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Screen time and suicidal behaviors among U.S. children 9–11 years old: A prospective cohort study

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Abstract

Suicide is a leading cause of death among adolescents. Emerging literature has described relationships between excessive screen time and suicidal behaviors, though findings have been mixed. The objective of this study is to determine the prospective associations between screen time and suicidal behaviors two-years later in a national (U.S.) cohort of 9–11-year-old-children. We analyzed prospective cohort data from the Adolescent Brain Cognitive Development (ABCD) Study (N = 11,633). Logistic regression analyses were estimated to determine the associations between baseline self-reported screen time (exposure) and suicidal behaviors (outcome) based on the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-5) at two-year-follow-up.

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Authors' contribution statements

Jonathan Chu – Conceptualization, Formal analysis, writing – original draft, Writing - review & editing,
Kyle Ganson, Alexander Testa, Dylan Jackson, Stuart Murray – Writing – review & editing.
Fiona Baker – Data curation, Project administration, Writing – review & editing.
Jason Nagata – Conceptualization, Formal analysis, Writing – review & editing, Supervision.
All authors approve of the final submitted version.

Ethics approval

The University of California, San Diego provided centralized institutional review board (IRB) approval and each participating site received local IRB approval.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Participants reported an average of 4.0 h of total screen time per day at baseline. At two-year-follow-up, 1.38% of the sample reported at least one suicidal behavior. Each additional hour of total screen time was prospectively associated with 1.09 higher odds of suicidal behaviors at 2-year-follow-up (95% CI 1.03–1.14), after adjusting for covariates. For specific screen time modalities, each additional hour of texting (aOR 1.36, 95% CI 1.06–1.74), video chatting (aOR 1.30, 95% CI 1.03–1.65), watching videos (aOR 1.21, 95% CI 1.04–1.39), and playing video games (aOR 1.18, 95% CI 1.01–1.38) was associated with higher odds of subsequent suicidal behaviors. Higher screen time is associated with higher odds of reporting suicidal behaviors at two-year-follow-up. Future research should seek to identify how specific screen time experiences may influence suicidal behaviors.

Keywords

Adolescent health; Mental health; Screen time; Suicidal behaviors; Suicide; Texting; Video games

1. Introduction

Suicide is the second most common cause of death among adolescents and young adults (Horowitz et al., 2020). Reports from the CDC show that suicide rates in this population increased by 30% between 2000 and 2020 (Curtin, 2020). In addition to the number of deaths by suicide, an even larger number of individuals report experiencing suicidal ideation or attempting suicide (Ivey-Stephenson et al., 2020; Lindsey et al., 2019). Risk factors for suicidal behaviors include psychosocial stressors, mental illness, and social isolation (Bilsen, 2018). In particular, early adolescence is a key period in which both the onset of puberty and increased social expectations may impact mental health (Dorn et al., 2019). Though the prevalence of mental health issues is lower in this age range, rising trends warrant further research that may guide earlier intervention and screening.

Screen time has become ubiquitous in society (LeBlanc et al., 2017). While studies have linked excessive screen time with negative psychological outcomes, they mostly use cross-sectional data, focus on adults, and report mixed results (Chassiakos et al., 2016; Hill et al., 2016a; Lissak, 2018). For example, while some studies have found minimal to no associations between digital technology and mental health problems (Orben and Przybylski, 2019a, Orben and Przybylski, 2019b), others have demonstrated positive associations between increased screen time and depressive symptoms and suicidal behaviors (Vuorre et al., 2021).

In one case-control study, adolescents with multiple online risk factors, such as cyberbullying and hate speech, were found to have higher odds of having a suicide alert, in which youth indicate an imminent or recent suicide attempt (Sumner et al., 2021). A longitudinal sample of 500 adolescents over 10 years found high levels of social media, television, and video game use predicted suicide risk in girls, while video game use was associated with suicide risk in boys when cyberbullying was high (Coyne et al., 2021). A recent meta-analysis of children 12 years or younger showed weak associations between screen time and internalizing and externalizing behaviors, but crucially, it did not examine

suicidal behaviors (Eirich et al., 2022). Few studies have examined specific types of screen time and suicidal behaviors in early adolescence using large, diverse, longitudinal samples and the Diagnostic and Statistical Manual, 5th Edition (DSM-5) criteria of suicidal behaviors.

The objective of this study was to determine the prospective associations between baseline screen time and suicidal behaviors two years later in a large, national cohort of 9–11-year-old children in the United States. In addition to total screen time, we sought to identify whether specific screen time modalities (television, videos, video games, texting, video chat, and social media) were associated with subsequent suicidal behaviors.

2. Methods

2.1. Study population

We used data from the Adolescent Brain Cognitive Development (ABCD) Study, which follows 11,875 children recruited from 21 diverse sites around the US. Details about the ABCD Study can be found elsewhere (Garavan et al., 2018). Specifically, we analyzed baseline (2016–2018, 9–10-years-old) and two-year-follow-up (2018–2020, 11–14-years-old) data from the ABCD 4.0 release. We excluded participants with missing data for screen time at baseline and suicidal behaviors at baseline and two-year follow-up. Gaussian normal regression imputation was used for those missing confounder data. Centralized institutional review board (IRB) approval was obtained from the University of California, San Diego. Study sites obtained approval from their respective IRBs. Caregivers provided written informed consent and each child provided written assent. Data were obtained from the ABCD Study (https://abcdstudy.org), held in the NIMH Data Archive (NDA).

2.2. Exposures: Screen time

Participants answered questions about their typical screen time use through the ABCD Youth Screen Time Survey, based on previously validated measures (Bagot et al., 2018; Paulus et al., 2019; Sharif et al., 2010). Modalities included viewing/streaming TV shows or movies, watching/streaming videos, playing video games, texting, video chatting, and social media.. Similar to a previous ABCD study, we performed a weighted average calculation of typical screen time as follows: ((weekday average × 5) + (weekend average × 2))/7 (Guerrero et al., 2019). The weighted average for each modality was then reported as a continuous variable.

2.3. Outcome: Suicidal behaviors

Suicidal behaviors were assessed using the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-5), a computerized tool based on the DSM-5 (Sarmiento and Lau, 2020; Townsend et al., 2020). Adolescents completed all modules of the KSADS-5 to reflect mental health symptoms and diagnoses. Participants who reported passive suicidal ideation, nonspecific active suicidal ideation, active suicidal ideation with a plan/method/preparation/intent, or suicide attempt were coded as having suicidal behaviors.

2.4. Confounders

Confounders were selected based on previous literature and theory (Willoughby et al., 2012). Age (years), sex (female, male), race/ethnicity (White, Latino/Hispanic, Black, Asian, Native American, other), household income (U.S. dollars, six categories: Less than $25,000, $25,000 through $49,999, $50,000 through $74,999, $75,000 through $99,999, $100,000 through $199,999, $200,000 and greater), and highest parent education (high school or less vs. college or more) were based on parents' self-report. Baseline major depressive disorder was determined from the KSADS-5 and included as a covariate. Family history of psychopathology was assessed with a modified version of the Family History Assessment from a previously validated study (Brown et al., 2015). ABCD Study site was included to adjust for potential regional variation.

2.5. Statistical analysis

Multiple logistic regression analyses were conducted in 2022 using Stata 15.1 (StataCorp, College Station, TX) to estimate associations between baseline screen time (exposure) and suicidal behaviors at two-year-follow-up (outcome), adjusting for confounders. In sensitivity analyses excluding participants with suicidal behaviors at baseline, findings were unchanged. Propensity weights were applied to yield representative estimates based on the American Community Survey from the US Census (Heeringa and Berglund, 2020).

3. Results

Table 1 describes sociodemographic characteristics of the 11,633 participants included. The sample was 48.8% female and racially diverse (47.8% non-White). At baseline, youth on average reported 4.0 ± 3.2 h of screen time per day. At two-year-follow-up, 1.38% of the sample reported at least one suicidal behavior.

Table 2 shows logistic regression analyses examining prospective associations between baseline screen time and suicidal behaviors at two-year-follow-up. In models adjusted for covariates, each additional hour of total screen time at baseline was prospectively associated with 1.09 higher odds of reporting suicidal behaviors at two-year-follow-up (95% confidence interval [CI] 1.03–1.14). The modalities most strongly associated with suicidal behaviors were texting, video chat, videos, and video games, with adjusted odds ratios ranging between 1.18 and 1.36.

4. Discussion

In a population-based, diverse cohort of 9–11-year-old children in the U.S., we found that greater screen time was prospectively associated with suicidal behaviors. In particular, texting, video chatting, watching videos, and playing video games were most strongly associated with suicidal behaviors at two-year-follow-up.

Our findings are congruent with prior studies examining the relationship between screen time and suicidal behaviors in adolescents (Coyne et al., 2021; Leventhal et al., 2021; Sumner et al., 2021). We add to the existing literature by: 1) using a large, national prospective cohort design with two-year-follow-up, 2) focusing on early adolescence

(children 9–14 years old), and 3) identifying specific contemporary screen time modalities associated with suicidal behaviors.

As the prevalence of suicidal behaviors and screen usage continue to increase among adolescents (Curtin, 2020; Robb et al., 2019), particularly during the COVID-19 pandemic (Nagata et al., 2022), these findings highlight the importance of assessing screen time as a potential risk factor for suicidal behaviors in youth. Consistent with a recent longitudinal study that followed adolescents for ten years starting in 2009 (Coyne et al., 2021), we found that greater screen time was associated with higher odds of reporting suicidal behaviors. That study followed a smaller sample of adolescents starting at an older age. Most studies investigating screen time and suicide have examined adolescents beginning at age 13, excluding those in middle childhood/early adolescence. Because screen use patterns may differ between age groups (Robb et al., 2019), it is important to characterize each group's particular risk factors. Furthermore, screen use and accessibility to media constantly expands over time; thus, repeated studies examining cohorts in varying periods will best reflect applicability to the general population.

While the current study does not examine the mechanisms through which screen time influences suicidal behaviors, several pathways may explain the presented findings. The interpersonal theory of suicide, which describes how thwarted belongingness and perceived burdensomeness drive suicide risk, has been used to describe the relationship between screen time and suicidal behaviors (Barzilay et al., 2015). Many experiences involving screen time may exacerbate these feelings. For example, cyberbullying has been shown to increase the risk of self-injurious behavior and suicide-related behaviors (Wiguna et al., 2021). Video games can involve multiplayer communication and expose adolescents to harassment and hate speech (Mendes Da Silva et al., 2020). Furthermore, videos and video games may expose youth to graphic content such as death or descriptions of suicide (Bridge et al., 2020). Higher screen time may also reflect higher sedentary time and lower physical activity, which in turn can negatively influence mental health and contribute to the development of suicidal behaviors (Forte et al., 2022; Hallgren et al., 2019).

Nevertheless, existing research has produced mixed findings regarding the relationship between screen time and mental health. For example, in one longitudinal study of adolescents in the UK, frequent video game use was associated with fewer depressive symptoms among adolescent boys, particularly those with low physical activity (Kandola et al., 2021). One proposed explanation for this is the varying nature of different screen time modalities (Hallgren et al., 2020). Playing video games is a more mentally active behavior, in contrast to modalities such as watching TV or videos. Some studies have begun to describe protective relationships between mentally active sedentary behaviors and mental health (Hallgren et al., 2018). While the current study does not examine this association, it is an interesting area of future research to better understand the factors influencing mental health in youth.

Notably, texting and video chat were associated with higher odds of suicidal behaviors. Although these modalities serve to increase social connectedness (Chassiakos et al., 2016; Hill et al., 2016b), high use may reflect problematic addictive behaviors (Lin et

al., 2014). Adolecents experiencing suicidal behaviors may require increased interaction levels not provided by these modalities. Alternatively, perhaps these associations relate to increased willingness to report suicidal ideation; that is, these modalities allow youth to feel comfortable expressing their behaviors. Studies of youth clusters in the U.S. have demonstrated robust conversations about suicide among online forums, so these individuals potentially have greater inclination to share rather than hide their behaviors (Swedo et al., 2021). It is important to highlight that in fully adjusted models, social media was not associated with suicidal behaviors at two-year follow-up. Of the modalities examined, social media had the lowest usage and the age of permissible use for most social media platforms is 13 years, which may explain these findings. Because social media usage is expected to increase through adolescence, further research may reveal more significant results.

Several limitations are worth noting. Although we adjusted for potential confounders, residual confounding remains possible. Specifically, suicide risk is complex and nuanced, depending on numerous factors that were not controlled for in this study, such as engagement in physical activity, social support and connectedness, and other health conditions. Furthermore, the two-year follow-up is relatively short for tracking changes in suicidal behaviors. The rate of suicidal behaviors in adolescence increases with age (Curtin, 2020), and it is possible screen time influences adolescents in certain developmental windows (Orben et al., 2022); thus, studies following the ABCD cohort over time will allow for improved longitudinal characterization of the relationship between screen time and suicidal behaviors. Given the observational study design, we cannot establish causality. Measures were self-reported, and possibly subject to reporting bias. This study also does not examine specific screen time engagement. Effect sizes of the associations were relatively small. However, they are reported for each hour per day; therefore, total effects are greater with higher screen time.

5. Conclusion

The rise in screen time in today's youth underscores the need for urgent guidance regarding screen time. Health care providers may consider assessing screen use when evaluating adolescents for suicidal behaviors. Future research may focus on identifying best practices for monitoring high-risk screen behaviors in adolescents at greatest risk for suicidal behaviors (Allen et al., 2019). Professional organizations such as the American Academy of Pediatrics should provide specific guidance for families regarding screen time usage and strategies to reduce suicidal behaviors in children and adolescents.

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https://abcdstudy.org/principal-investigators.html. ABCD consortium investigators designed and implemented the study and/or provided data but did not necessarily participate in the analysis or writing of this report.

Data availability

Written informed consent and assent were obtained from the parent/guardian and adolescent, respectively, to participate in the ABCD Study. Data used in the preparation of this article were obtained from the ABCD Study (https://abcdstudy.org), held in the NIMH Data Archive (NDA). Investigators can apply for data access through the NDA (https://nda.nih.gov/).

Abbreviations

ABCD	Adolescent brain cognitive development study
DSM-5	Diagnostic and statistical manual, 5th edition
KSADS-5	Kiddie schedule for affective disorders and schizophrenia

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Table 1.

Sociodemographic, screen time, and binge eating characteristics of 11,363 Adolescent Brain Cognitive Development (ABCD) Study participants.

Sociodemographic characteristics (baseline)	Mean (SD) / %
Age (years)	9.9 (0.6)
Sex, n (%)	
Female	48.8%
Male	51.2%
Race/ethnicity (%)	
White	52.2%
Latino / Hispanic	20.0%
Black	17.3%
Asian	5.5%
Native American	3.2%
Other	1.9%
Household income (%)	
Less than $25,000	18.7%
$25,000 through $49,999	20.4%
$50,000 through $74,999	17.5%
$75,000 through $99,999	13.4%
$100,000 through $199,999	22.6%
$200,000 and greater	7.4%
Parent with college education or more (%)	79.7%
Major depressive disorder (%)	0.2%
Family history of psychopathology (%)	59.7%
Screen time variables (baseline)	
Total screen time	3.99 (3.16)
Television shows/movies	1.31 (1.31)
Videos (e.g. YouTube)	1.05 (1.18)
Video games	1.06 (1.13)
Texting	0.24 (0.56)
Video chat	0.21 (0.52)
Social networking	0.13 (0.45)
Suicidal behaviors, DSM-5*	
Suicidal behaviors, two-year follow-up	1.38%

Propensity weights were applied to yield nationally representative estimates based on the American community survey from the US Census. SD = standard deviation.

* Suicidal behaviors were defined as reporting present passive suicidal ideation, non-specific active suicidal ideation, active suicidal ideation with a plan, active suicidal ideation with a method, active suicidal ideation with intent, preparatory actions towards suicide, a recent suicide attempt, or an aborted suicide attempt.

Table 2.

Associations between baseline screen time and suicidal behaviors at two-year follow-up in the Adolescent Brain Cognitive Development Study.

	Suicidal behaviors, unadjusted		Suicidal behaviors, adjusted[a]	
	OR (95% CI)	p	OR (95% CI)	p
Total screen time	**1.10 (1.05–1.14)**	**<0.001**	**1.09 (1.03–1.14)**	**0.001**
Television shows/movies	**1.19 (1.02–1.39)**	**0.024**	1.10 (0.93–1.30)	0.251
Videos (e.g., YouTube)	**1.25 (1.10–1.42)**	**0.001**	**1.21 (1.04–1.39)**	**0.012**
Video games	**1.15 (1.00–1.33)**	**0.045**	**1.18 (1.01–1.38)**	**0.036**
Texting	**1.43 (1.15–1.79)**	**0.001**	**1.36 (1.06–1.74)**	**0.014**
Video chat	**1.35 (1.08–1.67)**	**0.008**	**1.30 (1.03–1.65)**	**0.028**
Social networking	**1.40 (1.10–1.79)**	**0.007**	1.27 (0.97–1.66)	0.076

Bold indicates $p < 0.05$.

[a]Covariates: Race/ethnicity, sex, household income, parent education, site, baseline major depressive disorder, baseline suicidal behaviors, and family history of psychiatric disorders.