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Sleep duration across the lifespan: Implications for health

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Obtaining sufficient sleep of adequate quality is increasingly becoming recognized as an important domain of healthy behavior. The Institute of Medicine has released two separate reports in recent years focused on the public health and safety implications of untreated sleep disorders and insufficient sleep.^{1,2} Further, adequate sleep has been included as a national health priority in Healthy People 2020.³

Central to this issue of sleep as a growing health concern is the claim that sleep timing and sleep duration have changed dramatically over the past several decades. Previous reviews have explored changes in sleep duration in postindustrial society.⁴ The current issue includes two reviews which significantly advance knowledge in this area, and two additional reviews which address related issues.

The first paper, by Matricciani and colleagues,⁵ addresses the question of whether sleep durations have decreased worldwide for children and adolescents over the past 103 years. They pooled data from ~ 700,000 subjects between the ages of five and 18 from 20 countries. Overall, they found that over the study period, reports of sleep duration reflected a trend of 0.75 min less sleep per year. This reflected a decrease in sleep time of about 77 min over the study period. This suggests that children today may be more sleep deprived than their parents or grandparents were. However, any decline likely reflects a decline in the amount of time provided for sleep – these data do not sufficiently assess how much time is actually spent sleeping, and, more importantly, the slope of this decline relative to actual sleep needs.

That said, if the sleep of children and adolescents is different than it was, norms for sleep among children need to be revised. This task was undertaken by Galland and colleagues.⁶ They analyzed data from 50 studies and computed normative values for sleep duration by age, as well as norms for night waking, daytime fatigue, naps, and other parameters. This review found that infants sleep a mean of 12.7 h, though a wide range of values were reported. Toddler sleep reflected a slightly shorter mean duration (11.9 h), accompanied by a more narrow range of common values. As children got older, mean sleep duration declined from about 9.7 h at age six to 8.9 h at age 12. These values will likely be useful for parents and healthcare professionals in determining what to expect regarding normal sleep in infants, toddlers, and older children.

Paralleling the study in pediatric populations, Bin and colleagues⁷ approached the issue of potential declines in sleep duration among adults. They attempted to overcome the most important limitation of previous studies that have explored this issue – variable measures and sampling frames. Twelve studies, representing data from 15 countries and a time period of approximately 40 years, attempted to document changes in sleep duration over that time

period. They found that, overall, there is no consistent evidence that sleep durations worldwide are declining among adults. Sleep duration decreased in six countries, sleep duration increased in seven countries, and mixed results were detected in two (one of which was the USA). In particular, the data from the USA suggest that although mean sleep duration may have actually increased slightly over the past 40 years, the proportion of short sleepers (six hours per night or less) also seems to have increased over the past several decades. The disparate findings among countries could reflect a number of geographic, political and cultural factors, which also need to be explored.

These findings are important for several reasons. For example, the commonly-cited claim that we are sleeping less and less was found for children but was shown to lack support for adults. Further, these findings show that different countries are experiencing different changes in sleep duration. Future studies will be needed to discern the social and cultural factors that might explain these differences. Already, several researchers are investigating these factors in children^{8–10} and adults.^{11–13}

The finding that rates of short sleep duration are likely on the rise in the US (separate from changes in mean sleep duration) is relevant, as many recent studies have shown that short sleep duration is associated with a number of adverse health outcomes, including obesity,¹⁴ cardiometabolic disease,¹⁵ and mortality.¹⁶ A major limitation of these studies is that they typically employ cross-sectional designs, making the causal connection between sleep duration and adverse outcomes unclear.

In response to this limitation, the review by Magee and Hale¹⁷ assessed studies among adults and children that evaluated the relationship between short sleep duration and prospective weight gain. Among 13 studies in adults, the authors found that short sleep was inconsistently associated with prospective weight gain. Eight reviewed studies demonstrated that short sleepers were more likely to gain weight and/or gained more weight than comparison groups. However, five of the studies did not find such an association. It is possible that the differences in measurements and cohorts may explain some of these discrepancies. Future studies will need to evaluate this.

Among the seven studies of children, the findings were more consistent. Although measurements of sleep occurred at many different ages in different studies (as young as five months), short sleep duration was consistently associated with weight at later time points, even into adulthood. This finding was relatively robust, but it should be noted that no two studies examined the same age group, over the same follow-up period, using the same methods. In relation to the other papers in this issue, this pattern of findings becomes particularly relevant – not only are children sleeping less, but less sleep is associated with prospective weight gain, a major health risk factor.

Future studies, though, will need to assess whether the observed longitudinal changes in sleep time among children and adolescents are associated with other adverse health and functional outcomes. A number of studies have shown that shorter sleep durations among children and adolescents are associated with increased risk for obesity¹⁸ and early onset cardiometabolic disease.¹⁹ Also, a more complete understanding of the factors that influence the sleep times of children and adolescents need to be explored. For example, a more complete understanding of sleep disparities associated with race/ethnicity and socioeconomic position, social influences on sleep, the effects of electronic media use, and other factors, will aid in the development and implementation of effective strategies for improving sleep health among children and adolescents.

Regarding the findings from Bin et al.⁷ and Magee and Hale,¹⁷ the data on adults, particularly in the US, are inconsistent. Overall, the trend still seems to be that short sleep

duration is increasing in prevalence and that this may be associated with weight gain and new onset of obesity. It remains to be seen which factors mediate or moderate these relationships (and whether they partially explain the inconsistent findings). Also, future studies will be needed to see if short sleep duration is prospectively associated with other disease processes implicated in cross-sectional analyses, such as changes in blood pressure or metabolic function.

Taken together, the papers in the current issue all revolve around the idea that habitual short sleep duration is not only on the rise among many children and adults, but that short sleep has important implications for long-term health. These studies and others support the proposition that sleep should be considered a key domain of healthy behavior, alongside diet and exercise. As a society, we have come to recognize in the past few decades that a proper diet and healthy amounts of physical activity are crucial for the maintenance of health and prevention of chronic disease. Even though many, if not most American adults do not optimally regulate their diet and exercise, there is a consensus that these are highly important. Extensive resources are expended identifying individuals at risk, developing and implementing interventions (like the food pyramid or fitness standards in schools) intended to improve the public health. However, there have been no significant interventions or campaigns aimed at promoting healthy sleep. As the evidence accumulates that sleep should be considered as important as diet and exercise, several important future directions emerge.

First, we need to develop greater conceptual clarity when discussing sleep duration in its relation to health. Several problems with the existing literature (many highlighted in the reviews in this issue) include: varying definitions of sleep duration categories, varying definitions of sleep loss (e.g., sleep deprivation versus short sleep duration), inconsistent definition of sleep duration relative to time in bed, and aggregation of heterogeneous groups that consist of individuals with different amounts of sleep need and different circumstances for curtailing sleep, both voluntary and externally determined. These concerns have been raised previously.²⁰ Thus, we need a clearer idea of what the issue is.

Second, scientific inquiry into characterizing the adverse health effects of short sleep need to better distinguish those who are “true” short sleepers from those who are insufficient sleepers. It is likely that this exists along multiple domains, as it is unclear whether those with subjective complaints, those with objective performance deficits, and those that demonstrate health risks, represent three separate and/or overlapping groups. Thus, another important next step is to identify who is at risk.

Third, a more systematic assessment of the biological, behavioral, and social factors that contribute to insufficient sleep in children, adolescents, adults, and older adults, needs to be undertaken. The identification of the determinants of insufficient sleep will add conceptual clarity to the development and implementation of any successful intervention strategy by identifying the appropriate targets and/or outcome measures. Thus, a third important next step is to identify where our targets should be.

Finally, behavioral interventions need to be developed and implemented. Increasing sleep time in individuals who do not obtain sufficient sleep will likely require a community-based behavioral strategy, rather than a more traditional medical approach. Successful interventions will likely bear more resemblance to interventions for increasing healthy behavior in other domains (e.g., diet, exercise), rather than those aimed at sleep disorders (e.g., insomnia, sleep apnea). These interventions will likely be administered in a community, rather than clinical, setting. Thus, a long-term goal is to identify how we can help.

In conclusion, the reviews in this issue tell an important story -insufficient sleep, on a population level, is not improving and is likely increasing in prevalence. This is important, as shortened sleep is associated with a number of important health outcomes, including obesity, cardiometabolic disease, and mortality. Although there has been a great deal of scientific exploration in this area, there is still much work to be done, to better conceptualize the issues and to identify which individuals are in need of an intervention, what outcomes and modifiable factors should be a part of an intervention, and how to deploy a successful intervention at the community level.

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