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Digital media, book reading, and aspects of sleep and sleep-related fears in preschoolers: the Ulm SPATZ Health Study

Supplementary Information

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High levels of digital media use with screen-based devices have been found to threaten several aspects of child and adolescent health [29, 32]. In particular, media use has been identified as a potential determinant of circadian clock disruption. On one hand, a negative physiological effect of media use on sleeping has been hypothesized to act through multiple mechanisms such as melatonin suppression [34], and on the other hand, the media content and the timing were demonstrated to influence sleep in children and adolescents [16]. Several systematic reviews of varying quality are available on the effects of screen time on domains of sleep health such as sleep duration, prolonged bedtime, sleep onset problems, night wakings, or sleep problems [3, 7, 12, 14]. The majority of published evidence is inferred from studies including school-aged or older children and adolescents [23], but two recent systematic reviews document the consistent detrimental effect of screen time for sleep health in preschoolers as well [23, 35]. However, the overall quality of evidence in one of the two systematic

reviews judged by part of the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) scale was low [23]. Longitudinal evidence on determinants of children's sleep behavior is emerging and has been summarized by a further systematic review [5]. Here, the authors found moderate evidence for screen time as a determinant of child sleep duration [5]. Furthermore, two systematic reviews have set out to summarize the effect of interventions to control screen time on children's sleep [6, 26]. While the studies suggest that small improvements in screen time and sleep duration can be achieved in children [26], the number of studies is limited and the evidence may be blurred by the presence of co-interventions, low methodological quality, and heterogeneity [26]. Indeed, evidence to guide policy on safe screen time exposure among children and adolescents is limited [32].

Still, guidelines on media use, also with regard to child sleep health, have been issued in the past years [1, 18, 19, 30]. For Germany [18], as for other countries [1, 19], the guideline does not give an explicit, age-adapted time limit spent with digital media per day that should not be exceeded. Other guidelines have stated at most 0.5 to 1 h per day for 2- to 5-year-olds [9, 13, 30]. The advent and spread of mobile devices, such as tablets and smartphones, has spurred some interest into the effects of the type of end device [29, 33]. Another im-

portant dimension of digital media use could be active (e.g., gaming) vs. passive (e.g., TV viewing) use [1]. However, the rapid change of digital media use behavior in our society over the past decade has rendered a lot of the existing evidence outdated. A scoping review on 5- to 18-year-olds including 130 population-based surveillance studies showed that on average about 50% of the participants exceed 2 h per day of screen time [33]. This proportion is mirrored in contemporary data on German 10- to 18-year-olds [2]. The German Health Interview and Examination Survey for Children and Adolescents (KiGGS) has so far only published data on digital media use of 11- to 17-year-olds ascertained in the years 2009–2012 [25]. Data from the 2017 Spanish National Health Survey indicate that 67% of 3- to 5-year-olds spend ≥1 h per day on daily leisure screen time and that 36% even exceed 2 h per day [11]. Contemporary data on digital media use in German preschoolers are lacking, as they are in many other countries. Moreover, most existing data do not inform about the timing of media use across the day, although morning or evening use could have distinct effects on a child's sleep.

The present study seeks to close this gap by reporting descriptive data ascertained from 2016 to 2019 on preschooler's digital media use and book reading among 4- to 6-year-old children from the longitudinal Ulm SPATZ Health

Fig. 1 ▲ Time spent with digital media use and book reading (means and 95th centile, asterisks indicate statistically significant differences)

Study. These data are supplemented by exploring the association of child digital media use and book reading with aspects of sleep and sleep-related fears.

Materials and methods

Study design and investigation methods

The Ulm SPATZ Health Study

The Ulm SPATZ Health Study is a prospective birth cohort study based on 1006 children consecutively recruited after their birth between April 2012 and May 2013 at the University Medical Center of Ulm, Southern Germany. Baseline data were collected during the days following delivery. Subsequently, every year at the child's birthday, a battery of self-administered questionnaires is filled by participating families. These questionnaires concern a number of factors affecting children's and parents' health, in partic-

ular diagnoses, psychological health and wellbeing, lifestyle, sleeping habits, and socioeconomic characteristics.

The Ulm SPATZ Health Study has a prospective design with repeated measures aimed at investigating the wellbeing of the parents and their child. The present work includes data from study waves at the children's ages of 4, 5, and 6 years. Participation is voluntary and informed consent was obtained from all mothers of the participating children, their partners, and also of their siblings if older than 18 years. The Ulm SPATZ Health Study was approved by the ethics board of Ulm University (no. 311/11).

Children's sleep-related fears assessment

The German version of the Children's Sleep Habits Questionnaire (CSHQ) was used to collect parent-reported child sleep problems over a typical week [27]. For the present analyses, three items of

the sleep-related fears domain and one question regarding waking up at night were selected according to previous evidence relating sleep to media use in SPATZ children [17]: "Needs parents in room to sleep," "Afraid of sleeping in the dark," "Afraid of sleeping alone," and "Wakes up once during the night." The items were scored on a three-level Likert scale, as "rarely," "sometimes," and "usually." The CSHQ is a tool validated for the German population [31].

Digital media use and book reading

Parents reported the time their child spent using digital media and reading books separately for weekdays and weekends and for morning (06:00–12:00), afternoon (12:00–18:00), and evening (18:00–06:00). The four items (watching TV/DVD, video gaming, other computer/internet use, reading books) were coded as: never; up to 1 h/day; 1 to

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Digital media, book reading, and aspects of sleep and sleep-related fears in preschoolers: the Ulm SPATZ Health Study

Abstract

Background. High levels of digital media use with screen-based devices has been found to threaten several aspects of child and adolescent health. However, the rapid change in digital media use behavior in our society over the past decade has rendered much of the existing evidence outdated.

Materials and methods. The present work reports data ascertained from 2016 to 2019 on preschoolers' digital media use and book reading among 4- to 6-year-old children from the longitudinal Ulm SPATZ Health Study. These data are supplemented by exploring the association of child digital media use and book reading with aspects of children's sleep and sleep-related fears.

Results. After data management, 581 children participated at the age of 4 years. At the ages of 5 and 6 years, data were available for 508 and 426 participants, respectively. Median age of the mothers was 33 years (range 21–54) and 70% had graduated from high school. Most time spent using digital media was represented by passive activities in front of a screen. Time spent using digital media increased with children's age. An increased risk of the fear of sleeping alone (RR: 1.35, [95% CI: 1.07; 1.70]) and fear of the dark (1.47 [95% CI 1.16; 1.87]) was documented for exposure to "all media" higher than the median as compared to lower levels. Exposure to "books" above the median and compared

to lower levels was tentatively associated with a relevant 18% reduction in the risk of both fear of sleeping alone and fear of the dark (0.82 [95% CI 0.65; 1.03] and 0.82 [95% CI 0.64; 1.05], respectively).

Conclusion. Our results suggest that reducing time spent using digital media and potentially substituting this time by reading books, which seem to be a safe alternative, is a valid solution to reduce some common aspects of poor sleep in preschoolers.

Keywords

Circadian clocks · Questionnaires · Sex · Sleep initiation and maintenance disorders · Fear

Digitale Medien, Lesen von Büchern und Aspekte von Schlaf und schlafbezogenen Ängsten bei Vorschulkindern: die Ulmer SPATZ Gesundheitsstudie

Zusammenfassung

Hintergrund. Die extensive Nutzung digitaler Medien mit Bildschirmgeräten führt zu gesundheitsschädigenden Effekten bei Kindern und Jugendlichen. Doch ist einiges an bisheriger Evidenz durch die letzten 10 Jahre schnellen Wandels im Umgang der Gesellschaft mit digitalen Medien schon überholt.

Material und Methoden. In dieser Arbeit werden Daten über die Nutzung digitaler Medien und das Lesen von Büchern bei 4- bis 6-Jährigen vorgestellt, die 2016–2019 in der längsschnittlichen Ulmer SPATZ Gesundheitsstudie erhoben wurden. Diese Daten wurden ergänzt um die Exploration der Zusammenhänge zwischen kindlicher digitaler Mediennutzung sowie Bücherlesen

einerseits und Aspekten des kindlichen Schlafs und schlafbezogener Ängste andererseits.

Ergebnisse. Nach Bereinigung lagen Daten von 581 Kindern im Alter von 4 Jahren vor. Für ein Alter von 5 bzw. 6 Jahren lagen Daten für 508 bzw. 426 Kinder vor. Das mittlere Alter der Mütter bei Geburt der Kinder war 33 Jahre; 70% der Mütter hatten Abitur. Die digitale Mediennutzung erfolgte meist passiv vor einem Bildschirm, die tägliche Nutzungsdauer stieg mit dem Alter der Kinder an. Es zeigte sich ein erhöhtes Risiko für die schlafbezogenen Ängste vor dem Alleinschlafen (relatives Risiko, RR: 1,35; 95%-Konfidenzintervall, 95%-KI: 1,07–1,70) und vor Dunkelheit (1,47; 95%-KI: 1,16–1,87) für die Nutzung aller Bildschirmmedien > Median vs.

≤ Median. Die stärkere Nutzung von Büchern, ebenfalls über und unter Median verglichen, war ansatzweise mit einer relevanten Risikoreduktion von 18% für diese beiden schlafbezogenen Ängste assoziiert (0,82; 95%-KI: 0,65–1,03; bzw. 0,82; 95%-KI: 0,64–1,05).

Schlussfolgerung. Die vorliegenden Ergebnisse deuten darauf hin, dass eine Reduktion der Nutzungsdauer digitaler Medien und ggf. eine Substitution dieser Zeit mit Bücherlesen als offenbar sicherer Alternative eine valide Lösung zur Reduktion schlafbezogener Ängste bei Vorschulkindern ist.

Schlüsselwörter

Zirkadiane Uhren · Fragebögen · Geschlecht · Ein- und Durchschlafstörungen · Angst

<2h/day, 2 to <3h/day, 3 to <4h/day, and ≥4h/day. Values of time spent watching TV or DVD or using the computer or internet passively were aggregated and labelled as "TV/screen" whereas active video gaming was considered separately and labelled "gaming." Both together were labelled and analyzed as "all digital media." The categories were irrespective of the end device, i.e., the use of, e.g., a tablet, smartphone, or monitor/TV screen. Furthermore, the time spent

on self or parent-assisted book reading was analyzed separately and labelled as "books." Supplementary Table 1 reports the items investigating digital media use and book reading.

Statistical methods

All descriptive evaluations were stratified by sex and age. Digital media use and book reading were also described separately for weekdays and weekends. Values for time spent with "TV/screen,"

"gaming," "all digital media," and "books" were reported by averages and the upper 95th centile. Independent-sample Mann–Whitney U test was used to compare the sexes at different timepoints. For this comparison, a type-I error rate of 5% was considered as statistically significant. The percentages of time spent on different activities by time of the day were reported for weekdays and weekends using pie charts. Responses to the four selected items of the CSHQ

Fig. 2 ▲ Percentages of time spent with different activities during morning, afternoon, and evening (all digital media and book reading)

were reported by age and sex using bar charts. A correspondence analysis was applied to investigate the joint association of “books” and “all digital media” on the aforementioned sleeping features and sex. To this end, we first defined an indicator matrix of the median time spent with “books” and “all digital media” during weekdays and at weekends. This indicator matrix was transformed into a Burt matrix and then analyzed using a multiple correspondence analysis. Afterwards, children’s sleeping features, aggregating “sometimes” and “usually” levels into “yes” and labelling “rarely” as “no,” and sex were passively plotted over the dimension defined by the correspondence analysis. Finally, a generalizing estimating equation (GEE) based on a binomial model was used to compute relative risks for all four sleep problems, comparing levels of “books” and “all digital media” averaged over weekdays and weekends. These models were adjusted for sex and subsequently

stratified by sex. The sleep problems outcome of the logistic model was again coded according to the “sometimes” and “usually” levels vs. the level “rarely.” All statistical evaluations were performed using R version 3.6 (R: A language and environment for statistical computing; R Foundation for Statistical Computing, Vienna, Austria; <https://www.R-project.org/>). The packages GEE and FactoMineR were used to perform GEE fitting and correspondence analyses, respectively.

Results

After exclusion of missing records and inconsistencies, 581 children (291 [50%] boys) participated at the age of 4 years. At the ages of 5 and 6 years, data were available for 508 participants (259 [51%] boys) and 426 participants (211 [50%] boys), respectively (a flowchart of participant selection is reported in Supplementary Fig. 1). The median age of the mothers

was 33 years (range 21–54 years), approximately 70% had graduated from high school, and 11% of the mothers had an independent or high-profile/leadership job (Fig. 1).

Most time spent with digital media use was represented by time spent with passive activities in front of a screen. We also observed that time spent with digital media use increased with child age. There were no substantial differences between boys and girls at the ages of 4 and 5 years. In contrast, we found a statistically significant difference at the age of 6 years with girls spending 30 min/day more compared to boys on a weekday and 75 min/day more compared to boys on weekends. Moreover, we observed a larger use of digital media at weekends compared to weekdays in both boys and girls, with a difference of 20, 24, and 54 min at the ages of 4, 5, and 6 years, respectively. In boys, these differences were 20, 25, and 31 min, whereas the values were higher in girls, especially at age

Fig. 3 ▲ Distribution of items on sleep-related fears from the Children's Sleep Habits Questionnaire

6 years, with 21, 33, and 76 min, respectively. We also detected that a comparable amount of time was spent with “books” when compared to “all digital media” at ages 4 and 5 years, both for boys and girls and during weekdays and at weekends. This shifted at age 6 years, when more time at the weekend was spent with “all digital media” compared to “books,” especially in girls. The time spent on different media activities between 4 and 6 years of age is reported in [Fig. 1](#) for boys and girls separately. Investigating the timing across the day, time spent passively with “TV/screen” and on “book reading” had a similar pattern, with less time spent on these activities in the morning compared to the evening (Supplementary Fig. 2).

On the contrary, more time was spent with “gaming” during the afternoon. No particular patterns were observed at different ages, or by sex, or during weekdays and at weekends, apart from a higher use of “all digital media” and “books” in the mornings of weekends ([Fig. 2](#), Supplementary Fig. 3).

Concerning sleep problems, a similar pattern of frequency of fears and tendency to wake up at night was found for boys and girls at 4 years of age. In particular, at 4 years of age, 40% of boys and 38% of girls usually need their parents to fall asleep. About 10 and 13% of boys and girls usually feared the dark or feared sleeping alone, respectively. Finally, 26% of the boys and 24% of the girls usually woke up at night. The need for parents in the room to fall asleep decreased with age in both boys and girls. At 6 years of age, 24% of the boys and 23% of the girls needed their parents to fall asleep. The frequency of waking up at night also decreased over time, down to 16% of the boys and 10% of the girls usually waking up at 6 years of age. In contrast, fears increased with age, with 18% of the boys and 20% of the girls usually having a fear of the dark at the age of 6 years. The distribution of items regarding sleep-related fears is reported in [Fig. 3](#).

The correspondence analyses of “books” and “all digital media” resulted in two well-defined dimensions. The

first dimension separates high exposure to “all digital media” and low exposure to “books” from low exposure to “all digital media” and high exposure to “books.” This first dimension results in an explained variance of 53.5%, 50.2%, and 50.0% at the ages of 4, 5, and 6 years, respectively. The second dimension separates low exposure from high exposures to both “all digital media” and “books,” explaining the remaining 46.5%, 49.8%, and 50% of variance at the age of 4, 5, and 6 years, respectively. The three sleep-related fears (fear of the dark, fear of sleeping alone, and need of parent to fall asleep) cluster together at 4 years of age. They were related to higher exposure to “all digital media” and were apparently more common in girls. At the ages of 5 and 6 years, these relations are maintained for the fear of sleeping alone and fear of the dark. On the contrary, the need of parents to fall asleep appears to be a more independent factor at the ages of 5 and 6 years. The correspondence analysis also showed that waking up during night was more

Fig. 4 ▲ Correspondence analysis of media use (all media) and book reading: $\lambda_{1,2}$ percentage of explained variance by the first and second dimension, respectively; dotted arrows directions related to more/less use of digital media or book reading; ellipses clustering of sleep-related fear items and their correspondence with children's sex; PFA need of parent to fall asleep; FSA fear of sleeping alone; FOD fear of the dark; WUN waking up in the night

common in boys, irrespective of age. Notably, this sleep problem appears to be related to higher exposure to “books” at age 4, while at 5 and 6 years of age, it is related to lower exposure to “books.” Results of correspondence analysis of digital media use and book reading in association with sleep-related fears are reported in **Fig. 4**.

Finally, the results from the GEE analyses adjusted for sex documented a statistically significantly increased risk of the fear of sleeping alone (relative risk [RR]: 1.35, [95% CI: 1.07; 1.70]) and fear of the dark (RR: 1.47 [95% CI 1.16; 1.87]) for exposure to “all digital media” higher than the median as compared to lower levels. Exposure to “books” above the median and compared to lower levels was tentatively associated with a relevant 18% reduction in the risk of both fear of sleeping alone and fear of the dark (RR: 0.82 [95% CI 0.65; 1.03] and RR: 0.82 [95% CI 0.64; 1.05], respectively). Similar results were obtained when the data were analyzed stratified by sex, with even stronger risk increases in boys (RR: 1.73 [95% CI 1.25; 2.38] and RR: 1.69 [95% CI

1.20; 2.39] for the fear of sleeping alone and fear of the dark, respectively).

Discussion

In the present work including $n = 581$ children aged 4 to 6 years recruited in the context of the Ulm SPATZ Health Study and located in the south of Germany, it was shown that more time is spent on digital media use and book reading at weekends compared to weekdays, which was also stated by previous studies in part including adolescents [15, 22]. Moreover, we found that girls have higher exposure to digital media use but also to book reading compared to boys of the same age. Of note, total time spent with digital media exceeds recommendations for this preschool age group but is moderate compared to studies conducted in other societies such as the US [28].

Furthermore, in our study, sleep-related fears are different in boys and girls and this difference increased with age. Moreover, waking up at night was more common in boys than in girls of the same age, with an increase in this difference between 4 and 5 years of age. Furthermore,

sleep-related fears were more common in girls than in boys of the same age. Also, we found that the need of parents to fall asleep is more frequent at 4 years of age, while its prevalence decreases with age irrespective of sex. However, to need a parent to fall asleep was stated as a criterion concerning childhood insomnia in the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5). Therefore, one may assume that about 25% of the children suffered from insomnia symptoms and might benefit from professional help.

Very importantly, we showed the relations of digital media use and book reading with sleep-related fears and waking up at night. In particular, we found that excessive digital media use may result in a higher risk of the fear of sleeping alone and fear of the dark, which was also stated by parents as an important reason for impaired sleep of young children [4]. On the contrary, we found a non-significant but suggestive association between book reading and a decreased risk of the fear of sleeping alone and fear of the dark. This might be in line with the finding that playing with activating toys is very

sleep disturbing, alongside anxiety and fears [4]. Notably, these associations were observed in mutually adjusted models showing their independence. There are numerous possible explanations for why digital media use may cause sleep-related fears, as shown in previous studies [20]. Excessive digital media use was suggested to be related to fear and anxiety through mechanisms mediated by a possible lack of emotion-regulation skills [21]. Also, digital media use without the presence of a parent could come with a lack of interaction and effective guidance, which, in turn, could lead to a lack of confidence or self-regard, predisposing to sleep-related fears [8]. In contrast, book reading, especially if assisted by the parents, could increase the child's self-confidence, leading to reduced sleep-related fears.

The current work has numerous strengths. Firstly, it employed a rigorous approach based on a prospective design in which data regarding sleep features were collected using a questionnaire validated for the German population. Secondly, the work was based on preschoolers,

a population of great epidemiological interest for which there is still a lack of scientific evidence regarding sleep-related fears in relation to digital media use. Thirdly, data on digital media use and book reading were explored, the latter seldom ascertained in studies on digital media use and sleep-related fears.

The current research could be improved by extension to other sleep disorder symptoms or disorders such as sleep onset delay or parasomnias such as nightmares. Moreover, the current work might be affected by measurement error and information bias, given the use of self-reported outcomes. The use of objectively assessed sleep outcomes would reinforce and improve the quality of the evidence provided; however, sleep-related fears are difficult if not impossible to ascertain objectively. Furthermore, the observational nature of the study and the cross-sectional assessment of results at different ages potentially permits reverse causation, which could, for instance, drive the association of book reading with waking up at night in 4-year-old boys. Finally, we only in-

vestigated sex-specific effects and did not explore relations with other potentially important factors such as socioeconomic status of the family. Therefore, residual confounding could have affected our results. However, in the present work we did not aim to accurately estimate causal associations; we merely sought to describe patterns of digital media use and book reading in contemporary data and to explore their potential association with common sleep-related problems in preschoolers.

Further studies, particularly with an experimental approach [24], considering objective measures of sleep such as actigraphy or polysomnography and possibly taking into account socioeconomic status [10] and other possible confounders are necessary to uncover the causal nature of the impact of digital media use and book reading on children's sleep. Until these are available, the current results suggest that reducing time spent using digital media—and potentially substituting this time by reading books, which seem to be a safe alternative—is a valid solution

Hier steht eine Anzeige.

to reduce some common aspects of poor sleep in preschoolers.

Conclusion

Book reading should be promoted to entertain children by specific public health programs and campaigns in schools. On the other hand, scientific research should focus on valid experimental studies based on objectively assessed methods.

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Compliance with ethical guidelines

Conflict of interest. C. Ricci, A. A. Schlarb, D. Rothenbacher, and J. Genuneit declare that they have no competing interests.

For this article no studies with human participants or animals were performed by any of the authors. All studies performed were in accordance with the ethical standards indicated in each case.

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References

- Ashton JJ, Beattie RM (2019) Screen time in children and adolescents: is there evidence to guide parents and policy? *Lancet Child Adolesc Health* 3:292–294. [https://doi.org/10.1016/S2352-4642\(19\)30062-8](https://doi.org/10.1016/S2352-4642(19)30062-8)
- Auhuber L, Vogel M, Grafe N et al (2019) Leisure activities of healthy children and adolescents. *Int*

- J Environ Res Public Health*. <https://doi.org/10.3390/ijerph16122078>
- Bartel KA, Gradisar M, Williamson P (2015) Protective and risk factors for adolescent sleep: a meta-analytic review. *Sleep Med Rev* 21:72–85. <https://doi.org/10.1016/j.smrv.2014.08.002>
- Belmon LS, Busch V, van Stralen MM et al (2020) Child and parent perceived determinants of children's inadequate sleep health. A concept mapping study. *Int J Environ Res Public Health* 17:1583. <https://doi.org/10.3390/ijerph17051583>
- Belmon LS, van Stralen MM, Busch V et al (2019) What are the determinants of children's sleep behavior? A systematic review of longitudinal studies. *Sleep Med Rev* 43:60–70. <https://doi.org/10.1016/j.smrv.2018.09.007>
- Busch V, Altenburg TM, Harmsen IA, Chinapaw MJ (2017) Interventions that stimulate healthy sleep in school-aged children: a systematic literature review. *Eur J Public Health* 27:53–65. <https://doi.org/10.1093/eurpub/ckw140>
- Cain N, Gradisar M (2010) Electronic media use and sleep in school-aged children and adolescents: a review. *Sleep Med* 11:735–742. <https://doi.org/10.1016/j.sleep.2010.02.006>
- Campbell SB (1995) Behavior problems in preschool children: a review of recent research. *J Child Psychol Psychiatry* 36:113–149. <https://doi.org/10.1111/j.1469-7610.1995.tb01657.x>
- Canadian Paediatric Society, Digital Health Task Force (2017) Screen time and young children: promoting health and development in a digital world. *Paediatr Child Health* 22:461–477. <https://doi.org/10.1093/pch/pxx123>
- Cartanya-Hueso A, Lidón-Moyano C, González-Marrón A et al (2020) Screen time use and sleep in children: are there differences among social classes? *Sleep Med* 68:153. <https://doi.org/10.1016/j.sleep.2019.12.006>
- Cartanya-Hueso A, Lidón-Moyano C, Martín-Sánchez JC et al (2020) Association of screen time and sleep duration among Spanish 1–14 years old children. *Paediatr Perinat Epidemiol*. <https://doi.org/10.1111/ppe.12695>
- Carter B, Rees P, Hale L et al (2016) Association between portable screen-based media device access or use and sleep outcomes: a systematic review and meta-analysis. *JAMA Pediatr* 170:1202–1208. <https://doi.org/10.1001/jamapediatrics.2016.2341>
- Council on Communications and Media (2016) Media and young minds. *Pediatrics* 138:e20162591. <https://doi.org/10.1542/peds.2016-2591>
- Duch H, Fisher EM, Ensari I, Harrington A (2013) Screen time use in children under 3 years old: a systematic review of correlates. *Int J Behav Nutr Phys Act* 10:102. <https://doi.org/10.1186/1479-5868-10-102>
- Engberg E, Figueiredo RAO, Rounge TB et al (2020) Heavy screen use on weekends in childhood predicts increased body mass index in adolescence: a three-year follow-up study. *J Adolesc Health* 66:559–566. <https://doi.org/10.1016/j.jadohealth.2019.09.002>
- Garrison MM, Liekweg K, Christakis DA (2011) Media use and child sleep: the impact of content, timing, and environment. *Pediatrics* 128:29–35
- Genuneit J, Brockmann PE, Schlarb AA, Rothenbacher D (2018) Media consumption and sleep quality in early childhood: results from the Ulm SPATZ Health Study. *Sleep Med* 45:7–10. <https://doi.org/10.1016/j.sleep.2017.10.013>
- Gießelmann K (2018) Kindesgesundheit: Medienkompetenz fördern. *Dtsch Arztebl Int* 115:A-422
- Hale L, Kirschen GW, LeBourgeois MK et al (2018) Youth screen media habits and sleep: sleep-friendly screen behavior recommendations for clinicians, educators, and parents. *Child Adolesc Psychiatr Clin N Am* 27:229–245. <https://doi.org/10.1016/j.chc.2017.11.014>
- Harrison K, Cantor J (1999) Tales from the screen: Enduring fright reactions to scary media. *Media Psychol* 1:97–116
- Hoge E, Bickham D, Cantor J (2017) Digital media, anxiety, and depression in children. *Pediatrics* 140:S76–S80
- Jago R, Thompson JL, Sebire SJ et al (2014) Cross-sectional associations between the screen-time of parents and young children: differences by parent and child gender and day of the week. *Int J Behav Nutr Phys Act* 11:54. <https://doi.org/10.1186/1479-5868-11-54>
- Janssen X, Martin A, Hughes AR et al (2019) Associations of screen time, sedentary time and physical activity with sleep in under 5s: a systematic review and meta-analysis. *Sleep Med Rev*. <https://doi.org/10.1016/j.smrv.2019.101226>
- LeBourgeois MK, Hale L, Chang A-M et al (2017) Digital media and sleep in childhood and adolescence. *Pediatrics* 140:S92–S96. <https://doi.org/10.1542/peds.2016-1758J>
- Manz K, Schlack R, Poethko-Müller C et al (2014) Physical activity and electronic media use in children and adolescents: results of the KiGGS study: first follow-up (KiGGS wave 1). *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 57:840–848. <https://doi.org/10.1007/s00103-014-1986-4>
- Martin KB, Bednarz JM, Aromataris EC (2020) Interventions to control children's screen use and their effect on sleep: a systematic review and meta-analysis. *J Sleep Res*. <https://doi.org/10.1111/jsr.13130>
- Owens JA, Spirito A, McGuinn M (2000) The Children's Sleep Habits Questionnaire (CSHQ): psychometric properties of a survey instrument for school-aged children. *Sleep* 23:1043–1051
- Przybylski AK (2019) Digital screen time and pediatric sleep: evidence from a preregistered cohort study. *J Pediatr* 205:218–223.e1. <https://doi.org/10.1016/j.jpeds.2018.09.054>
- Saunders TJ, Vallance JK (2017) Screen time and health indicators among children and youth: current evidence, limitations and future directions. *Appl Health Econ Health Policy* 15:323–331. <https://doi.org/10.1007/s40258-016-0289-3>
- Sauseng W, Sonleitner A, Hofer N et al (2017) Empfehlungen zur Regulierung von Bildschirmzeiten im Kindes- und Jugendalter: Konsensuspapier der Arbeitsgruppe Schlafmedizin und Schlafforschung der Österreichischen Gesellschaft für Kinder- und Jugendheilkunde. *Monatsschr Kinderheilkd* 165:254–256. <https://doi.org/10.1007/s00112-016-0201-0>
- Schlarb AA, Schwerdtle B, Hautzinger M (2010) Validation and psychometric properties of the German version of the Children's Sleep Habits Questionnaire (CSHQ-DE). *Somnol Schlafforsch Schlafmed* 14:260–266. <https://doi.org/10.1007/s11818-010-0495-4>
- Stiglic N, Viner RM (2019) Effects of screentime on the health and well-being of children and adolescents: a systematic review of reviews. *BMJ Open* 9:e23191. <https://doi.org/10.1136/bmjopen-2018-023191>

-
33. Thomas G, Bennie JA, De Cocker K et al (2020) A descriptive epidemiology of screen-based devices by children and adolescents: a scoping review of 130 surveillance studies since 2000. *Child Indic Res* 13:935–950. <https://doi.org/10.1007/s12187-019-09663-1>
 34. Touitou Y, Touitou D, Reinberg A (2016) Disruption of adolescents' circadian clock: the vicious circle of media use, exposure to light at night, sleep loss and risk behaviors. *J Physiol Paris* 110:467–479. <https://doi.org/10.1016/j.jphysparis.2017.05.001>
 35. Zhang Z, Sousa-Sá E, Pereira JR et al (2020) Correlates of sleep duration in early childhood: a systematic review. *Behav Sleep Med*. <https://doi.org/10.1080/15402002.2020.1772264>

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