

Never Enough Sleep: A Brief History of Sleep Recommendations for Children

abstract

BACKGROUND AND OBJECTIVE: There is a common belief that children are not getting enough sleep and that children's total sleep time has been declining. Over the century, many authors have proposed sleep recommendations. The aim of this study was to describe historical trends in recommended and actual sleep durations for children and adolescents, and to explore the rationale of sleep recommendations.

METHODS: A systematic literature review was conducted to identify recommendations for children's sleep requirements and data reporting children's actual total sleep time. For each recommendation identified, children's actual sleep time was determined by identifying studies reporting the sleep duration of children of the same age, gender, and country in the same years. Historical trends in age-adjusted recommended sleep times and trends in children's actual sleep time were calculated. A thematic analysis was conducted to determine the rationale and evidence-base for recommendations.

RESULTS: Thirty-two sets of recommendations were located dating from 1897 to 2009. On average, age-specific recommended sleep decreased at the rate of -0.71 minute per year. This rate of decline was almost identical to the decline in the actual sleep duration of children (-0.73 minute per year). Recommended sleep was consistently ~ 37 minutes greater than actual sleep, although both declined over time.

CONCLUSIONS: A lack of empirical evidence for sleep recommendations was universally acknowledged. Inadequate sleep was seen as a consequence of "modern life," associated with technologies of the time. No matter how much sleep children are getting, it has always been assumed that they need more. *Pediatrics* 2012;129:548–556

AUTHORS: Lisa Anne Matricciani, BA,^a Tim S. Olds, PhD,^{a,b} Sarah Blunden, PhD,^c Gabrielle Rigney, BA(Hons),^c and Marie T. Williams, PhD^b

^aHealth and Use of Time Group, ^bSansom Institute for Health Research, and ^cCentre for Sleep Research, University of South Australia, Adelaide, Australia

KEY WORDS

adolescents, children, recommendations, sleep

www.pediatrics.org/cgi/doi/10.1542/peds.2011-2039

doi:10.1542/peds.2011-2039

Accepted for publication Nov 9, 2011

Address correspondence to Lisa Anne Matricciani, BA, Health and Use of Time Group, C7-37, School of Health Sciences, University of South Australia, GPO Box 2471, Adelaide SA 5001, Australia. E-mail: matla005@mymail.unisa.edu.au

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

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FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

Insufficient sleep has been associated with a wide range of physical and psychosocial health deficits,¹ including an impaired ability to concentrate² and retain information,^{3,4} mood disorders,^{3,5} impaired motor skills,⁶ and poorer overall health and immune function.⁷ Inadequate sleep among children has also been associated with impaired academic performance,^{2,5} an increased risk of obesity,^{8,9} injuries and accidents,¹⁰ suicide ideation,¹¹ and drug and alcohol use.¹² Adequate sleep among children has therefore become an important health issue.

Concerns that children do not get enough sleep are widespread.^{13–17} Within the last decade, Oginska and Pokorski¹⁸ warned that “sleep loss is one of the common plagues of modern societies,” while Yu et al¹⁹ claimed that “sleep curtailment is pervasive in modern society.” Such concerns, however, are not new and have persisted for well over a century. In 1899, Johnson commented that “pupils do not get enough sleep”,²⁰ while in 1905, Crichton Browne (as cited in Acland) bemoaned the fact that “this is a sleepless age and more and more ... we are turning night into day.”²¹ In 1913, Lewis Terman expressed a common opinion that “physicians and writers on school hygiene agree that children are likely to receive less sleep than is needful to them.”²²

These enduring concerns have spawned a number of attempts at formulating recommendations on appropriate sleep durations for children and adolescents, dating as far back as 1897.²³ In 1905, Acland suggested that “the subject of giving the younger boys ample sleep is one which is deserving of their most serious consideration” and that, according to Dukes (as cited in Acland), “adequate sleep must not only be permitted but enforced.”²¹ The same message persists today, with groups such as the National Commission on Sleep Disorders Research calling for a “radical

change in the way society deals with sleep”²⁴ and editorials advising that “it is time for international leaders to take action by emphasizing education, public policy, and research on the importance of sleep in our youth.”²⁵ In line with these increasing concerns, public policies, practices, and guidelines are also evolving, and it has been suggested that concerns over children not getting enough sleep have “moved out of the bedroom, home and neighbourhood, and into the courts, boardrooms and even parliament.”²⁶

Despite growing concerns, few studies have aimed to determine how much sleep children actually need to provide an evidence base for these recommendations. It is therefore of interest to explore the history of sleep recommendations to better understand which strategies are shaping public policies. The specific aims of this study were to: (1) describe and quantify historical trends in sleep recommendations for children; (2) compare recommended sleep durations with data on the actual sleep duration of children; and (3) comment on the evidence and rationale provided for these recommendations, and the social and philosophical context in which they are embedded.

METHODS

A systematic literature review was conducted to identify articles providing recommendations for children’s sleep need and/or actual sleep duration. A mixed methods approach, by using both quantitative and qualitative research methods, was used to analyze data from these studies. A quantitative analysis was used to quantify and compare secular trends in children’s actual and recommended sleep times, and a deductive thematic qualitative analysis was used to explore the rationale for sleep recommendations and the social and philosophical context in which they are embedded.

Data Location

A systematic literature review was conducted to locate all studies, reports, and documents that provided recommendation for the number of hours children should sleep, as well as self- or proxy-reported actual sleep values. A pilot search determined the scope and relevance of candidate databases. The Scopus, EBSCOhost, Ovid, and Web of Science platforms were searched (Fig 1).

All articles retrieved from the systematic review were retained and read in full if the abstract stated that the self- or proxy-reported sleep duration of children aged 5 to 18 years (inclusive) was assessed and/or if children’s sleep needs were discussed. To identify additional sources, references were reviewed for articles that were referred to as either examining children’s sleep need, containing recommended sleep durations, or describing children’s self- or proxy-reported sleep duration. Books were also sourced through random library catalog searches and from sleep institution Web sites. There were no language or date restrictions.

All studies identified by using these search strategies were included the analysis if they reported the actual sleep duration of children and/or made an explicit statement regarding how much sleep children “should get,” “need,” or “require.” In cases in which the original document could not be located or in cases in which references were not included in the reference list, cited recommendations were included for analysis.

Data Extraction: Quantitative Analysis

Data were cross-checked with original hard-copy documents on 4 different occasions. Several variables were extracted for analysis. These variables included year of recommendation/ reported actual sleep time, which was taken as the year of publication or the

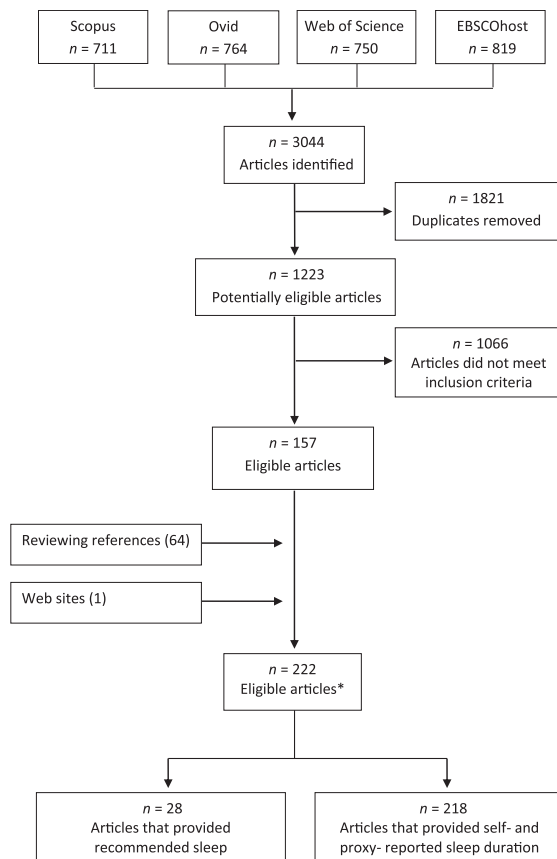


FIGURE 1 Flowchart showing the systematic review process. Some articles contained both sleep recommendations and actual sleep durations.

date last updated, in the case of online Web pages. Country of recommendation/ reported actual sleep time was also included. Age of the child was considered. In cases in which the child's age was reported in categorical bands (eg, 9–12 years) the suggested amount of sleep was recorded for each of the ages included in the category. If the terms “infant,” “toddler,” “preschool child,” “school-aged child,” and “adolescent” were used instead of numerical values, the ages 0, 1 to 2, 3 to 4, 5 to 12, and 13 to 17 years (inclusive), respectively, were used for analysis. Recommended sleep was taken to mean the recommended total number of hours asleep in a 24-hour period. In cases where sleep was reported in categorical bands, the average value was taken and the range was recorded. Recommended sleep was recorded at

the age times country level. Children's actual total sleep time was taken to mean the self- or proxy-reported time spent asleep (as opposed to time in bed). Both raw and summary data (data expressed as means and SDs) were collected, and Monte Carlo simulation was used to generate “pseudodata” from the summary data collected. This technique attempts to “recreate” the unavailable raw data by using a random normal generator to produce data points based on reported means and SDs. The Monte Carlo method assumes that distributions are approximately normal, which is appropriate for this study on the basis of distribution of the raw data sets. This approach has been used previously in studies of children's sleep duration²⁷ and fitness,²⁸ as well as a more recent study²⁹ that quantified secular trends

in children's sleep duration; a subset of that data were used for this study.

Data Analysis

Quantitative Analysis

To determine whether there had been historical changes in the amount of recommended sleep, recommended sleep was adjusted for age and regressed against the year of the recommendations. The slope of the line of best fit (in minutes per year) was taken to be the rate of change of recommended sleep. The analysis was repeated by using unadjusted values for each age group from 0 to ≥ 17 years.

To determine whether there were differences between the recommended sleep and actual sleep, paired *t* tests were conducted comparing recommended sleep and the mean actual sleep duration for children in whom matches were possible. Comparisons were made by using actual sleep duration data for children 5 years before and after the published guideline date, or 10 years before and after if data were insufficient. Comparisons were made for children of the same country; that is, recommended sleep durations were compared with the actual sleep durations of children of the same age and gender in the same country at or about the same date. An α level of 0.05 was used for all analyses.

Qualitative Analysis

Reports providing recommendations for children's sleep duration were read in an open-ended fashion. Deductive thematic analysis was conducted following the approach outlined by Braun and Clarke,³⁰ whereby articles were read and re-read and coded independently by the 2 reviewers. Regular meetings were held to discuss and compare codes and to resolve any discrepancies. Once all coding had been completed, preliminary themes based on content were determined.

Preliminary themes were then organized to derive key themes and to provide a deeper analysis.

RESULTS

This study located 32 sets of sleep recommendations for children, yielding 360 age-specific recommendations (Table 1).

Historical Trends in Sleep Recommendations

Adjusted for age, recommended sleep decreased over time at the rate of -0.71 (95% confidence interval: -0.88 to -0.54) minute per year ($r = -0.40$; $P < .0001$; $n = 360$), falling as a result, on average, by about 70 minutes over the course of the 20th century (Fig 2). Table 2 displays the age-specific rates of change. There were declines in all 18 age groups, ranging from -0.05 to -2.44 minutes per year, of which 8 findings were statistically significant. Declines were greatest among younger children, stabilizing at about -0.3 minute per year after age 9 years.

Recommended Versus Actual Sleep Duration

Matching data were available on actual sleep for 173 of the 360 recommended sleep durations. Recommended sleep exceeded actual sleep in 144 (83%) of these comparisons, with a mean difference of 37 minutes ($P < .0001$). The differences between recommended and actual sleep were not related to age. Because recommended sleep consistently exceeded actual sleep, and recommended sleep declined over time, there was a concomitant decline in actual sleep, averaging -0.73 minute per year ($r = 0.85$, $P < .0001$), strikingly similar to the decline in recommended sleep (-0.71 minute per year).

Qualitative Analysis: Evidence Base and Rationale

Qualitative analysis revealed 3 key themes: (1) a consistent acknowledgment for the lack of empirical evidence

for the recommendations proposed; (2) a physiologic rationale for children requiring a certain amount of sleep; and (3) a social rationale for why many children receive an inadequate amount of sleep.

Lack of Empirical Evidence

Of the 35 sets of recommendations, only 1 article provided a rationale for their recommendations. Seham and Seham made recommendations for children aged 6 to 15 years on the basis of actual sleep of 500 "healthy" children.³¹ Most authors proposing sleep recommendations indicated that there was very little empirical evidence and even their promoters often accompanied their recommendations with disclaimers about the lack of evidence: "What is the correct amount of sleep for school children? A study of text-books and literature reveals various opinions but little confirmatory evidence or research."³²

Reference is made to "rules of thumb" and recommendations being "largely a matter of opinion",³³ "loose observation,"²² and indeed "practically unsubstantiated opinions".³⁴ The acknowledgment of a lack of evidence persists to this day: "Research cannot pinpoint an exact amount of sleep needed by people at different ages."³⁵

Similarly, it is also acknowledged that although there are comprehensive studies that report normative sleep durations for children, the sleep need of children remains unknown.³⁶

Rationale for Children Requiring a Certain Amount of Sleep

Early studies saw sleep as largely anabolic, a way of restoring "wearing brain tissue."³⁷ Sleep was essential to allow "the nutrition of the nervous tissue to go on at a greater rate than its destructive metamorphosis."³⁸ Brain work (ie, school work) was thought to consume the structure of the brain,

and rest (the absence of thought) as essential for restoring it. It was believed that "the more active the mind, the greater the necessity for sleep."³⁸ The restorative power of sleep was often construed as a restoration of structure (for Anderson, "during sleep, anabolic processes predominate"³²), countering schoolwork-induced catabolism, and sometimes as a restoration of depleted energy ("the organism is dependent upon sleep as a means of restoring its energies").³⁴ "Nervous" children, who use the most energy, were believed to be in the most need of sleep,³⁹ as were "clever" children.²¹ The primacy of the concern about inadequate sleep affecting academic performance has continued well into the 20th and 21st centuries. Medscape Medical News warns, "Children in middle school may suffer adverse cognitive, behavioural, and emotional consequences due to an increased risk of being chronically sleep deprived."⁴⁰

Sleep was therefore construed as "rest and recovery," that is, the opposite of brain work, and the pure absence of thought; hence, the admonitions to minimize stimulation at bed time. Read recommended giving the child just "one toy to occupy his hands; prohibit more than one, to prevent mental activity".³⁹ This admonition was echoed almost 100 years later by Taheri,⁴¹ who advised parents to remove televisions, computers, and gadgets from their child's bedroom and to avoid exposing their children to activities that may be arousing before bedtime. Here, the message is the same, only the technologies have changed.

The Social Rationale: "Modernism"

The strain on brain tissue is increased by "modernism," the speed and stresses of modern life and technologies, which subject children to increased stimulation. There was a common perception 100 years ago (as now) that life was

TABLE 1 Summary of Sleep Recommendations Made for Children and Adolescents Over the Last Century

References	Year	Age of Child (y)																		
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Manacine ²⁵	1897	22	17	16	15	14	14	11	11	11	9	9	9	9	9	—	—	—	—	—
Stearns ³⁸	1910	—	—	—	—	—	13	12	12	12	—	11	10.5	10.5	10	10	9	9.5	9.5	9.5
Dukes ³⁷	1905	19	17	16	15	14	13.5	13	12.5	12	11.5	11	11	10.5	10	10	9.5	9.5	9.5	9
Hertle ^{22-a}	1903	—	—	—	—	—	11	11	10.5	10.5	10	10	9.75	9.5	9.5	9	8.75	—	—	—
Claparedo ^{22-a}	1903	—	—	—	—	—	11.5	11.5	11.5	11.5	10.5	10.5	9.5	9.5	9.5	9	—	—	—	—
Krollioff ^{22-a}	1903	—	—	—	—	—	—	—	11	11	11	10.5	10.5	10	10	9.5	9	8.5	8.5	8.5
Cavanagh ^{22-a}	1903	—	—	—	—	—	—	—	12	—	—	—	—	—	—	—	—	—	—	9
Pfauder ^{22-a}	1903	—	—	—	—	—	11	11	—	—	—	—	9	—	—	—	—	—	—	—
Norsworthy ^{57-b}	1903	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bernhard ⁵⁸	1906	—	—	—	—	—	—	11	11	11	10.5	10	10	9.5	—	—	—	—	—	—
Ravenhill ⁵⁹	1908	—	—	—	13.75	13.75	13.75	13.20	12.65	12.25	11.75	11.25	10.8	10.75	—	—	—	—	—	—
Truby ^{39-c}	1913	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Read ³⁹	1917	15	14	14	14	13	13	12	12	11.5	11.5	11	—	10.5	10.5	10	9.5	9.5	9.5	9.5
Hess ⁶⁰	1919	21	17	12.5	12.5	10.5	10.5	8.5	8.5	—	—	—	—	—	—	—	—	—	—	—
Burnham ^{61-d}	1920	—	13	13	13	13	11.5	11.5	11.5	11.5	10	10	—	—	—	—	—	—	—	—
Lucas ⁴³	1923	—	13	12	12	11	11	10	10	10	9	9	9	9	9	—	—	—	—	—
McCarthy ^{57-b}	1923	—	15	14	13	12.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fraser and Porters ⁶²	1925	—	—	—	—	—	—	—	—	—	—	—	—	10	—	—	—	—	—	—
Brown ⁶³	1926	14	16	13	12	12	12	12	—	—	—	—	—	—	—	—	—	—	—	—
Seham and Seham ³¹	1926	—	—	—	—	—	—	12	12	11.5	11	11	10.5	10	9.5	9.5	—	—	—	—
Blanton and Blanton ⁶⁴	1927	20	16	15	14	13.5	12	—	—	—	—	—	—	—	—	—	—	—	—	—
Stearns ³⁸	1931	15	—	13.5	13.5	12.5	12.5	12.5	12.5	12.5	—	—	—	—	—	—	—	—	—	—
Reynolds and Mallay ⁶⁵	1933	—	—	13.5	12	12	12	—	—	—	—	—	—	—	—	—	—	—	—	—
Ames ⁶⁶	1964	—	12	10.5	11	11	11	11	11.5	11	11	10.5	10	10	9.5	9.5	9	9	8.5	8.5
Bogatschenco ^{67-e}	1953	—	17	—	16	—	15	14.5	—	—	—	—	—	—	—	—	—	—	—	—
Howard and Wong ⁶⁸	2001	15.05	13.75	13	12	11.5	11	10.75	10.5	10.25	10	9.75	9.5	9.25	9.25	9	8.75	8.5	8.25	8.25
Heussler ⁶⁹	2005	—	14.5	—	—	—	10	10	10	10	10	10	10	10	10	8	8	8	8	8
Sleep Medicine and Research Center ^{70-f}	2007	—	—	—	—	—	—	—	—	10.5	10.5	10	10	9.5	9.5	9.5	—	—	—	—
National Heart, Lung and Blood Inst ⁷¹	2009	17	—	—	10.5	11	9	9	9	9	9	9	9	9	9	9	9	9	9	9
National Sleep Foundation ⁷²	2009	14	13	12-14	12	12	10.5	10.5	10.5	10.5	10.5	10.5	10.5	8.88	8.88	8.88	8.88	8.88	8.88	8.88
Lamm ⁷³	2009	14.5	13	—	12	—	10.5	10.5	10.5	10.5	10.5	10.5	10.5	—	—	—	—	—	—	—
Harvard Medical School ⁷⁴	2009	18	—	11.5	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Several reports were extremely specific, advising different sleep durations for children of slightly different ages (eg, 5 years and 1 month, 5 years and 2 months, 5 years and 3 months) and at different times of a 24-hour period (eg, recommended sleep at night and the recommended amount of sleep during the day). Other studies used a more descriptive report of sleep at different ages (eg, 5-year-old should sleep 12 hours, which should gradually decrease to 9 hours at age 12 years). This table shows the average sleep for each of the ages. Where descriptive recommendations were made, the numerical values were included only in the table above. The data included in this study were more detailed, as described in the Methods.

^a As cited in Terman and Hocking, 1913.
^b As cited in Anderson et al, 1928.
^c As cited in Read, 1916.
^d As cited in Chant and Blatz, 1928.
^e As cited in Baumecker, 1958.
^f As cited in Teutzel et al, 2007.

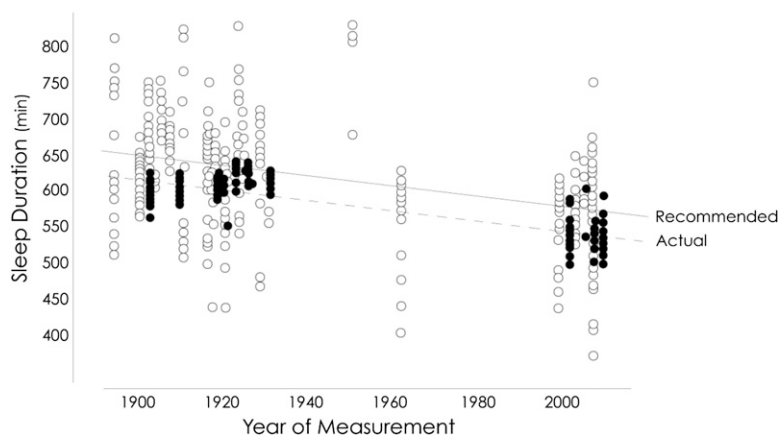


FIGURE 2

Historical trends in recommended sleep (minutes per day, adjusted for age). Open circle and solid line indicate trends in recommended sleep duration. Filled circles and dotted line indicate actual sleep duration.

becoming faster and faster, imposing ever greater cognitive demands: “the intensity of modern civilization is apt to soften the vigour of children unless they are taught to apply widely the principles of rest and sleep.”³⁸ In 1894, the *British Medical Journal* published an editorial titled “Sleeplessness,” which stated: “The hurry and excitement of modern life is quite correctly held to be responsible for much of the insomnia of which we hear; and most of the articles

and letters are full of good advice to live more quietly and of platitudes concerning the harmfulness of rush and worry.”⁴²

The link between modern life and sleep is taken up by Hyslop (as cited by Acland in 1905): “The stress and strain of modern life necessitates increased brain activity, and in order that the mental energies may last, it is obvious that brain rest should be obtained ... Insomnia, brain fatigue, neurasthenia are products of the last few decades.”²¹

In 1923, Lucas commented that “the complexity and rush of modern life is not only affecting the adult [sleeping patterns] but is reflected in the children.”⁴³ The concept of the catabolic effect of brain activity therefore links concerns about inadequate sleep in schools and the perverse effects of modern life.

Concerns that modernity and associated overstimulation result in many children not getting the sleep that they need persist to this day. The most recent avatars of these concerns regarding overstimulation are the electronic media, with contemporary studies concluding that “the demands of today’s ‘24 hour society’ have increased night time activity and affected sleep patterns of not only adults, but also children. In addition, sleep wake patterns may also

be influenced by usage of video games, cell phones and the internet.”⁴⁴ Children are “increasingly being bombarded with electronic stimulation until the lights go out.”²⁶

DISCUSSION

Our review found that recommended sleep duration consistently exceeded actual sleep duration by ~37 minutes, in spite of declines in actual sleep duration, as if children always needed extra sleep, no matter how much they were actually getting. The rationale for sleep recommendations was also strikingly consistent for more than 100 years: children were overtaxed by the stimulation of modern living, although that stimulation was embodied in whatever the technological avatar of the time was (eg, schoolbooks, radio, television, Internet). This overstimulation resulted in impaired brain structure or function that sleep would restore. Similarly striking was the consistency with which authors acknowledged the lack of empirical foundation for their recommendations, despite extremely detailed and quantified guidelines. It is remarkable that after more than 100 years, sleep recommendations are still being issued in the acknowledged absence of meaningful evidence.

Strengths and Limitations

This is the first study to describe historical trends in children’s recommended sleep need and corresponding actual sleep times. Although every effort was made to ensure that this study was as comprehensive as possible, there are several limitations. First, this study used self- or proxy-reported sleep times to estimate children’s actual total sleep time. Objective measures (ie, polysomnography, actigraphy) are the preferred methods of measuring sleep because they are techniques that can quantify sleep onset, offset, and waking after sleep onset. However,

TABLE 2 Rates of Change in Sleep Recommendations for Children According to Age Group

Age (y)	r	P	n	Rate of Change (min/y)
0	0.68	<.0001 ^a	36	-2.44
1	0.30	.22	19	-0.68
2	0.23	.37	17	-0.56
3	0.35	.14	19	-0.73
4	0.58	.01 ^a	18	-0.98
5	0.55	.006 ^a	24	-1.17
6	0.48	.03 ^a	22	-0.87
7	0.65	.001 ^a	21	-0.84
8	0.67	.0008 ^a	21	-0.76
9	0.38	.10	20	-0.42
10	0.33	.14	33	-0.31
11	0.21	.34	21	-0.20
12	0.05	.81	23	-0.05
13	0.38	.10	20	-0.32
14	0.56	.03 ^a	16	-0.38
15	0.60	.03 ^a	13	-0.45
16	0.57	.05	12	-0.32
≥17	0.36	.15	17	-0.27
All children	0.40	<.0001 ^a	360	-0.71

The correlation coefficient (r), associated probability (P), and number of recommendations (n) are also shown.

^a Statistically significant changes.

these methods are expensive, time-consuming, have only been recently developed, and have not been applied at the population level. Therefore, these methods are not appropriate to determine secular trends. Although subjective methods have been found to overestimate children's actual sleep time when compared with criterion objective measures of sleep, several studies^{45–48} have shown a good correlation for both questionnaires ($r = 0.60–0.78$) and diaries ($r = 0.97$) compared with objective measures of sleep. Given that these measures have been applied at the population level and are consistently correlated with criterion measures, they are suitable for trend analysis. More significantly, 1 of the primary aims of this study was to compare recommendations and actual sleep durations. These recommendations should therefore be operationalized in the same way, in this case as total sleep time (the time between falling asleep and waking, not including sleep onset or offset).

Discourses of Sleep

The history of sleep guidelines offers a window into the discourse of sleep. First, sleep emerged in the 19th century as a public health issue that required regulation at the institutional and family level and which was subject to the advice of medical experts. Children's sleep was problematized, and a "sleep hygiene" regimen emerged. Parents were advised to monitor and regulate their children's sleep schedules, to advocate "quiet time" before bed, and to ensure that their children received the recommended hours of sleep.³⁸ Extremely specific and quantified guidelines were developed. The problematization and medicalization of sleep operates within a context of social surveillance and biopower, situating it in more general contexts of risk and expert opinion.⁴⁹ Today sleep is more and more linked to mental and physical

health issues; as noted by Chung and Cheung, "sleep has become a major international health concern."⁵⁰

The problematization of sleep has consistently been linked to the problematization of modernism. In the early 1900s, artificial lighting, radio, reading, and the cinema were considered to be the causes of delayed bedtimes. By the late 1990s, video games, television viewing, the Internet, and mobile telephones were largely held responsible for such delays.

Second, reports about sleep have been "framed" in a certain way. Framing involves presenting issues from a certain perspective, making some aspects more salient and backgrounding others.⁵¹ A network of metaphors has been constructed as a physiologic rationale for the need for sleep. This involves notions of catabolism and anabolism, of depletion and energization, and of exhaustion and nutrition. These metaphors are given a physical instantiation (eg, in terms of neuronal connections or substrate utilization).

Finally, it is acknowledged that there is almost no empirical evidence for the optimal sleep duration for children. In principle, the optimal amount of sleep could be determined by "unconstrained sleeping" (ie, letting children sleep as long as they feel necessary⁵²); however, as Horne⁵³ and Harrison and Horne⁵⁴ argue, sleep may be discretionary, and sleeping longer does not indicate a need for more sleep, in the same way that eating more does not indicate a need for more food. Alternatively, sleep need could be determined by studies of sleep extension and sleep restriction accompanied by monitoring relevant outcome variables,⁵⁵ but in fact such studies are very rare, particularly in ecologically valid contexts, and none of the studies offering recommendations provided supporting evidence of this nature. In practice, recommendations were often

justified in terms of an analysis of the sleep children actually got, with an extra allowance based on the assumption that they were not getting enough. Given the disagreement and uncertainty about children's sleep need, it is likely to be 1 of the primary reasons for lack of empirical support for sleep recommendations. Interestingly, during the latter part of the 20th century (1960 and 1990), when sleep research was mostly directed toward determining the physiology and regulation of sleep, no sleep recommendations were made. Yet, as studies emerged to suggest that short sleep duration impairs daytime function, results in daytime sleepiness, and alters metabolism, children's sleep need gained further interest. At the same time, Carskadon⁵⁶ conducted their seminal study (published in 1979), which showed children will sleep more if given the chance, suggesting that they may be in need of more sleep. During this period, there were also several societal changes: people began to work longer hours, 24-hour convenience stores were opening, television became universal, and various national sleep organizations emerged. The combination of evidence suggesting that children may be in need of more sleep and that society is restricting the opportunity for sleep and the development of national groups to inform the public of the importance of sleep, may have acted as a catalyst to reintroduce the enforcement of sleep guidelines.

CONCLUSIONS

The social construction of children's sleep as a public health issue has drawn from the same well of discourse for more than a century. This may be due to a lack of empirical support for sleep recommendations. Proper empirical consideration of optimal sleep based on titrating sleep duration in ecologically valid contexts (ie, outside the laboratory) against carefully measured physical,

cognitive, and affective outcomes is needed. We have reasonably good dose-response data for physical activity,

sedentary behaviors, and nutrients but virtually nothing for sleep. We also need to understand the actual mechanisms

whereby inadequate sleep affects health and performance outcomes, as we do for physical activity and nutrition.

REFERENCES

- Eisenmann JC. Insight into the causes of the recent secular trend in pediatric obesity: Common sense does not always prevail for complex, multi-factorial phenotypes. *Prev Med*. 2006;42(5):329–335
- Wolfson AR, Carskadon MA. Sleep schedules and daytime functioning in adolescents. *Child Dev*. 1998;69(4):875–887
- Steenari MR, Vuontela V, Paavonen EJ, Carlson S, Fjällberg M, Aronen E. Working memory and sleep in 6- to 13-year-old schoolchildren. *J Am Acad Child Adolesc Psychiatry*. 2003;42(1):85–92
- Walker MP, Stickgold R. Sleep, memory, and plasticity. *Annu Rev Psychol*. 2006;57(1):139–166
- Blunden S, Hoban TF, Chervin RD. Sleepiness in children. *Sleep Med Clin*. 2006;1(1):105–118
- Kuriyama K, Stickgold R, Walker MP. Sleep-dependent learning and motor-skill complexity. *Learn Mem*. 2004;11(6):705–713
- Sekine M, Chandola T, Martikainen P, Marmot M, Kagamimori S. Work and family characteristics as determinants of socioeconomic and sex inequalities in sleep: the Japanese Civil Servants Study. *Sleep*. 2006;29(2):206–216
- Cappuccio FP, Taggart FM, Kandala NB, et al. Meta-analysis of short sleep duration and obesity in children and adults. *Sleep*. 2008;31(5):619–626
- Patel SR, Hu FB. Short sleep duration and weight gain: a systematic review. *Obesity (Silver Spring)*. 2008;16(3):643–653
- Koulouglioti C, Cole R, Kitzman H. Inadequate sleep and unintentional injuries in young children. *Public Health Nurs*. 2008;25(2):106–114
- Liu X. Sleep and adolescent suicidal behavior. *Sleep*. 2004;27(7):1351–1358
- Wong MM, Brower KJ, Fitzgerald HE, Zucker RA. Sleep problems in early childhood and early onset of alcohol and other drug use in adolescence. *Alcohol Clin Exp Res*. 2004;28(4):578–587
- Carskadon MA. Patterns of sleep and sleepiness in adolescents. *Paediatrician*. 1990;17(1):5–12
- Dorofaeff TF, Denny S. Sleep and adolescence. Do New Zealand teenagers get enough? *J Paediatr Child Health*. 2006;42(9):515–520
- Smaldone A, Honig JC, Byrne MW. Sleepless in America: inadequate sleep and relationships to health and well-being of our nation's children. *Pediatrics*. 2007;119(suppl 1):S29–S37
- Loessl B, Valerius G, Kopasz M, Hornyak M, Riemann D, Voderholzer U. Are adolescents chronically sleep-deprived? An investigation of sleep habits of adolescents in the Southwest of Germany. *Child Care Health Dev*. 2008;34(5):549–556
- Walsh J, Dement W, Dinges D. Sleep medicine, public policy, and public health. In: Kryger M, Roth T, Dement W, eds. *Principles and Practice of Sleep Medicine*. Philadelphia, PA: Elsevier/Saunders; 2005:648–656
- Oginska H, Pokorski J. Fatigue and mood correlates of sleep length in three age-social groups: school children, students, and employees. *Chronobiol Int*. 2006;23(6):1317–1328
- Yu Y, Lu BS, Wang B, et al. Short sleep duration and adiposity in Chinese adolescents. *Sleep*. 2007;30(12):1688–1697
- Johnson N. Habits of work and methods of study of high school pupils in some cities in Indiana. *Sch Rev*. 1899;7(5):257–277
- Acland T. *On the Hours of Sleep at Public School*. London, UK: Churchill; 1905
- Terman L, Hocking A. The sleep of school children: Its distribution according to age, and its relation to physical and mental efficiency. *J Educ Psychol*. 1913;4(3):138–147
- Manaceine M. The hygiene of sleep. In: *Sleep: Its Physiology, Pathology, Hygiene, and Psychology*. London, UK: Walter Scott Publishing; 1897:153–161
- Holden C. Wake-up call for sleep research. *Science*. 1993;259(5093):305
- Mindell JA, Owens J, Alves R, et al. Give children and adolescents the gift of a good night's sleep: a call to action. *Sleep Med*. 2011;12(3):203–204
- Williams S. *Sleep and Society: Sociological Ventures Into the (Un)known*. London, UK: Routledge; 2005
- Olds T, Blunden S, Petkov J, Forchino F. The relationships between sex, age, geography and time in bed in adolescents: a meta-analysis of data from 23 countries. *Sleep Med Rev*. 2010;14(6):371–378
- Tomkinson GR, Léger L, Olds T, Cazorla G. Secular trends in the fitness of children and adolescents 1980-2000—an analysis of 20 m shuttle run studies. *Sports Med*. 2003;33(4):385–400
- Matricciani L, Olds T, Petkov J. In search of lost sleep: secular trends in the sleep time of school-aged children and adolescents [published online ahead of print May 23, 2011]. *Sleep Med Rev*. doi: 10.1016/j.smrv.2011.03.005
- Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77–101
- Seham M, Seham G. *The Tired Child*. Philadelphia, PA: JB Lippincott Company; 1926
- Anderson A. An inquiry into the hours of rest (sleep) of 1,600 school children. *Med Off*. 1936;2(4):147–148
- Erwin D. An analytical study of children's sleep. *Pedagog Semin J Genet Psychol*. 1934;45(2):199–226
- Foster J, Goodenough F, Anderson J. The sleep of young children. *Pedagog Semin J Genet Psychol*. 1928;35(1):201–211
- National Sleep Foundation [NSF]. How Much Sleep Do We Really Need? Available at: www.sleepfoundation.org/article/how-sleep-works/how-much-sleep-do-we-really-need. Accessed October 15, 2010
- Lumeng J. Future directions for research on sleep durations in pediatric populations. *Sleep*. 2010;33(10):1281–1282
- Dukes C. Sleep in relation to education. *J R Sanit Inst*. 1905;26(2):41–44
- Stearns P, Rowland P, Giannella L. Children's sleep: sketching historical change. *J Soc Hist*. 1996;30(2):345–366
- Read M. The physical care of young children. In: *The Mothercraft Manual*. New York, NY: Little, Brown, and Company; 1916
- Medscape Medical News. Older, Preteen Children May Not Be Getting Enough Sleep. Available at: www.medscape.com/viewarticle/411864. Accessed October 10, 2010
- Taheri S. The link between short sleep duration and obesity: we should recommend more sleep to prevent obesity. *Arch Dis Child*. 2006;91(11):881–884
- Sleeplessness. *BMJ*. 1894; September 29 (1761):719
- Lucas W. *The Health of the Runabout Child: The Journey From Mother's Lap to the School Grade*. New York, NY: The Macmillan Company; 1923

44. Oka Y, Suzuki S, Inoue Y. Bedtime activities, sleep environment, and sleep/wake patterns of Japanese elementary school children. *Behav Sleep Med*. 2008;6(4):220–233
45. Acebo C, Sadeh A, Seifer R, et al. Estimating sleep patterns with activity monitoring in children and adolescents: how many nights are necessary for reliable measures? *Sleep*. 1999;22(1):95–103
46. Wolfson AR, Carskadon MA, Acebo C, et al. Evidence for the validity of a sleep habits survey for adolescents. *Sleep*. 2003;26(2):213–216
47. Gaina A, Sekine M, Chen X, Hamanishi S, Kagamimori S. Validity of child sleep diary questionnaire among junior high school children. *J Epidemiol*. 2004;14(1):1–4
48. Bauer K, Blunden SL. How accurate is subjective reporting of childhood sleep patterns: a review of the literature and implications for practice. *Current Pediatric Reviews*. 2008;4(2):132–142
49. Foucault M. *Discipline and Punish: The Birth of the Prison*. London, UK: Penguin Books; 1991
50. Chung KF, Cheung MM. Sleep-wake patterns and sleep disturbance among Hong Kong Chinese adolescents. *Sleep*. 2008;31(2):185–194
51. Entman R. Framing: toward clarification of a fractured paradigm. *J Commun*. 1993;43(4):51–58
52. Carskadon MA, Harvey K, Duke P, Anders TF, Litt IF, Dement WC. Pubertal changes in daytime sleepiness. *Sleep*. 1980;2(4):453–460
53. Horne J. *Sleepfaring: A Journey Through the Science of Sleep*. New York, NY: Oxford University Press; 2006
54. Harrison Y, Horne JA. Should we be taking more sleep? *Sleep*. 1995;18(10):901–907
55. Sadeh A, Gruber R, Raviv A. The effects of sleep restriction and extension on school-age children: what a difference an hour makes. *Child Dev*. 2003;74(2):444–455
56. Carskadon M. Determinants of daytime sleepiness: adolescent development, extension and restriction of nocturnal sleep [doctoral dissertation]. Stanford, CA: Stanford University; 1979
57. Anderson J, Foster J, Goodenough F. The sleep of young children. *Pedagog Semin J Genet Psychol*. 1928;35(2):201–217
58. Bernhard L. Beitrag zur Kenntnis der Schlafverhältnisse Berliner Gemeindeschüler. *Beitr Kinderf Heilerziehung*. 1907;39(5):5–13
59. Ravenhill A. Some results of an investigation into hours of sleep among children in the elementary schools of England. *Internationales Archiv fuer Schulhygiene*. 1908;15(1):9–25
60. Hess J. *Feeding and the Nutritional Disorders in Infancy and Childhood*. Philadelphia, PA: Davis; 1928
61. Chant N, Blatz W. A study of sleeping habits of children. In: Bott E, Blatz W, Chant N, Bott H, eds. *Genetic Psychology Monographs: Child Behaviour, Differential and Genetic Psychology*. Clark University (Worcester, MA), Toronto, Canada: 1928:13–43
62. Fraser D, Porter G. *Ontario Public School Health Book*. Toronto, Canada: The Copp Clark Company; 1925
63. Brown A. *The Normal Child: Its Care and Feeding*. Toronto, Canada: McClelland and Steward; 1926
64. Blanton S, Blanton M. Learning to sleep. In: *Child Guidance*. New York, NY: The Century Company; 1927
65. Reynolds M, Mallay H. The sleep of young children. *J Genet Psychol*. 1933;43:322–351
66. Ames L. Sleep and dreams in childhood. In: Harms E, ed. *Problems of Sleep and Dream in Children*. New York, NY: The Macmillan Company; 1964
67. Baumecker W. Die Schlafzeit des Kleinkindes. *Deutsche Gesundh Wes*. 1958;13(16):496–499
68. Howard BJ, Wong J. Sleep disorders. *Pediatr Rev*. 2001;22(10):327–342
69. Heussler HS. 9. Common causes of sleep disruption and daytime sleepiness: childhood sleep disorders II. *Med J Aust*. 2005;182(9):484–489
70. Teufel J, Brown S, Birch D. Sleep among early adolescent students. *Am J Health Studies*. 2007;22(1):10–17
71. National Heart, Lung and Blood Institute. Your Guide to Healthy Sleep. US Department of Health and Human Services. Available at: www.nhlbi.nih.gov/health/public/sleep/healthy_sleep.pdf. Accessed October 15, 2010
72. National Sleep Foundation [NSF]. Children and Sleep. Available at: www.sleepfoundation.org/article/sleep-topics/children-and-sleep. Accessed September 11, 2010
73. Lamm C. Sleep and children. American Academy of Sleep Medicine Education Committee. 2006. Available at: www.sleepeducation.com/Topic.aspx?id=8. Accessed November 4, 2010
74. Harvard Medical School. Changes in sleep with age. Available at: <http://healthysleep.med.harvard.edu/healthy/science/variations/changes-in-sleep-with-age>. Accessed November 9, 2010

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Lisa Anne Matricciani, Tim S. Olds, Sarah Blunden, Gabrielle Rigney and Marie T. Williams

Pediatrics; originally published online February 13, 2012;
DOI: 10.1542/peds.2011-2039

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