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BRIEF REPORT

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Contemporary screen time modalities among children 9–10 years old and binge-eating disorder at one-year follow-up: A prospective cohort study

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Abstract

Objective: To determine the prospective associations between contemporary screen time modalities in a nationally representative cohort of 9–10-year-old children and binge-eating disorder at one-year follow-up.

Method: We analyzed prospective cohort data from the Adolescent Brain Cognitive Development (ABCD) Study (N = 11,025). Logistic regression analyses were conducted to estimate associations between baseline child-reported screen time (exposure) and parent-reported binge-eating disorder based on the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-5, outcome) at one-year follow-up, adjusting for race/ethnicity, sex, household income, parent education, BMI percentile, site, and baseline binge-eating disorder.

Results: Each additional hour of total screen time per day was prospectively associated with 1.11 higher odds of binge-eating disorder at 1-year follow-up (95% CI 1.05–1.18) after adjusting for covariates. In particular, each additional hour of social networking (aOR 1.62, 95% CI 1.18–2.22), texting (aOR 1.40, 95% CI 1.08–1.82), and watching/streaming television shows/movies (aOR 1.39, 95% CI 1.14–1.69) was significantly associated with binge-eating disorder.

Discussion: Clinicians should assess screen time usage and binge eating in children and adolescents and advise parents about the potential risks associated with excessive screen time.

KEYWORDS
binge-eating disorder, adolescents, binge eating, disordered eating, eating disorder, pediatrics, screen time, smart phone, social media, television

1 | INTRODUCTION

The advancement and accessibility of technology has led to the rapid increase in children and adolescents using screens to interact with the world (Hill et al., 2016). As time spent in front of screens has risen, so have concerns regarding the effects of excessive screen time on young people's wellbeing (Hill et al., 2016; Viner, Davie, & Firth, 2019). Recent research has linked excessive screen time with adverse effects on children's health, including depression, anxiety, inattention, poor sleep, and physical inactivity (Lissak, 2018; Viner et al., 2019), although it is increasingly apparent that effects of screen time are nuanced, depending on various factors, such as level of engagement and interaction (Orben & Przybylski, 2019; Przybylski, Orben, & Weinstein, 2020).

One particular area of interest is the relationship between excessive screen time and binge eating. Prior studies have demonstrated links between screen time and snacking (Fiechtner et al., 2018; Kim et al., 2020); however, fewer studies have specifically addressed the relationship between screen time and binge eating. Screen time could be linked to binge eating through overeating in the absence of hunger during passive (as opposed to interactive) screen time (Fiechtner et al., 2018; Kim et al., 2020), binge-watching behaviors (Flayelle et al., 2019; Vizcaino, Buman, Desroches, & Wharton, 2020), and negative body image (Dakanalis et al., 2015). Furthermore, while research in this area has progressed from the initial focus on television-watching, screen interactions have continued to diversify rapidly since the advent of video games, texting, and social media, and require further continual investigation to differentiate potential effects (Abdel Magid, Milliren, Pettee Gabriel, & Nagata, 2021).

Moreover, the majority of current literature focuses on older adolescents or adults (Burmeister & Carels, 2014; Smith, Hames, & Joiner, 2013). However, children's screen time usage increases at the greatest rate in early adolescence (Smink, Van Hoeken, & Hoek, 2012; Twenge & Campbell, 2018). Some studies have examined the cross-sectional association between screen time and binge eating in children and adults (Burmeister & Carels, 2014; Fiechtner et al., 2018; Vizcaino et al., 2020), but few have used longitudinal study designs or focused on younger adolescents. One study analyzing clinical samples of children and adolescents for weight loss treatment found a subgroup (n = 15) where eating alone, in some cases while watching television, was associated with binge eating (Tanofsky-Kraff et al., 2007). Another population-based study of adolescents in Minnesota did not find an association between television viewing and binge eating (Neumark-Sztainer et al., 2007). However, there is a paucity of data using large, diverse, longitudinal samples examining the association between specific types of screen time and binge-eating disorder in early adolescents using the Diagnostic and Statistical Manual, 5th Edition (DSM-5) criteria (American Psychiatric Association, 2013).

The objective of this study was to determine the prospective associations between screen time in a population-based, demographically diverse cohort of 9–10-year-old children in the United States and binge-eating disorder at one-year follow-up. In addition, we sought to identify the specific types of screen time (television, videos, video games, texting, video chat, and social networking) that are associated with binge eating. We hypothesized that excessive screen time, particularly passive forms (television, videos) and those that may exacerbate a negative body image (social networking), would be prospectively associated with binge-eating disorder at one-year follow-up.

2 | METHODS

2.1 | Study population

We analyzed prospective cohort data from the Adolescent Brain Cognitive Development (ABCD) Study, a longitudinal study of brain development and health across adolescence consisting of 11,875 children recruited from 21 sites around the United States. (See [Barch et al., 2018] for descriptions of study sample, recruitment, procedures, and measures). Data analyzed here are from the ABCD 3.0 release for the baseline (2016–2018, ages 9–10 years) and one-year follow-up (2017–2019, ages 10–11 years) assessments. Participants with missing data for baseline screen time (N = 63) or binge-eating disorder at one-year follow-up (N = 793) were excluded, leaving a total of 11,025 participants in the cohort. For participants with missing covariate data (N = 1,016), Gaussian normal regression imputation was used to impute missing covariate data. Centralized institutional review board (IRB) approval was obtained from the University of California, San Diego. Study sites obtained approval from their local IRBs. Caregivers provided written informed consent and each child provided written assent.

2.2 | Measures

2.2.1 | Exposures: Screen time

Screen time was determined using the self-reported ABCD Youth Screen Time Survey. Participants answered questions about typical hours per day spent on six different screen modalities (viewing/streaming television shows or movies, watching/streaming videos [e.g., YouTube], playing video games, texting, video chatting [e.g., Skype, Facetime], and social networking [e.g., Facebook, Instagram, Twitter]) separately for weekdays and weekend days based on a previously validated measure (Bagot et al., 2018; Gray, Schvey, & Tanofsky-Kraff, 2019; Paulus et al., 2019; Sharif, Wills, & Sargent, 2010). We calculated a weighted average calculation of the participants' typical weekday and weekend screen time use (((weekday average × 5) + (weekend average × 2))/7) to report a single typical hours-per-day measure (Guerrero, Barnes, Chaput, & Tremblay, 2019). After obtaining this screen time total for each type of media utilized by the participants, we reported the weighted average as a continuous variable.

2.2.2 | Outcome: Binge-eating disorder

The ABCD Study utilized the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-5), a computerized tool for categorizing child and adolescent mental health concerns based on the DSM-5 (American Psychiatric Association, 2013), for assessment of current binge-eating disorder at baseline and one-year follow-up (Townsend et al., 2020). Parents/caregivers completed the binge-eating disorder modules of the KSADS-5 (assessing frequency, duration, characteristics, and associated distress of their child's binge eating) on behalf of their child given evidence that parents are particularly important reporters for these behaviors in this age range (Barch et al., 2018) and young children may have less insight regarding their eating behaviors (Braet et al., 2007). Using the KSADS-5 computerized scoring system, responses to the interview questions from parents were extrapolated into the diagnosis of current binge-eating disorder from reported symptoms corresponding to the DSM-5 (American Psychiatric Association, 2013).

2.2.3 | Covariates

Sociodemographic covariates were selected based on previous literature and theory as being potential confounders for the association between screen time and binge-eating disorder (Fiechtner et al., 2018; Neumark-Sztainer et al., 2007; Tanofsky-Kraff et al., 2007). Age (years), sex assigned at birth (female, male [including three intersex-male participants]), race/ethnicity (White, Latino/Hispanic, Black, Asian, Native American, other), past year household income (dollars, six categories), and highest parent education (high school or less vs. college or more) were based on parents' self-report. Body mass index (BMI) was based on measured height and weight (BMI = weight/height^2) and converted into sex and age-specific percentiles in accordance with CDC growth curves (Centers for Disease Control and Prevention, 2019).

2.3 | Statistical analysis

Data analysis was performed in 2020 using Stata 15.1 (StataCorp, College Station, TX). Unadjusted logistic regression analyses estimated the association between baseline screen time (total and each type of screen time independently) and binge-eating disorder at one-year follow-up. Multiple logistic regression analyses were conducted to estimate the association between baseline screen time (total and each type of screen time independently; exposure) and binge-eating disorder at one-year follow-up (outcome), adjusting for sex, race/ethnicity, household income, parent education, site, and baseline binge-eating disorder. Some children within the sample were twins or siblings. Sensitivity analyses were conducted including only one sibling per family and findings did not differ; therefore, we present results from the full sample. We tested for effect modification by sex and present sex-stratified results where sex significantly modifies the association between screen time and binge-eating disorder ($p < .05$). Propensity weights were applied to yield nationally representative estimates based on the American Community Survey from the US Census (Heeringa & Berglund, 2020).

3 | RESULTS

Table 1 describes sociodemographic characteristics of the 11,025 participants included. The sample was approximately matched by sex

TABLE 1 Sociodemographic, screen time, and binge-eating characteristics of 11,025 Adolescent Brain Cognitive Development (ABCD) Study participants

	Total
Sociodemographic characteristics (baseline)	Mean (SD)/%
Age (years)	9.95 (0.63)
Sex assigned at birth (%)	
Female	48.8%
Male[a]	51.2%
Race/ethnicity (%)	
White	52.4%
Latino/Hispanic	20.1%
Black	17.3%
Asian	5.5%
Native American	3.2%
Other	1.5%
Household income (%)	
Less than $25,000	18.1%
$25,000 through $49,999	20.7%
$50,000 through $74,999	18.0%
$75,000 through $99,999	15.7%
$100,000 through $199,999	20.1%
$200,000 and greater	6.7%
Parent with college education or more (%)	79.7%
Body mass index (BMI) percentile	62.13 (30.70)
Screen time variables (hours per day, 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)
Binge-eating disorder, DSM-5	
Binge-eating disorder, baseline (%)	0.7%
Binge-eating disorder, one-year follow-up (%)	1.1%

Note: Propensity weights were applied to yield nationally representative estimates based on the American Community Survey from the US Census.
[a]Includes three participants whose sex at birth was intersex-male.

TABLE 2 Associations between baseline screen time and binge-eating disorder at one-year follow-up in the Adolescent Brain Cognitive Development Study

	Binge-eating disorder, unadjusted		Binge-eating disorder, adjusted[a]	
	OR (95% CI)	*p*	aOR (95% CI)	*p*
Total screen time (hours per day)	**1.13 (1.08–1.17)**	**<.001**	**1.11 (1.05–1.18)**	**.001**
Television shows/movies	**1.48 (1.24–1.77)**	**<.001**	**1.39 (1.14–1.69)**	**.001**
Videos (YouTube)	**1.23 (1.05–1.45)**	**.010**	1.09 (0.89–1.32)	.407
Video games	**1.22 (1.03–1.44)**	**.019**	1.13 (0.90–1.41)	.310
Texting	**1.48 (1.18–1.87)**	**.001**	**1.40 (1.08–1.82)**	**.011**
Video chat	**1.38 (1.11–1.72)**	**.004**	1.32 (0.99–1.76)	.057
Social networking	**1.66 (1.29–2.12)**	**<.001**	**1.62 (1.18–2.22)**	**.003**

Note: Bold indicates $p < .05$.
[a]Covariates: race/ethnicity, sex, household income, parent education, BMI percentile, site, and baseline binge-eating disorder.

(48.8% female) and was racially and ethnically diverse (47.6% non-White). On average, at baseline, children reported 4.0 ± 3.2 hr (mean ± SD) of screen time per day, with the most time spent watching/streaming television shows/movies (1.3 ± 1.3 hr), playing video games (1.1 ± 1.1 hr), and watching/streaming videos (1.1 ± 1.2 hr). At one-year follow-up, 1.1% of participants met criteria for binge-eating disorder.

Table 2 shows logistic regression analyses examining the prospective associations between baseline screen time and binge-eating disorder at one-year follow-up. In unadjusted models, all forms of screen time were associated with binge-eating disorder at one-year follow-up. In models adjusting for covariates, each additional hour of total screen time per day at baseline was prospectively associated with 1.11 higher odds of binge-eating disorder at one-year follow-up (95% confidence interval [CI] 1.05–1.18). The screen time types that were most strongly associated with binge-eating disorder in fully-adjusted models were social networking, texting, and television/movie viewing. There was no evidence of effect modification by sex for any of the screen time exposures (all $p > .05$) except for video games ($p = .013$). Each additional hour of video games at baseline was prospectively associated with higher odds of binge-eating disorder in females (AOR 1.54, 95% CI 1.11–2.14, $p = .010$) but not males (AOR 0.92, 95% CI 0.73–1.16, $p = .486$).

4 | DISCUSSION

In a population-based, demographically diverse cohort of 9–10-year-old children in the United States, we found that greater screen time was prospectively associated with binge-eating disorder at one-year follow-up. In particular, more time spent social networking, texting, and watching/streaming television were most strongly associated with incident binge-eating disorder.

Our findings confirm those of mostly cross-sectional studies (Burmeister & Carels, 2014; Fiechtner et al., 2018; Vizcaino et al., 2020) in older adolescents or adults (Burmeister & Carels, 2014; Smith et al., 2013) examining the relationship between screen time and binge eating. We add to the prior literature on screen time and binge eating by: (a) using a nationally representative prospective cohort design, (b) focusing on an important developmental period for screen time and binge eating (children 9–10 years old followed for 1 year), and (c) assessing DSM-5 binge-eating disorder as an outcome. The estimates of daily screen time (4 hr per day, on average) and binge-eating disorder (0.7%–1.1%) in the ABCD Study were consistent with those from other epidemiological studies with overlapping age ranges (Fiechtner et al., 2018; Marzilli, Cerniglia, & Cimino, 2018).

As technology platforms consistently evolve and diversify, the need to study new specific screen time mediums now accessible to children and their impacts on binge eating is important. We find that greater amounts of time spent on social networking, texting, and watching television shows/movies are associated with binge-eating disorder. This finding is similar to prior studies that identified television and social networking as associated with triggering binge-eating episodes (Burmeister & Carels, 2014; Smith et al., 2013; Tanofsky-Kraff et al., 2007). We add to this literature by showing that more time spent texting, a relatively new form of screen time for children, is a potential risk factor for subsequent binge-eating disorder, as well. Of note, we did not find significant associations between video chat or video games (except in females) and binge-eating disorder. These forms of screen time may be more interactive and, thus, children may be less prone to binge eating during these more interactive pursuits (Kim et al., 2020; Yland, Guan, Emanuele, & Hale, 2015).

Several mechanisms may help to explain the prospective association between screen time and binge eating, including overeating in the absence of hunger, binge-watching behaviors, and negative body image. First, children may be more prone to overeating in the absence of hunger while distracted in front of screens (Fiechtner et al., 2018; Kim et al., 2020). Second, binge-watching behaviors may lead to overconsumption and a loss of control, similar to binge-eating behaviors (Flayelle et al., 2019; Vizcaino et al., 2020). Third, adolescents who hold negative feelings toward their own body image are more likely to binge eat, and researchers posit that media or advertising content reflecting an unattainable body ideal may exacerbate binge eating (Dakanalis et al., 2015).

Limitations of the study should be noted. Although we adjusted for several potential confounders, including baseline levels of binge eating and BMI percentile, there is the possibility of residual confounding. There may be a bidirectional relationship between screen time and binge-eating disorder, which should be explored in future research. While the prospective study design improves on prior cross-sectional evidence, given the observational study design, we cannot definitively establish causality. The screen time measures were based on self-report, which could be subject to reporting bias. Future studies could use automated measurements of device use to assess screen time. It is important to note that the effect sizes of the associations between screen time and binge-eating disorder were relatively small. Screen time use and incidence of binge-eating disorder may rise after ages 9–11; thus, studies following the ABCD cohort into later adolescence will be an important area of future research. Although parent and child reports of binge eating tend to have low concordance (Bartholdy et al., 2017; Tanofsky-Kraff, Yanovski, & Yanovski, 2005), parents are particularly important reporters for eating disorders in this age range (Barch et al., 2018) since young children may have less insight regarding their eating behaviors (Braet et al., 2007). The binge-eating questions came from a reliable and validated tool (KSADS-5) that was based on DSM-5 diagnostic criteria.

5 | CONCLUSION

In a population-based, demographically diverse cohort of 9–10-year-old children in the United States, we found that greater television and social media screen time was prospectively associated with binge-eating disorder at one-year follow-up. Given the rapid rise in screen time and disordered eating (Nagata, Abdel Magid, & Pettee Gabriel, 2020; Termorshuizen et al., 2020) during the COVID-19 pandemic, future research should study these associations during the pandemic. Health care providers should assess for associations between excess screen time usage and binge eating, and advise about potential risks associated with excessive screen time. Professional organizations, such as the American Academy of Pediatrics, should provide further specific guidance for families regarding screen time usage and strategies to prevent binge-eating disorder related to screen time usage (Chassiakos et al., 2016).

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

DATA AVAILABILITY STATEMENT

Data used in the preparation of this article were obtained from the ABCD Study (https://abcdstudy.org), held in the NIMH Data Archive (NDA). This is a multisite, longitudinal study designed to recruit more than 10,000 children aged 9–10 years and follow them over 10 years into early adulthood.

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