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Sleep Duration Does Not Mediates the Association between Screen Time and Adolescent Depression and Anxiety: Findings from the 2018 National Survey of Children's Health

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Abstract

Objective/Background: Adolescence is a crucial time period in which individuals are at high risk for depression and anxiety. Associations between screen time and adolescent depression and anxiety have been inconclusive. We examined 1) the associations of screen time with adolescent depression and anxiety and 2) whether sleep duration mediates these relationships.

Methods: This study utilized data from the 2018 U.S. National Survey of Children's Health, a large cross-sectional population representative dataset with parent/caregiver responses. Multivariable logistic regression was used to estimate the associations between screen time and depression and anxiety in separate models. Path models were used to test the mediating role of sleep duration. Confounders, as sex, age, and sociodemographic variables were included in our adjusted models.

Results: Data of 10,907 adolescents aged 13 to 17 were included in this study. The average screen time was 3.76 hours daily. Compared to no screen time, adolescents who used over 4 hours of screen time per day had higher odds of depression (OR=2.23, 95% CI:1.27 – 3.91) and anxiety (OR=1.85, 95% CI: 1.26 – 2.72). Sleep duration did not mediate the associations between screen time and depression and anxiety.

Conclusions—Further research is necessary to examine the associations of screen time content with depression and anxiety, as well as the effects of sleep quality in conjunction with sleep duration on the relationships of screen time and depression and anxiety.

Conflict of Interest: None declared.

Keywords

sleep duration; adolescents; anxiety; depression; screen time

1. Introduction

Adolescence is a vulnerable period in which developing and maintaining healthy social and emotional habits are important for mental health and well-being. This crucial period when there are tremendous changes places adolescents at high-risk for mental health conditions. It is estimated that half of all mental health conditions begin by 14 years of age but are often not detected or treated [1]. Depression is one of the leading causes of illness and disability as well as the most common mental health disorder among adolescents [2]. In the United States, a staggering 2.3 million or 9.4% of adolescents aged 12 to 17 years of age had at least one major depressive episode [3]. Depression can manifest during early adolescence [4], with the prevalence increasing during this period [5], and may recur during adulthood [6]. Furthermore, depression can lead to poorer outcomes including academic achievement, cognitive development, and social skills [7] as well as lead to high-risk behaviors, such as suicide [8], drug and alcohol abuse [9].

Depression and anxiety disorders in adolescence are highly comorbid, whether concurrently or sequentially, and may increase the risk of one another over time [10]. Some studies have identified that anxiety disorders are the most common mental health conditions among adolescents, with a lifetime prevalence rate estimated at 31.9% [10]. Additionally, anxiety disorders affect about 2–7% of the child and adolescent populations [10]. Anxiety disorders often begin during childhood [1] and may predict future recurrence, as well as other mental health issues including, depression, and substance use disorders [11–14]. Since both adolescent anxiety and depression are associated with poorer health outcomes and increased health care utilization [15, 16], it is critical to not only diagnose and manage these mental health conditions early but also identify predictors associated with these conditions.

Screen-based technology is rapidly evolving. While traditional screen time once consisted of television viewing and videogame playing, it now includes a plethora of content and through several types of devices, including cell phones, computers, and tablets. Based on a 2016 population-based study, it was estimated that U.S. adolescents aged 14–17 years spent approximately 4.59 hours on recreational screen time each day [17]. Another study in 2010 highlighted that adolescents spend over 7 hours on screen time [18]. While the American Academy of Pediatrics (AAP) does not have specific recommendations on time spent on electronic devices, they recommend that consistent limits are placed on screen time and media use [19]. Additionally, the AAP warns that screen time should not take the place of experiences and behaviors essential to physical and mental health, including adequate sleep [19].

Research on screen time as a risk factor for adolescent depression and anxiety has been inconclusive. While most studies have documented significant associations between screen time and anxiety and depression [15, 20–23], some have identified no associations [24, 25], negative associations, or even positive associations [26–28] with more screen time on overall

mental health and well-being. Thus, it is imperative to clarify screen time as a predictor for adolescent mental health conditions since screen-based technologies are ever changing and excessive screen time can replace adolescent experiences and peer relationships, which have been reported beneficial for adolescent health [29].

The association between screen time with depression may be mediated through sleep duration [30]. However, the role of sleep as a mediator of the associations of screen time and anxiety are less clear. The AAP recommends that adolescents aged 13 to 18 years of age sleep for 8 to 10 hours each night [31], but sleep may be disrupted and substituted by increased use of screen time [32]. Forty-four percent of parents were concerned that their children had inadequate sleep on weekdays and 56% of parents reported that their adolescents (15 to 17 years of age) slept for less than 7 hours each night [33]. Research has shown that screen time can have negative impacts on sleep [34], while sleep has been reported to be associated with depression [35, 36] and anxiety [37]; therefore, sleep may play a mediating role between the associations of screen time and depression and anxiety. This study aims to 1) examine the associations of recreational screen time (time spent using a device that does not promote activity or have an educational component) with depression and anxiety in separate models and 2) test whether sleep mediates the associations between screen time with depression and anxiety. To our knowledge, our study is the first to explore the mediating role of sleep on screen time and two mental health outcomes, depression and the less studied anxiety, in separate models, utilizing a large population-representative sample.

2. Methods

2.1. Participants

The U.S. National Survey of Children's Health (NSCH) is a large cross-sectional population representative dataset that is designed to evaluate the well-being and physical and emotional health of U.S. children from 0 to 17 years of age in all 50 states. The 2018 NSCH was conducted by the Centers for Disease Control's National Center for Health Statistics. Households were contacted by random mailing to identify households with one or more children between 0 and 17. One child was randomly selected for the survey if households had more than one child. A parent or caregiver provided responses either online or on a paper. A total of 30,540 surveys were completed, with an overall weighted response rate of 43.1%. The public use dataset is available at the Data Resource Center for Child and Adolescent Health (DRC) website at http://www.childhealthdata.org.

2.2. Measures

2.2.1. Independent Variable—Screen time was measured by using the questions pertaining to time spent watching TV or videos and time spent using electronic devices. Screen time was obtained from the question "ON MOST WEEKDAYS, about how much time did this child spend in front of a TV, computer, cellphone or other electronic device watching programs, playing games, accessing the internet or using social media?" Responses were categorized as: less than "1 hour," "1 hour," "2 hours," "3 hours," and "4 or more hours."

2.2.2. Dependent Variables

2.2.2.1.   Depression: Depression was ascertained through the question "Has a doctor or health professional ever told you that your child has depression?" Estimates included "yes" and "no" responses while responses of "don't know" or "refused" were excluded.

2.2.2.2.   Anxiety: Anxiety was obtained similarly, through the question "Has a doctor or health professional ever told you that your child has anxiety problems? Estimates included "yes" and "no" responses while responses of "don't know" or "refused" were excluded.

2.2.3.   Mediating variable—Sleep duration was obtained from the question "During the past week, how many hours of sleep did this child get on most weeknights?" Responses were categorized as "less than 6 hours", "6 hours," "7 hours," "8" hours," "9 hours," "10 hours," and "11 hours."

2.2.4.   Confounders—The following confounders were included in our study: sex (male or female); age; federal poverty level (FPL; 0–99% FPL, 100–199% FPL, 200–399% FPL, 400% FPL or greater); insurance type (public insurance, private insurance, both private and public, and uninsured); parent education (less than high school, high school graduate, or more than high school); primary language spoken at home (English or other); race/ethnicity (Hispanic; White, Non-Hispanic; Black, Non-Hispanic; Asian, Non-Hispanic; and Other, Non-Hispanic); household generational status (1st, 2nd, 3rd generation, and other); and family structure (two biological or adoptive parents, two parents with one step-parent, single parent, grandparent and other family type).

Comorbid (medical and behavioral) conditions were included in our analyses. Conditions as brain injury, intellectual disability, cerebral palsy, autism, behavior problems, and ADD/ADHD were measured by the questions: 1) "Has a doctor or other health care provider EVER told you that this child has…" and 2) "If yes, does this child CURRENTLY have the condition? The responses were categorized as "yes" and "no." Additionally, medications for emotions/behavior were included in our study. These medications were asked by the question: DURING THE PAST 12 MONTHS, has this child taken any medication because of difficulties with his or her emotions, concentration, or behavior?" The responses were categorized as "yes" and "no."

2.3.   Statistical Analyses

Data were analyzed using STATA v15.0 [38]. Differences in characteristics of the adolescents by screen time were assessed using the Chi-square test. The prevalence of depression was generated by comorbid conditions as well as emotional/behavioral medications.

Multivariable logistic regression to estimate the relationships between screen time (independent variable) and the mental health outcomes, depression and anxiety (dependent variables), from which estimated odds ratios (ORs) with 95% confidence intervals (CIs) are presented. We presented 3 models adjusting for confounders. The first model adjusted for age, and sex. The second model additionally adjusted for sociodemographic status, including

poverty level, insurance type, parent education. Lastly, the third model additionally adjusted for primary language spoken at home, household generation, family structure, race/ethnicity, comorbid conditions, and emotional/behavioral medications.

The examination of the mediating role of sleep duration between screen time and the mental health outcomes, adjusting for all confounders, was conducted with path models. We followed a two-step procedure to test for mediation, which requires significant associations between 1) the independent variable (predictor) and mediating variable and 2) the mediating variable and dependent variable (outcome) adjusting for the independent variable (predictor) [39]. Estimations were calculated using the Paramed command in STATA v15.0 to measure mediating effects [40]. 2.7% of cases were removed through listwise deletion, and missing data was not replaced. The indirect effects of screen time and depression were determined using the bias-corrected bootstrap 95% CI in 1,000 samples. Figure 1 shows the complete model with sleep duration as the mediating variable, screen time as the predictor, and depression as the dependent variable. Figure 2 shows the complete model with sleep duration as the mediating variable, screen time as the predictor, and anxiety as the dependent variable.

3. Results

Data from 10,907 adolescents between the ages of 13 to 17 were included in this study. In this cohort of adolescents aged 13–17 years of age, the participants were primarily White, Non-Hispanic, English speaking, 3rd generation, from a two-parent household, had 400% FPl or greater, received public insurance, and had parents who had a high school education or higher. Descriptive characteristics of the adolescents in this study are described in Table 1. The Chi-square p-values indicate that all characteristics, except sex, were associated with screen time. Furthermore, the average screen time was 3.76 hours (standard deviation=1.12). Figure 3 shows the distribution of screen time based on age.

Tables 2 and 3 show the prevalence of depression and anxiety, respectively by comorbidities (medical and behavioral conditions) and emotional and behavioral medications. The prevalence of depression among this cohort of 13 to 17 year old adolescents was 8.64%. The prevalence of anxiety among this cohort was 14.3%. Additionally, while 8,902 participants (83.6%) did not have any comorbid conditions, 1,740 (16.4%) had one or more comorbid conditions. One thousand five hundred and sixty three participants (14.5%) were taking emotional/behavior medications, with over two thirds of the depressed participants (68.4%) taking these medications and over half of the anxious participants (56.2%) taking these medications.

Table 4 shows the associations between screen time and depression and anxiety. In separate models, adolescents who used screen time for 4 or more hours were associated with an increased odds of depression and anxiety. In the fully adjusted model, adolescents using 4 or more hours of screen time, compared to less than 1 hour of screen time, had a 2.23 times odds (95% CI: 1.27 to 3.91) of having depression and 1.85 times odds (95% CI: 1.26 to 2.72) of having anxiety. The associations were attenuated by the addition of more covariates as seen in Models 2 and 3.

For our depression outcome, screen time was significantly associated with sleep duration (path a; β=−0.022, 95% CI: −0.040 to −0.003) using the ordinary least squares regression model. Sleep duration was significantly associated with depression (path b; OR=0.828, 95% CI: 0.780 to 0.879) using a logistic regression model. Table 5 shows the total, direct, and indirect effects of screen time and depression using mediation analysis. The total effect from screen time to depression was statistically significant (OR=1.347, p<0.001) while the direct path from screen time to depression was slightly diminished yet remained significant (OR=1.345, p=0.374) and the indirect path from screen time to depression was not significant (OR=1.001, p=0.374). Therefore, sleep duration did not play a mediating role in the relationships of screen time and depression.

Similarly, for our anxiety outcome, screen time was significantly associated with sleep duration (path a; β=−0.022, 95% CI: −0.040 to −0.003) using the ordinary least squares regression model. Sleep duration was significantly associated with depression (path b; OR=0.914, 95% CI: 0.871 to 0.958) using a logistic regression model. Table 6 shows the total, direct, and indirect effects of screen time and anxiety using mediation analysis. The total effect from screen time to anxiety was statistically significant (OR=1.230, p<0.001) as well, and the direct path from screen time to anxiety was slightly diminished and significant (OR=1.229, p<0.001) and the indirect path from screen time depression was not significant (OR=1.001, p=0.386). Thus, sleep duration did not play a mediating role in the relationships of screen time and anxiety.

4. Discussion

In this large population-representative U.S. cohort, adolescents averaged over 3 hours of screen time per weekday, 8.6% of adolescents had depression, and 14.3% of adolescents had anxiety. Only the associations of screen time of 4 or more hours per day with depression and anxiety were statistically significant. There was a negative association between screen time and sleep, such that more screen time was associated with less sleep. Furthermore, more sleep was associated with a lower odds having depression and anxiety. However, sleep duration did not play a mediating role in the associations between screen time and our mental health outcomes, depression and anxiety.

There are several psychosocial reasons for our findings. With limited exposure or exposure in moderation, adolescents can possibly benefit from devices and screen time. With controlled or limited exposure, adolescents are perhaps spending their time wisely on viewing more positive, protective content. However, as screen time increases, adolescents may begin to displace healthy habits, such as sleep, reading, physical activity, and physical social interactions, with screen time. Adolescents who use more screen time may also have a tendency to self-isolate [41], which may result in a higher risk for depression and anxiety. There is also the possibility that this increased risk for depression and anxiety may lead to more screen time, as evidenced by Houghton et al.'s (2018) study on the reciprocal relationships between depressive symptoms and screen use [42]. Our findings that screen time in moderation is protective in some models is consistent with findings from a few studies [26, 27], whereas findings that increased screen time predict depression and anxiety are more strongly supported [43]. Furthermore, increased screen time may expose

adolescents to more negative content, such as cyberbullying [44], that can affect their mental health. Nonetheless, one recent study by Orben and Przybylski (2019) found that although a relationship exists between screen use and psychological well-being, the association is small, explaining no more than 0.4% of the variation of well-being [45]. As such, our findings suggest that the AAP consider providing more guidance on screen time as parents and guardians may not always be able to monitor their adolescents' exposure to negative, harmful content. Our findings also suggest that parents and guardians should be educated about the risk for depression when their adolescents spend more than 4 hours a day on their screens.

Additionally, our findings support the AAP recommendations that adolescents sleep more than 8 or more hours nightly [31]. Consistent with previous studies, relationships exist among screen time and sleep duration [46], and sleep duration with depression and anxiety [47, 48]. While our study did not examine at what times during the day the adolescents were engaging in screen time, this factor may play an important role in sleep duration. Previous studies have reported negative effects of adolescents using screen time 30 minutes to 2 hours before bedtime, which can contribute to delayed bedtimes [25] and both reduced and worse sleep [32]. Additionally, screen time on social media and internet surfing had the strongest associations with poor sleep [49]. Therefore, further investigation into screen time content, screen time duration in relation to bedtime, and poor sleep is warranted. Furthermore, since sleep deprivation can have a reciprocal relationship with adolescent depression and its related symptoms [48], which our study was unable to assess for due to its cross-sectional design, considerations for future longitudinal studies to clarify these relationships are necessary. However, unlike previous studies on adolescent depression [41] and psychological symptoms [32], sleep duration as a mediating role between screen time with depression and anxiety was not supported by our study findings. As such, there may be other mediating variables associated with screen time and depression and anxiety as sleep partially mediated the associations of screen time and depression in these previous studies [25, 30, 50] Further, the relationships between screen time and depression and anxiety are complex, as these previous studies included sleep quality and its interactions with sleep duration and sleep onset difficulties in their models."

While this study is population-representative with a large sample size and caregiver-reported diagnoses of both adolescent anxiety and depression, as opposed to the use of screening tools, there are some limitations. First, all variables in this study are caregiver-reported, which can introduce bias. As opposed to adolescent self-report, caregivers may underestimate the number of hours spent on screen time as well as misreport of sleep duration. Second, the questions pertaining to depression and anxiety were asked in such a way that medical diagnoses were implied. However it is unclear how the children were diagnosed since parents were asked whether they were ever told by a healthcare provider their child has depression. Furthermore, caregivers may under-report symptoms and behaviors to health care providers due to the stigma on mental illness,[44] resulting in misdiagnosis or lack of diagnosis, leading to under-reporting on the NSCH. Third, screen time was limited to one question and did not differentiate among the devices, while media content was not elicited in the 2018 NSCH survey as in other studies [32]. Nonetheless, the relationship between screen time and mental health outcomes is crucial to examine as a

prerequisite for further investigation of content. Fourth, screen time and sleep were limited to weekdays, so weekend activity is unknown. However, investigating weekday screen time in previous studies have shown similar results [17, 28], and increased weekday screen time can replace weekday sleep, disrupt sleep patterns, educational activities, and physically activity, all of which are associated with mental health and well-being. Fifth, sleep quality was not assessed as previous studies have shown that the sleep quality may both affect depression and anxiety [30, 37, 51]. Previous research has also shown that screen time has a negative impact on sleep duration, which could also impact depression and anxiety in adolescents. Lastly, this was a cross-sectional study, thus does not provide a temporal relationship between the variables. However, longitudinal studies have consistently shown that screen time and sleep leads to poorer mental health outcomes [30, 52] with few studies showing bidirectional relationships between screen time, sleep, and depression and anxiety [53]. Nevertheless, our findings have clinical implications. Health care providers should consider educating adolescents that increased screen time and less than the recommended 8 hours of sleep on weekdays are associated with depression and anxiety risk.

5. Conclusions

In summary, this study highlights that increased screen time and less sleep may contribute to poorer adolescent mental health outcomes. Since this is a period in which adolescents are at risk for depression and anxiety due to their development and social surroundings, it is critical that researchers continue to examine the relationships between screen-based technologies and content with sleep duration and quality as they relate to depression and anxiety. Sequentially, healthcare providers should consider educating adolescents and their families that excessive screen time can be detrimental to sleep and mental health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- There is conflicting evidence on the associations of screen time and depression and limited studies examining the relationships between screen time and anxiety in adolescents.

- Our study found that screen time greater than 4 hours per weekday is associated with adolescent depression and anxiety.

- Our study found that while sleep duration is associated with both our independent (screen time) and dependent (depression and anxiety) variables, sleep duration does not play a mediating role in these relationships.

Indirect effect

Mediator
Sleep duration

a

b

Independent
Variable
Screen time

Total effect

Dependent
Variable
Depression

Direct effect
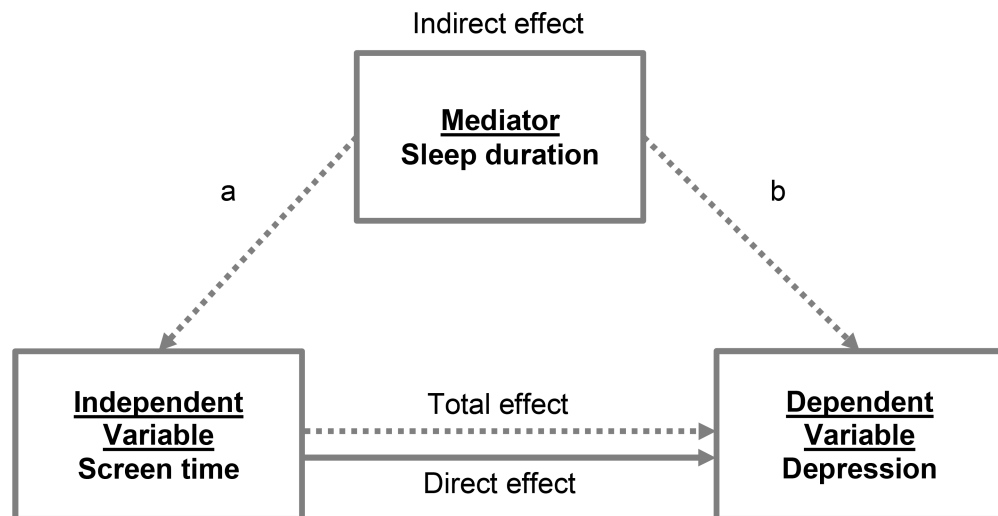
Figure 1. Mediation analysis.
The figure depicts the hypothesized relationship between screen time, sleep, and depression. a represents the "a" path and b represents the "b" path. Analysis adjusted for confounders (not shown) including sex, age, poverty level, insurance type, parent education, language spoken at home, race/ethnicity, household generation, family structure, comorbid conditions, and emotional/behavioral medications.
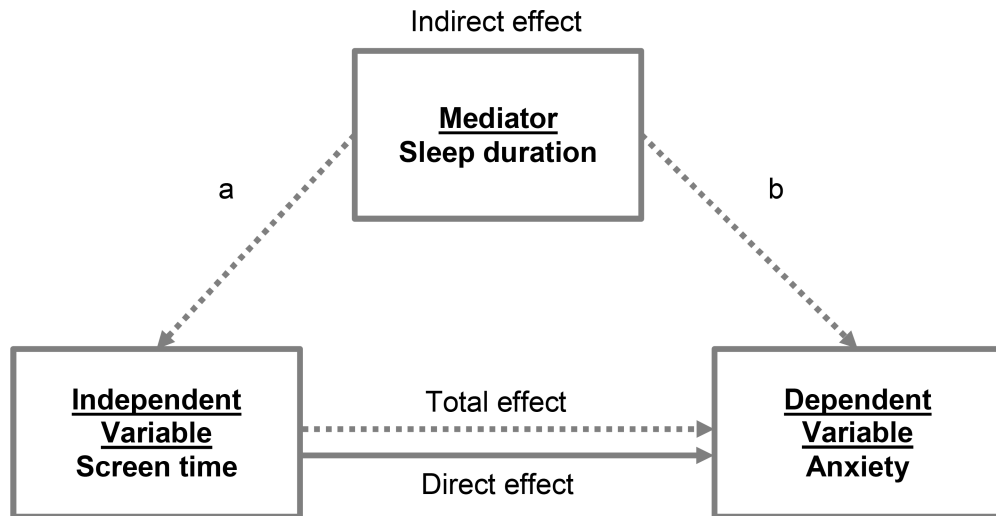
Figure 2. Mediation analysis.
The figure depicts the hypothesized relationship between screen time, sleep, and anxiety. a represents the "a" path and b represents the "b" path. Analysis adjusted for confounders (not shown) including sex, age, poverty level, insurance type, parent education, language spoken at home, race/ethnicity, household generation, family structure, comorbid conditions, and emotional/behavioral medications.

Figure 3. Average screentime by age.

Hours per weekday spent on screens by age (13–17 years). Error bars are ±1 SE.

Table 1.

Adolescent characteristics by screen time (hours per weekday) from the 2018 National Survey of Children's Health (NSCH) dataset

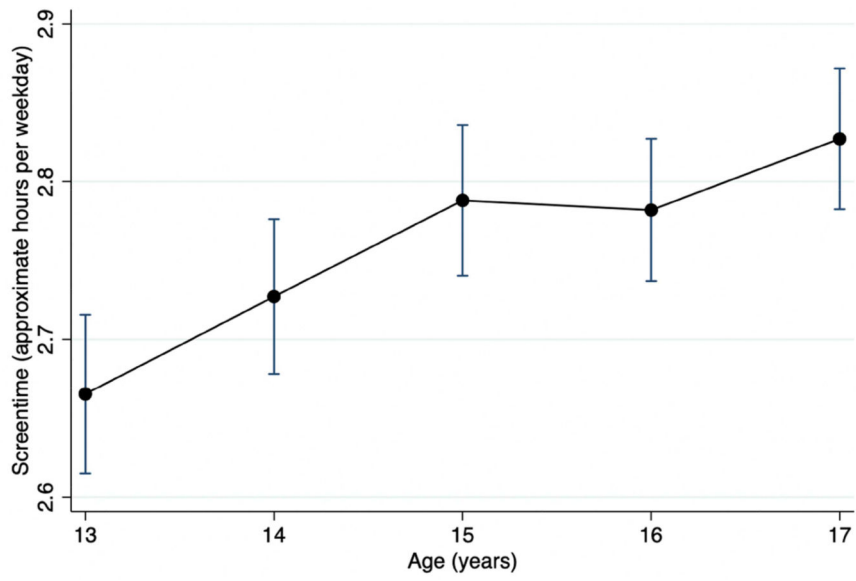| Characteristics | Screen time (hours per weekday) | | | | | | | | | | X^2 P-Value |
	Less than 1		1		2		3		4 or more		
	n	%	n	%	n	%	n	%	n	%	
Individual characteristics											
Sex											
Male	176	3.08	506	8.86	1615	28.28	1435	25.13	1978	34.64	0.006
Female	186	3.66	544	10.7	1420	27.93	1254	24.67	1680	33.04	
Race/Ethnicity											
Hispanic	50	4.13	123	10.15	320	26.40	291	24.01	428	35.31	<0.001
White, Non-Hispanic	225	2.95	756	9.92	2218	29.11	1931	25.34	2490	32.68	
Black, Non-Hispanic	32	4.48	52	7.28	163	22.83	174	24.37	293	41.04	
Asian, Non-Hispanic	26	4.90	66	12.43	146	27.50	109	20.53	184	34.65	
Other, Non-Hispanic	29	4.04	53	7.39	188	26.22	184	25.66	263	36.68	
Family characteristics											
Primary language spoken at home											
English	314	3.11	969	9.61	2855	28.31	2526	25.04	3422	33.93	<0.001
Other	44	6.70	77	11.72	166	25.27	148	22.53	222	33.79	
Household generation											
1 st generation	9	3.81	25	10.59	57	24.15	63	26.69	82	34.75	<0.001
2nd generation	68	4.64	162	11.06	405	27.65	332	22.66	498	33.99	
3rd generation	252	2.98	810	9.59	2423	28.67	2132	25.23	2833	33.53	
Other	28	5.48	41	8.02	119	23.29	128	25.05	195	38.16	
Family structure											
Two Parents	236	3.39	765	10.98	2067	29.68	1737	24.94	2160	31.01	<0.001
Two Parents (step-parent)	23	2.43	67	7.08	242	25.58	205	21.67	409	43.23	
Single Parent	72	3.10	172	7.41	598	25.75	599	25.80	881	37.94	
Grandparent	14	4.46	21	6.69	74	23.57	83	26.43	122	38.85	
Other	5	4.10	12	9.84	24	19.67	34	27.87	47	38.52	
Socioeconomic status											

Characteristics	Screen time (hours per weekday)										X² P-Value
	Less than 1		1		2		3		4 or more		
	n	%	n	%	n	%	n	%	n	%	
Poverty status (FPL [a])											
0–99% FPL	69	5.82	113	9.53	274	23.10	293	24.70	437	36.85	<0.001
100–199% FPL	63	3.70	151	8.87	466	27.36	406	23.84	617	36.23	
200–399% FPL	109	3.38	282	8.73	895	27.72	816	25.27	1127	34.90	
400% FPL or greater	121	2.59	504	10.78	1400	29.94	1174	25.11	1477	31.59	
Insurance type											
Private	76	4.15	152	8.29	448	24.44	464	25.31	693	37.81	<0.001
Public	218	2.78	787	10.03	2294	29.25	1978	25.22	2566	32.72	
Both Private and Public	17	3.96	29	6.76	123	28.67	99	23.08	161	37.53	
Uninsured	41	7.66	64	11.96	128	23.93	120	22.43	182	34.02	
Parent education											
Less than high school	27	7.99	32	9.47	77	22.78	77	22.78	125	36.98	<0.001
High school	53	3.31	130	8.12	402	25.11	413	25.80	603	37.66	
High school or higher	282	3.18	888	10.03	2556	28.87	2199	24.83	2930	33.09	
Individual characteristics											
Sex											
Male	176	48.62	506	48.19	1615	53.21	1435	53.37	1978	54.07	0.006
Female	186	51.38	544	51.81	1420	46.79	1254	46.63	1680	45.93	
Race/Ethnicity											
White, non-Hispanic	225	62.15	756	72	2218	73.08	1931	71.81	2490	68.07	<0.001
Other	137	37.85	294	28	817	26.92	758	28.19	1168	31.93	
Family characteristics											
Primary language spoken at home											
English	314	87.71	969	92.64	2855	94.51	2526	94.47	3422	93.91	<0.001
Other	44	12.29	77	7.36	166	5.49	148	5.53	222	6.09	
Household generation											
1 st generation	9	2.52	25	2.41	57	1.9	63	2.37	82	2.27	<0.001
2nd generation	68	19.05	162	15.61	405	13.48	332	12.5	498	13.8	
3rd generation	252	70.59	810	78.03	2423	80.66	2132	80.3	2833	78.52	

Characteristics	Screen time (hours per weekday)										X² P-Value
	Less than 1		1		2		3		4 or more		
	n	%	n	%	n	%	n	%	n	%	
Other	28	7.84	41	3.95	119	3.96	128	4.82	195	5.4	
Family structure											
Two Parents	236	67.43	765	73.77	2067	68.79	1737	65.35	2160	59.68	<0.001
Two Parents (step-parent)	23	6.57	67	6.46	242	8.05	205	7.71	409	11.3	
Single Parent	72	20.57	172	16.59	598	19.9	599	22.54	881	24.34	
Grandparent	14	4	21	2.03	74	2.46	83	3.12	122	3.37	
Other	5	1.43	12	1.16	24	0.8	34	1.28	47	1.3	
Socioeconomic status											
Poverty status (FPL[a])											
0–99% FPL	69	19.06	113	10.76	274	9.03	293	10.9	437	11.95	<0.001
100–199% FPL	63	17.4	151	14.38	466	15.35	406	15.1	617	16.87	
200–399% FPL	109	30.11	282	26.86	895	29.49	816	30.35	1127	30.81	
400% FPL or greater	121	33.43	504	48	1400	46.13	1174	43.66	1477	40.38	
Insurance type											
Private	76	21.59	152	14.73	448	14.97	464	17.44	693	19.24	<0.001
Public	218	61.93	787	76.26	2294	76.65	1978	74.33	2566	71.24	
Both Private and Public	17	4.83	29	2.81	123	4.11	99	3.72	161	4.47	
Uninsured	41	11.65	64	6.2	128	4.28	120	4.51	182	5.05	
Parent education											
Less than high school	27	7.46	32	3.05	77	2.54	77	2.86	125	3.42	<0.001
High school	53	14.64	130	12.38	402	13.25	413	15.36	603	16.48	
High school or higher	282	77.9	888	84.57	2556	84.22	2199	81.78	2930	80.1	

Abbreviation: FPL, federal poverty level

Table 2.

Prevalence of parent-reported depression among U.S. adolescents aged 13–17 years by medical conditions/ behavioral conditions, and medications from the 2018 National Survey of Children's Health (NSCH) dataset

Characteristic	No depression (n=9918, 91.36%)		Depression (n=938, 8.64%)		
	n	**%**	**n**	**%**	*X² p-value*
Intellectual disability					
No	9791	91.50	909	8.50	**<0.001**
Yes	109	78.99	29	21.01	
Brain injury					
No	9807	91.43	919	8.57	**0.002**
Yes	75	82.42	16	17.58	
Cerebral palsy					
No	9855	91.40	927	8.60	**0.050**
Yes	27	81.82	6	18.18	
Autism					
No	9622	91.94	843	8.06	**<0.001**
Yes	265	74.23	92	25.77	
Behavioral problems					
No	9430	93.26	681	6.74	**<0.001**
Yes	456	64.14	255	35.86	
ADD/ADHD					
No	8774	93.76	584	6.24	**<0.001**
Yes	1016	74.65	345	25.35	
Medications [a]					
No	8863	96.78	295	3.22	**<0.001**
Yes	919	58.95	640	41.05	

[a] Medications taken for emotions, concentration, and/or behavior

Table 3.

Prevalence of parent-reported anxiety among U.S. adolescents aged 13–17 years by medical conditions/ behavioral conditions, and medications from the 2018 National Survey of Children's Health (NSCH) dataset

Characteristic	No anxiety (n=9268, 85.30%)		Anxiety (n=1597, 14.70%)		
	n	%	n	%	X^2 p-value
Intellectual disability					
No	9176	85.70	1531	14.30	**<0.001**
Yes	75	54.35	63	45.65	
Brain injury					
No	9181	85.52	1555	14.48	**<0.001**
Yes	55	60.44	36	39.56	
Cerebral palsy					
No	9216	85.39	1577	14.61	**<0.001**
Yes	20	60.61	13	39.39	
Autism					
No	9081	86.69	1394	13.31	**<0.001**
Yes	164	45.94	193	54.06	
Behavioral problems					
No	8892	87.87	1227	12.13	**<0.001**
Yes	346	48.66	365	51.34	
ADD/ADHD					
No	8342	89.03	1028	10.97	**<0.001**
Yes	812	59.75	547	40.25	
Medications [a]					
No	8471	92.41	696	7.59	**<0.001**
Yes	666	42.75	892	57.25	

[a]Medications taken for emotions, concentration, and/or behavior

Table 4.

Adjusted associations of screen time (hours per weekday) with depression and anxiety using multivariable logistic regression from the 2018 National Survey of Children's Health (NSCH) dataset

Mental health outcome	Screen time	Model 1		Model 2		Model 3	
		OR	95% CI	OR	95% CI	OR	95% CI
Depression							
	Less than 1 hour	1		1		1	
	1 hour	0.59	(0.33 – 1.04)	0.62	(0.34 – 1.12)	0.66	(0.34 – 1.28)
	2 hours	1.24	(0.76 – 2.02)	1.22	(0.34 – 1.12)	1.26	(0.71 – 2.25)
	3 hours	1.56	(0.96 – 2.53)	1.55	(0.94 – 2.57)	1.48	(0.83 – 2.63)
	4 or more hours	2.77**	(1.72 – 4.44)	2.62**	(1.60 – 4.29)	2.23*	(1.27 – 3.91)
Anxiety							
	Less than 1 hour	1		1		1	
	1 hour	0.67*	(0.45 – 1.00)	0.66*	(0.44 – 0.99)	0.69	(0.44 – 1.07)
	2 hours	1.11	(0.78 – 1.57)	1.08	(0.76 – 1.53)	1.14	(0.77 – 1.69)
	3 hours	1.36	(0.96 – 1.92)	1.32	(0.93 – 1.87)	1.34	(0.90 – 1.98)
	4 or more hours	2.04**	(1.45 – 2.86)	1.97**	(1.40 – 2.78)	1.85*	(1.26 – 2.72)

*
p<0.05

**
p<0.001

Abbreviation: OR, odds ratio; CI, confidence interval

[a] Adjusted for sex and age

[b] Additionally adjusted for poverty level, insurance type, and parent education

Additionally adjusted for language spoken at home, race/ethnicity, household generation, family structure, comorbid conditions and emotional/behavior medications

Table 5.

Mediation analysis of the relationship between screen time and depression by sleep duration [a]

	OR	SE	95% CI
Screen time --> Depression total	1.347[**]	<0.001	(1.243 − 1.460)
Screen time --> Depression direct	1.345[**]	<0.001	(0.998 − 1.004)
Screen time --> Depression indirect	1.001	0.374	(1.241 − 1.458)
Proportion of mediation	0.744		

[**]
p<0.001

Abbreviation: OR, odds ratio; SE, standard error; CI, confidence interval

[a] Adjusted for sex, age, poverty level, insurance type, parent education, language spoken at home, race/ethnicity, household generation, family structure, and comorbid conditions, and emotional/behavioral medications.

A

Table 6.

Mediation analysis of the relationship between screen time and anxiety by sleep duration[a]

	OR	SE	95% CI
Screen time --> Anxiety total	1.230[**]	0.314	(1.156 – 1.307)
Screen time --> Anxiety direct	1.229[**]	0.009	(1.555 – 1.308)
Screen time --> Anxiety indirect	1.001	0.314	(0.998 – 1.001)
Proportion of mediation	0.813		

[**] p<0.001

Abbreviation: OR, odds ratio; SE, standard error; CI, confidence interval

[a] Adjusted for sex, age, poverty level, insurance type, parent education, language spoken at home, race/ethnicity, household generation, family structure, comorbid conditions, and emotional/behavior medications.