

https://dspace.org/

# Screen time and obsessive-compulsive disorder among children 9-10 years old: a prospective cohort study

**Nagata, Jason M.; Chu, Jonathan; Zamora, Gabriel; Ganson, Kyle T.; Testa, Alexander ...**

**2023**
Elsevier
https://hdl.handle.net/10539/50236
Nagata, J. M., Chu, J., Zamora, G., Ganson, K. T., Testa, A., Jackson, D. B., Costello, C. R., Murray, S. B., & Baker, F. C. (2023). Screen Time and Obsessive-Compulsive Disorder Among Children 9-10 Years Old: A Prospective Cohort Study. The Journal of adolescent health : official publication of the Society for Adolescent Medicine, 72(3), 390–396. https://doi.org/10.1016/j.jadohealth.2022.10.023

Downloaded from a DSpace repository. https://dspace.org/

Journal of Adolescent Health 72 (2023) 390–396

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Original article

# Screen Time and Obsessive-Compulsive Disorder Among Children 9–10 Years Old: A Prospective Cohort Study

Jason M. Nagata, M.D., M.Sc. [a,*], Jonathan Chu [a], Gabriel Zamora [a], Kyle T. Ganson, Ph.D., M.S.W. [b], Alexander Testa, Ph.D. [c], Dylan B. Jackson, Ph.D. [d], Caitlin R. Costello, M.D. [e], Stuart B. Murray, D.Clin.Psych., Ph.D. [f], and Fiona C. Baker, Ph.D. [g,h]

[a] *Department of Pediatrics, University of California, San Francisco, San Francisco, California*
[b] *Factor-Inwentash Faculty of Social Work, University of Toronto, Toronto, Ontario, Canada*
[c] *Department of Management, Policy and Community Health, University of Texas Health Science Center at Houston, Houston, Texas*
[d] *Department of Population, Family, and Reproductive Health, Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland*
[e] *Department of Psychiatry and Behavioral Sciences, University of California, San Francisco, San Francisco, California*
[f] *Department of Psychiatry and Behavioral Sciences, University of Southern California, Los Angeles, California*
[g] *Center for Health Sciences, SRI International, Menlo Park, California*
[h] *School of Physiology, University of the Witwatersrand, Johannesburg, South Africa*

*Article history:* Received June 17, 2022; Accepted October 13, 2022
*Keywords:* Screen time; Video game; Video; Obsessive-compulsive disorder; Adolescent

A B S T R A C T

**Purpose:** The aim of this study is to determine the prospective associations between baseline screen time and obsessive-compulsive disorder (OCD) at 2-year follow-up in a national (United States) cohort of 9- to 10-year-old children.

**Methods:** We analyzed prospective cohort data from the Adolescent Brain Cognitive Development study (n = 9,208). Logistic regression analyses were used to determine the associations between baseline self-reported screen time (exposure) and OCD, based on the Kiddie Schedule for Affective Disorders and Schizophrenia (outcome), at 2-year-follow-up, adjusting for race/ethnicity, sex, household income, parent education, family history of psychopathology, and study site, excluding participants with baseline OCD.

**Results:** The sample was 48.9% female and racially and ethnically diverse (43.5% non-White). Each additional hour of total screen time was prospectively associated with 1.05 higher odds of OCD at 2-year follow-up (95% confidence interval [CI] 1.01–1.09). For specific screen time modalities, each additional hour of playing video games (adjusted odds ratio 1.15, 95% CI 1.03–1.28) and watching videos (adjusted odds ratio 1.11, 95% CI 1.01–1.23) was associated with a subsequent OCD diagnosis.

**Conclusion:** Video games and watching videos are prospectively associated with new-onset OCD in early adolescents. Future research should examine mechanisms linking these specific screen modalities to OCD development to inform future prevention and intervention efforts.

© 2022 Society for Adolescent Health and Medicine. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

**IMPLICATIONS AND CONTRIBUTION**

In a demographically diverse nationwide sample of 9,208 children 9–10 years old in the United States, the current study found that greater screen time, particularly from playing video games and watching videos, was prospectively associated with new-onset obsessive-compulsive disorder at 2-year follow-up.

**Conflicts of interest:** The authors have no conflicts to interest to declare.
**Disclaimer:** The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

* Address correspondence to: Jason M. Nagata, M.D., M.Sc., Department of Pediatrics, University of California, San Francisco, 550 16th Street, 4th Floor, Box 0503, San Francisco, CA 94143.
*E-mail address:* jason.nagata@ucsf.edu (J.M. Nagata).

1054-139X/© 2022 Society for Adolescent Health and Medicine. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
https://doi.org/10.1016/j.jadohealth.2022.10.023

Digital technology has become more integrated in the lives of adolescents than ever before. Exacerbated by the COVID-19 pandemic, both screen use and mental health problems in adolescents have increased in recent years [1,2], and most evidence indicates an association between high levels of screen time and unfavorable psychological outcomes [3–6]. One mental health condition of concern as screen use ubiquitously rises is obsessive-compulsive disorder (OCD) [7]. OCD is characterized by recurrent and unwanted intrusive thoughts and repetitive behaviors that an individual feels driven to perform [8]. OCD can have severely debilitating and long-lasting effects on adolescent development that extend into adulthood such as social isolation, having fewer relationships than their peers, comorbid mental illnesses, and diminished quality of life [9,10]. With contemporary technology platforms potentially facilitating compulsive checking of content and repetitive behaviors [11], the question of whether high levels of screen time are associated with mental health conditions like OCD is of the utmost importance.

Several etiological theories for OCD have been proposed [12,13], and cognitive-behavioral models may provide the theoretical basis for an association between high levels of screen time and increased OCD risk in adolescents. Screen use may be related to OCD through cognitive-behavioral models linking OCD with perfectionism, overestimation of threat, or perceptual biases or deficits [12,13]. Screen use could promote perfectionism through needing to attain a perfect score on a video game or overestimation of threat by being exposed to screen violence. Perfectionism and overestimation of threat are belief domains that may play an important role in the development of obsessions from intrusive thoughts [12]. In addition, screen time could lead to biases in self-perception through comparisons with others such as influencers on social media or YouTube videos, which could lead to intrusive thoughts and develop into obsessions [13]. For instance, recent literature has proposed that when followers develop intense relationships with social media influencers, they can become increasingly obsessed, leading to problematic engagement and unstable emotional responses (i.e., envy, anxiety, fear of missing out) that may ultimately contribute to OCD [14,15].

Previous literature highlighted a variety of negative mental health outcomes such as anxiety and depression being associated with greater screen time in adolescents [3]. However, limited research has analyzed the associations between screen time and OCD in adolescents. One study of young adults found that addictive use of video games and social media was associated with OCD [16]. However, other studies have shown mixed results and often did not target OCD as their primary focus [7,17,18]. Previous literature has also focused on young adults with minimal study of adolescents [19]. As there is a peak of incidence of OCD at 9–10 years of age, there is a need to study screen time exposure during this critical time period in the development of OCD [20]. Furthermore, most previous studies have been cross-sectional, thus offering less utility in determining possible causes of adolescent OCD development than a prospective cohort study design, in which the exposure temporally precedes the outcome. Given these gaps in the current literature and the fact that around half a million adolescents in the United States suffer from OCD [21], it is critical that the associations between screen use and OCD in adolescents become better elucidated using prospective data from cohort studies. Analyzing these associations could offer new insights in the context of adolescent and public health.

The current study aims to bridge current gaps in the literature by examining the prospective relationship between different contemporary forms of screen time and subsequent diagnosis of OCD in a diverse, nationwide sample of 9- to 10-year-old adolescents participating in the Adolescent Brain Cognitive Development (ABCD) study. This study allows for the examination of the association between different forms of screen use such as television, video games, texting, watching videos, video chat, and social networking with the development of new-onset OCD. Furthermore, it examines this relationship in early adolescents, an age group that has previously been neglected in the current literature on screen time and OCD. The current prospective study hypothesizes that greater screen time will be associated with subsequent diagnosis of OCD.

## Methods

### *Study population*

The current study analyzed prospective data from the ABCD study (https://abcdstudy.org). The ABCD study is a longitudinal study of brain development and health across adolescence in 11,875 children recruited from 21 sites around the United States (Appendix A). With the aim of creating a sample representative of the diversity within the United States, the ABCD study implemented epidemiologically informed strategies via school systems and attention to sociodemographic factors. Additional details are outlined elsewhere [22]. The present study analyzed data from the ABCD 4.0 release (held in the National Institute of Mental Health Data Archive) for the baseline (2016–2018, 9–10 years old) and 2-year follow-up (2018–2020, 11–12 years old) assessments. Exclusion criteria included participants who had missing data for screen time, OCD, or confounder data used in the analysis (n = 2,667), leaving 9,208 included in the analysis (Appendix B). We further excluded 666 participants with OCD at baseline for one of the regression models (Model 3). Centralized institutional review board approval was obtained from the University of California, San Diego. Study site approvals were obtained from their respective institutional review boards. Caregivers of participants provided written informed consent and each child participant provided written assent.

### *Exposures: screen time*

Screen time was determined using the ABCD Youth Screen Time Survey. Each participant answered questions about the typical number of hours per day they spent on several different screen modalities (viewing TV shows or movies, watching videos [e.g., YouTube], playing video games, texting, video chatting [e.g., Skype, FaceTime], and social media [e.g., Facebook, Instagram, Twitter]) for both weekdays and weekends, based on a previously validated measure [23,24]. The current study performed a weighted average calculation of the participants' typical weekday and weekend screen time use ((weekday average × 5) + (weekend average × 2)/7) to formulate a typical day measure for each screen modality [25]. The current study reported the weighted average of usage as a continuous variable. Total screen time was calculated as the sum of the six screen modalities.

*Outcome: obsessive-compulsive disorder*

The ABCD study utilized the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS-5), a widely used diagnostic tool for assessing symptoms of child and adolescent mental health disorders in the DSM-5, for the assessment of OCD [8,26]. Caregivers completed all modules of the KSADS-5 to reflect mental health symptoms and diagnoses of each participant. The present study used the KSADS-5 computerized scoring system to extrapolate interview question responses into an OCD diagnosis from reported symptoms of obsessions or compulsions corresponding to the DSM-5 at both baseline and 2-year follow-up [8]. OCD scoring mirrored DSM-5 criteria including the presence of either obsessions or compulsions. The DSM-5 criteria characterize obsessions as recurrent thoughts that an individual attempts to suppress, and compulsions as repetitive behaviors that the individual feels compelled to perform secondary to the obsession [8]. For obsessions to be calculated as present in the current study, at least one "yes" indicated from an obsessions list, "yes" to having intrusive/unwanted thoughts, and "yes" to attempts to neutralize or ignore the thoughts were all necessary. For compulsions to be calculated as present, at least one "yes" was indicated from a compulsions list and at least one "yes" to purpose of compulsions being positive. For the OCD outcome to be positive, either obsessions or compulsions needed to be calculated as present, along with any of the following being positive: time-consuming obsessions, time-consuming compulsions, impairment due to obsessions or compulsions, or distress related to obsessions or compulsions.

*Confounders*

Potential sociodemographic confounders for the association between screen time and OCD were chosen based on previous literature [27]. Age (years), sex (female, male), race/ethnicity (White, Latino/Hispanic, Black, Asian, Native American, other), household income (US dollars, six categories: less than $25,000, $25,000–$49,999, $50,000–$74,999, $75,000–$99,999, $100,000–$199,999, $200,000 and greater), and highest education of participants' parents (high school or less vs. college or more) were based on parents' self-report. Baseline major depressive disorder and OCD were determined from the KSADS-5 and were included as covariates. We also excluded participants with baseline OCD in one regression model (Model 3). Family history of psychopathology was assessed with a modified version of the Family History Assessment from a previously validated study [28,29], and included as a covariate. We adjusted for study site given potential site and regional differences (see Appendix A for a full list of the 21 study sites across the United States).

*Statistical analysis*

Analyses were conducted in 2022 using Stata 15.1 (StataCorp, College Station, Texas). We calculated descriptive characteristics for the total sample and compared baseline sociodemographic and screen characteristics of participants with and without OCD at baseline. Independent samples *t*-tests were conducted for continuous variables and adjusted *F* tests, a variant of the second-order Rao-Scott adjusted chi-squared test, were conducted for categorical or binary variables. We additionally compared baseline screen characteristics for participants with and without OCD at 2-year follow-up using independent samples *t*-tests. Multiple logistic regression analyses were conducted to estimate associations between baseline screen time (exposure variable) and OCD at 2-year follow-up (outcome variable). We analyzed associations in three sets of logistic regression models: unadjusted models (Model 1); models adjusting for age, sex, race/ethnicity, household income, parent education, baseline depression, family history of psychopathology, study site, and baseline OCD (Model 2); and models adjusting for age, sex, race/ethnicity, household income, parent education, baseline depression, family history of psychopathology, and study site, excluding participants with baseline OCD (Model 3). Propensity weights were applied to yield representative estimates based on the American Community Survey from the US Census [30].

## Results

Table 1 describes sociodemographic characteristics of the 9,208 participants included and compares those with (n = 666) and without (n = 8,542) an OCD diagnosis. The sample was 48.8% female and was racially and ethnically diverse (47.8% non-White). At baseline, youth on average reported 3.9 hours of screen time per day, including watching television shows/movies (1.3 hours), playing video games (1.0 hours), watching videos (1.0 hours), texting (0.2 hours), video chatting (0.2 hours), and using social media (0.1 hour). At year 2, 6.1% of the sample met diagnostic criteria for OCD, with 4.4% developing new-onset OCD from baseline to 2-year follow-up.

Table 2 shows baseline screen time differences between participants with and without OCD at 2-year follow-up. Participants with OCD at follow-up reported 4.4 hours per day of total screen time, while participants without OCD at follow-up reported 3.9 hours per day of total screen time ($p = .002$).

Table 3 shows logistic regression analyses examining the associations between baseline screen time and OCD at 2-year follow-up. In unadjusted models (Model 1), total screen time, watching television shows/movies, watching videos, and playing video games were associated with OCD at 2-year follow-up. In models adjusting for potential confounders including baseline OCD (Model 2), total screen time, watching videos, and playing video games were associated with OCD at 2-year follow-up. In adjusted models excluding participants with baseline OCD (Model 3, n = 8,542), findings were mostly similar to those reported in Model 2. Each additional hour of total screen time was prospectively associated with higher odds of OCD at 2-year follow-up (adjusted odds ratio [aOR] 1.05, 95% confidence interval [CI] 1.01–1.09). For specific screen time modalities, each additional hour of playing video games (aOR 1.15, 95% CI 1.03–1.28) and watching videos (aOR 1.11, 95% CI 1.01–1.23) was associated with subsequent OCD.

## Discussion

In a demographically diverse nationwide sample of 9,208 children 9–10 years old in the United States, the current study found that longer total screen time was prospectively associated with OCD at 2-year follow-up, even after adjusting for confounders. These results were held after adjusting for baseline OCD, as well as removing those with baseline OCD from the sample. The specific screen modalities most strongly associated with OCD were playing video games and watching videos. Each additional hour spent on video games was associated with 13% higher risk of subsequent OCD while each additional hour spent

**Table 1**
Sociodemographic, screen time, and obsessive-compulsive disorder diagnoses of 9,208 Adolescent Brain Cognitive Development study participants

| | Total, n = 9,208 | OCD (baseline), n = 666 | No OCD (baseline), n = 8,542 | *p*-value[a] |
|---|---|---|---|---|
| | Mean (SD)/% | Mean (SD)/% | Mean (SD)/% | |
| Sociodemographic characteristics (baseline) | | | | |
| Age (years) | 9.94 (0.62) | 9.94 (0.60) | 9.93 (0.63) | .979 |
| Sex, n (%) | | | | <.001 |
| Female | 48.9% | 40.0% | 49.7% | |
| Male | 51.1% | 60.0% | 50.3% | |
| Race/ethnicity (%) | | | | .002 |
| White | 56.5% | 52.4% | 56.9% | |
| Latino/Hispanic | 18.6% | 19.2% | 18.5% | |
| Black | 15.3% | 20.4% | 14.9% | |
| Asian | 5.2% | 3.2% | 5.3% | |
| Native American | 3.1% | 4.3% | 3.0% | |
| Other | 1.3% | 0.6% | 1.4% | |
| Household income (%) | | | | <.001 |
| Less than $25,000 | 16.7% | 29.9% | 15.6% | |
| $25,000–$49,999 | 20.1% | 21.6% | 20.0% | |
| $50,000–$74,999 | 17.9% | 17.7% | 17.9% | |
| $75,000–$99,999 | 14.1% | 10.7% | 14.4% | |
| $100,000–$199,999 | 23.6% | 16.1% | 24.2% | |
| $200,000 and greater | 7.6% | 3.9% | 7.9% | |
| Parent with college education or more (%) | 83.7% | 75.1% | 84.4% | <.001 |
| Major depressive disorder (%) | 0.2% | 0.1% | 0.2% | .695 |
| Family history of psychopathology (%) | 60.1% | 73.4% | 58.9% | <.001 |
| Screen time variables (baseline) | | | | |
| Total screen time | 3.88 (3.06) | 4.49 (3.10) | 3.83 (3.06) | <.001 |
| Television shows/movies | 1.29 (1.06) | 1.46 (1.10) | 1.28 (1.05) | <.001 |
| Videos (YouTube) | 1.02 (1.16) | 1.23 (1.27) | 1.01 (1.15) | <.001 |
| Video games | 1.03 (1.11) | 1.26 (1.20) | 1.01 (1.10) | <.001 |
| Texting | 0.23 (0.54) | 0.23 (0.55) | 0.21 (0.43) | .144 |
| Video chat | 0.19 (0.48) | 0.19 (0.48) | 0.19 (0.48) | .866 |
| Social networking | 0.11 (0.40) | 0.14 (0.45) | 0.11 (0.40) | .184 |

Propensity weights were applied to yield estimates based on the American Community Survey from the US Census.
OCD = obsessive-compulsive disorder; SD = standard deviation.
[a] *p*-value from independent samples *t*-test (continuous variables) or adjusted *F*, a variant of the second-order Rao-Scott adjusted chi-squared test (binary or categorical variables).

watching videos was associated with 11% higher risk of subsequent OCD.

The present study is novel and adds to the scant literature by examining the relationship between different contemporary forms of screen time and OCD in a large, national prospective cohort of 9- to 10-year-old children followed for 2 years. Although we did not examine underlying mechanisms of how higher levels of watching videos and video gaming could lead to increased risk for new-onset OCD, there exists a theoretical basis explaining the association between these screen time modalities and OCD. Gaming disorder, attributed to excessive engagement with video games, is associated with compulsivity and loss of behavioral control, which are core symptoms of OCD [31,32]. Cognitive-behavioral theories may explain links between video gaming and OCD. Specifically, playing video games may lead to perception biases or deficits that advance sentiments such as superfluous needs for self-reevaluation or feelings of worry, both of which may be related to OCD symptoms [13]. At the root of obsession is the culmination of persistent intrusive thoughts or images; the belief domains of perfectionism and overestimation of threat may facilitate the transition from the culmination of such intrusions to obsession [12]. Intrusions associated with video gaming may involve ideas of aggression that increase stress in the screen time user. This may perpetuate feelings of discomfort and anxiety that may be reduced by further engaging with screen time as a coping mechanism. In addition to developing or amplifying overestimation of threat—as in through exposure to violence during gaming—video game use could promote perfectionism where users may prioritize the need to attain a perfect score or exceed a previous best score. The resulting behaviors, alongside rituals within video game culture, could become compulsions. Time spent playing video games is significantly correlated with problematic video game use including spending a lot of time thinking about playing video games, feeling the need to play video games more and more, and being unable to play video games less despite trying [33].

**Table 2**
Comparisons of baseline screen time among participants with and without OCD at 2-year follow-up in the Adolescent Brain Cognitive Development study (n = 9,208)

| | OCD (year 2), Mean (SD) | No OCD (year 2), Mean (SD) | *p*-value[a] |
|---|---|---|---|
| Total screen time | **4.36 (3.39)** | **3.85 (3.04)** | **.002** |
| Television shows/movies | **1.43 (1.14)** | **1.28 (1.05)** | **.011** |
| Videos (YouTube) | **1.18 (1.31)** | **1.01 (1.15)** | **.008** |
| Video games | **1.17 (1.22)** | **1.02 (1.10)** | **.009** |
| Texting | 0.26 (0.59) | 0.25 (0.59) | .320 |
| Video chat | 0.19 (0.50) | 0.19 (0.48) | .937 |
| Social networking | 0.13 (0.40) | 0.11 (0.40) | .430 |

Bold indicates $p < .05$. Propensity weights were applied to yield estimates based on the American Community Survey from the US Census.
OCD = obsessive-compulsive disorder; SD = standard deviation.
[a] *p*-value from independent samples *t*-test (continuous variables).

**Table 3**
Associations between baseline screen time and OCD at 2-year follow-up in the Adolescent Brain Cognitive Development study

| | Model 1: OCD at year 2, unadjusted (n = 9,208) | | Model 2: OCD at year 2, adjusting for covariates and OCD at baseline[a] (n = 9,208) | | Model 3: OCD at year 2, adjusting for covariates and excluding participants with OCD at baseline[b] (n = 8,542) | |
|---|---|---|---|---|---|---|
| | OR (95% CI) | *p*-value | AOR (95% CI) | *p*-value | AOR (95% CI) | *p*-value |
| Total screen time | **1.05 (1.02–1.08)** | **.001** | **1.04 (1.01–1.08)** | **.018** | **1.05 (1.01–1.09)** | **.012** |
| Television shows/movies | **1.13 (1.03–1.23)** | **.007** | 1.08 (0.97–1.19) | .146 | 1.10 (0.98–1.24) | .106 |
| Videos (YouTube) | **1.12 (1.04–1.22)** | **.005** | **1.10 (1.01–1.19)** | **.033** | **1.11 (1.01–1.23)** | **.038** |
| Video games | **1.12 (1.03–1.22)** | **.005** | **1.11 (1.01–1.22)** | **.025** | **1.15 (1.03–1.28)** | **.015** |
| Texting | 1.10 (0.93–1.29) | .275 | 1.13 (0.94–1.36) | .194 | 1.20 (1.00–1.44) | .056 |
| Video chat | 1.00 (0.82–1.24) | .937 | 0.99 (0.80–1.22) | .917 | 0.91 (0.70–1.18) | .483 |
| Social networking | 1.09 (0.90–1.31) | .391 | 1.01 (0.81–1.27) | .927 | 1.07 (0.83–1.39) | .604 |

Bold indicates $p < .05$. Propensity weights were applied to yield estimates based on the American Community Survey from the US Census.
AOR = adjusted odds ratio; OCD = obsessive-compulsive disorder; OR = odds ratio; SD = standard deviation.
[a] Model 2 is adjusted for race/ethnicity, sex, household income, parent education, site, baseline major depressive disorder, family history of psychiatric disorders, and study site, and baseline OCD.
[b] Model 3 is adjusted for race/ethnicity, sex, household income, parent education, site, baseline major depressive disorder, family history of psychiatric disorders, study site, and excluding participants with OCD at baseline.

Watching videos (such as on YouTube) could allow for compulsive viewing of homogenous content [11], which may be facilitated through algorithms or advertisements suggesting related content. Repeatedly watching the same or similar content could lead to overestimation of threats that could contribute to obsessions stemming from intrusions instigating fear. It is interesting that we did not find an association between television watching and OCD. Possible explanations are that traditional television viewing generally has fewer programming options than YouTube, which may limit users' engagement. Thus, behaviors surrounding traditional television may not have the same potential for the clustering of specific content that may otherwise exacerbate intrusive thoughts or images.

Texting, video chat, and social media were less common screen behaviors among our 9- to 10-year-old sample but are expected to increase through adolescence and should be studied in older adolescent age groups. Nonsignificant results were likely due to the less prevalent use of these forms of screen behaviors in early adolescence. These findings may also suggest that specific forms of screen use may be more relevant to OCD development than total screen time. Future research is warranted in ascertaining whether affective symptoms co-occur with such screen time use, and whether potential patterns of compulsive screen time engagement may belong to an OCD prodrome.

Given early adolescence is a critical time period in the onset of OCD, the present study offers several implications within the realms of public and clinical healthcare. Findings are also relevant amidst the recent dramatic rise in adolescent screen time throughout the COVID-19 pandemic. The current study's cohort reported a mean of 8 hours of recreational screen time per day at the beginning of the pandemic, which is four times the previous screen time limits set by the American Academy of Pediatrics. Concurrently, several studies have shown that OCD symptoms worsened during the COVID-19 pandemic [34], especially for individuals with contamination-related OCD [35]. Although a definitive causal relationship between screen time and OCD has not yet been established, our findings inform several possibilities for intervention. These include OCD educational programs for grade school educators, which have been shown to increase educator OCD knowledge, decrease stigma, and improve early identification and intervention in students with OCD [36]. Implementation of digital literacy classes in grade schools have demonstrated success in promoting a variety of health-related behavior changes, with limiting screen use being among the most common behavior changes undertaken [37]. Healthcare professionals could consider limiting excessive video games and videos in children with OCD. Video game developers and companies could develop more safeguards and game structures that encourage breaks from the game.

The current study has several limitations. The screen time measures do not capture the content, context, or quality of screen use [38], which may be important factors to consider in the development of OCD. The screen time measures were self-reported, which make them prone to social desirability bias. Furthermore, it may be difficult for early adolescents to estimate screen time correctly. Screen time was also not specified to be recreational, though most of the screen types analyzed in the study would be used recreationally. Although the social media measure provided examples such as Facebook, Instagram, and Twitter, there may have been other examples that could be more relevant for the targeted group. The association between total screen time and OCD was relatively weak and was mainly explained through video games and watching videos. Thus, further research is necessary to analyze the relationships between watching videos, video gaming, and OCD, and how they covary over time, as well as potential underlying mechanisms such as the content, context, and quality of videos and video games. The current study adjusted for a variety of potential confounders including race, gender, income, parent education, baseline OCD, and family history of psychiatric disorders; however, residual confounders like the type of media that was consumed during screen time, as well as parenting and cultural differences were not examined. Future research could examine trajectories of OCD symptoms and the association between screen time and changes in OCD symptoms over time using latent growth curve analyses. Selection bias is a possibility given that participants excluded due to missing data were more likely to be racial/ethnic minorities, have lower household income, and have lower parent education. However, given that these excluded populations generally report higher screen time [2], findings may

be biased toward the null. Notable strengths of the study are the large, diverse, and nationwide sample that focused on early adolescence as well as the prospective study design.

*Conclusion*

The current study indicates that higher screen time use is associated with new-onset OCD in early adolescents. The findings should increase awareness around screen use and its possible role in OCD development. Videos and video games had the strongest associations between screen time and OCD and offer focus points for future research and interventions to prevent OCD development in early adolescence.

## Acknowledgments

The authors thank Joanne Yang and Sanya Dhama for analytic and editorial assistance.

## Funding Sources

J.M.N. was funded by the National Institutes of Health (K08HL159350), the American Heart Association Career Development Award (CDA34760281), and the Doris Duke Charitable Foundation (2022056).The Adolescent Brain Cognitive Development study was supported by the National Institutes of Health and additional federal partners under award numbers U01DA041022, U01DA041025, U01DA041028, U01DA041048, U01DA041089, U01DA041093, U01DA041106, U01DA041117, U01DA041120, U01DA041134, U01DA041148, U01DA041156, U01DA041174, U24DA041123, and U24DA041147. A full list of supporters is available at https://abcdstudy.org/federal-partners/. A listing of participating sites and a complete listing of the study investigators can be found at https://abcdstudy.org/principal-investigators.html. Adolescent Brain Cognitive Development consortium investigators designed and implemented the study and/or provided data but did not necessarily participate in the analysis or writing of this report.

## Supplementary Data

Supplementary data related to this article can be found at 10.1016/j.jadohealth.2022.10.023.

## References

[1] Meherali S, Punjani N, Louie-Poon S, et al. Mental health of children and adolescents amidst COVID-19 and past pandemics: A rapid systematic review. Int J Environ Res Public Health 2021;18:3432.
[2] Nagata JM, Cortez CA, Cattle CJ, et al. Screen time use among us adolescents during the COVID-19 pandemic: Findings from the Adolescent Brain Cognitive Development (ABCD) study. JAMA Pediatr 2022;176:94–6.
[3] Balkan E, Adalıer A. The relationship between internet addiction and psychological symptoms. Int J Glob Education 2012;1:42–9.
[4] Oswald TK, Rumbold AR, Kedzior SGE, et al. Psychological impacts of "screen time" and "green time" for children and adolescents: A systematic scoping review. PLoS One 2020;15:e0237725.
[5] Nagata JM, Iyer P, Chu J, et al. 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 2021;54:887–92.
[6] Nagata JM, Chu J, Ganson KT, et al. Contemporary screen time modalities and disruptive behavior disorders in children: A prospective cohort study. J Child Psychol Psychiatry 2022.
[7] Wacks Y, Weinstein AM. Excessive smartphone use is associated with health problems in adolescents and young adults. Front Psychiatry 2021;12:669042.
[8] American Psychiatric Association.. Diagnostic and statistical manual of mental disorders. 5th. Arlington, VA: American Psychiatric Association; 2022.
[9] Subramaniam M, Soh P, Vaingankar JA, et al. Quality of life in obsessive-compulsive disorder: Impact of the disorder and of treatment. CNS Drugs 2013;27:367–83.
[10] Thomsen PH. Obsessions: The impact and treatment of obsessive-compulsive disorder in children and adolescents. J Psychopharmacol 2000;14:S31–7.
[11] Klobas JE, McGill TJ, Moghavvemi S, et al. Compulsive YouTube usage: A comparison of use motivation and personality effects. Comput Hum Behav 2018;87:129–39.
[12] Doron G, Kyrios M. Obsessive compulsive disorder: A review of possible specific internal representations within a broader cognitive theory. Clin Psychol Rev 2005;25:415–32.
[13] Ouimet AJ, Ashbaugh AR, Radomsky AS. Hoping for more: How cognitive science has and hasn't been helpful to the OCD clinician. Clin Psychol Rev 2019;69:14–29.
[14] James TL, Lowry PB, Wallace L, et al. The effect of belongingness on obsessive-compulsive disorder in the use of online social networks. J Management Inf Syst 2017;34:560–96.
[15] Farivar S, Wang F, Turel O. Followers' problematic engagement with influencers on social media. Comput Hum Behav 2022;133:107288.
[16] Andreassen CS, Billieux J, Griffiths MD, et al. The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. Psychol Addict Behav 2016;30:252–62.
[17] Yi X, Liu Z, Qiao W, et al. Clustering effects of health risk behavior on mental health and physical activity in Chinese adolescents. Health Qual Life Outcomes 2020;18:211.
[18] Starcevic V, Khazaal Y. Relationships between behavioural addictions and psychiatric disorders: What is known and what is yet to Be learned? Front Psychiatry 2017;8:53.
[19] Bipeta R, Yerramilli SSRR, Karredla AR, et al. Diagnostic stability of internet addiction in obsessive-compulsive disorder: Data from a naturalistic one-year treatment study. Innov Clin Neurosci 2015;12:14.
[20] Geller DA, Homayoun S, Johnson G. Developmental considerations in obsessive compulsive disorder: Comparing pediatric and adult-onset cases. Front Psychiatry 2021;12:678538.
[21] March J, Benton C. Talking Back to OCD. New York: The Guilford Press; 2007:10–1.
[22] Garavan H, Bartsch H, Conway K, et al. Recruiting the ABCD sample: Design considerations and procedures. Dev Cogn Neurosci 2018;32:16–22.
[23] Bagot KS, Matthews SA, Mason M, et al. 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 2018;32:121–9.
[24] Paulus MP, Squeglia LM, Bagot K, et al. Screen media activity and brain structure in youth: Evidence for diverse structural correlation networks from the ABCD study. Neuroimage 2019;185:140–53.
[25] Guerrero MD, Barnes JD, Chaput JP, et al. Screen time and problem behaviors in children: Exploring the mediating role of sleep duration. Int J Behav Nutr Phys Activity 2019;16:105.
[26] Townsend L, Kobak K, Kearney C, et al. 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 2020;59:309–25.
[27] Willoughby T, Adachi PJC, Good M. A longitudinal study of the association between violent video game play and aggression among adolescents. Dev Psychol 2012;48:1044–57.
[28] Brown SA, Brumback T, Tomlinson K, et al. The national consortium on alcohol and neuro-development in adolescence (NCANDA): A multisite study of adolescent development and substance use. J Stud Alcohol Drugs 2015;76:895–908.
[29] Barch DM, Albaugh MD, Avenevoli S, et al. Demographic, physical and mental health assessments in the adolescent brain and cognitive development study: Rationale and description. Dev Cogn Neurosci 2018;32:55–66.
[30] Heeringa S, Berglund P. A guide for population-based analysis of the Adolescent Brain Cognitive Development (ABCD) study baseline data. BioRxiv 2020.
[31] Klugah-Brown B, Zhou X, Pradhan BK, et al. Common neurofunctional dysregulations characterize obsessive-compulsive, substance use, and gaming disorders-An activation likelihood meta-analysis of functional imaging studies. Addict Biol 2021;26:e12997.
[32] Brakoulias V, Starcevic V, Albert U, et al. The rates of co-occurring behavioural addictions in treatment-seeking individuals with obsessive-compulsive disorder: A preliminary report. Int J Psychiatry Clin Pract 2020;24:173–5.
[33] Nagata JM, Singh G, Sajjad OM, et al. Social epidemiology of early adolescent problematic screen use in the United States. Pediatr Res 2022:1–7.
[34] Linde ES, Varga TV, Clotworthy A. Obsessive-compulsive disorder during the COVID-19 pandemic-A systematic review. Front Psychiatry 2022;13:806872.

[35] Guzick AG, Candelari A, Wiese AD, et al. Obsessive-compulsive disorder during the COVID-19 pandemic: A systematic review. Curr Psychiatry Rep 2021;23:71.
[36] Chaves A, Arnáez S, Roncero M, et al. Teachers' knowledge and Stigmatizing attitudes associated with obsessive-compulsive disorder: Effectiveness of a brief educational intervention. Front Psychiatry 2021;12:677567.
[37] Hyman A, Stewart K, Jamin AM, et al. Testing a school-based program to promote digital health literacy and healthy lifestyle behaviours in intermediate elementary students: The Learning for Life program. Prev Med Rep 2020;19:101149.
[38] Kaye LK, Orben A, Ellis DA, et al. The conceptual and methodological Mayhem of "screen time". Int J Environ Res Public Health 2020;17:3661.