



## EDITORIAL

# Sleep and electronic media exposure in adolescents: the rule of diminishing returns<sup>☆,☆☆</sup>



## Sono e exposição à mídia eletrônica em adolescentes: a lei dos rendimentos decrescentes

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Electronic media has now pervasively invaded our households and one group of individuals that has clearly been a major and early adopter of such disruptive technology is the adolescent age group. The issue of screen and media exposure as a potentially adverse risk factor to health has now been enunciated for quite some time,<sup>1</sup> and yet despite such ominous correlates, there is still ongoing debate as to the potential consequences of electronic media to adolescent well-being. Children in general, and more specifically adolescents, spend more time connected to media than to any other daily activity. It has been estimated that the media exposure revolves around seven hours per day.<sup>2,3</sup> One of the major issues with such media abundance is the fact that even 12 years ago, most of the devices already resided in the bedrooms of the adolescents: two-thirds had a television set, one-half had a VCR, DVD player or video-game console, and >30% had Internet access or a computer in their bedroom. It is therefore not surprising that such plethora of bedroom devices and enhanced connectivity are likely to influence adolescent behaviors in many possible and potentially divergent directions.

Increased media access will affect youth not only by reducing or compromising the time they would need to

spend doing their school homework or sleeping, but also by potentially affecting their beliefs and behaviors. Social learning theory postulates that learning is predicated on observation and imitation of behaviors by peers, or even by relating to fictive situations such as movies or games. In this context, super peer theory has clearly shown that the media may operate as powerful best friends, with the caveat that risky behaviors may be misinterpreted and adopted as if they were *de facto* normative and socially acceptable.<sup>4</sup> Before generalizing the effects of media as untoward to adolescents, we should point out that exposures to media may also have important beneficial effects. Indeed, the media can exert powerful pro-social and educational effects, whereby adolescents can learn anti-violence approaches, foster empathy and tolerance behaviors toward people of other ethnicities, and also enhance the respect for their elders and other authoritative figures in their lives.<sup>4,5</sup> Furthermore, media exposure can promote healthy behaviors, adherence to treatment in chronic disorders, and promote learning through educational programs and socially integrated web-based training opportunities. Therefore, what constitutes excessive media exposure or type of media exposure that will be detrimental to any given adolescent is reflected by the delicate balance between beneficial aspects of media weighed against the potential harmful consequences of such exposures. For example, recent studies from China have shown a small effect of screen time on the presence of mental health problems in adolescents, but also indicated that such effect is small and that no definite cut-off screen time duration can be identified.<sup>6,7</sup>

In this issue of the Journal, Amra et al. examined the association between portable telephone use in the late

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evening hours and sleep patterns as well as daytime functioning and physical activity.<sup>8</sup> The authors indicated that more extended use of the phone after 9 pm increased the risk for poorer sleep quality, more problems during daytime functioning, and reduced likelihood of engaging in physical activity. Although the study was exclusively reliant on questionnaires and did not perform any objective measurements, their overall findings are clearly aligned with those of previously published studies.<sup>9</sup> I should remark that experimental sleep restriction in adolescents and young adults is likely to translate into reduced daytime performance in the absence of the perception of somnolence,<sup>10,11</sup> an issue that was not explored by Amra et al.<sup>8</sup>

Bright light exposure during the early night period, particularly when enriched with light in the blue spectrum, as is the case of most modern device screens, imposes immediate effects on both physiological and behavioral measures.<sup>12,13</sup> In comparison to darkness, bright light exposure decreases sleepiness, promotes increased alertness, and also attenuates the melatonin-induced reduction in core body temperature. Such effect will lead to delayed sleep onset and curtailed sleep, at least during weekdays (*i.e.*, school days) with futile attempts to catch-up during weekends. These irregular sleep patterns have been implicated in curtailed sleep duration, along with metabolic dysfunction, obesity, and excessive caffeine consumption among school-age children.<sup>14,15</sup> Furthermore, daytime performance has also been impaired along with the emergence of daytime somnolence (not necessarily recognized and acknowledged by youth),<sup>11</sup> which further exacerbates the use of caffeinated beverages.<sup>16</sup> Such patterns are particularly prominent during weekdays during the school year, when the earlier class start times appear to be an additional burden to the cumulative sleep debt that is pervasively present among adolescents.<sup>17</sup> As mentioned earlier, the potential consequences of sleep restriction in adolescents have been extensively explored in experimental settings.<sup>18</sup> Although adolescents showed the anticipated emergence of sleepiness following sleep restriction, reduced performance was detected in only a subset of complex neurocognitive functions, including abstract problem solving, verbal fluency, and creativity, as well as computational processing speed. However, simpler tasks or routine tasks, such as sustained auditory and visual attention and short-term verbal memory, remained intact. Notwithstanding, difficulty with multi-tasking and enhanced susceptibility to depressive mood states and increased risk for motor vehicle and other accidents may well represent the challenges typically encountered in adolescents' daily lives, and performance may be challenged in the context of curtailed sleep.<sup>19,20</sup> When these variables are considered together, no easily implementable solutions come to mind. There is no doubt that efforts to limit or reduce screen time exposures, especially around bedtime hours, should be recommended at the individual level.<sup>21</sup> In addition, the implementation of school start times and schedules aiming to address some of the issues revolving around adolescent sleep and its modifiers should prove a step in the right direction.<sup>22</sup>

In summary, there is no doubt that the more reductions in sleep occur in the life of any adolescents in the context of a misguided effort to increase their social engagements, educational performance or any other laudable goal, the

less "bang for the buck" they will reap – the rule of diminishing returns! Sleep health awareness and implementation are achievable, but they are not one late evening portable phone call away...

## Conflicts of interest

The author declares no conflicts of interest.

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