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Editorial

EDITORIAL

Touchscreen devices—impact on 24-hour sleep in "cyber" babies

Mirja Quante[1,*] and Susan Redline[2,3]

[1]Department of Neonatology, University of Tuebingen, Tuebingen, Germany, [2]Division of Sleep and Circadian Disorders, Department of Medicine, Brigham & Women's Hospital & Harvard Medical School, Boston, MA, USA and [3]Department of Medicine, Beth Israel Deaconess Medical Center, Boston, MA, USA

*Corresponding author. Mirja Quante, MD, Department of Neonatology, University of Tuebingen, Calwerstr. 7, 72076 Tuebingen, Germany. Email: mirja.quante@med.uni-tuebingen.de

Screen time such as television viewing and exposure to smartphones, tablets, and laptops is associated with multiple adverse health and behavioral effects in infants, including obesity, aggressive behavior, decreased physical activity, and sleep disorders [1–3]. These associations are likely mediated, at least in part, by the effects of light from these devices on the circadian system, which can suppress melatonin, delay sleep onset, and possibly affect sleep stage distributions and result in daytime sleepiness [4]. In addition, use of these devices may cause cognitive stimulation, which can result in arousal, thus further negatively impacting sleep. Accordingly, avoidance of digital media use is integral to sleep hygiene recommendations, and for children younger than 18 months, the American Academy of Pediatrics explicitly discourages the use of screen media other than video-chatting [5]. However, adoption of these guidelines has had poor uptake in the real world. For example, a UK study reported that 75% of toddlers between 6 months and 3 years of age use a touchscreen on a daily basis [6]. It is likely that the prevalence of screen use is further rising in the era of coronavirus disease (COVID-19) with baby online classes and increasing virtual interactions.

Given the widespread use of these devices, it is particularly important to generate data that could further inform policy and clinical practice, including identifying groups most at risk for adverse effects of devices, as well as contextual factors that may modify the sensitivity to light from these devices. Prior studies have looked at the effect of screen use on sleep outcomes in infants. In general, higher exposure to screen use was linked to shorter sleep duration [1, 7, 8]. But these studies had several limitations such as sleep measures solely relying on parental report, relatively small sample sizes and broad age groups. Younger and older infants and children may differ in regards of sensitivity to light and other external stimuli, underscoring the need to carefully consider developmental factors. The complexity of sleep, particularly in infants who sleep across the 24-hour period and experience rapid changes in circadian and sleep-wake control, requires nuanced analysis, including assessment of the timing of exposures and impact on sleep quantity and continuity in both the day and night.

In this issue of SLEEP, Kahn and colleagues investigated the impact of screen time (day and night touchscreen use and TV) on objectively and subjectively measured sleep in a sample of 1074 infants (ages 0 to 18 months) [9]. Surprisingly and contrary to expectations, when sleep was assessed objectively, nighttime touchscreen exposure was associated with shorter daytime sleep and longer nighttime sleep. In addition, an age interaction was observed for daytime touchscreen exposure; i.e. daytime touchscreen use was associated with decreased daytime sleep duration but increased nighttime sleep duration, higher nighttime sleep efficiency, and fewer awakenings in younger (3 months), but not older infants (8 and 13 months).

In contrast, and as expected, in the older infants higher daytime touchscreen exposure associated with shorter nighttime sleep and poorer sleep quality. Significant associations were not observed for TV exposure, potentially reflecting misclassification of this exposure. Study strengths were the large sample size (n = 1074) with nearly 14 000 nights of sleep data for evaluation.

These findings are provocative. But rather than suggest a beneficial effect of screen use in young infants, they underscore the need to consider the impact of device use on sleep across the 24-hour day, the complex inter-relationship between day and nighttime sleep, and potential sources of biases that may contribute to the study results.

In considering the findings, it is useful to consider the novel approaches used by Kahn and colleagues- which have both advantages and limitations. The study used a "big-data" approach. Rather than rely on only subjectively reported sleep measures or objective data collected from in-laboratory studies, or in modest samples studied using actigraphy, auto-videosomnography from commercially distributed camera monitors coupled with a parent-completed sleep survey were used. The videosomnography device is marketed as a "baby monitor" that is placed near the crib to help parents track the sleep of their infant. Such non-invasive monitoring conducted in the baby's typical sleep environment has the potential to capture more representative data than is collected in many research protocols, as well as provides the ability to collect many nights of data on large numbers of individuals across the globe. A key question concerns the validity of such data compared to gold-standard polysomnography [10], and how well videosomnography data compare to data collected from commonly used tools in research, such as actigraphy and questionnaire. The authors reported the results of a validation study for sleep–wake assessment, showing a sensitivity of 75% and specificity of 89%; however, this evaluation was conducted in a laboratory-based study of only seven children. Therefore, it is possible that measurement error would be greater when used in the home setting and when assessed in a larger and diverse sample. Of note, while the videosomnography and parent-report measures were reported to correlate in their study, it was only the results of the videosomnography that showed the finding of increased nighttime sleep duration in the young infants. Each approach—videosomnography and parent-assessment—have limitations, and a key question is which method yields the most accurate findings in this population.

A second concern relates to potential selection biases. While the sample was large and included families from across the globe, was this sample representative? Nelson explored more than 100 consumer reviews of baby monitors published on Epinions.com and showed that users of baby monitors are often well-educated moms who normalize parental anxiety, who have little trust in their own skills and who have a higher affinity to technology [11]. Therefore, data from users of baby cameras likely have distinct parenting styles compared to non-users, limiting generalizability of study findings.

One remarkable aspect of the study was the high prevalence of "high" reported daytime (33.2%) and nighttime (19.2%) screen use. While screen use was determined by a single electronically administered questionnaire and validation of its properties is needed, infants with high screen time were from families lower parental education level and were more likely African American than other races. These associations are consistent with prior data indicating higher prevalence of bedroom TVs in minority and low-income families [12, 13], and suggest the need to provide improved education and support to low socioeconomic families regarding healthy sleep practices.

The parents in the study by Kahan et al. who reported higher screen time also reported a lower frequency of breastfeeding and sharing a room with their infant. Prior data indicate that both room sharing and breastfeeding are associated with less consolidated sleep in infants [14]. While these factors were included as covariates in regression models, there remains the possibility of unmeasured confounding, including by factors other than feeding mode and sleep arrangements that influence sleep-wake. For example, bedtime routines reflecting level of parental involvement, maternal depression, infant-parent attachment, day care attendance, and prematurity are all factors associated with sleep outcomes that might contribute to the observed differences between high and low daytime screen exposed infants [14]. A key question relates to the possibility of indication bias: what was the intention of parents who provided their infants the touchscreen devices. Did they use these to entertain or to soothe their babies? Did parents perform active parental co-viewing or were infants exposed to age-inappropriate content through background consumption?

The differences reported between the younger and older children may also reflect factors not addressed in this study, such as specific timing of when screens were used relative to the infants rapidly developing circadian system. The variation in the distribution of daytime and nocturnal sleep varies markedly across infancy, and also differs by socioeconomic factors, with infants from households of low socioeconomic status having more daytime sleep than white infants (but lower nocturnal sleep) [15]. It is unclear whether there are differences in the physiological benefits of day vs nighttime sleep in infants. To answer this question, it may be important to further understand the inter-relationships between day and night sleep. For example, the authors hypothesized that the shorter nighttime sleep observed in association with nighttime touchscreens (in all) or with daytime touchscreen (in the youngest infants) may reflect the greater accumulation of sleep homeostatic pressure through displacement of daytime sleep. Further research is needed to understand how daytime sleep in infants impacts nighttime sleep consolidation and duration. There are other fundamental questions regarding the development of sleep-wake patterns across infancy. For example, is sleep consolidation at younger ages beneficial and should parents intervene? The capability for sustained sleep increases rapidly during the first 4 months of life and most infants sleep through the night by 6 months [16]. The consequences or advantages of enforcing this process have yet to be studied.

Despite these open questions, the study by Kahn and colleagues adds to our current knowledge about touchscreen device usage by showing reciprocal effects on sleep in the day as compared to the night and highlighting the potential susceptibility of the youngest infants (3 months) to daytime touchscreen exposure. Further research is needed to replicate these findings across more diverse samples and understand more about the "dose" and timing of screen exposures on sleep patterns across the day.

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