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RESEARCH

Screen time, problematic screen use, and eating disorder symptoms among early adolescents: findings from the Adolescent Brain Cognitive Development (ABCD) Study

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Abstract

Purpose Emerging research evidence suggests positive relationships between higher screen time and eating disorders. However, few studies have examined the prospective associations between screen use and eating disorder symptoms in early adolescents and how problematic screen use may contribute to symptom development.

Methods We analyzed prospective cohort data from the Adolescent Brain Cognitive Development (ABCD) Study ($N = 10{,}246$, 2016–2020, ages 9–14). Logistic regression analyses were used to estimate the longitudinal associations between baseline self-reported screen time and eating disorder symptoms in year two. Logistic regression analyses were also used to estimate cross-sectional associations between problematic screen use in year two (either problematic social media or mobile phone use) and eating disorder symptoms in year two. Eating disorder symptoms based on the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-5) included fear of weight gain, self-worth tied to weight, engaging in compensatory behaviors, binge eating, and distress with binge eating.

Results Each additional hour of total screen time and social media use was associated with higher odds of fear of weight gain, self-worth tied to weight, compensatory behaviors to prevent weight gain, binge eating, and distress with binge eating two years later (odds ratio [OR] 1.05–1.55). Both problematic social media and mobile phone use were associated with higher odds of all eating disorder symptoms (OR 1.26–1.82).

Conclusions Findings suggest greater total screen time, social media use, and problematic screen use are associated with more eating disorder symptoms in early adolescence. Clinicians should consider assessing for problem screen use and, when high, screen for disordered eating.

Level of evidence Level III: Evidence obtained from well-designed cohort or case–control analytic studies.

Keywords Eating disorders · Adolescent health · Screen time · Problematic screen use

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Introduction

Eating disorders are distressing and chronic disorders, linked to significant medical complications and reduced quality of life [1]. Examples of eating disorders include but are not limited to anorexia nervosa, bulimia nervosa, and binge-eating disorder, which are three of the most notable eating disorders among young people around the world [2]. The etiology of eating disorders is thought to be multifactorial. Studies have identified risk factors across biological, psychological, and sociocultural domains, such as genetic predisposition, elevated body mass index (BMI), comorbidity with other mental health disorders, socioeconomic status, and gender [3, 4]. Among these risk factors, a rising area of research is the relationship between screen use, the time spent using devices such as television, video game consoles, and mobile phones for various activities, and eating disorder risk [5, 6].

In recent years, the increasing popularity of social media has led to numerous studies describing the associations between social media use, body image, and eating concerns [7, 8]. However, the majority of these studies have occurred in mostly older female adolescents and young adults (approximately 15–29 years of age). While the focus on this age range is most likely related to the age of onset of clinical diagnoses, studies have shown that eating disorder symptoms may develop in early adolescence [9]. In addition, studies tend to focus on restrictive behaviors, excluding other symptoms of eating disorders such as compensatory behaviors (e.g., vomiting, excessive exercise) and binge eating and also eating disorder cognitions (e.g., feeling self-worth tied to weight, fear of weight gain, and distress with binge eating) that also make up DSM-5 criteria for eating disorder diagnoses [8, 10, 11]. The early adolescent population is known to also have increasing rates of screen use [12], and early symptom development may predispose individuals to long-term disordered eating [3, 13]. Furthermore, early adolescence is a key developmental period in which both the onset of puberty and increased social expectations impact mental health [14]. Therefore, it is imperative to further investigate these risk factors for eating disorders in younger populations to inform advancements in early identification and prevention.

Though the exact mechanisms through which screen time may influence the development of eating disorders is not yet fully understood, the Dual Pathways model describes how pressures to obtain socially constructed body ideals and subsequent body dissatisfaction increase the risk for negative eating disorder cognitions and disordered eating [15]. For example, increased exposure to idealized images of bodies on social media platforms (e.g., Facebook, Instagram, TikTok) may contribute to eating disorder symptoms in youth [16]. One cross-sectional study of 996 Australian adolescents with a mean age of 13 years linked increased social media usage with more disordered eating behaviors, suggesting that these influences may begin at younger ages [17]. However, the cross-sectional design of this study limited its generalizability regarding the directionality of the relationship and thus evidence for social media use as a risk factor for eating disorders. Therefore, longitudinal studies are needed to better understand media use as a potential risk factor for eating disorder symptoms in younger adolescents.

In addition to social media, it is also important to explore how other modalities of screen use, such as television, videos, video games, and texting factor into the potential development of eating disorder symptoms. One prior investigation found longitudinal associations between these screen time modalities and binge-eating disorder in early adolescents [6]. However, the eating outcomes assessed only included binge-eating disorder, and thus, individual symptoms characteristic of anorexia nervosa and bulimia nervosa, such as fearing weight gain, feeling self-worth tied to weight, and inappropriate compensatory behaviors/purging were overlooked. Increased screen time may influence emotional regulation in children and adolescents [5], and prior models have suggested strong associations between emotional dysregulation and eating disorders [18]. Thus, it is of importance to elucidate potential detrimental effects related to eating disorder risk.

Beyond the time spent using screens, further specific screen time behaviors and experiences should be investigated in relation to the risk of developing eating disorder symptoms. For example, problematic social media use, defined as the preoccupation with and compulsion to excessively engage in social media platforms [19], has been linked to deleterious outcomes in physical and mental health, including poorer mental health, sleep disturbances, and dietary problems [5]. Problematic mobile phone use shares similarities with problematic social media use and includes broader applications such as texting, apps, and video chatting. Studies have begun to examine the relationship between problematic screen use and negative eating habits and increased sedentary time [7, 20], suggesting that more problematic screen use is associated with higher body mass index [21, 22].

However, the associations between problematic screen use and eating disorder symptoms (e.g., body dissatisfaction) are less understood. In a large study of adolescents in Slovakia, eating disorder symptoms were associated with excessive internet use and potentially linked to poorer self-control and increased impulsivity [23]. As such, there may exist an overlap between the maladaptive behaviors and symptoms associated with eating disorders and the impulsivity related

to problematic screen use. Additional cross-sectional studies have also shown similar relationships between problematic screen use and eating disorders symptoms, but have primarily been limited to smaller samples and older populations [10, 24, 25]. As the literature has shown that both problematic screen use and eating disorder symptoms may begin in early adolescence [9, 26], further studies are needed to potentially inform early prevention strategies.

The current study aimed to determine the prospective associations between total screen time and social media use at baseline and eating disorder symptoms (e.g., fear of obesity, feeling self-worth is tied to weight, engaging in compensatory behaviors, binge eating, distress with binge eating) at two-year follow-up in a large, national sample of early adolescents. Given the availability of problematic screen use data at the 2-year follow-up, the study also sought to determine the cross-sectional associations between problematic screen use (e.g., problematic social media or mobile phone use) and eating disorder symptoms. To better understand the specific relationship between these screen measures and eating disorder symptoms, we adjusted for potential confounders based on known risk factors, including sociodemographic factors (age, race/ethnicity, household income, parent education status), BMI, anxiety, and impulsivity [3, 26, 27]. We hypothesized that higher total screen time and social media use would be prospectively associated with reporting eating disorder symptoms [6, 16, 17]. We also hypothesized that problematic screen use would be cross-sectionally associated with eating disorder symptoms [24, 25].

Methods

Study population

We analyzed prospective data from the Adolescent Brain Cognitive Development (ABCD) Study, a longitudinal study of brain development and health across adolescence in 11,875 children recruited from 21 sites around the U.S. The ABCD study implemented epidemiologically informed strategies to recruit a sample representative of U.S. diversity, largely through school systems and considering sociodemographic factors. Additional details are described elsewhere [28]. Data analyzed are from the ABCD 4.0 release for the baseline (2016–2018, 9–10 years old), year one (2017–2019) and year two (2018–2020) assessments. Participants with missing data for screen time and eating disorder symptoms were excluded ($N = 1{,}552$, 13.1%, characteristics of included and excluded participants may be found in Additional file 1: Table S1). For participants missing sociodemographic data at baseline, including race/ethnicity, sex, household income, parental education, and study site, we implemented Gaussian normal regression imputation in Stata to impute missing 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 used in this study were obtained from the ABCD Study (https://abcdstudy.org), held in the NIMH Data Archive (NDA).

Exposures

Baseline total screen time and social media use

Total screen time and social media use were determined using the self-reported ABCD Youth Screen Time Survey. Participants answered questions about typical hours per day spent on six different screen time modalities (viewing/streaming television shows or movies, watching/streaming videos [e.g., YouTube], playing videogames, texting, video chatting [Skype, Facetime], and social media [e.g., Facebook, Instagram, Twitter]) separately for weekdays and weekend days, based on a previously validated measure [29, 30]. We calculated a weighted average 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 for each modality [22, 31]. We reported the weighted average as a continuous variable after obtaining this screen time total for each modality utilized by participants. Total screen time was determined by summing the weight averages of all modalities.

Year-two problematic screen use

Problematic social media use

Starting in year two, the ABCD Study utilized the adolescent self-reported Social Media Addiction Questionnaire (SMAQ) to assess problematic social media. The six questions of the SMAQ were modeled after the Bergen Facebook Addiction Scale [32]. Examples of the questions included "I've tried to use my social media apps less but I can't" and "I've become stressed or upset if I am not allowed to use my social media apps." Likert-type scale responses ranged from 1 (never) to 6 (very often). Only participants who reported having at least one social media account were asked these items ($n = 5{,}587$).

Problematic mobile phone use

Starting in year two, a similar eight-question Mobile Phone Involvement Questionnaire (MPIQ) was used to assess problematic mobile phone use as reported by adolescents [33]. Examples of questions from the MPIQ included "I interrupt

whatever else I am doing when I am contacted on my phone" and "I lose track of how much I am using my phone." Likert-type scale responses ranged from 1 (strongly disagree) to 7 (strongly agree). This questionnaire has been previously used to assess smartphone dependence and digital multitasking during homework among US high school students [34]. Only participants who reported having mobile phones were asked these items ($n = 7,280$).

Outcome: year-two eating disorder symptoms

The ABCD Study utilized the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-5), a widely used computerized tool for categorizing child and adolescent mental health concerns based on the DSM-5, for assessment of eating disorder symptoms at two-year follow-up [35, 36]. Participants completed all modules of the KSADS-5 to assess the frequency, duration, and characteristics of eating disorder symptoms. Examples of questions participants were asked included "Do you feel like your self-worth is tied to your weight?" and "Was there ever a time, for a month or longer, that you worried all the time about your weight or becoming fat?" Participants were also asked about behaviors such as compensatory behaviors to lose weight and binge eating. Compensatory behaviors included only eating foods with minimal calories, exercising a lot, throwing up, and taking water pills, laxatives, or diet pills. Those who responded yes to any of the behaviors were coded as engaging in compensatory behaviors to lose weight. Participants were asked about binge eating and whether they experienced distress with binge eating. Additional information regarding the KSADS-5 assessment of eating disorder symptoms used in this study may be found in Additional file 1: Table S2.

Confounders

We selected potential sociodemographic confounders based on previous literature and theory [3, 26, 27, 37]. Age (years), sex (female, male), race/ethnicity (White, Latino/Hispanic, Black, Asian, Native American, other), household income (grouped into two categories reflecting the US median household income: less than $75,000 and $75,000 or more), and highest parent education (high school or less vs. college or more) were based on parents' self-report at baseline. Participant BMI was recorded at baseline. Measures of impulsivity were obtained using the Behavioral Inhibition and Approach Systems scale in the ABCD Study, which assesses participant reward responsiveness, drive, and fun-seeking behavior [38, 39]. Anxiety symptoms at baseline were obtained from parent/caregiver responses to the Child Behavior Checklist (CBCL), a screening tool used to assess psychiatric symptoms and behavior problems in children aged 4–18 [28, 40]. Because participants were asked about eating disorder symptoms at the year two assessment but not asked at baseline, we included parent-reported baseline eating disorder symptoms of their child based on the caregiver KSADS-5 assessment as a confounder in longitudinal analyses. ABCD Study site was included as a confounder to adjust for potential regional variation.

Statistical analysis

Multiple logistic regression analyses were conducted using Stata 18.0 (StataCorp, College Station, TX) to (1) estimate prospective associations between screen time (exposure variable) and the presence of adolescent-reported eating disorder symptoms (fearing obesity, feeling self-worth tied to weight, engaging in compensatory behaviors to lose weight, and binge eating) at two-year follow-up, adjusting for confounders including parent-reported baseline eating disorder symptoms, and (2) estimate cross-sectional associations between problematic screen use and eating disorder symptoms, adjusting for confounders. Additionally, testing for interactions between eating disorder symptoms and sex was not statistically significant, and thus, we did not stratify by sex. Propensity weights developed by the ABCD Study were applied to yield estimates representative of the age, sex, and race/ethnicity distribution of US adolescents based on the American Community Survey from the US Census using the svyset and svy commands in Stata as described in the ABCD Study's guide for population-based analysis [38].

Results

Table 1 describes the sociodemographic characteristics of the 10,246 participants included. The sample was approximately matched by sex (48.6% female) and racially and ethnically diverse (45.6% non-White). At baseline, youth reported an average of 3.9 h of total screen time. At two-year follow-up, 1.4% reported fear of obesity, 1.6% felt their self-worth was tied to their weight, 0.7% engaged in compensatory behaviors to lose weight, 7.5% engaged in binge eating, and 2.9% had distress with binge eating.

Logistic regression analyses examining the prospective associations between baseline screen time and adolescent-reported eating disorder symptoms at two-year follow-up are shown in Table 2. In fully adjusted models, each additional hour of total screen time and social media use was prospectively associated with higher odds of fearing weight gain, feeling self-worth tied to weight, engaging in compensatory behaviors to prevent weight gain, binge eating, and distress with binge eating at two-year follow-up, with odds ratios ranging from 1.05 to 1.55.

Table 3 shows logistic regression analyses examining the cross-sectional associations between problematic screen use

Table 1 Sociodemographic, screen time, problematic screen use, and eating disorder symptoms among 10,246 Adolescent Brain Cognitive Development (ABCD) Study participants

Sociodemographic characteristics (baseline)	Mean (SD)/%
Age (years)	9.9 (0.6)
Sex, *n* (%)	
Female	48.6%
Male	51.4%
Race/ethnicity (%)	
White	54.4%
Latino/Hispanic	19.7%
Black	16.0%
Asian	5.4%
Native American	3.2%
Other	1.4%
Household income (%)	
Less than $75,000	45.0%
$75,000 and greater	55.0%
Parent with college education or more (%)	81.2%
Screen time measures	
Total screen time at baseline (hours)	3.9 (3.1)
Total screen time at year one of follow-up (hours)	4.7 (3.6)
Total screen time at year two of follow-up (hours)	6.1 (5.9)
Social media (hours)	0.1 (0.4)
Problematic screen use measures	
Social media addiction questionnaire score[a]	1.9 (0.9)
Mobile phone involvement questionnaire score[b]	3.1 (1.1)
Eating disorder symptoms	
Fear of obesity	1.4%
Self-worth tied to weight	1.6%
Inappropriate compensatory behaviors to prevent weight gain	0.7%
Binge eating	7.5%
Distress with binge eating	2.9%
BMI (kg/m^2)	18.9 (4.2)
BMI percentile	61.6 (30.8)
Weight (kg)	28.0 (13.5)
Weight percentile	61.8 (29.7)
Anxiety symptoms (t-score)	53.7 (6.3)
BAS reward responsiveness sum score	2.2 (0.6)

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

[a]Asked among a subset who reported social media use ($n = 5,587$)

[b]Asked among a subset who reported mobile phone use ($n = 7,280$)

(social media use or mobile phone use) and eating disorder symptoms at two-year follow-up. Both problematic social media use and problematic mobile phone use were associated with all eating disorder symptoms in fully adjusted models with odds ratios ranging from 1.26 to 1.82.

Discussion

In this population-based, demographically diverse cohort of early adolescents in the US, we found that greater

Table 2 Associations between baseline total screen time and eating disorder symptoms at two-year follow-up in the Adolescent Brain Cognitive Development Study

Eating disorder symptom	Total screen time[a]		Social media use[a]	
	OR (95% CI)	*p*	OR (95% CI)	*p*
Fear of obesity	**1.12 (1.08–1.17)**	**< 0.001**	**1.55 (1.21–1.98)**	**0.001**
Self-worth tied to weight	**1.10 (1.06–1.15)**	**< 0.001**	**1.30 (1.03–1.63)**	**0.025**
Inappropriate compensatory behaviors to prevent weight gain	**1.06 (1.03–1.09)**	**< 0.001**	**1.18 (1.01–1.40)**	**0.039**
Binge eating	**1.08 (1.05–1.11)**	**< 0.001**	**1.28 (1.10–1.49)**	**0.002**
Distress with binge eating	**1.05 (1.01–1.09)**	**0.011**	**1.31 (1.06–1.61)**	**0.012**

Bold indicates $p < 0.05$

[a]Covariates: race/ethnicity, sex, household income, parent education, site, baseline parent-reported eating disorder symptom, baseline BMI percentile, baseline anxiety symptoms, and baseline BAS reward responsiveness

Table 3 Cross-sectional associations between problem screen time use and eating disorder symptoms in the Adolescent Brain Cognitive Development Study

Eating disorder symptom	Problematic social media use[a]		Problematic mobile phone use[a]	
	$n = 5{,}587$[b]		$n = 7{,}280$[b]	
	OR (95% CI)	*p*	OR (95% CI)	*p*
Fear of obesity	**1.38 (1.11–1.71)**	**0.004**	**1.43 (1.18–1.72)**	**< 0.001**
Self-worth tied to weight	**1.75 (1.45–2.10)**	**< 0.001**	**1.51 (1.27–1.79)**	**< 0.001**
Inappropriate compensatory behaviors to prevent weight gain	**1.43 (1.28–1.60)**	**< 0.001**	**1.26 (1.15–1.39)**	**< 0.001**
Binge eating	**1.63 (1.48–1.81)**	**< 0.001**	**1.66 (1.51–1.81)**	**< 0.001**
Distress with binge eating	**1.79 (1.54–2.08)**	**< 0.001**	**1.82 (1.57–2.12)**	**< 0.001**

Bold indicates $p < 0.05$

[a]Covariates: race/ethnicity, sex, household income, parent education, site, baseline BMI percentile, baseline anxiety symptoms, and baseline BAS reward responsiveness

[b]Assessments for problematic social media and mobile phone use were only performed on participants who responded "yes" to having a social media account or mobile phone, respectively

screen time and social media use were prospectively associated with eating disorder symptoms at two-year follow-up. We also revealed cross-sectional associations between problematic screen use and eating disorder symptoms. In particular, problematic social media use was most strongly associated with feeling self-worth tied to weight, and problematic mobile phone use was most associated with binge eating.

Our findings regarding the relationship between screen time, social media use, and eating disorder symptoms are consistent with prior studies [8, 10, 17]. While this relationship has been previously examined, longitudinal studies are scarce, particularly in younger adolescents, making this an important extension of previous work. Furthermore, as screen time and media use patterns rapidly evolve over time, continued studies are necessary to best capture their potential influence on youth growing up in different periods. Thus, we add to the literature by (1) using a large, national prospective cohort design; (2) focusing on early adolescence, an important period for the development of screen use and eating disorder symptoms; and (3) examining the associations between problematic screen use and eating disorder symptoms.

Of note, social media use only made up a small portion of total screen time in this population of early adolescents and had significant associations particularly with fear of weight gain. Through social media, youth may gain exposure to unrealistic beauty standards that could precipitate low self-esteem, leading to concerns regarding weight and body image [10, 17, 41]. The other forms of screen time that were not focused on in this study and which youth appear to be engaging with at higher amounts (e.g., television, videos, video games, texting) may also expose youth to similar content. Television shows and advertisements frequently depict and glamorize thinness in women and muscularity in men [42]. Influencers across various platforms, such as Instagram, YouTube, or TikTok have been shown to motivate and positively impact people's exercise goals [43]; however, they often portray a "fit" ideal that may similarly lead to body dissatisfaction [20]. Future studies may seek to identify the relationships between

specific screen time modalities and content that place youth at the greatest risk for developing eating disorder symptoms.

The relationship between problematic screen use and disordered eating is less well described in the literature, with existing studies primarily focusing on older adolescents, college students, and young adults [23, 25, 44]. In contrast to benign use, problematic screen use involves dependence and inability to remove oneself from screens, resulting in functional impairment in daily life. Prior studies have shown that problematic screen use and internet addiction may contribute to the development of poor eating habits [45]. For example, individuals may become so engrossed in their screen use that they unwittingly engage in disordered eating behaviors such as skipping meals to spend more time on their devices or binging due to a lack of awareness around how much they have eaten. Some preliminary studies have shown that mindful and intuitive eating practices, approaches to healthy eating that focus on non-judgmental observations of sensations and cognitions during meals, may reduce disordered eating behaviors [46]. As such, it may be possible that the decreased engagement during meals because of problematic screen use can predispose individuals to develop eating habits that then transform into disordered eating.

In our study, the association with the largest odds ratio was between problematic social media use and feeling self-worth tied to weight. Models describing the etiology of eating disorders often include environmental factors such as social pressure regarding physical appearance [47]. Social media has erupted in the last decade, resulting in increased connectedness to peers [48]; however, increased exposure may result in negative cognitions around body dissatisfaction, fearing obesity, and greater emphasis on body image due to social comparisons with content that embodies thinness ideals [10, 17]. Those who engage in problematic social media use are potentially more prone to constantly comparing themselves to other social media users at greater frequencies, which has been shown to have associations with body dissatisfaction and drive for thinness [16]. Consequently, it is possible that constant social media use can make adolescents more vulnerable to these body ideals and feelings of self-worth tied to their weight and body image.

In addition to these negative body image cognitions, we also found that problematic screen use was associated with binge eating and compensatory behaviors to prevent weight gain. Binge eating involves the overconsumption of food in a short period coupled with a loss of control during episodes. In a prior study, we showed that total screen time was longitudinally associated with binge-eating disorder. However, that study did not examine problematic screen use. Combined with purging, which are compensatory behaviors such as vomiting or excessive exercise to prevent weight gain, binge eating also contributes to bulimia nervosa as well as the binge–purge subtype of anorexia nervosa [49]. Theoretical frameworks attempting to explain the etiologies of these disorders have discussed the potential role of impulsivity [50, 51]. The seemingly impulsive nature of binge eating and purging may share similarities with characteristics of addiction and problematic screen use. Poor inhibitory control in impulsivity has well-established links to addictive behaviors [52]. Impulsivity generally refers to taking action or engaging in behaviors without consideration of consequences. High levels of impulsivity are thought to increase the risk of binge–purge episodes and have been demonstrated in longitudinal studies of adults as well as cross-sectional studies of adolescents [51, 53, 54]. Problematic usage and overconsumption of either social media or mobile phones may reflect the similar loss of control and overconsumption exhibited through binge-eating behaviors, which is consistent with our longitudinal findings between total screen time and eating disorder symptoms. Furthermore, children may be prone to overeating in the absence of hunger while distracted in front of screens. Finally, researchers posit that media and advertising content that youth may become exposed to can reflect unattainable body ideals and exacerbate binge eating [41], and adolescents who hold negative feelings towards their own body image are more likely to binge eat [55].

Our study includes notable limitations. Although we adjusted for several potential confounders, including parent-reported baseline eating disorder symptoms, the possibility of residual confounding due to other factors exists. Though the prospective study design for analyses between screen time and eating disorder symptoms improves on prior cross-sectional evidence, we cannot establish causality given the observational nature of the study. As the prevalence of eating disorder symptoms and the diagnoses of eating disorders increase as youth enter later adolescence, additional studies following the ABCD cohort will be an important area of future research. Furthermore, in this study eating disorder symptoms were assessed by parents at baseline and then adolescents at two-year follow-up since participants themselves were not screened for symptoms at baseline. Prior studies have demonstrated parents may provide lower estimates of eating disorder symptoms [56]; however, we acknowledge that generally, there exists discordance between youth–parent reporting of eating disorder pathology that future research may consider evaluating further [56]. Additionally, in this study eating disorder symptoms were analyzed categorically rather than dimensionally, which may not capture the relationship between screen use and the spectrum of symptom severity. It is important to note that the effect sizes of the associations between screen time and eating disorder symptoms were relatively small. However, they are reported for each additional hour, and thus, greater exposure may result in higher odds of developing symptoms. Despite the large sample

size, participants in the study represent adolescents only within the US, which limits generalizability as both screen time and eating disorder patterns can vary in different regions globally [57, 58]. Because problematic screen use measures were not asked at the initial assessment of the ABCD Study, we were unable to determine the prospective associations between problematic screen use and eating disorder symptoms, though this may be another area of future research. Finally, all measures, including evaluations of screen time and eating disorder symptoms, were based on self-reported responses to survey questions and may be subject to reporting bias.

Given the ubiquitous nature of screen and media use in society and the mounting evidence for risks associated with their use, it is imperative to understand their potential downstream effects on youth. Especially with recent rises in both screen use and eating disorders [12, 59], future research should continue to examine their relationship in adolescent populations. Parent education regarding digital media literacy, which has been shown in some studies to decrease screen time in children, can potentially include guidance on body image concerns. The American Academy of Pediatrics encourages the development of Family Media Use Plans, which can include discussions surrounding problematic screen use and disordered eating concerns with children. Clinicians are encouraged to regularly assess screen time in youth, given the accumulating support for its association with a range of poor mental health outcomes. Moreover, clinicians should consider screening for disordered eating in youth who report high or problematic screen use, given the benefits of early identification for prognosis.

Strength and limits

Strengths of the study include the analysis of a large, diverse prospective cohort of early adolescents in the US. Limitations include the use of self-reported measures which could be subject to reporting bias, the lack of problematic screen use measures at baseline, and the possibility of residual confounding.

What is already known on the subject?

Emerging research evidence suggests positive relationships between higher screen time and eating disorders. However, few studies have examined the prospective associations between screen use and eating disorder symptoms in early adolescents and how problematic screen use may contribute to developing eating disorder symptoms.

What does this study add?

Findings suggest greater total screen time, social media use, and problematic screen use are associated with more eating disorder symptoms in early adolescence. Clinicians should consider assessing for problem screen use and, when high, screen for disordered eating.

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Author contributions JC conducted the analysis, drafted the manuscript, and edited the manuscript. KG, AT, DJ, RR, JH and FB provided critical revision of the manuscript. JN conceptualized the study, provided critical revision of the manuscript, and provided supervision. All authors approve the final manuscript.

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Availability of data and materials Data used in the preparation of this article were obtained from the ABCD Study (https://abcdstudy.org), held in the NIMH Data Archive (NDA).

Declarations

Ethics approval and consent to participate 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.

Informed consent Not applicable.

Competing interests The authors declare no competing interests.

References

1. Hambleton A, Pepin G, Le A, Maloney D, National Eating Disorder Research Consortium, Aouad P, et al (2022) Psychiatric and medical comorbidities of eating disorders: findings from a rapid review of the literature. J Eat Disord 10:132
2. Silén Y, Keski-Rahkonen A (2022) Worldwide prevalence of DSM-5 eating disorders among young people. Curr Opin Psychiatry 35:362–371
3. Striegel-Moore RH, Bulik CM (2007) Risk factors for eating disorders. Am Psychol 62:181–198
4. Barakat S, McLean SA, Bryant E, Le A, Marks P, National Eating Disorder Research Consortium, et al (2023) Risk factors for eating disorders: findings from a rapid review. J Eat Disord 11:8
5. Lissak G (2018) Adverse physiological and psychological effects of screen time on children and adolescents: literature review and case study. Environ Res 164:149–157
6. Nagata JM, Iyer P, Chu J, Baker FC, Pettee Gabriel K, Garber AK, et al (2021) Contemporary screen time modalities among children 9–10 years old and binge-eating disorder at one-year follow-up: a prospective cohort study. Int J Eat Disord 54:887
7. Holland G, Tiggemann M (2016) A systematic review of the impact of the use of social networking sites on body image and disordered eating outcomes. Body Image 17:100–110
8. Fardouly J, Vartanian LR (2016) Social media and body image concerns: current research and future directions. Curr Opin Psychol 9:1–5
9. Murray SB, Ganson KT, Chu J, Jann K, Nagata JM (2022) The prevalence of preadolescent eating disorders in the United States. J Adolesc Health 70:825–828
10. Sidani JE, Shensa A, Hoffman B, Hanmer J, Primack BA (2016) The association between social media use and eating concerns among US young adults. J Acad Nutr Diet 116:1465
11. Sarmiento C, Lau C (2020) Diagnostic and statistical manual of mental disorders, 5th ed. In: The Wiley encyclopedia of personality and individual differences. DSM-5
12. Nagata JM, Cortez CA, Cattle CJ, Ganson KT, Iyer P, Bibbins-Domingo K, et al (2022) Screen time use among US adolescents during the COVID-19 pandemic: findings from the adolescent brain cognitive development (ABCD) Study. JAMA Pediatr 176:94
13. Littleton HL, Ollendick T (2003) Negative body image and disordered eating behavior in children and adolescents: what places youth at risk and how can these problems be prevented? Clin Child Fam Psychol Rev 6:51–66
14. Dorn LD, Hostinar CE, Susman EJ, Pervanidou P (2019) Conceptualizing puberty as a window of opportunity for impacting health and well-being across the life span. J Res Adolesc 29:155
15. Maraldo TM, Zhou W, Dowling J, Vander Wal JS (2016) Replication and extension of the dual pathway model of disordered eating: the role of fear of negative evaluation, suggestibility, rumination, and self-compassion. Eat Behav 23:187–194
16. Lonergan AR, Bussey K, Fardouly J, Griffiths S, Murray SB, Hay P, et al (2020) Protect me from my selfie: Examining the association between photo-based social media behaviors and self-reported eating disorders in adolescence. Int J Eat Disord 53:755
17. Wilksch SM, O'Shea A, Ho P, Byrne S, Wade TD (2020) The relationship between social media use and disordered eating in young adolescents. Int J Eat Disord 53:96
18. Paulus FW, Ohmann S, Möhler E, Plener P, Popow C (2021) Emotional dysregulation in children and adolescents with psychiatric disorders. a narrative review. Front Psychiatry 12:628252
19. Domoff SE, Borgen AL, Radesky JS (2020) Interactional theory of childhood problematic media use. Hum Behav Emerg Technol 2:343–353
20. Holland G, Tiggemann M (2017) "Strong beats skinny every time": Disordered eating and compulsive exercise in women who post fitspiration on Instagram: disordered eating in women who post fitspiration. Int J Eat Disord 50:76–79
21. Julian V, Bergsten P, Forslund A, Ahlstrom H, Ciba I, Dahlbom M, et al (2022) Sedentary time has a stronger impact on metabolic health than moderate to vigorous physical activity in adolescents with obesity: a cross-sectional analysis of the Beta-JUDO study. Pediatr Obes. 17:e12897
22. Nagata JM, Iyer P, Chu J, Baker FC, Gabriel KP, Garber AK, et al (2021) Contemporary screen time usage among children 9–10-years-old is associated with higher body mass index percentile at 1-year follow-up: a prospective cohort study. Pediatr Obes 16:e12827
23. Šablatúrová N, Gottfried J, Blinka L, Ševčíková A, Husarova D (2021) Eating disorders symptoms and excessive internet use in adolescents: the role of internalising and externalising problems. J Eat Disord 9:152
24. Panea-Pizarro I, López-Espuela F, Martos-Sánchez A, Domínguez-Martín AT, Beato-Fernández L, Moran-García JM (2020) Internet addiction and Facebook addiction in Spanish women with eating disorders. Arch Psychiatr Nurs 34:442
25. Tayhan Kartal F, Yabancı Ayhan N (2021) Relationship between eating disorders and internet and smartphone addiction in college students. Eat Weight Disord 26:1853
26. Nagata JM, Singh G, Sajjad OM, Ganson KT, Testa A, Jackson DB et al (2022) Social epidemiology of early adolescent problematic screen use in the United States. Pediatr Res 92:1443–1449
27. Nagata JM, Ganson KT, Iyer P, Chu J, Baker FC, Pettee Gabriel K et al (2022) Sociodemographic correlates of contemporary screen time use among 9- and 10-year-old children. J Pediatr 240:213-220.e2
28. Barch DM, Albaugh MD, Avenevoli S, Chang L, Clark DB, Glantz MD, et al (2018) Demographic, physical and mental health assessments in the adolescent brain and cognitive development study: rationale and description. Dev Cogn Neurosci 32:55
29. Bagot KS, Matthews SA, Mason M, Squeglia LM, Fowler J, Gray K et al (2018) Current, future and potential use of mobile and wearable technologies and social media data in the ABCD study to increase understanding of contributors to child health. Dev Cogn Neurosci 32:121–129
30. Sharif I, Wills TA, Sargent JD (2010) Effect of visual media use on school performance: a prospective study. J Adolesc Health 46:52–61
31. Guerrero MD, Barnes JD, Chaput JP, Tremblay MS (2019) Screen time and problem behaviors in children: exploring the mediating role of sleep duration. Int J Behav Nutr Phys Act 16:105
32. Andreassen CS, Torsheim T, Brunborg GS, Pallesen S (2012) Development of a Facebook Addiction Scale. Psychol Rep 110:501–517
33. Walsh SP, White KM, McD YR (2010) Needing to connect: the effect of self and others on young people's involvement with their mobile phones. Aust J Psychol 62:194–203
34. Mrazek AJ, Mrazek MD, Ortega JR, Ji RR, Karimi SS, Brown CS et al (2021) Teenagers' smartphone use during homework: an analysis of beliefs and behaviors around digital multitasking. Educ Sci 11:713
35. Townsend L, Kobak K, Kearney C, Milham M, Andreotti C, Escalera J et al (2020) Development of three web-based computerized versions of the kiddie schedule for affective disorders and

schizophrenia child psychiatric diagnostic interview: preliminary validity data. J Am Acad Child Adolesc Psychiatry 59:309–325
36. Cheng CM, Chu J, Ganson KT, Trompeter N, Testa A, Jackson DB et al (2023) Cyberbullying and eating disorder symptoms in US early adolescents. Int J Eat Disord 56:2336–2342
37. Nagata JM, Smith-Russack Z, Paul A, Saldana GA, Shao IY, Al-Shoaibi AAA et al (2023) The social epidemiology of binge-eating disorder and behaviors in early adolescents. J Eat Disord 11:182
38. Heeringa SG, Berglund PA (2020) A guide for population-based analysis of the adolescent brain cognitive development (ABCD) study baseline data. bioRxiv. https://doi.org/10.1101/2020.02.10.942011
39. Pagliaccio D, Luking KR, Anokhin AP, Gotlib IH, Hayden EP, Olino TM et al (2016) Revising the BIS/BAS Scale to study development: measurement invariance and normative effects of age and sex from childhood through adulthood. Psychol Assess 28:429–442
40. Achenbach TM, Ruffle TM (2000) The child behavior checklist and related forms for assessing behavioral/emotional problems and competencies. Pediatr Rev 21:265–271
41. Aparicio-Martinez P, Perea-Moreno A-J, Martinez-Jimenez MP, Redel-Macías MD, Pagliari C, Vaquero-Abellan M (2019) Social media, thin-ideal, body dissatisfaction and disordered eating attitudes: an exploratory analysis. Int J Environ Res Public Health 16:4177
42. Tiggemann M, Pickering AS (1996) Role of television in adolescent women's body dissatisfaction and drive for thinness. Int J Eat Disord 20:199–203
43. Li W, Ding H, Xu G, Yang J (2023) The impact of fitness influencers on a social media platform on exercise intention during the COVID-19 pandemic: the role of parasocial relationships. Int J Environ Res Public Health 20:1113
44. Hinojo-Lucena FJ, Aznar-Díaz I, Cáceres-Reche MP, Trujillo-Torres JM, Romero-Rodríguez JM (2019) Problematic Internet use as a predictor of eating disorders in students: a systematic review and meta-analysis study. Nutrients 11:2151
45. Kim Y, Park JY, Kim SB, Jung I-K, Lim YS, Kim J-H (2010) The effects of Internet addiction on the lifestyle and dietary behavior of Korean adolescents. Nutr Res Pract 4:51
46. Anderson LM, Reilly EE, Schaumberg K, Dmochowski S, Anderson DA (2016) Contributions of mindful eating, intuitive eating, and restraint to BMI, disordered eating, and meal consumption in college students. Eat Weight Disord Stud Anorex Bulim Obes 21:83–90
47. Rikani AA, Choudhry Z, Maqsood Choudhry A, Ikram H, Waheed Asghar M, Kajal D et al (2013) A critique of the literature on etiology of eating disorders. Ann Neurosci 20:157–161
48. Ryan T, Allen KA, Gray DL, McInerney DM (2017) How social are social media? A review of online social behaviour and connectedness. J Relatsh Res 8:e8
49. American Psychiatric Association (2013) Diagnostic and statistical manual of mental disorders. American Psychiatric Publishing, Arlington, VA
50. Lavender JM, Mitchell JE (2015) Eating disorders and their relationship to impulsivity. Curr Treat Options Psychiatry 2:394–401
51. Wonderlich SA, Connolly KM, Stice E (2004) Impulsivity as a risk factor for eating disorder behavior: assessment implications with adolescents. Int J Eat Disord 36:172–182
52. Lee RSC, Hoppenbrouwers S, Franken I (2019) A systematic meta-review of impulsivity and compulsivity in addictive behaviors. Neuropsychol Rev 29:14–26
53. Claes L, Vandereycken W, Vertommen H (2005) Impulsivity-related traits in eating disorder patients. Personal Individ Differ 39:739–749
54. Fischer S, Peterson CM, McCarthy D (2013) A prospective test of the influence of negative urgency and expectancies on binge eating and purging. Psychol Addict Behav 27:294–300
55. Lewer M, Bauer A, Hartmann A, Vocks S (2017) Different facets of body image disturbance in binge eating disorder: a review. Nutrients 9:1294
56. Mariano P, Watson HJ, Leach DJ, McCormack J, Forbes DA (2013) Parent–child concordance in reporting of child eating disorder pathology as assessed by the eating disorder examination. Int J Eat Disord 46:617–625
57. Hoek HW (2016) Review of the worldwide epidemiology of eating disorders. Curr Opin Psychiatry 29:336–339
58. Mullan K, Hofferth SL (2022) A comparative time-diary analysis of UK and US children's screen time and device use. Child Indic Res 15:795–818
59. Rodgers RF, Lombardo C, Cerolini S, Franko DL, Omori M, Fuller-Tyszkiewicz M, et al (2020) The impact of the COVID-19 pandemic on eating disorder risk and symptoms. Int J Eat Disord 53:1166