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# Sleep Quality in School-Aged Children: A Concept Analysis

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Adequate sleep is essential for the proper functioning of all body systems (Altevogt & Colten, 2006; Shepard et al., 2005). Insufficient sleep across the lifespan is linked to an increased risk for obesity, hypertension, and type 2 diabetes (Arteaga et al., 2018; Benjamin et al., 2019). Evidence suggests that sleep duration, or the number of hours of sleep per night, has been decreasing over the last 50 years in all age groups (Olgivie & Patel, 2017), and by at least one hour in pediatric groups over the previous 100 years (Matricciani, Olds & Petkov, 2012). According to the Center for Disease Control (CDC, 2017), 32% of adults, ages 18–24, report having less than seven hours of sleep per night. Sleep deprivation, generally defined as not achieving the required hours of sleep per night (American Academy

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CRediT Roles
S.R. : conceptualization, methodology, formal analysis, investigation, writing- original draft, writing- review & editing, visualization
A.J.: validation, writing- review & editing, visualization
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None

of Sleep Medicine, 2008), increases in children as they age with the result that 95% of 12th graders are getting less than recommended sleep (Basch et al., 2014). However, there are limited data on the percentage of school-aged children who report less than the recommended amount of sleep per night.

Another gap in the literature is the description of sleep quality in children, which is much more than insomnia, which is defined as difficulty initiating or maintaining sleep (American Psychiatric Association, 2013; Harvey, Stinson, Whitaker, Moskovitz, & Harvinder, 2008). Sleep quality is a combination of subjective and objective sleep factors (Buysse, Reynolds III, Monk, Berman, & Kupfer, 1989); thus, there is difficulty in defining the concept (Ohayon et al., 2017), as sleep quality is reflective of one's overall sleep. Sleep quality also has physical health implications (Ohayon et al., 2017), impacting blood pressure and adiposity or fat mass in children, which are risk factors for hypertension and obesity, respectively (Fatima, Doi, & Mamun, 2016; Javaheri, Storfer-Isser, Rosen, & Redline, 2009).

Both pediatric obesity and pediatric hypertension are increasing in the United States (Benjamin et al., 2017; Olgivie & Patel, 2017). Thirteen million children are considered obese (CDC, 2018), while one in ten children have elevated blood pressure (Benjamin et al., 2019). Obesity and hypertension in childhood or the increased risk for these disorders can persist into adulthood (Hales et al., 2017). Further, even one occurrence of elevated blood pressure in childhood can affect adult cardiovascular risk (Guaer & Qui, 2012). Cardiovascular disease currently costs the United States $351 billion and is projected to increase to $749 billion by 2035 (Benjamin et al., 2019).

However, the majority of studies on sleep quality have been conducted in adults (Javaheri et al., 2008). There is a paucity of research on sleep quality in pediatrics, especially in school-aged children. This lack of research is possibly due to inconsistencies in the definitions of sleep quality (Buysse et al., 1989; Erwin & Bashore, 2017; Ohayon et al., 2017) and the lack of clarity on what instruments are the most effective at measuring sleep quality in school-aged children (Buysse et al., 1989; Erwin & Bashore, 2017).

Knowledge about the influence of sleep quality on risks for chronic disease has implications for the health of future generations and decreasing healthcare costs in America. In a recent review of instruments measuring sleep in pediatrics, Erwin and Bashore (2017) indicated the need for a concept analysis of sleep in healthy children to address some of the research questions in this area. Therefore, the purpose of this concept analysis is to define specific attributes of sleep quality in school-aged children and the empirical referents that measure these attributes. This review will help guide future research on sleep in children and aid pediatric clinicians in the assessment of sleep and in promoting healthy sleep habits.

## Methods

### Walker and Avant

The Walker and Avant method provided the framework and process for completing this concept analysis. The process is composed of the following eight steps: 1) select a concept;

2) determine the aims or purposes of the analysis; 3) identify all possible uses of the concept; 4) determine the defining attributes; 5) identify model cases; 6) identify borderline, related, contrary, invented, and illegitimate cases; 7) identify antecedents and consequences; and 8) define empirical referents (Walker & Avant, 2011). Using this method elucidated the knowledge obtained from objective and subjective data acquired from studying sleep quality through the inclusion of empirical referents. The assessment of antecedents and consequences illuminated the impact that sleep quality can have on multiple body systems and mental and emotional health.

## Literature Search

In July 2019, a literature search for research on sleep quality in children was conducted using CINAHL, PubMed, PsycINFO, and Scopus databases (Figure 1). The original search terms were for titles, abstracts, and keywords using the Boolean phrases “sleep” AND “children,” which yielded 68,064 articles. The search was narrowed to include only manuscripts focused on “sleep” AND “school-aged children,” which generated 1,356 articles. To capture more sleep quality specific articles, the final search included the following Boolean phrase (“sleep quality” OR “sleep duration” OR “sleep impairment” OR “sleep disturbances” OR “sleep patterns” OR “sleep habits” OR “sleep hygiene” OR “sleep characteristics”) AND “school-aged children.” These search terms were chosen due to the inconsistent use of the term “sleep quality” to describe the overall quality of sleep (Ohayon et al., 2017). The search yielded 464 manuscripts in English that were published within the last ten years (2009–2019). The search was narrowed to the last ten years since the most recent recommendations for sleep duration and sleep quality in children were recently published (Paruthi et al., 2006; Ohayon et al., 2017) and pediatric sleep research has accelerated over the last ten years (Sheldon, 2014b). However, additional seminal articles were found after the search to help further define some of the attributes of the concept.

After duplicate article removal, there were 281 manuscripts to examine titles and abstracts for content relevancy and web availability. Inclusion criteria for the manuscripts were (a) studying the school-aged pediatric population and (b) including a subjective sleep quality questionnaire or actigraphy as a measurement. This step produced 89 documents for further review. After a full review, excluded articles (a) did not use questionnaires or actigraphy; (b) included participants outside the school-age range; (c) included participants with diagnoses that can interfere with sleep; (d) measured only one variable of sleep; or e) not a primary article, a systematic review or meta-analysis.

Since sleep quality is defined by a combination of several sleep factors (Buysse et al., 1989; Ohayon et al., 2017), more than one measure of sleep was necessary to be included in the literature review. This method was used to help further define sleep factors and quality of sleep. Additionally, the studies had to include participants who only fit within the school-age developmental stage. The National Sleep Foundation (NSF) considers school-aged to be 6–13 years of age (Ohayon et al., 2017), while the CDC classifies the age groups by children (ages 511) and adolescents (ages 12–17) (2017). However, sleep duration recommendations are based on school-aged being within ages 6–12 (Paruthi et al., 2016). Therefore, for this paper, school-aged children were classified as children from ages 6–12 years. Since many

studies also included participants outside of this age range in their samples, several articles were excluded to capture only school-aged data. After this step, there was a total of 10 articles to examine for the concept analysis (Table 1). No articles were excluded during data extraction. Four articles were found through a manual search, which made the final total article yield 14.

## Results

### Use of the Concept

The Walker and Avant method entails determining the use of the concept, thus allowing the investigators to know the breadth of the concept and implications for research and practice (Walker &Avant, 2011). Based on the review of the literature, six definitions of sleep quality emerged.

**Common definition—**The Oxford English Dictionary defines sleep as “a condition of body and mind, which typically recurs for several hours every night, in which the nervous system is inactive, the eyes closed, the postural muscles relaxed, and consciousness practically suspended (n.d.).” The definition of quality is “the standard of something as measured against other things of a similar kind; the degree of excellence of something (Oxford English Dictionary, n.d.).”

**Medical definition—**“Sleep quality” is a term consistently used in health-related disciplines, mostly psychology, medicine, and nursing (Buysse et al., 1989; National Institute of Nursing Research (NINR), 2016; Shepard et al., 2005). Sleep medicine, as a discipline, has significantly advanced over the last 60 plus years due, in part, to the discovery of rapid eye movement (REM) sleep (Shepard et al., 2005). This discovery was a catalyst for a specialized research discipline in sleep that has now led to the need for a better definition of sleep quality (Shepard et al., 2005). Taber’s Medical Dictionary (2017) does not have a definition of sleep quality. The query only revealed the following closely related topics: sleep restriction, dyssomnia, disturbed sleep pattern, insomnia, sleep disorder, and hygiene (Taber’s, 2017). In the literature, sleep quality is associated with or called other terms such as, “sleep disturbance,” “sleep impairment,” “sleep patterns,” “sleep duration,” “sleep disorder,” and “sleep hygiene” making it difficult to have a common definition (Bevans et al., 2018; Firouzi et al., 2014; Jiang et al., 2014; Narang et al., 2012; Pesonen et al., 2014).

**Objective definition—**Sleep quality is composed of both subjective and objective aspects (Buysse et al., 1989). This combination adds to the confusion about the definitions because the individual components of sleep quality overlap with individual measurements of sleep (Buysse et al., 1989; Pilcher, Ginter, & Sadowsky, 1996). The objective or quantitative components typically include arousals, sleep duration, and sleep latency, and are measured with electrophysiological monitoring (Buysse et al., 1989; Pilcher, Ginter, & Sadowsky, 1997).

**Subjective definition—**The subjective aspect of sleep quality, which includes how a person feels upon awakening (i.e., sleepiness, fatigue), separates it from other measures of

sleep (Pilcher, Ginter, & Sadowsky, 1997). Harvey and colleagues (2008) completed a qualitative study that resulted in three definitions of subjective sleep quality. The definitions are (1) tiredness on waking and throughout the day, (2) feeling rested and restored on waking, and (3) the number of nightly awakenings experienced (Harvey et al., 2008).

**National Sleep Foundation definition—**The NSF developed a broad definition of sleep quality for use across the lifespan (Ohayon et al., 2017). This definition states that the following are stable measures of sleep quality: (1) sleep latency, (2) number of awakenings greater than 5 minutes (3) wake after sleep onset, and (4) sleep efficiency (Ohayon et al., 2017). However, the members of the NSF's study committee were unable to agree on the architecture of sleep (REM sleep, other stages of sleep, and arousals) or naps, which would define sleep quality in all age groups (Ohayon et al., 2017). Also, this recommendation only included objective sleep factors of sleep quality (Ohayon et al., 2017).

**Conceptual definition—**The following conceptual definition was derived from the knowledge synthesized for this concept analysis. Sleep quality in school-aged children is an allencompassing term for children ages 6–12 going to bed at a consistent time and sleeping for nine to twelve hours (Paruthi et al., 2016) with minimal delay between getting into bed and falling asleep, limited sleep disturbances, and absence of daytime dysfunction due to sleepiness.

## Attributes

Attributes refer to characteristics of a concept that set the criteria for identifying the presence of the concept (Walker & Avant, 2011). Based on the available literature, six attributes of sleep quality were derived.

**Sleep latency—**Sleep latency is the amount of time it takes to transition from wakefulness to sleep (Ohayon et al., 2017). Sleep latency between 16 and 30 minutes is considered good sleep quality, but greater than 45 minutes is seen as poor sleep quality (Ohayon et al., 2017; Sheldon, 2014a). These classifications are definitive of sleep latency throughout the pediatric lifespan. It is an objective measurement of sleep quality (McCall & McCall, 2012).

**Sleep duration—**Sleep duration is the total amount of sleep minus arousals (Paruthi et al., 2016). School-aged children should obtain nine to twelve hours of sleep at night (Paruthi et al., 2016). Sleep duration can differ in children depending on the day of the week (school versus weekend night); therefore, it is essential to analyze both periods (Biggs et al., 2013; Biggs et al., 2010; Esposito et al., 2014; Fletcher et al., 2010). Sleep duration is both an objective and subjective measurement of sleep; however, the objective measurement is more accurate (McCall & McCall, 2012).

**Sleep efficiency—**Sleep efficiency is the ratio of the total amount of time spent asleep versus the total time in bed (Ohayon et al., 2017). If a child has less than 74% sleep efficiency, the child is said to have a poor quality of sleep (Ohayon et al., 2017). Since sleep efficiency is a ratio of sleep duration, it can also vary depending on the day of the week (Biggs et al., 2013; Biggs et al., 2010; Esposito et al., 2014; Fletcher et al., 2010). Sleep

efficiency can be measured both subjectively and objectively; however, as with sleep duration, the objective measurement is more accurate (McCall & McCall, 2012).

**Sleep disturbance—**Sleep disturbance can be a combination of occurrences during or before sleep that inhibits sleep, leads to arousal, or physiological responses (Cormier, 1990; Ravid et al., 2009). Disturbances can include awakenings after going to sleep, parasomnias such as periodic limb movement, nightmares, or sleepwalking (Cormier, 1990; Jarrin, McGarth, & Drake, 2013; Ravid et al., 2009), and sleep-disordered breathing such as obstructive sleep apnea, an airway obstruction causing a pause in breathing greater than 10 seconds (Guilleminault et al., 1975). Several external factors such as medications, or excessive exposure to television or electronics before bed can lead to these disturbances (Cormier, 1990). Sleep disturbances can be measured both subjectively and objectively to capture the frequency or what is the cause of the disturbances as well as subcomponents such as night awakenings, wake after sleep onset, and bedtime resistance (McCall & McCall, 2012; Rafii, Oskouie, & Shoghi, 2013).

**Night awakenings:** Night awakenings are spontaneous arousals after going to sleep (Mindell & Moore, 2012; Ohayon et al., 2017). Night awakenings are a variable that focuses more on the frequency of the occurrence of these awakenings. The NSF considers a child having one or fewer awakenings as good sleep quality and four or more as poor sleep quality (Ohayon et al., 2017).

**Wake after sleep onset (WASO):** Wake after sleep onset is focused on how long a night awakening lasts (Ohayon et al., 2017). The NSF states that a WASO that lasts 41 minutes or longer in school-aged children is considered poor sleep quality (Ohayon et al., 2017). This attribute can be measured both objectively and subjectively (McCall & McCall, 2012). However, the subjective measurement may not be as accurate unless a proxy is aware of the timing.

**Bedtime Resistance:** Bedtime resistance is when a child delays their bedtime with resistant behavior such as refusal to sleep or “stalling” (Blader, Koplewicz, Abikoff, & Foley, 1997; Wilson et al., 2014). Bedtime resistance is a sleep disturbance that is subjectively measured (Rafii et al., 2013). External factors such as watching television before bed (Owens et al., 1999) and co-sleeping (Blader et al., 2997) increases the risk for bedtime resistance.

**Daytime sleepiness/dysfunction—**The definition of daytime sleepiness and dysfunction is the occurrence of feeling sleepy, falling asleep, or becoming fatigued while doing everyday tasks (Johns, 1991), such as schoolwork, watching television, or reading. Taking several purposeful naps during the day, regardless of nighttime sleep duration, can also define this attribute (Sheldon, 2014a). Daytime sleepiness and dysfunction are often associated with sleep disturbances, such as sleep apnea or parasomnias (Johns, 1991). This attribute is an overall reflection of one’s alertness (Sheldon, 2014a). Daytime sleepiness/dysfunction in children can be measured by both objective and subjective instruments and may require clinical diagnostic expertise (Littner et al., 2005).

**Bedtime—**Bedtime is the time at night that a child is scheduled to get in bed with the intent to sleep (Mindell & Moore, 2012). When a child goes to bed, it does not necessarily mean that they immediately fall asleep (Mindell & Moore, 2012). Bedtime can also change depending on the weekend versus school schedule (Biggs et al., 2010; Bos et al., 2009; Mindell & Moore, 2012). Therefore, it is essential to determine the bedtime for each of those periods. Bedtime can be measured objectively and subjectively (McCall & McCall, 2012). However, unless a parent or guardian is examining the child at bedtime, an objective measurement is more accurate.

## Identification of Cases

The Walker and Avant (2011) method uses example cases to add context to the concept. A model case is an example of the concept that is demonstrated by all of the defining attributes (Walker & Avant, 2011). Contrary cases are clearly not an example of the concept (Walker & Avant, 2011). A borderline case is an example that contains most of the concept's attributes but lacks some of the attributes or differs in the characteristics of one the attributes (Walker & Avant, 2011). Related cases are example cases related to the concept but lack some of the defining attributes (Walker & Avant, 2011). The review of the literature did not reveal any sample cases, so examples have been constructed specifically for this article.

**Model Cases—**A 6-year-old male gets nine hours of sleep with no naps at home and goes to bed every night, weekday and weekend, at 9 pm. He generally falls asleep within 10 minutes and has no nighttime awakenings greater than five minutes. He and his parents deny any sleep disturbances such as restlessness and difficulty breathing. He reports no daytime sleepiness. His sleep patterns are consistent with good sleep quality based on the results of this concept analysis.

**Contrary Case—**Another 6-year-old male gets seven hours of sleep and one nap at home. His bedtime changes from 9 pm on school-nights to 11 pm on weekends. The television is on while he is asleep. He generally falls asleep within 5 minutes and has several nighttime awakenings with a total duration of around 50 minutes. His parents state that he also has some breathing disturbance while sleeping and that he gets sleepy during the daytime at school or during quiet activities, like watching television. His sleep patterns are consistent with poor sleep quality.

**Borderline Case—**A 10-year-old male states that he has a hard time staying awake in class and is sometimes hyperactive. The teacher states that he finishes his assignments quickly and then takes a nap. His teacher reports that when asked why he is sleeping, he states that he is tired. His parents state that he has the same bedtime of 9 pm every night and sleeps a total of nine hours every day, and he falls asleep within 10 minutes. The parents report that their child does not have any apparent nighttime sleep disturbance, but he is difficult to wake up in the mornings. This child needs an evaluation to determine the cause for his daytime sleepiness, considering apparently good sleep quality at night. His daytime sleepiness is impairing his daytime function.

**Related Case—**A 12-year-old female is in her primary care provider's office for a wellness visit. During the visit, the provider interviews the girl about her health habits, including sleep, nutrition, and activity patterns. The girl reports that she sleeps well, eats plenty of fresh fruit and vegetables, and is active on the school basketball team. She also mentions that frequently she is tired after sports practice. In this child's case, there are no obvious red flags for poor sleep quality, and the girl appears to have normal fatigue, which is expected after strenuous exercise. However, there is not enough specific patient or parent-report of sleep habits to state she has good sleep quality.

## Antecedents and Consequences

The Walker and Avant (2011) method also entails identifying antecedents and consequences. Antecedents are occurrences that happen before the concept is present, and consequences are events that occur as a result of the concept (Walker & Avant, 2011). In several studies (Firouzi et al., 2012; Fletcher et al., 2010; Rubens et al., 2017), there was a lack of clarity about which occurred first, sleep quality or these phenomena. Therefore, some outcomes are considered as both antecedents and consequences. Also, there are several antecedents and consequences that can be inferred from clinical experiences that were not captured in the literature review due to the lack of research on the topic in this population. Therefore, they are not included.

In total, there were 16 antecedents and 23 consequences derived from the available literature (Table 1). Overall, antecedents of sleep quality were physiological, psychological / behavioral, geographical, or environmental, and included family history. The consequences were physiological, nutritional, and psychological/behavioral.

Physiological antecedents were the age of participants (Gruber et al., 2014), body mass index (Firouzi et al., 2012), pubertal development (Noone et al., 2013), and obesity/ overweight (Firouzi et al., 2012). Antecedents in the psychological/ behavioral category were mobile phone use (Huss et al., 2015), hyperactivity (Bos et al., 2009), school-night or weekend status (Bos et al., 2009; Esposito et al., 2014; Fletcher et al., 2010); symptoms of general anxiety disorder (Fletcher et al., 2010), and the amount of homework (Sun et al., 2014). Environmental antecedents were co-sleeping or sharing a room (Esposito et al., 2014), not sleeping at home (Okamoto-Mizuno et al., 2018), crowded spaces (Okamoto-Mizuno et al., 2018), room temperature (Okamoto-Mizuo et al., 2018), grade level (Surani et al., 2015), and previously disturbed sleep (Okamoto-Mizumo et al., 2018). Another antecedent related to family history was the father's education level (Sun et al., 2014).

Physiological consequences were body mass index (Spaeth et al., 2019) and energy (Firouzi et al., 2012). Consequences in the nutritional category were carbohydrate intake (Firouzi et al., 2012), daily fat intake (Spaeth et al., 2019), first mealtime (Spaeth et al., 2019), last mealtime (Spaeth et al., 2019), and after dinner caloric intake (Spaeth et al., 2019).

Psychological/behavioral consequences were catastrophizing, or constant questioning (Noone et al.,2013), hyperactivity (Bos et al., 2009), conduct problems (Bos et al., 2009), emotional problems (Bos et al., 2009; Rubens et al., 2017), general anxiety symptoms (Fletcher et al., 2010; Rubens et al., 2017), depression (Rubens et al., 2017), irritability

(Rubens et al., 2017), delinquency (Rubens et al., 2017), aggression (Rubens et al., 2017), report card grades (Gruber et al., 2014), academic achievement (Segura-Jimenez et al., 2014), accidental injury (Rafii et al., 2013), reporting health complaints (Segura- Jimenez et al., 2014), perceived health (Segura- Jimenez et al., 2014), life satisfaction (Segura- Jimenez et al., 2014), and quality of family relationships (Segura- Jimenez et al., 2014).

## Empirical Referents

Walker and Avant (2011) identify empirical referents in their method, which are observable and measurable instances demonstrating that a concept is occurring. The referents, in summary, discussed in the literature include daytime sleepiness/dysfunction (Sheldon, 2014a), sleep onset (Ohayon et al., 2017), the total amount of sleep hours (weekday and weekend) (Biggs et al., 2013; Ohayon et al., 2017; Paruthi et al., 2016), sleep disturbances, bedtime (weekday and weekend) (Biggs et al., 2010; Mindell & Moore, 2012), WASO (Ohayon et al., 2017), and night awakenings (Ohayon et al., 2017).

These referents can be measured using various instruments. All can be measured using subjective questionnaires (Table 2), that usually define sleep quality as a composite assessment of sleep duration, sleep latency, number of night awakenings, the amount of time to fall asleep after awakening, feelings of fatigue or restlessness upon awakening in the morning, and overall satisfaction (Pilcher et al., 1996). In the literature reviewed, eight questionnaires are used, with the Children's Sleep Habits Questionnaire (CSHQ) appearing the most frequently (Table 1).

There are several measures of sleep quality in children; however, many have not been validated against polysomnography (PSG) for objective measurements and controls for subjective measurement across all developmental stages or for self-report (Erwin & Bashore, 2017). Self-report measures in sleep quality are necessary because they can capture the subjective portion of sleep quality (Pilcher, Ginter, & Sadowsky, 1997). However, some of the existing self-report measures of sleep quality are lacking psychometric support for use in children (Erwin & Bashore, 2017).

Some researchers used actigraphy to measure total sleep time, sleep efficiency, wake after sleep onset, and sleep latency (Martin & Hakim, 2011) (Table 1). Actigraphy is a costefficient, noninvasive measurement of sleep which correlates reliably with PSG only when assessing total sleep time (Markovich, Gendron, & Corkum, & 2015; Martin & Hakim, 2011; Ohayon et al., 2017). There is a diminished ability to measure sleep quality due to difficulties interpreting early sleep stages and misinterpreting movement as wakefulness in children, which can result in overestimation of sleep disturbances (Martin & Hakim, 2011; Spruyt, Gozal, Dayyat, Roman, & Molfese, 2011). In contrast, the gold standard of sleep measurement, PSG, can measure all referents in a laboratory setting (Meltzer & Mindell, 2006). With PSG, however, one may miss some subjective context that questionnaires and one-on-one interviews can give (Markovich, Gendron, & Corkum, 2015; Ohayon et al., 2017).

## Limitations

A limitation of the literature search was that the focus was on publications within the last ten years (except for sentinel articles). This decision was made to include the most current data; however, there may be novel research before those years that were omitted. The literature search also only included English language articles; therefore, there is the possibility that some nonEnglish articles could have added evidence. This literature search excluded articles without sleep quality instruments. Those excluded could include information that could help develop a newer questionnaire or provide a subjective view of sleep quality in school-aged children. Most of the instruments did not have psychometrics available to determine if they were validated against the gold standard of objective sleep, PSG, or controls, and children with sleep disorders for subjective content. Some of the instruments that did have psychometrics had low reliability. Finally, the search terms for the literature review were developed by the authors. Including a librarian may have resulted in a different set of search terms yielding different articles for inclusion. However, given the paucity of research in this area, it is unlikely that the results would vary greatly.

## Discussion

The results of the literature review further support the fact that there are gaps in knowledge in the area of sleep quality research, especially in the school-aged population. These gaps are primarily due to the lack of a clear and consistent definition of sleep quality in school-aged children (Ohayon et al., 2017). This inconsistency appears to be due to a lack of studies using uniform, validated sleep questionnaires. Actigraphy also has limitations when measuring sleep quality due to low specificity for some sleep parameters (Meltzer et al., 2012).

Instruments measuring subjective reports of sleep are essential to defining sleep quality since objective neurophysiological laboratory measurements like PSG are not always the best at measuring the concept (Rosa & Bonnet, 2000). Also, large scale use of PSG or actigraphy monitoring may not be feasible (Eaton, Henning, Lam, & Paasch, 2019; Morgenthaler et al., 2007). While the literature search revealed several sleep quality questionnaires that measured the defining attributes of sleep quality in school-aged children, most required a proxy for completion (Table 1). Few studies utilized direct accounts of how children view their sleep quality (Erwin & Bashore, 2017; Rubens, Evans, Becker, Fite, & Tountas, 2017). The parent perspective of child sleep quality is affected by the fact that they are usually asleep at the same time as their children; therefore, they are not entirely aware of their child’s sleep habits even after the lights are turned out (Fuller, Lehman, Hicks, & Novick, 2017; Surani et al., 2015).

There are existing (CRSP; CSHQ-SSR) and new (PROMIS) sleep quality instruments that do not require a proxy for children at or above age eight; however, these questionnaires either do not measure all of the previously mentioned attributes (Bevans et al., 2018) or, have not yet been used extensively by sleep researchers (Erwin & Bashore, 2017).

## Implications for Future Research

There are gaps in the literature as it relates to sleep quality in children, particularly in the consistent use of valid measures of sleep and in the focused sampling of the school-age group. Future research should focus on including a uniform definition of sleep quality to ensure the measurement of similar attributes of sleep and to facilitate comparisons across studies. Investigators should also focus on using a validated, subjective assessment of sleep quality that measures all of the attributes and can be completed without proxy. Results from this study and future studies can be used to develop a conceptual framework that explains the risk factors of sleep quality and what impact they make on a child's health. An example of this type of framework would be the conceptual model of impaired sleep developed by Lee et al. (2004).

This model demonstrates how impaired sleep and sleep deprivation leads to sleep loss in adults and some adverse health outcomes of sleep loss (Lee et al., 2004).

Researchers should utilize a comprehensive methodology to investigate the impact of sleep quality on child health, disorders, and populations. Samples should include varying developmental stages to determine the effect of neurological, psychological, and physiological differences on sleep quality. Impactful factors such as electronic use at bedtime in the young school-age group should receive special attention. There is also a need for studies that focus on specific scenarios that can acutely change sleep quality in children, such as summertime or school breaks. Finally, future research should also include longitudinal studies to help disentangle causality between sleep quality and its potential antecedents and consequences.

## Implications for Clinical Practice

This concept analysis has further supported sleep quality as an essential factor in health, growth, and development beginning in childhood (Paruthi et al., 2016). The evidence supports the assessment of sleep quality during clinic visits, hospital stays, and long-term care. Incorporating sleep assessment throughout childhood will help to prevent biological or psychological sequelae that may persist into adulthood.

Routine sleep assessment should address the attributes presented in this article: sleep latency, night awakenings, sleep efficiency/duration, sleep disturbances, daytime sleepiness/dysfunction, and bedtime. Once these factors are assessed, personalized preventive measures should be employed and discussed with the parents or guardians. Inpatient clinicians should assess these attributes and determine how they can affect the recovery and treatment of pediatric patients with acute and chronic illnesses. The goal of improved sleep quality should also be included in nursing plans of care, and nurses should consider clustering/bundling care to limit sleep disturbances in their patients.

## Conclusion

This concept analysis of sleep quality in school-aged children was a beginning and essential step into exploring the relationship between sleep quality and other associated disorders.

This process produced a clearer and applicable conceptual definition of sleep quality in school-aged children and provided guidance for determining instruments that can examine the concept. A clarified definition and identification of validated instruments enables researchers to study the concept across populations and different disease processes. These discoveries can lead to updated practice guidelines in the pediatric population for sleep and related diagnoses. This concept analysis also pointed to the need for the development of instruments that measure all attributes of sleep quality. Further, where appropriate, children should be the respondents in completing the subjective instruments to measure their sleep. Sleep quality is a vital component of health and poor sleep quality can contribute to disease. It is essential that all components of sleep quality be assessed in children.

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## References

Adam K, & Oswald I (1984). Sleeps helps healing. British Medical Journal (Clinical Research ed.), 289(6456),1400. doi:10.1136/bmj.289.6456.1400 [PubMed: 6437572]

Altevogt BM, & Colten HR (Eds.). (2006). Sleep disorders and sleep deprivation: an unmet public health problem. National Academies Press.

American Academy of Sleep Medicine. (2008). Sleep Deprivation. Retrieved from https://aasm.org/resources/factsheets/sleepdeprivation.pdf

American Psychiatric Association. (2013). Sleep-Wake Disorders. Diagnostic and statistical manual of mental disorders (5th ed.). doi:10.1176/appi.books.9780890425596.dsm12

Arteaga SS, Esposito L, Osganian SK, Pratt CA, Reedy J, & Young-Hyman D (2018). Childhood obesity research at the NIH: Efforts, gaps, and opportunities. Translational Behavioral Medicine. doi:10.1093/tbm/iby090

Basch CE, Basch CH, Ruggles KV, & Rajam S (2014). Prevalence of sleep duration on an average school night among 4 nationally representative successive samples of American high school students, 2007–2013, Preventing Chronic Disease,11, E216–E216 doi:10.5888/pcd11.140383 [PubMed: 25496556]

Benjamin EJ, Muntner P, & Bittencourt MS (2019). Heart disease and stroke statistics- 2019 update: A report from the American Heart Association. Circulation, 139(10), e56–e528. doi: 10.1161/CIR.0000000000000659 [PubMed: 30700139]

Bevans KB, Meltzer LJ, De La Motte A, Kratchman A, Viél D, & Forrest CB (2018). Qualitative Development and Content Validation of the PROMIS Pediatric Sleep Health Items. Behavioral Sleep Medicine, 1–15. 10.1080/15402002.2018.1461102

Blader JC, Koplewicz HS, Abikoff H, & Foley C (1997). Sleep problems of elementary school children: a community survey. Archives of pediatrics & adolescent medicine, 151(5), 473–480. DOI:10.1001/archpedi.1997.02170420043007 [PubMed: 9158439]

Biggs SN, Lushington K, James Martin A, van den Heuvel C, & Declan Kennedy J (2013). Gender, socioeconomic, and ethnic differences in sleep patterns in school-aged children. Sleep Medicine, 14(12), 1304–1309. doi:10.1016/j.sleep.2013.06.014 [PubMed: 24074692]

Biggs SN, Lushington K, van den Heuvel CJ, Martin AJ, & Kennedy JD (2011). Inconsistent sleep schedules and daytime behavioral difficulties in school-aged children. Sleep Medicine, 12(8), 780–786. doi:10.1016/j.sleep.2011.03.017 [PubMed: 21862401]

Bos SC, Gomes A, Clemente V, Marques M, Pereira AT, Maia B, … Azevedo MH (2009). Sleep and behavioral/emotional problems in children: A population-based study. Sleep Medicine, 10(1), 66–74. 10.1016/j.sleep.2007.10.020 [PubMed: 18276186]

Buysse DJ, Reynolds CF III, Monk TH, Berman SR, & Kupfer DJ (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Research, 28(2), 193–213. 10.1016/0165-1781(89)90047-4 [PubMed: 2748771]

Centers for Disease Control and Prevention (2017). Short Sleep Duration Among US Adults. Retrieved from https://www.cdc.gov/sleep/data_statistics.html

Centers for Disease Control and Prevention. (2018). Defining Childhood Obesity. Retrieved from https://www.cdc.gov/obesity/childhood/defining.html

Cormier RE (1990). Sleep Disturbances. In: Walker HK, Hall WD, Hurst JW(Eds.), Clinical Methods: The History, Physical, and Laboratory Examinations.3rd edition. Chapter 77. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK401/

Eaton CK, Henning E, Lam J, & Paasch V (2019). Actigraphy technology: Informing assessment and intervention for sleep disturbances in young children. Clinical Practice in Pediatric Psychology. 10.1037/cpp0000279

Erwin AM, & Bashore L (2017). Subjective sleep measures in children: self-report. Frontiers in pediatrics, 5, 22 10.3389/fped.2017.00022 [PubMed: 28243584]

Esposito MJ, Gnisci A, Fabbri M, & Cicogna P (2014). Sleep Duration in Italian Children: Parental Control on Bedtime as Explaining Factor. Sleep & Hypnosis, 16(1/2), 1–9.

Fatima Y, Doi SAR, & Mamun AA (2016). Sleep quality and obesity in young subjects: a meta-analysis. Obesity Reviews. 17(11), 1154–1166. doi:10.1111/obr.12444 [PubMed: 27417913]

Firouzi S, Poh BK, Ismail MN, & Sadeghilar A (2014). Sleep habits, food intake, and physical activity levels in normal and overweight and obese Malaysian children. Obesity Research and Clinical Practice, 8(1), e70–e78. doi:10.1016/j.orcp.2012.12.001 [PubMed: 24548579]

Fletcher FE, Conduit R, Foster-Owens MD, Rinehart NJ, Rajaratnam SMW, & Cornish KM (2018). The Association Between Anxiety Symptoms and Sleep in School-Aged Children: A Combined Insight from the Children's Sleep Habits Questionnaire and Actigraphy. Behavioral Sleep Medicine, 16(2), 169–184. doi:10.1080/15402002.2016.1180522 [PubMed: 27254114]

Fuller C, Lehman E, Hicks S, & Novick MB (2017). Bedtime use of technology and associated sleep problems in children. Global Pediatric Health, 4, doi:10.1177/2333794X17736972

Gauer R, & Qiu K (2012). Does blood pressure screening benefit children? Journal of Family Physicians. 61(7) 2012: 425–426.

Gruber R, Somerville G, Enros P, Paquin S, Kestler M, & Gillies-Poitras E (2014). Sleep efficiency (but not sleep duration) of healthy school-age children is associated with grades in math and languages. Sleep Medicine, 15(12), 1517–1525. doi:10.1016/j.sleep.2014.08.009 [PubMed: 25441747]

Guilleminault C, Eldridge FL, Simmon FB, & Dement WC (1975). Sleep apnea syndrome: can it induce hemodynamic changes?. Western Journal of Medicine, 123(1), 7. [PubMed: 1154791]

Hales CM, Carroll MD, Fryar CD, & Ogden CL (2017). Prevalence of obesity among adults and youth: United States, 2015–2016. NCHS Data Brief (288), 1–8.

Harvey AG, Stinson K, Whitaker KL, Moskovitz D, & Virk H (2008). The subjective meaning of sleep quality: a comparison of individuals with and without insomnia. Sleep, 31(3), 383–393. 10.1093/sleep/31.3.383 [PubMed: 18363315]

Huss A, van Eijsden M, Guxens M, Beekhuizen J, van Strien R, Kromhout H, … & Vermeulen R (2015). Environmental radiofrequency electromagnetic fields exposure at home, mobile and cordless phone use, and sleep problems in 7-year-old children. PloS one, 10(10), e0139869 10.1371/journal.pone.0139869 [PubMed: 26509676]

Jarrin DC, McGrath JJ, & Drake CL (2013). Beyond sleep duration: distinct sleep dimensions are associated with obesity in children and adolescents. International Journal of Obesity37(4), 552–558. doi:10.1038/ijo.2013.4 [PubMed: 23419602]

Javaheri S, Storfer-Isser A, Rosen CL, & Redline S (2008). Sleep quality and elevated blood pressure in adolescents. Circulation, 118(10), 1034. doi: 10.1161/CIRCULATIONAHA.108.766410 [PubMed: 18711015]

Jiang YR, Spruyt K, Chen WJ, Shen XM, & Jiang F (2014). Somatic growth of lean children: the potential role of sleep. World Journal of Pediatrics, 10(3), 245–250. Scale. Sleep 14(6), 540–545. 10.1007/s12519-014-0500-2 [PubMed: 25124976]

Johns MW (1991). A new method for measuring daytime sleepiness: the Epworth sleepiness Scale. Sleep 14(6), 540–545. 10.1093/sleep/14.6.540 [PubMed: 1798888]

Lee KA, Landis C, Chasens ER, Dowling G, Merritt S, Parker KP, … & Umlauf MG (2004). Sleep and chronobiology: recommendations for nursing education. Nursing Outlook, 52(3), 126–133. 10.1016/j.outlook.2003.12.002 [PubMed: 15197361]

Littner MR, Kushida C, Wise M, Davila G, D., Morgenthaler T, Lee-Chiong T, … & Kapen S (2005). Practice parameters for clinical use of the multiple sleep latency test and the maintenance of wakefulness test. Sleep, 28(1), 113–121. [PubMed: 15700727]

Markovich AN, Gendron MA, & Corkum PV (2015). Validating the Children's Sleep Habits Questionnaire against polysomnography and actigraphy in school-aged children. Frontiers in Psychiatry, 5 (188). doi.10.3389/fpsyt.2014.00188

Martin JL, & Hakim AD (2011). Wrist actigraphy. Chest, 139(6), 1514–1527. 10.1093/sleep/15.4.293 [PubMed: 21652563]

Matricciani L, Olds T, & Petkov J (2012). In search of lost sleep: secular trends in the sleep time of school-aged children and adolescents. Sleep Medicine Reviews, 16(3), 203–211. 10.1016/j.smrv.2011.03.005 [PubMed: 21612957]

McCall C, & McCall WV (2012). Objective vs. subjective measurements of sleep in depressed insomniacs: first night effect or reverse first night effect?. Journal of Clinical Sleep Medicine, 8(01), 59–65. [PubMed: 22334811]

Meltzer LJ, & Mindell JA (2006). Sleep and sleep disorders in children and adolescents. Psychiatric Clinics, 29(4), 1059–1076. 10.1016/j.psc.2006.08.004 [PubMed: 17118282]

Meltzer LJ, Montgomery-Downs HE, Insana SP, & Walsh CM (2012). Use of actigraphy for assessment in pediatric sleep research. Sleep Medicine Reviews, 16(5), 463–475. doi:10.1016/j.smrv.2011.10.002 [PubMed: 22424706]

Mindell JA & Moore M (2014). Bedtime problems and night wakings Principles and Practice of Pediatric Sleep Medicine: Second Edition. (pp. 106–109). Elsevier Inc 10.1016/j.jsmc.2007.05.008

Morgenthaler T, Alessi C, Friedman L, Owens J, Kapur V, Boehlecke B, … & Pancer J (2007). Practice parameters for the use of actigraphy in the assessment of sleep and sleep disorders: an update for 2007. Sleep, 30(4), 519–529. 10.1093/sleep/30.4.519 [PubMed: 17520797]

Narang I, Manlhiot C, Davies-Shaw J, Gibson D, Chahal N, Stearne K, … McCrindle BW (2012). Sleep disturbance and cardiovascular risk in adolescents. Cmaj, 184(17), E913–E920. doi:10.1503/cmaj.111589 [PubMed: 23027917]

National Institute of Nursing Research (NINR). 2016). The NINR strategic plan: advancing science, improving lives. Retrieved from https://www.ninr.nih.gov/sites/files/docs/NINR_StratPlan2016_reduced.pdf

Noone DM., Willis TA, Cox J, Harkness F, Ogilvie J, Forbes E, … & Gregory AM(2014). Catastrophizing and poor sleep quality in early adolescent females. Behavioral Sleep Medicine, 12(1), 41–52. 10.1080/15402002.2013.764528 [PubMed: 23473103]

Ohayon M, Wickwire EM, Hirshkowitz M, Albert SM, Avidan A, Daly FJ, … Vitiello MV (2017). National Sleep Foundation's sleep quality recommendations: first report. Sleep Health: Journal of the National Sleep Foundation, 3(1), 6–19. doi:10.1016/j.sleh.2016.11.006

Okamoto-Mizuno K, Mizuno K, Tanabe M, & Niwano K (2018). Effects of the environment of a simulated shelter in a gymnasium on sleep in children. International Journal of Biometeorology, 62(11), 2015–2023. 10.1007/s00484-018-1608-1 [PubMed: 30187236]

Ogilvie RP, & Patel SR (2017). The epidemiology of sleep and obesity. Sleep Health, 3(5), 383–388. doi:10.1016/j.sleh.2017.07.013 [PubMed: 28923198]

Owens Judith, Maxim Rolanda, Melissa McGuinn Chantelle Nobile, Msall Michael, and Alario Anthony. "Television-viewing habits and sleep disturbance in school children." Pediatrics 104, no. 3 (1999): e27–e27. doi: 10.1542/peds.104.3.e27 [PubMed: 10469810]

Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, … & Rosen CL (2016). Recommended amount of sleep for pediatric populations: a consensus statement of the American

Academy of Sleep Medicine. Journal of Clinical Sleep Medicine, 1212(11):1549–61. doi: 10.5664/jcsm.6288

Pesonen AK, Martikainen S, Heinonen K, Wehkalampi K, Lahti J, Kajantie E, & Räikkönen K (2014). Continuity and change in poor sleep from childhood to early adolescence. Sleep,37(2), 289–297. 10.5665/sleep.3400 [PubMed: 24497657]

Pilcher JJ, Ginter DR, & Sadowsky B (1997). Sleep quality versus sleep quantity: relationships between sleep and measures of health, well-being and sleepiness in college students. Journal of psychosomatic research, 42(6), 583–596. 10.1016/S0022-3999(97)00004-4 [PubMed: 9226606]

Quality. (n.d.). In Oxford's English online dictionary. Retrieved from https://en.oxforddictionaries.com/definition/quality

Quist JS, Sjödin A, Chaput JP, & Hjorth MF (2016). Sleep and cardiometabolic risk in children and adolescents Sleep Medicine Review, 29, 76–100. doi:10.1016/j.smrv.2015.09.001

Rafii F, Oskouie F, & Shoghi M (2013). The association between sleep and injury among school-aged children in Iran. Sleep disorders, 2013. doi:10.1155/2013/891090

Ravid S, Afek I, Suraiya S, Shahar E, & Pillar G (2009). Sleep disturbances are associated with reduced school achievements in first-grade pupils. Developmental Neuropsychology, 34(5), 574–587. 34(5), 574–587. doi:10.1080/87565640903133533 [PubMed: 20183720]

Rosa RR, & Bonnet MH (2000). Reported chronic insomnia is independent of poor sleep as measured by electroencephalography. Psychosomatic Medicine, 62(4), 474–482. [PubMed: 10949091]

Rubens S, Evans S, Becker S, Fite P, & Tountas A (2017). Self-reported time in bed and sleep quality in association with internalizing and externalizing symptoms in school-age youth. Child Psychiatry & Human Development, 48(3), 455–467. doi:10.1007/s10578-016-0672-1 [PubMed: 27448289]

Segura-Jimenez V, Carbonell-Baeza A, Keating XD, Ruiz JR, & Castro-Pinero J (2015). Association of sleep patterns with psychological positive health and health complaints in children and adolescents. Quality of Life Research, 24(4), 885–895. doi:10.1007/s11136-014-0827 [PubMed: 25319339]

Sheldon SH (2014). Development of sleep in infants and children Principles and Practice of Pediatric Sleep Medicine: Second Edition (pp. 17–23). Elsevier Inc.

Sheldon SH (2014). History of Pediatric Sleep Medicine Principles and Practice of Pediatric Sleep Medicine: Second Edition (pp. 13–16). Elsevier Inc.

Shepard JW, Buysse DJ, Chesson AL, Dement WC, Goldberg R, Guilleminault C, Harris CD, Iber C, Mignot E, Mitler MM, Moore KE, Phillips BA, Quan SF, Rosenberg RS, Roth T, Schmidt HS, Silber MH, Walsh JK, … White DP (2005). History of the development of sleep medicine in the United States. Journal of clinical sleep medicine: JCSM : official publication of the American Academy of Sleep Medicine, 1(1), 61–82. [PubMed: 17561617]

Sleep. (n.d.). In Oxford's English online dictionary. Retrieved from https://en.oxforddictionaries.com/definition/sleep

Sleep Quality. (2017). Taber's Electronic Medical Dictionary. Retrieved from https://www.tabers.com/tabersonline/search?st=OSS&q=sleep+quality

Spaeth AM, Hawley NL, Raynor HA, Jelalian E, Greer A, Crouter SE, … & Hart CN (2019). Sleep, energy balance, and meal timing in school-aged children. Sleep Medicine. 10.1016/j.sleep.2019.02.003

Spruyt K, Gozal D, Dayyat E, Roman A, & Molfese DL (2011) Sleep assessments in healthy school-aged children using actigraphy: Concordance with polysomnography. Journal of Sleep Research, 20(1pt2), 223–232. doi:10.1111/j.1365-2869.2010.00857.x [PubMed: 20629939]

Sun WQ, Spruyt K, Chen WJ, Jiang YR, Schonfeld D, Adams R, … Jiang F (2014). The relation among sleep duration, homework burden, and sleep hygiene in chinese school-aged children. Behavioral Sleep Medicine, 12(5), 398–411. doi:10.1080/15402002.2013.825837 [PubMed: 24188543]

Surani S, Hesselbacher S, Surani S, Sadasiva S, Surani Z, Surani SS, … Subramanian S (2015). Sleep habits of elementary and middle school children in south texas. Sleep Disorders, 2015, 179103–9. doi:10.1155/2015/179103 [PubMed: 26770835]

Walker LO, & Avant KC (2011). Strategies for Theory Construction in Nursing (5th ed.). Upper Saddle River, NJ: Pearson Prentice-Hall.

Wilson KE, Lumeng JC, Kaciroti N, Chen SY, LeBourgeois MK, Chervin RD, & Miller AL (2015). Sleep Hygiene Practices and Bedtime Resistance in Low-Income Preschoolers: Does Temperament Matter?. Behavioral sleep medicine, 13(5), 412–423. 10.1080/15402002.2014.940104 [PubMed: 25221914]

## Highlights

- Sleep quality impacts the growth and development of school-aged children.
- The definition and measurement of sleep quality is inconsistent in school-aged children.
- The measurable attributes found can be used in treatment and prevention care plans.
- Sleep quality in the pediatric population should be consistently assessed.

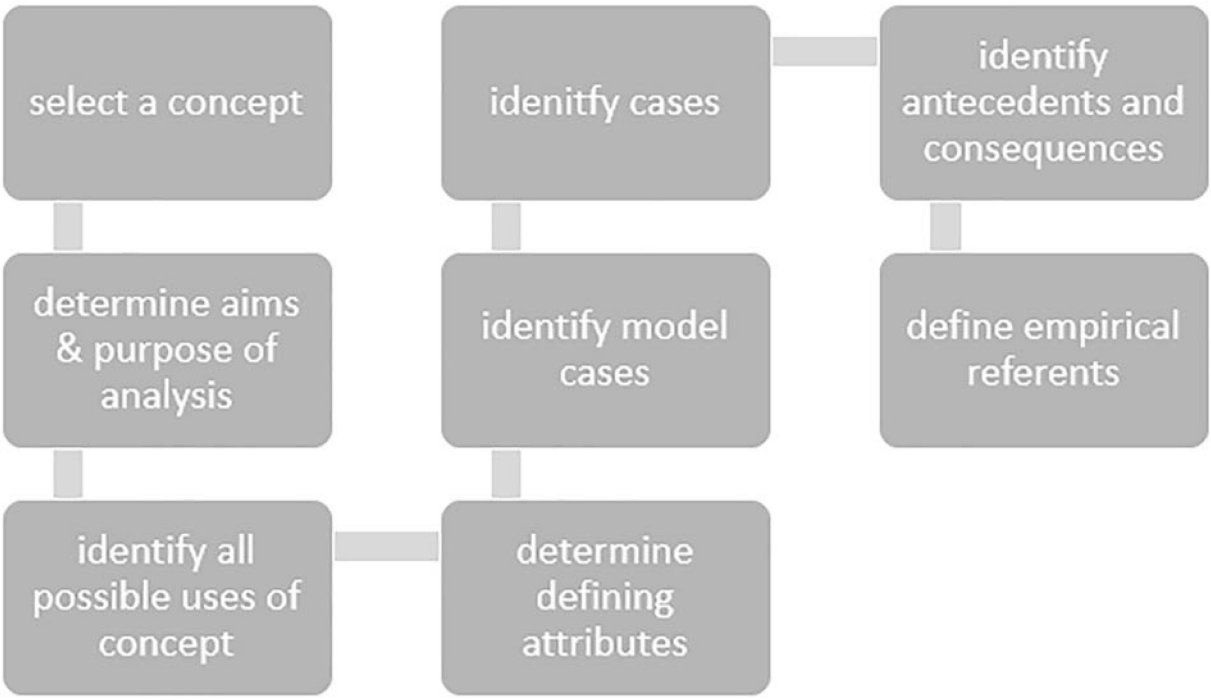


**Figure 1.**

A visual representation of the Walker and Avant concept analysis method. Description: Eight grey boxes connected in a maze shape. It can be printed in grey scale.

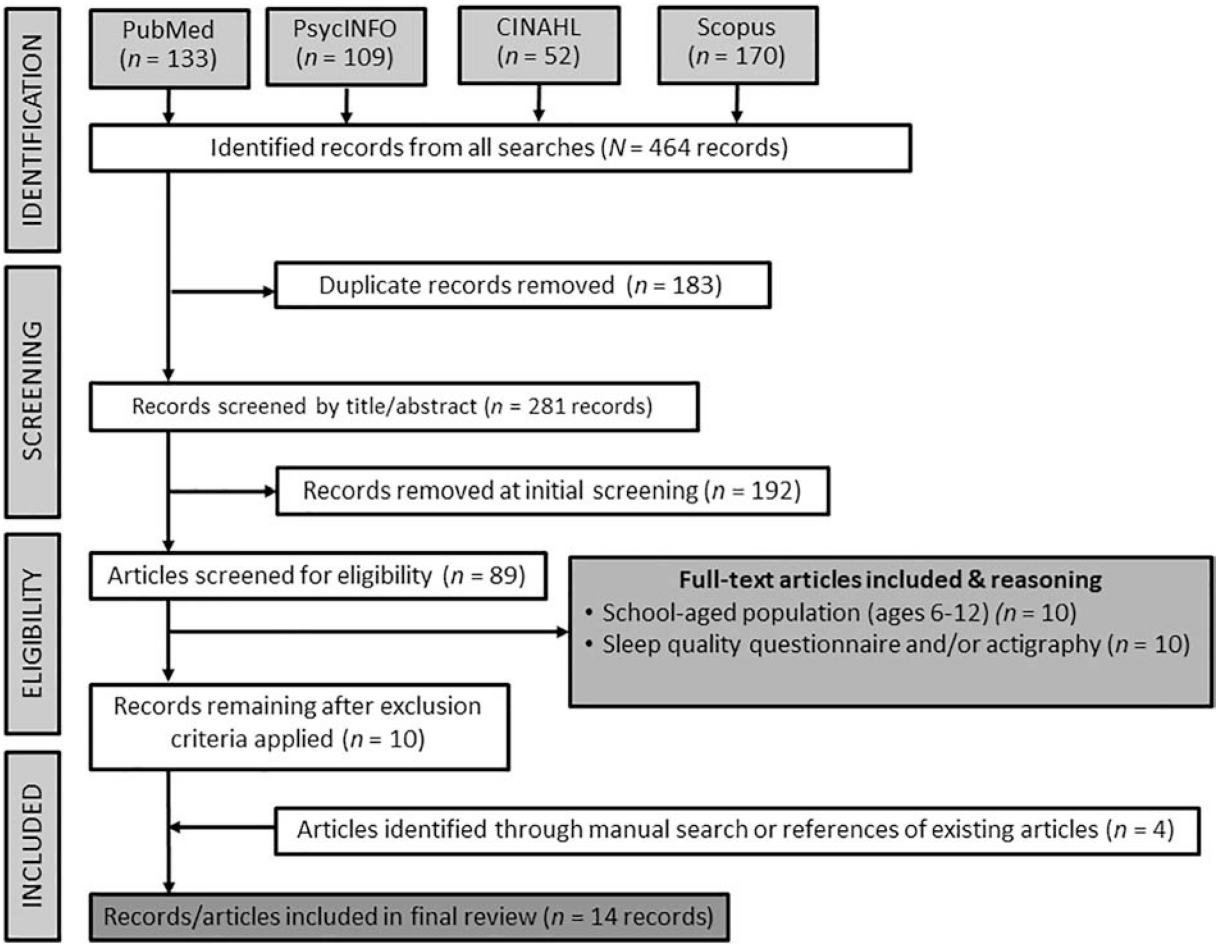


**Figure 2:**

PRISMA diagram demonstrating a visual representation of the literature search. Description: A four tiered diagram representing the literature search with identification, screening, eligibility, and included. The figure is a mixture of grey and white. It can be printed as is in grey scale.

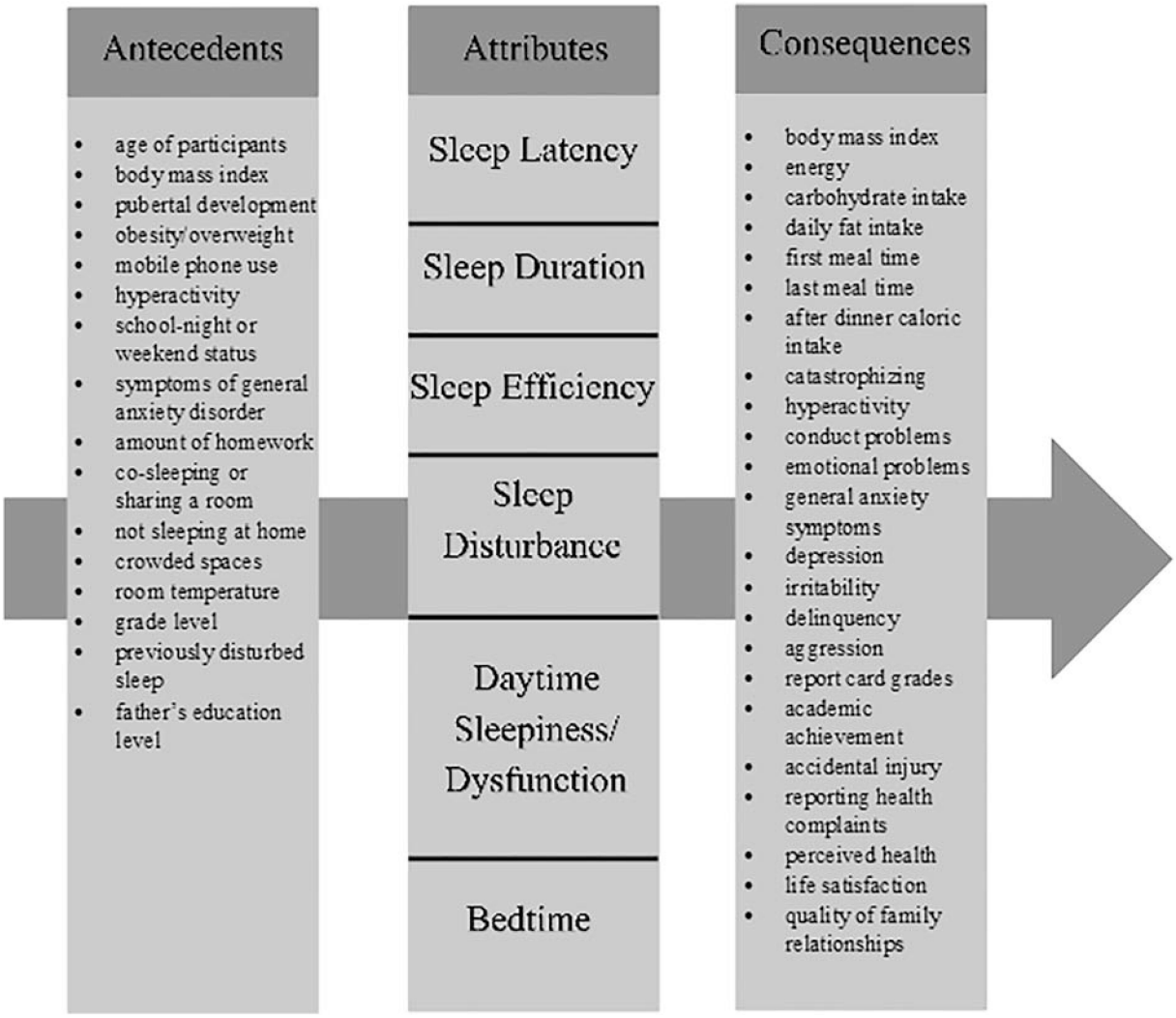


**Figure 3.**

A visual representation of the antecedents, attributes, and consequences of the concept, Sleep Quality in School-Aged Children. However, in many cases, antecedents and consequences may be bidirectional.

Description: a diagram with three large vertical rectangles with a right pointing arrow in the background. It is depicting the antecedents, attributes, and consequences of the concept. The figure is a mixture of grey and white. It can be printed in grey scale.

**Table 1**

Literature Review

| Article | Purpose | Sample | Identified Antecedents | Identified Consequences | Empirical Referents | Attributes |
|---|---|---|---|---|---|---|
| Bos et al., 2009 | Examine the potential relationships between sleep-wake behaviors and emotional/disruptive problems in school-aged children | -ages 6–11<br>-n= 779 (403 girls)<br>-Coimbra, Portugal | -hyperactivity<br>-school-night or weekend status | -hyperactivity<br>-conduct problems<br>-emotional problems | -Sleep-Waking Questionnaire | -bedtime<br>-sleep duration<br>-daytime sleepiness/ dysfunction<br>-sleep disturbances |
| Esposito et al., 2014 | Assess the relationship among sleep habits and sleep-wake quality in school-aged children and specific environmental factors | -ages 9–11<br>-n=776 (408 boys)<br>- urban Italy | -school-night or weekend status<br>- co-sleeping or sharing a room | | -Life Rhythms and Sleep Habits Questionnaire [1] | -bedtime<br>-sleep latency<br>-sleep disturbances<br>-sleep duration<br>-sleep efficiency |
| Fletcher et al., 2018 | Assess the association between anxiety and sleep | -ages 6–12<br>-n= 90 (52.2 % boys)<br>-Australia | -school-night or weekend status<br>- symptoms of general anxiety disorder | -general anxiety symptoms | -Child Sleep Habits Questionnaire<br>-Actigraphy[2] | -bedtime<br>-sleep duration<br>-sleep efficiency<br>-sleep disturbances<br>-sleep latency<br>-daytime sleepiness/ dysfunction |
| Firouzi et al., 2014 | Determine the association between sleep habits and physical characteristics, physical activity level, and food pattern in overweight and obese versus normal weight children | -ages 6–12<br>- n= 164 (82 normal weight)<br>-Malaysia | -body mass index<br>-obesity/overweight | -energy<br>-carbohydrate intake | -Child Sleep Habits Questionnaire | -bedtime<br>-sleep duration<br>-daytime sleepiness<br>-sleep disturbances |
| Gruber et al., 2014 | Examine the associations between objective measures of sleep duration and sleep efficiency with grades | -ages 7–11<br>- n= 75 (41 boys)<br>- Montreal, Canada | -age of participants | -report card grades | -Actigraphy[2] | -sleep duration<br>-sleep efficiency |
| Huss et al., 2015 | Evaluate if environmental radiofrequency electromagnetic fields exposure was association with sleep quality | -age 7<br>- n = 2,361<br>-The Netherlands | -mobile phone use | | -Child Sleep Habits Questionnaire | -sleep duration<br>-sleep efficiency<br>-bedtime<br>-sleep disturbances<br>-daytime sleepiness/ dysfunction |
| Noone et al., 2013 | Examine the association between sleep quality and catastrophizing in girls and if puberty moderates the association | -ages 11–12<br>-n= 115 girls<br>-London | -pubertal development | -catastrophizing | -Pittsburgh Sleep Quality Index (self-report version)[1] | -sleep latency<br>-sleep duration<br>-sleep efficiency<br>-sleep disturbances<br>-daytime sleepiness/ dysfunction |
| Okamoto-mizuno et al., 2018 | Examine the effects of the environment of a simulated shelter in a gymnasium on sleep in children | - school-aged children, mean age 10.9 ± 0.85 years old<br>-n = 20 (10 boys)<br>-Sendai, Japan | - not sleeping at home<br>-crowded spaces<br>-room temperature<br>-grade level | | -Actigraphy[2] | -bedtime<br>-sleep duration<br>-sleep efficiency<br>-sleep disturbances |

| Article | Purpose | Sample | Identified Antecedents | Identified Consequences | Empirical Referents | Attributes |
|---|---|---|---|---|---|---|
| | | | -previously disturbed sleep | | | -daytime sleepiness/ dysfunction |
| Rafii et al., 2013 | Assess the association between sleep and injury among school-aged children | -ages 6–11<br>-n = 400 (260 boys)<br>- Iran | | -accidental injury | -Child Sleep Habits Questionnaire | -sleep duration<br>-sleep efficiency<br>-bedtime<br>-sleep disturbances<br>-daytime sleepiness/ dysfunction |
| Rubens et al., (2017). | Investigate the relationship between self-reported time in bed and sleep quality in association with self-reported internalizing and externalizing symptoms | -ages 8–11<br>-n = 285 (54% female)<br>- rural, Midwestern, United States | | -emotional problems<br>-general anxiety symptoms<br>-depression<br>-irritability<br>-delinquency<br>-aggression | Meijer Child Self Report Four Item Scale[1] | -sleep latency<br>-sleep disturbances<br>-sleep duration<br>-bedtime |
| Segura-Jimenez et al., 2014 | Study the association of sleep duration and quality with psychological positive health and health complaints in children | -ages 6–11.9<br>-n=380<br>- southern Spain | | -academic achievement<br>-reporting health complaints<br>-perceived health<br>-quality of family relationships<br>-life satisfaction | -Health Behavior in School-Aged Children[1] | -sleep duration<br>-sleep efficiency<br>-daytime sleepiness/ dysfunction<br>-bedtime<br>-sleep latency |
| Spaeth et al., 2019 | Determine associations among objectively-measured nocturnal sleep time, bedtime, and obesogenic behaviors | -ages 8–11<br>-n = 87 (58 female)<br>- United States | | -body mass index<br>-daily fat intake<br>-first mealtime<br>-last mealtime<br>-after dinner caloric intake | -Actigraphy[2] | -bedtime<br>-sleep duration<br>-sleep efficiency<br>-sleep disturbances |
| Sun et al., 2014 | Explore the effect of sleep hygiene on the association between homework and sleep duration | -ages 10–11<br>-n = 734 (371 girls)<br>- Shanghai, People's Republic of China | -the amount of homework<br>-father's education level | | -Adolescent Sleep Hygiene Scale[1] | -bedtime<br>-sleep duration<br>-daytime sleepiness/ dysfunction<br>-sleep disturbances |
| Surani et al. (2015) | Assess the prevalence of sleep abnormalities among elementary and middle school students | -ages 9–11<br>-n= 1507 (499 elementary students)<br>-Corpus Christi, TX, United States | -grade level | | -Sleep Self Report[1] | -bedtime<br>-sleep latency<br>-sleep duration<br>-sleep disturbances<br>-daytime sleepiness/ dysfunction |

Note.

[1]Survey does not require proxy, self-report

[2]Objective data measurement

**Table 2**

Defining Attributes and Questionnaires

| Defining Attribute | Questionnaire |
|---|---|
| Sleep Latency | PSQI, CSHQ, MCSR, SSR, HBSC, LRSHQ |
| Sleep Efficiency | PSQI, LRSHQ |
| Sleep Duration | PSQI, ASHS, CSHQ, SSR, HBSC, LRSHQ, SWQ |
| Sleep Disturbances | PSQI, CSHQ, ASHS, SSR, SWQ, MCSR, LRSHQ |
| Daytime Sleepiness/Dysfunction | PSQI, CSHQ, ASHS, HBSC, SSR, SWQ |
| Bedtime | PSQI, CSHQ, ASHS, SSR, LRSHQ, SWQ |

*Note.* Pittsburgh Sleep Quality Index (PSQI), Adolescent Sleep Hygiene Scale (ASHS), Children's Sleep Habits Questionnaire (CSHQ), Meijer Child Self Report (MCSR), Health Behavior in School-Aged Children (HBSC), Sleep Self Report (SSR), Life Rhythms and Sleep Habits Questionnaire (LRSHQ), Sleep-Waking Questionnaire (SWQ)