are observed as a result of changes in sleep duration on morbidity and mortality [15].

Although 3 meta-analyses have concluded that both short and long sleep duration were associated with an increased risk of mortality and also showed greater effects on long sleepers [6,8,16], sleep duration seems to reflect comorbidity and health status. Few studies have considered the relationship between sleep duration and self-rated health in detail. Therefore, the purpose of this study was to review the association between sleep duration and self-rated health.

2.   Method

A search for original and review articles focusing on SD and SRH was performed in PubMed. The general search strategy was [("sleep duration" OR "total sleep time" OR "time in bed") AND "self-rated health"]. No filters were used. Titles and abstracts were independently reviewed by the authors (CF and SSQ) against the inclusion and exclusion criteria. The inclusion criteria were the association between SD and SRH in adults and/or elderly with no specific disease and SRH as the main outcome. The full-text article was read when the abstracts were unclear. All articles were in English. The reference lists of the identified articles were also searched for additional papers. The search was conducted until January 2014.

3.   Results

We found 22 articles in English. Fig. 1 depicts the steps used to reach the final result. The associations of SD on SRH are shown in Table 1. In all 5 articles, the extremes of SD exhibited an interaction with poor or worse SRH, and all articles utilized self-administered questionnaires.

4.   Discussion

This review shows that SD is associated with poor or worse SRH. Short and long SD are associated with important health endpoints such as general mortality [16].

A retrospective observational study assessed the relationship between SD and SRH in young adults in 24 countries [17] and indicated a dose–response relationship, as those who

slept less than 7 h were more likely to be in the poor health category. The association between short sleep (6–7 h in this study) and poorer SRH is intriguing. Despite the fact that short sleep might be due to cultural and social reasons, genetic aspects may also interfere with short SD. For example, objective short sleep duration may be a biological marker for a genetic predisposition to chronic insomnia [18].
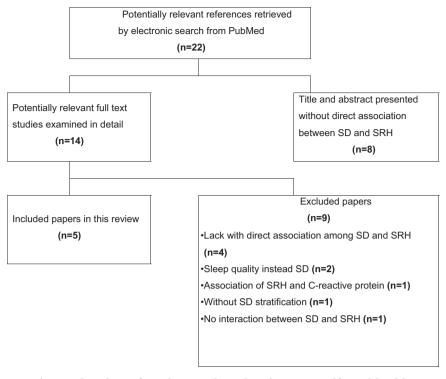
As most of the studies include a heterogeneous group, it is possible to have individuals who are not sleeping enough with a wide range of sleep insufficiency and its consequences [19,20], as well as individuals with a lower physiological need for sleep [21]. Therefore, it seems beneficial to distinguish between short sleepers and insufficient sleepers, who are often deprived of and/or restricted from sleep. Additionally, the direction of causality cannot be established: does shorter SD lead to poor SRH or does poor SRH cause shorter sleep? In the aforementioned Steptoe et al. study [17], it seems less likely that poor health causes shorter SD, as the investigation was performed using health subjects, suggesting the existence of underlying factors that possibly cause shorter SD and poorer SRH. Additionally, both possibilities can be associated with socioeconomic background, physical activity, body weight [15], health habits, mental health condition [22], mood changes, sleep disturbances [23] and genetic factors [20,24], as these analyses were controlled/adjusted for some of these factors.

In a study of more than 377,000 participants aged 18 years or older, Geiger et al. [13] used logistic regression models to calculate the odds ratio of the SRH associated with increasing categories of insufficient rest/sleep. They found a positive association between increasing categories of insufficient sleep and poor SRH, independent of relevant covariates. The presence of a positive dose–response trend and the persistence of the association in stratified analyses by subgroups from potential confounders, such as gender, age, BMI, and race-ethnicity, suggest that these findings are not due to chance. These results suggest that poor SRH may be an indirect mediator of the association between insufficient sleep, cardiovascular disease and mortality, and self-reported insufficient rest/sleep appears to be a strong predictor of SRH. Kim et al. [25] found an association between short and long SD and poor SRH in the adjusted analyses in a large representative sample of the Korean adult population.

Conversely, short and long SD could be a result of poor SRH. One third of the older adult population has extreme SD (short or long) and presents difficulties in sleep onset and maintenance or has daytime sleepiness [7,26]. A prospective observational study of adults ages 40–64 found no evidence that SD is associated with SRH in either subjective or actigraphic measures [27].

Studies involving middle-aged and elderly participants have documented adverse effects for both short and long SD, although they are related to different health outcomes [28,29]. In this review, we found the SD–SRH interaction in 2 studies with this population [22,30], suggesting that long SD predicts worse SRH.

Magee et al. [22] stratified the analysis by age and found that for participants between the ages of 45 and 74 years, short (<6 h) and long (≥ 9 h) sleep were associated with SRH; participants aged 75–84 had only long sleep associated with

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┌─────────────────────────────────────┐
│  Potentially relevant references     │
│  retrieved                           │
│  by electronic search from PubMed    │
│            (n=22)                    │
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┌─────────────────────────────┐        ┌──────────────────────────────┐
│ Potentially relevant full    │        │ Title and abstract presented  │
│ text                         │        │ without direct association    │
│ studies examined in detail   │        │ between SD and SRH            │
│          (n=14)              │        │           (n=8)               │
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│ Included papers in this      │   │ Excluded papers                            │
│ review                       │   │           (n=9)                            │
│          (n=5)               │   │ •Lack with direct association among SD     │
│                              │   │  and SRH                                   │
│                              │   │  (n=4)                                     │
│                              │   │ •Sleep quality instead SD (n=2)            │
│                              │   │ •Association of SRH and C-reactive         │
│                              │   │  protein (n=1)                             │
│                              │   │ •Without SD stratification (n=1)           │
│                              │   │ •No interaction between SD and SRH (n=1)   │
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Fig. 1 – Flowchart of results. SD: sleep duration, SRH: self-rated health.

SRH in the adjusted analysis; and finally, participants between the ages of 85 and 97 did not show these correlations even in the unadjusted models. In fact, while much is known about the negative impacts in insufficient sleep, very little is known about the risks associated with long sleep duration.

Long sleep is defined as a habitual sleep length of at least 9 h, except hypersomnia as a clinical condition, and a long sleep duration may be associated with an increased mortality hazard caused by factors such as sleep fragmentation (excessive time in bed, wake after sleep onset and delayed sleep latency); fatigue and lethargy; immune function (long sleep may influence the increase of cytokine expression); photo-periodic abnormalities (long periods of time in a darkened environment); lack of challenge (longer time in bed provides fewer opportunities for experiencing stressors, offering physiological changes); and depression or underlying disease process (sleep apnea, heart disease, failing health). Additionally, these factors may also be related to each other [31].

In a self-reported habitual long sleep duration study in the Nurses Health Study II, Patel et al. [32] found that long sleepers reported an increased likelihood of a history of depressive symptoms, antidepressant use, benzodiazepine use, lack of physical activity, never married or divorced status, living alone, lower income, unemployed status and lower social status. Finally, mortality risks of long sleepers may be associated with general failing health. Specifically, Kakizaki et al. [23] found an association between stroke mortality and SRH in long sleepers. In this sense, the possibility of poor health leading to longer sleep duration seems more plausible than the alternative. Long sleep is more prevalent in those over 60 years old [7], thus leading to excessive daytime sleepiness [33]. On the other extreme, Steptoe and colleagues [17] expected that SD > 8 h would have

poorer SRH, but no significant associations were found in this group or even in the very long sleeper group (>10 h).

Subjective reports of sleep time are often inaccurate. Self-rated SD modestly corresponds with more objective measurements of sleep involving polysomnography and/or actigraphy, and there is evidence that some individuals overestimate their SD [34]. There is evidence in the literature showing that self-assessments of health are often mistaken [35] and may not be suitable for tracking changes in population health over time [36]. On the other hand, self-reported SD is well documented and a reliable measure. SD is an issue commonly used as a subjective sleep measure and is assessed by asking participants a simple question (e.g., "On average, how many hours of sleep do you have in a 24 hour period?") and categorizing the response into groups (≤ 5 h, 6 h, 7 h, 8 h, ≥ 9 or 10 h) [37–39]. SRH is often measured by a single question (e.g., "In general, how would you say that your health is?"), and the respondents choose an option from a Likert scale that consists of five levels (poor, fair, good, very good or excellent). SRH provides an important and valid indicator of an individual's health status and associated health outcomes [40,41]. We cannot disregard the fact that self-reported or perceived variables/measures could be biased due to its subjectivity because some participants may have a different understanding of the categories of answers.

The International Classification of Sleep Disorders defined short sleep as ≤ 5 h and long sleep as ≥ 9 h [42]. However, the categories of self-rated SD used by NSF Poll 2013 [43] are different from those found in the current literature, which interfere with accurate comparisons. In Table 1, we depict different categories of SD found in the studies, which could lead to mistaken interpretations of data.

Reference	Study design (cohort)	Sample size	Age (years)	Categories of SD (h)	Interaction between SD and SRH	Main outcomes	Adjusted variables
Steptoe et al. [17]	Cross-sectional	17.465	17–30	<6 (very short)	Yes	Short SD had poorer SRH than 7–8 h of SD, even after adjusting for a range of covariates[*].	Age, depressive symptoms, recent health problems, socio-economic background, BMI, smoking, alcohol and physical activity.
	(International Health and Behaviour Study)			6–7 (short)		The OR for poor SRH adjusted for covariates was 1.99 (95% CI, 1.31–3.03) for very short SD and 1.56 (95% CI, 1.22–1.00) for short SD.	
				7–8[a]		Asian countries had a higher proportion of poor SRH and a shorter average SD.	
				8–10 (long) >10 (very long)			
Magee et al. [22]	Cross-sectional	63.408	45–95	<6	Yes	Short and long SD were associated with poor SRH in individuals aged 45-74 years.	Socio-demographic factors (age, sex, country of birth, education level, marital status, work hours, place of residence), health-related behaviors (alcohol consumption and smoking status), chronic health conditions (obesity, cancer, heart disease, diabetes and stroke) and emotional disturbances.
	(45 and Up Study)			≥6–<7		Long SD was associated with poor SRH in individuals aged 75–84 years.	
				≥7–<9[a]		The OR for SD of <6 was 1.49 (95% CI, 1.31–1.70); ≥6–<7 was 1.28 (95% CI, 1.17–1.38); and ≥9 was 1.56 (95% CI, 1.46–1.67), and SD was associated with poor SRH.	
				≥9			
Shankar et al. [12]	Cross-sectional	20.663	>18	≥5	Yes	Short and long SD were associated with fair/poor SRH.	Age, sex, race-ethnicity, education, smoking, alcohol, BMI, exercise, depression, diabetes, hypertension and CVD.
	(National Health Interview Survey 2008)			6		The OR for SD ≤5 was 2.29 (95% CI, 1.86–2.83); 6 h was 1.68 (95% CI, 1.42–2.00); 8 h was 1.38 (95% CI, 1.18–1.61) and ≥9 was 1.98 (95% CI, 1.63–2.40).	
				7[a] 8 ≥9			
Kakizaki et al. [30]	Longitudinal	42.256	40–70	≤6 (short)	Yes	Long SD had worse SRH[*].	Age, sex, total caloric intake, BMI, marital status, level of education, job status, time spent walking, perceived mental stress, self-rated health, physical function, history of the following: myocardial infarction, cancer, stroke, hypertension, diabetes mellitus, smoking, alcohol drinking.

Table 1 – Association between sleep duration and self-rated health.

Reference / Study	Design	N	SD (h)	Depression adjusted	Results	Covariates
(Ohsaki Cohort Study)			7[a] 8 9 ≥10 (long)		Short SD had higher HR with worse SRH. The association of long SD and mortality was not modified by SRH.	Age, household income, residency region, occupation, marital status, alcohol use, smoking status, and walking chronic diseases (high blood pressure, diabetes, stroke, myocardial infarction, and angina), BMI, and major depression.
Kim et al. [25] (Korea National Health and Nutrition Examination Survey IV)	Cross-sectional	15.252 ≥19	≤5 (short) 6 7[a] 8 ≥9 (long)	Yes	Short or long SD was associated with poor SRH. The OR for short SD was 1.35 (95% CI, 1.16–1.58) and 1.32 (95% CI, 1.09–1.60) for long SD.	

SD: Sleep duration; SRH: self-rated health; HR: Hazard Ratio; BMI: body mass index; OR: Odds ratio; CVD: cardiovascular disease
a reference category.
* p≤0.001.

Furthermore, in future studies, sleep quality should be assessed along with the interest variables described in this paper. Distinguishing between sleep quality and SD in the context of health is quite important. A previous study reported a moderate positive correlation between overall self-rated sleep quality and average nightly sleep duration. They also showed that a better quality of sleep was associated with higher family income, but not with higher levels of education, suggesting that more education could possibly improve the quality of people's sleep [44]. Thus, poor sleep quality is predictive of worse health [3]. Additionally, sleep quality was more commonly reported by respondents who are more highly educated, have greater family incomes, exhibit fewer symptoms of non-specific psychological distress and are in better physical health. Sleep quality was also more commonly reported by respondents who are older, married, had fewer children, were more highly educated, employed, experiencing little financial hardship and in good physical health [45]. In addition to being associated with better health [46], sleep quality was considered a stronger and more consistent predictor of mental and physical health [47].

Specifically about mental health, depression is known to influence both the quality and duration of sleep [17], and this issue is also presented as a covariate in two other studies [12,25] in this review. However, comparisons are not possible due to different methods used. The findings of these 3 studies [12,17,25] shows that even adjusting for depression in the statistical analysis, extreme SD established a close association with poorer SRH and also a higher prevalence of depression was noted in people with SD ≥ 9 h [12]. Magee [22] and Kakisaki [30] investigations pointed out that regardless emotional issues, SD can contribute to worse SRH and also worse quality of life. Again, no comparison is feasible as the methods of collection and classification of this clinical condition are different between the studies, becoming a limitation in our review. Thus the depressive symptom is undoubtedly one of the potential confounders of the presented analysis and should be considered separately in future studies and further investigated.

In summary, our results indicate the importance of using SD and SRH as predictors of diseases (physical, mental, emotional) which can result in the implementation of accessible and less expensive health programs, especially prevention programs that are able to raise the awareness of the population, as well as preventive measures to change life habits (e.g., sleep hygiene).

5. Conclusion

In this review we found that both short and long SD had prominent negative impacts on SRH, indicating an association between SD and SRH even when the adjusted analysis for possible confounders was performed. The sleep duration issue should be considered together with inquiries about health conditions, as this factor can lead to adverse results in global health status.

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