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Neuroscience and digital childhoods: A spotlight on *SLEEP*

Executive summary

It is estimated that up to 75% of adolescents get less sleep than nationally recommended. Sleep is central to human flourishing, fundamental to brain development, emotional regulation, mental health, physical health, and educational attainment. Our research, led from the University of York, suggests that bedtime smartphone and social media use is one of the most significant threats to adolescent sleep in modern society, but that this threat is modifiable. Across observational, longitudinal, and emerging and large-scale landmark experimental studies—including our own randomised controlled trial funded by the Huo Family Foundation—we find converging evidence that reducing smartphone and social media use, particularly in the evening, improves sleep and may yield downstream benefits for anxiety, depression, attention, and memory. We recommend a precautionary public health approach focused on sleep-centred digital health education, platform design standards, parental modelling, and continued investment in mechanistic and longitudinal research.

Our evidence submission focuses specifically on the impacts that smartphones and social media (S/SM) have on sleep - as a critical driver of physical, mental and brain health across development - as this is our area of expertise. There are also other important strands of evidence that speak to this Call for Evidence, that are not reviewed here.

1. What impact do digital devices have on the brain development of children and adolescents?

- How does this affect physical and mental health, behaviour, and attainment?
- How does this vary with characteristics including age, sex, socioeconomic background, ethnicity, and others?

Sleep is strongly, causally, and bidirectionally related to mental health¹ and academic success², as well as being critical for physical and brain health³. Sleep is particularly critical during adolescence - a rapid brain development and heightened vulnerability to neurobiological insults that give rise to poor mental health and impaired cognitive performance⁴. Adolescence is characterised by changes in sleep patterns that often clash with school schedules, and increasing independence over pre-bedtime behaviours, leaving a staggering 73% sleep-

deprived^{5,6}. There is growing evidence that adolescent sleep is at particular risk in the digital age, owing to rising smartphone and social media (S/SM) use at bedtime⁷. This is a multifaceted problem - screen time can displace sleep, increase psychological arousal before bed and delay sleep onset, and through exposure to harmful content can also hamper wellbeing directly, leading to a spiraling vicious cycle of problematic S/SM behaviours, sleep deprivation and worsening mental health. This is of huge concern given that we now live in a society where 1 in 5 young people have a probable mental health condition and are falling short of their true potential. Yet, sleep as a key risk factor was relatively overlooked in the recent UK Government review commissioned by the Department of Science, Innovation and Technology⁸.

Sleep as a putative causal mechanism linking S/SM to negative effects on development

Our research on digitally related safeguarding incidents reported by schools suggests that the majority of these incidents happen in the evening, highlighting bedtime as a critical period⁹. Our recent survey of 2,333 11-19-year-olds¹⁰ (see [infographic](#)) further highlights the impact of S/SM on sleep as a growing societal problem. Aligning with recent national surveys (e.g., Ofcom, 2025), we found that 1 in 5 young people reported spending more time on their smartphones than they do at school (i.e., > 6 hours per day), with usage increasing over the age range. Regarding S/SM behaviours that hinder sleep specifically:

- 38% reported using their smartphones after 10pm
- 47% said they sleep with their smartphones next to their beds
- 18% reported using them immediately upon waking.
- Adolescents who continued using their smartphones later in the evening were more likely to encounter age-inappropriate explicit/harmful material, and to do so more frequently, even when controlling for overall daily S/SM use.

In a scoping review¹¹, we found that 8/12 longitudinal studies report at least some negative impact of social media on sleep, with bedtime usage particularly problematic and females at greater risk. This tallies with other findings that females may be more susceptible to the adverse effects of social media on sleep and mood¹². Socioeconomic status was also noted as a risk factor, aligning with findings that individuals from lower socioeconomic backgrounds tend to engage more frequently with social media¹³. Large-scale prospective studies are now confirming the downstream impact of S/SM on sleep in early adolescence¹⁴, demonstrating that problematic S/SM use precedes sleep disturbance and mental ill-health). Other longitudinal studies have found that sleep mediates the associations between time spent on S/SM and symptoms of depression and anxiety^{15,16}, with these mediatory pathways aligning with our findings¹⁰.

Causal evidence?

Researchers have sought causal evidence by manipulating access to S/SM and ascertaining effects on sleep and wellbeing. However, studies have focused on adult populations, with a need for adolescent data. Through our feasibility study—widely featured on UK broadcaster Channel 4's *Swiped* (>1.5M views within 5 days of release) and our subsequent pilot RCT¹⁷, we have found that a total 21-day S/SM ban improves sleep, with concomitant improvements in anxiety, depression, attention and memory among 12-17 year olds, relative to controls. Funded by a Huo Family Foundation Special Project, we have recently launched “SmartSleep”, a landmark larger-scale randomised controlled trial of total versus bedtime smartphone detox (compared to usual use) in teens. Through objective and rich brain-level monitoring of sleep at scale, we will gather robust causal evidence on *why* S/SM are problematic for sleep, mental health, attitudes and cognition, going beyond existing and parallel trials, which rely on broad-brush self-report.

What are the mechanisms? Why might sleep at the core of S/SM harms?

We have shown that sleep deprivation influences the brain's ability to inhibit unwanted memories^{18,19}, a key feature of psychiatric mood disorders, through the depletion of rapid eye movement sleep (REM). Sleep deprivation also hampers the brain's ability to suppress emotional responses to negative thoughts²⁰ including in adolescents²¹. Thus, S/SM might be both depriving adolescents of sleep and feeding them with damaging content that their brains are struggling to regulate and control, worsening cycles of mental health and susceptibility to toxic social attitudes (e.g., as demonstrated by our work on exposure to misogynistic content in youth²²). The same brain networks that are critical for regulating thoughts and emotions are also critical for cognitive capacities that underlie learning and educational performance. Indeed, our internationally recognised research has consistently demonstrated the critical role of sleep for learning and memory in children, and used home-based EEG recordings to ascertain how the underlying neurocognitive mechanisms can go awry in sleep deprived states²³⁻²⁶.

Summary

There is an accumulation of evidence from our own research and that of others pointing to sleep (a key marker of brain health) as directly at risk from S/SM, and in turn, a key driver of mental health and social and cognitive harms.

2. What are the short-, medium- and long-term effects on the brain of using digital devices in childhood and adolescence?

There is a wealth of evidence that sleep is displaced by time spent on S/SM, suggesting therefore that S/SM has immediate effects on the plethora of brain functions that are critically dependent by sleep, especially during adolescence (a major period of brain refinement and social change). Our research has also demonstrated immediate benefits of S/SM detox approaches on sleep duration and sleep onset latency in adolescents¹⁷, suggesting that these effects are malleable. Nevertheless, our recent large-scale longitudinal studies using state-of-the-art person-centred approaches via trajectory modelling are demonstrating that poor sleep patterns can have long-term effects both on sleep itself, but also mental health and cognitive development (including academic performance)²⁷⁻²⁹. Such findings underscore the need for timely and effective interventions.

Sleep difficulties are highly prevalent in neurodevelopmental conditions such as autism and ADHD³⁰. Our large-scale UK Biobank analysis demonstrated that relationships between sleep and mental health are significantly stronger in autism populations³¹. Neurodiverse individuals (including those experiencing ADHD^{32,33}) also tend to engage more frequently with S/SM. Thus, it follows that they may be at greater risk of the negative effects of S/SM on sleep; however, this remains to be determined directly. Adolescents with clinical anxiety/depression are also more likely to be problematic users and engage in social comparison, with negative impacts on mood and friendship satisfaction³². Thus, the effects of S/SM on sleep are likely to be even more pronounced in particular at-risk groups.

Short-term

- reduced sleep duration
- impaired attention

- poorer memory
- heightened emotional reactivity

Medium-term

- altered sleep habits
- poorer academic performance
- increased anxiety/depressive symptoms

Long-term

- possible impacts on neurodevelopmental trajectories
- increased psychiatric vulnerability
- educational and occupational consequences

3. How do children and adolescents view the impact of digital devices, and how far are their views taken into account in policy?

Young people are not merely passive recipients of digital harms; many actively recognise the risks and support proportionate regulation. For instance, 48% say that social media harms them or their peers, which was up by 32% from 2022³⁴). In our pilot RCT of S/SM restriction, 83% of participants from the total restriction groups reported endorsing the need for governments to act (e.g. through bans, restrictions, regulations, and education)¹⁷. It is absolutely critical that the views of children must be taken into account in developing policy around this matter, especially if policy enactment is to be successful.

4. Is there adequate evidence around the impact of digital devices on the development of children and adolescents?

- Where is more research needed on their impact?

While evidence for broad “screen time harms” remains mixed, evidence specifically linking bedtime S/SM use with sleep disruption is becoming increasingly consistent across study designs. Thus, there is substantial evidence to take precautionary steps but there remains a need for more nuanced evidence that underscores evidence-based solutions. For example:

- We need a finer-grained mechanistic understanding of S/SM harms to underscore any public health campaigns on this topic. For example, as mentioned above, exactly what are S/SM doing to sleep (i.e., is it changing sleep architecture) and/or having broader effects on the ability to get to sleep, perceived sleep quality, and how and for how long is this influencing brain structure and function.
- There’s been a focus on mental health, for good reason, but what about cognitive performance and cognitive development, are there long-term detrimental effects here too? Physical health (e.g., obesity) and the consequences of reduced physical activity during childhood and adolescence, particularly in girls, is also deserving of further research attention.
- What kind of educational approaches to enhancing digital health are most effective?

- We need to consider the impact of modelling behaviours in the home environment. In our recent survey¹⁰, approximately 25% of adolescents indicated that their parents spend >6 hours a day on screens. Parent screen time was significantly associated with adolescents' self-reported daily smartphone use, suggesting that adolescents with higher self-reported daily smartphone usage were more likely to perceive their parents as using screens more frequently.
- Consideration of which architectural features of platform design are most problematic for sleep (e.g., notifications, infinite scroll, autoplay, algorithmic reinforcement)
- Evidence relating to risk profiles (e.g., speaking to ethnicity, SES, gender, religion etc) remains limited and represents an important research gap.

5. What are the wider social and economic implications of the impacts of use of digital devices in childhood and adolescence on brain development?

- What is the government doing to measure, regulate or respond to these, and what more should it be doing?
- How could the government future-proof its interventions in this area against developments in technology and its use?

Given the above mentioned evidence, there are clear grounds for public health campaigns that warn of the risks of S/SM for sleep. The messaging here could be clear, simple and targeted around the likes of “Digital 5 a Day” marketing to encourage healthier digital lives. Given the high likelihood that smartphones are here to stay, this kind of campaign would be future-proof to developments in the likes of social media platform regulations and restrictions for under 16s. Regarding digital education, we are currently examining the extent to which collective digital detox approaches could be rolled out in secondary schools as a means to educate pupils and their families about digital health. This kind of concept would again continue to be relevant as the digital world evolves. Drawing together the evidence presented here, we make the following recommendations:

1: Introduce a national public health campaign on adolescent sleep and digital hygiene.

2: Require schools to include digital sleep health within PSHE.

3: Require platforms to implement default night-time protections for under-18s.

4: Support independent longitudinal trials that incorporate rich and objective sleep monitoring research as well as a range of mental and physical health measures.

5: Commission guidance for parents on household digital modelling.

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