

Future Directions for Research on Sleep Durations in Pediatric Populations

Commentary on Olds et al. Normative data on the sleep habits of Australian children and adolescents. *SLEEP* 2010;33:1381-1388.

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IN THIS ISSUE OF *SLEEP*, OLDS AND COLLEAGUES¹ PROVIDE VALUABLE DATA REGARDING SELF-REPORTED SLEEP DURATION IN CROSS-SECTIONS OF Australian children between ages 10 and 18 years. The authors demonstrate the steady decline in sleep duration with age and document differences in sleep duration by day of the week, season, region, and sex. This study adds to the growing body of literature documenting patterns of self-reported sleep duration across populations, as well as changes with age during childhood.^{2,3} Studies such as these are useful to track changes in sleep duration within populations over time, to identify intergroup differences in sleep duration, and to generate hypotheses about ideal sleep durations and influences on sleep duration. These types of studies provide support for the impression that sleep duration within some pediatric populations is declining,² and therefore provide an impetus for public health interventions that target improving sleep. These types of studies also, however, highlight a number of important gaps in our current knowledge that frame a research agenda in the coming years.

What is the Ideal Sleep Duration for an Individual for Specific Outcomes?

Although work such as that by Olds et al.¹ can provide data regarding what the typical individual reports as usual sleep duration, it remains unknown what the range of ideal sleep duration might be for individuals. For example, even if a specific child's sleep duration falls at the 90th percentile of sleep duration compared to a reference population, it is still quite possible that that amount of sleep is inadequate for the individual child. The type of data provided by the Olds et al. study¹ and others³ is useful for clinicians to the extent that it enables them to explain to a parent whether an individual child's sleep duration falls within the typical range of children of the same age. However, whether or not that sleep duration for that individual child is ideal will still be unknown. For example, a parent may be concerned that their child's sleep duration is too short. The clinician, in referencing the type of data provided by Olds et al.,¹ will be able to support or refute the parent's impression in relation to the typical parent-reported sleep duration of other children of the same age. However, if the child's sleep dura-

tion is very short, at the lowest 10th percentile, the clinician is still left to determine whether this is inadequate sleep for the individual child that needs to be addressed, or if this is simply a child who does not need as much sleep as his or her peers. For example, a child may not appear sleepy to the parent during the day, but may be experiencing behavioral problems at school. Alternatively, the child may not appear sleepy during the day, have no behavior problems, and be functioning within the typical range academically at school, but their sleep duration may be associated with very subtle neuropsychological deficits such that with an appropriate amount of sleep, the child could be performing even better.

The matter is further complicated by recent findings that more sleep is not necessarily always better. Although longer sleep duration appears to be related to improved neurocognitive functioning,⁴ it has become increasingly recognized that longer sleep duration is not necessarily associated with reductions in cardiovascular disease risk, obesity, and mortality.⁵⁻⁷ Rather, for these outcomes, there appears to be a U-shaped curve such that risk is lowest at some specific sleep duration, and increases with longer or shorter sleep durations. This "ideal" sleep duration for each individual, and how to identify it, at present remains unknown. Furthermore, whether this "ideal" systematically varies across populations, and why, also remains unknown. These are all pressing research questions.

Are there Typical Patterns of Change in Sleep Duration Apparent in the Population and What are Their Correlates?

An additional related question regards patterns of sleep duration change over time. Specifically, studies that generate "growth curves" of sleep using cross sections of the population at varying ages have an inherent limitation in that they cannot identify normal variability in sleep duration change within individuals. For example, perhaps there are 3 different patterns of "sleep duration change" over time during childhood. One may show a relative plateau (no change) in sleep duration from toddlerhood until age 5, and then show a rapid decline. Another pattern may show relatively short sleep duration in toddlerhood that persists as short throughout childhood. Another pattern may show an increase relative to the normative population with time, such that a previous "short sleeper" in preschool may become a "long sleeper" in adolescence relative to peers. All of these patterns may be "normal" and each may be associated with specific predictors and outcomes. In short, these types of patterns may be clinically and biologically significant, but have not been examined. It is only possible to provide such data by following large cohorts of children longitudinally. Several of the prior studies of sleep duration have done so,² but they have

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not used statistical methods that would allow for an investigation of whether these types of patterns exist and to what they might correlate. This question presents itself as a potentially important area for future study.

Why does Sleep Duration Differ across Demographic Groups and with Age?

Finally, Olds et al.¹ provide some evidence to suggest that sleep duration declines more rapidly over childhood in some cultures as compared to others, as depicted in their Figure 2, and reviewed in detail in their recent review.³ It has also been documented in a number of studies that reported sleep duration declines with age into adolescence. It remains unknown, however, what underlies these intergroup differences. It is also unclear whether the shifts in sleep duration that are observed with age are biologically driven by a brain with less sleep need as the child ages, or if they are driven mostly or entirely by external societal forces. A recent review by Ohayon et al.⁸ suggests that these changes are driven by external, and not biological forces, in that total sleep time remained the same from age 5 years to adolescence on non-school days. Significant additional work is needed to better understand the biological and non-biological factors contributing to differences in sleep duration with age and across demographic groups.

In summary, providing normative curves across populations is a critical step towards better understanding sleep duration across cultures and populations. However, a tremendous

amount of additional work is needed to identify “ideal” sleep for an individual, patterning of sleep duration across the lifespan and its correlates, and the biological and non-biological influences on these observed differences in sleep duration within individuals.

DISCLOSURE STATEMENT

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REFERENCES

1. Olds T, Maher C, Blunden S, Matricciani L. Normative data on the sleep habits of Australian children and adolescents. *Sleep* 2010;33:1381-8.
2. Iglowstein I, Jenni OG, Molinari L, Largo RH. Sleep Duration from infancy to adolescence: reference values and generational trends. *Pediatrics* 2003;111:302-7.
3. 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*;In Press.
4. Durmer J, Dinges D. Neurocognitive consequences of sleep deprivation. *Semin Neurol* 2005;25:117-29.
5. Gallicchio L, Kalesan B. Sleep duration and mortality: a systematic review and meta-analysis. *J Sleep Res* 2009;18:148-58.
6. Chien K, Chen P, Hsu H, et al. Habitual sleep duration and insomnia and the risk of cardiovascular events and all-cause death: Report from a community-based cohort. *Sleep* 2010;33:177-84.
7. Patel S, Hu F. Short sleep duration and weight gain: a systematic review. *Obesity* 2008;16:643-53.
8. Ohayon M, Carskadon M, Guilleminault C, Vitiello M. Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human lifespan. *Sleep* 2004;27:1255-73.