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Screen Time Use Among US Adolescents During the COVID-19 Pandemic: Findings From the Adolescent Brain Cognitive Development (ABCD) Study

Excessive screen use in adolescents has been associated with physical and mental health risks,[1] and there are known disparities in screen use across sex, race and ethnicity, and income in adolescents.[2] The COVID-19 pandemic and subsequent stay-at-home mandates, online learning, and social distancing requirements have led to an increasing reliance on digital media (ie, screens) for nearly all facets of adolescents' lives (eg, entertainment, socialization, education). Although studies conducted worldwide have suggested an increase in screen time among children and teens during the pandemic,[3,4] this has not yet been explored using national US data. The aims of this study were to evaluate adolescents' self-reported screen use during the pandemic across 7 modalities by sociodemographic categories and to assess mental health and resiliency factors associated with screen use among a demographically diverse, national sample of children and adolescents aged 10 to 14 years.

Supplemental content

Methods | Cross-sectional data from the May 2020 COVID-19 survey (COVID-19 Rapid Response Research Release) from the Adolescent Brain Cognitive Development (ABCD) Study were analyzed. The sample consisted of 5412 adolescents predominantly aged 12 to 13 years. Centralized institutional review board approval was obtained from the University of California, San Diego. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline. Written informed consent and assent were obtained from a parent or guardian and the child, respectively, to participate in the ABCD study.

Screen use for the following modalities was determined using adolescents' self-reported hours of use on a typical day, excluding hours spent on school-related work: multiple-player gaming, single-player gaming, texting, social media, video chatting, browsing the internet, and watching or streaming movies, videos, or television shows.[5] Total typical daily screen use, excluding schoolwork, was calculated as the sum. Multiple linear regression analyses estimated associations between mental health and resiliency factors (eMethods in the Supplement provides the measures) and total screen use, after adjustment for potential confounders including sex, race and ethnicity (as self-reported from a list of categories), annual household income, parent educational level, and study site. Analyses were conducted in 2021 using Stata 15.1, weighting data to approximate the American Community Survey by the US Census. Testing was 2-sided, and $P < .05$ was considered statistically significant.

Results | Among the 5412 adolescents included in our sample, 50.7% were female and 49.3% were male. The sample was racially and ethnically diverse (7.2% Asian; 11.1% Black; 17.2% Hispanic, Latina, and Latino; 2.5% Native American; 60.6% White; and 1.4% self-reported as other). Adolescents reported a mean (SD) of 7.70 (5.74) h/d of screen use, mostly spent on watching or streaming videos, movies, or television shows (2.42 [2.45] h/d), multiple-player gaming (1.44 [2.21] h/d), and single-player gaming (1.17 [1.82] h/d). The mean and SD screen use time for each modality by sociodemographic characteristics are given in **Table 1**. In adjusted models (**Table 2**), poorer mental health (B, 0.29; 95% CI, 0.06-0.52; $P = .01$) and greater perceived stress (B, 0.67; 95% CI, 0.43-0.91; $P < .001$) were associated with higher total screen use, while more social support (B, −0.32; 95% CI, −0.59 to −0.04; $P = .02$) and coping behaviors (B, −0.17; 95% CI, −0.26 to −0.09; $P < .001$) were associated with lower total screen use.

Discussion | In this cross-sectional study of a large, national sample of adolescents surveyed early in the COVID-19 pandemic, we found that the mean total daily screen use was 7.70 h/d. This is higher than prepandemic estimates (3.8 h/d) from the same cohort at baseline, although younger age and slightly different screen time categories could also account for differences.[6] Despite the gradual reversal of quarantine restrictions, studies have suggested that screen use may remain persistently elevated.[4] Screen time disparities across racial, ethnic, and income groups in adolescents have been reported previously and may be due to structural and systemic racism-driven factors (eg, built environment, access to financial resources, and digital media education)—all of which have been amplified in the COVID-19 pandemic.[2] Different screen use modalities may have differential positive or negative consequences for ado-

Table 1. Summary of Adolescent-Reported Screen Time Use During the COVID-19 Pandemic by Sociodemographic Characteristics Among 5412 Participants in the Adolescent Brain Cognitive Development Study, May 2020[a]

Sociodemographic characteristic	Screen time, mean (SD), h/d[b]							
	Total screen time	Streaming	Multiple-player gaming	Single-player gaming	Social media	Texting	Video chatting	Browsing the internet
Total	7.70 (5.74)	2.42 (2.45)	1.44 (2.21)	1.17 (1.82)	0.98 (1.66)	0.84 (1.51)	0.65 (1.18)	0.42 (0.67)
Sex								
Female	7.23 (5.52)	2.44 (2.37)	0.69 (1.38)	0.70 (1.24)	1.30 (1.86)	1.05 (1.70)	0.85 (1.32)	0.40 (0.64)
Male	8.18 (5.92)	2.41 (2.53)	2.22 (2.60)	1.66 (2.16)	0.65 (1.34)	0.63 (1.24)	0.44 (0.97)	0.44 (0.71)
Race and ethnicity								
Asian	6.60 (5.60)	2.07 (2.45)	1.31 (2.11)	0.84 (1.55)	0.69 (1.32)	0.72 (1.23)	0.64 (1.26)	0.40 (0.63)
Black	10.06 (7.21)	2.82 (2.89)	1.75 (2.71)	1.68 (2.41)	1.40 (2.14)	1.36 (2.33)	0.95 (1.71)	0.58 (0.95)
Hispanic, Latina, and Latino	8.73 (5.64)	2.65 (2.44)	1.73 (2.20)	1.44 (1.87)	1.05 (1.59)	1.05 (1.62)	0.70 (1.26)	0.45 (0.67)
Native American	9.67 (7.31)	2.87 (2.76)	1.65 (2.49)	1.59 (2.26)	1.42 (2.32)	1.38 (2.56)	0.82 (1.69)	0.55 (0.86)
White	6.98 (5.22)	2.30 (2.32)	1.31 (2.11)	1.02 (1.66)	0.88 (1.56)	0.69 (1.23)	0.56 (0.97)	0.38 (0.61)
Other[c]	9.65 (5.11)	2.82 (2.67)	1.66 (1.75)	1.58 (1.70)	1.69 (2.02)	0.65 (0.83)	1.08 (1.49)	0.29 (0.38)
Highest parent educational level								
College education or more	7.47 (5.68)	2.39 (2.44)	1.39 (2.19)	1.10 (1.76)	0.94 (1.66)	0.81 (1.49)	0.65 (1.18)	0.40 (0.66)
High school education or less	9.23 (5.75)	2.64 (2.43)	1.83 (2.27)	1.69 (2.05)	1.20 (1.63)	1.11 (1.55)	0.65 (1.18)	0.53 (0.73)
Annual household income, $								
≥75 000	7.01 (5.85)	2.28 (2.59)	1.30 (2.26)	0.97 (1.77)	0.88 (1.72)	0.71 (1.39)	0.63 (1.19)	0.37 (0.67)
<75 000	8.48 (5.26)	2.58 (2.20)	1.61 (2.04)	1.40 (1.73)	1.08 (1.52)	1.00 (1.49)	0.66 (1.11)	0.47 (0.64)

[a] Propensity weights from the Adolescent Brain Cognitive Development Study were applied based on the American Community Survey from the US Census.

[b] Individual screen time estimates do not equal the sum total because a winsorization method was applied to minimize the impact of extreme values within the distributions of each screen time category and the total category.

[c] This subcategory was listed as "other" but with no specific racial and ethnic groups defined, although write-ins were allowed.

Table 2. Mental Health and Resiliency Factors Associated With Total Screen Time Use During the COVID-19 Pandemic Among 5412 Participants in the Adolescent Brain Cognitive Development Study, May 2020[a]

Factor	Unadjusted		Adjusted	
	Difference in total screen time, B (95% CI), h/d	*P* value	Difference in total screen time, B (95% CI), h/d	*P* value
Mental health	0.02 (−0.22 to 0.25)	.89	0.29 (0.06 to 0.52)	.01
COVID-19–related worry	0.15 (−0.05 to 0.35)	.13	0.01 (−0.19 to 0.20)	.94
Perceived stress	0.66 (0.41 to 0.91)	<.001	0.67 (0.43 to 0.91)	<.001
Social support	−0.12 (−0.40 to 0.16)	.42	−0.32 (−0.59 to −0.04)	.02
Coping behaviors	−0.32 (−0.40 to −0.24)	<.001	−0.17 (−0.26 to −0.09)	<.001

[a] Estimated differences in total screen time were obtained as the regression coefficient (B) (95% CI) from a series of linear regression models, with total screen time as the dependent variable and each mental health and resiliency factor (eg, mental health, COVID-19–related worry) as the independent variable of interest. The contrast for these variables is a 1-point difference in their corresponding scale; see the eMethods in the Supplement for further details on the coding of these scales. The table represents the abbreviated outputs from 10 regression models in total. Adjusted models represent the abbreviated output from linear regression models including covariate adjustment for sex, race and ethnicity, annual household income, parent educational level, and site. Propensity weights from the Adolescent Brain Cognitive Development Study were applied based on the American Community Survey from the US Census.

lescents' well-being during the COVID-19 pandemic. Adolescents experiencing stress and poor mental health may use screens to manage negative feelings or withdraw from stressors. Although some screen modalities may be used to promote social connection, higher coping behaviors and social support in this sample were associated with lower total screen usage. Limitations of this study include the use of self-reported data. Furthermore, adolescents often multitask on screens; thus, the computed total could be an overestimate. Future studies should examine screen use trends as pandemic restrictions are lifted and also explore mechanisms to prevent sociodemographic disparities.

Jason M. Nagata, MD, MSc
Catherine A. Cortez, BS
Chloe J. Cattle, BS
Kyle T. Ganson, PhD, MSW
Puja Iyer, BA
Kirsten Bibbins-Domingo, PhD, MD, MAS
Fiona C. Baker, PhD

Author Affiliations: Department of Pediatrics, University of California, San Francisco (Nagata, Cattle, Iyer); Fielding School of Public Health, University of California, Los Angeles (Cortez); Factor-Inwentash Faculty of Social Work, University of Toronto, Toronto, Ontario, Canada (Ganson); Department of Epidemiology and Biostatistics, University of California, San Francisco (Bibbins-Domingo); Center for Health Sciences, SRI International, Menlo Park, California (Baker).

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Corresponding Author: Jason M. Nagata, MD, MSc, Department of Pediatrics, University of California, San Francisco, 550 16th St, Fourth Floor, Box 0110, San Francisco, CA 94158 (jason.nagata@ucsf.edu)

Author Contributions: Dr Nagata and Ms Cortez had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: Nagata, Cortez, Cattle, Ganson.
Acquisition, analysis, or interpretation of data: Nagata, Cortez, Ganson, Iyer, Bibbins-Domingo, Baker.
Drafting of the manuscript: Nagata, Cortez, Cattle, Iyer.
Critical revision of the manuscript for important intellectual content: Nagata, Cortez, Ganson, Iyer, Bibbins-Domingo, Baker.
Statistical analysis: Nagata, Cortez.
Administrative, technical, or material support: Ganson.
Supervision: Nagata.

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The Role of Face Masks in the Recognition of Emotions by Preschool Children

Since the beginning of the COVID-19 pandemic, health policy requires staff working in preschool education to wear face masks. This has prompted worries about the ability of young children to recognize emotions and the possible impact on their development. Without face masks, preschoolers aged 36 to 72 months had a rate of correctly identified emotions on pictures of 11.8% to 13.1%.[1] Recent studies using photographs with digitally added face masks showed that participants had worse emotional recognition of the images with face masks; the first of these[2] tested preschoolers on a smartphone at home, and the second[3] tested children aged 7 to 13 years. We therefore aimed to study the role of actual face masks on the recognition of joy, anger, and sadness in younger preschool children.

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Methods | The primary outcome of this cross-sectional experimental study was the rate of correct responses using pictures of adults displaying joy, anger, or sadness. With 15 actors with and without a surgical face mask (10 women and 5 men, based on demographic information of childminders in local public day care centers), we created a data set of 90 pictures displaying joy, anger, or sadness (**Figure 1**). We built the experiment with E-Prime version 3.0 (Psychology Software Tools). The ethics committee for human research of the Canton Vaud approved the study and accepted that, given the pandemic situation, consent could be waived. Parents of children attending public day care centers received written, oral, and filmed information, with the possibility to opt out. Children aged 36 to 72 months without a treated neurodevelopmental impairment were eligible to participate. They sat in front of a computer, with a known caretaker if they wanted, and a trained pediatrician randomly showed the 90 pictures. Children could either name the emotion, point on a card showing emoticons of these 3 emotions, or choose the response options "I don't know" or "Quit the experiment." The responses of children who stopped the session prematurely were included in analyses. The statistical analysis included a comparison of the correct response rates in the different conditions with χ^2 tests and bias-corrected Cramer V to calculate effect sizes. Data were analyzed with SPSS Statistics version 27 (IBM) and R studio version 1.3.1093 using R version 4.1.0 (R Foundation for Statistical Computing).

Results | Data were collected in 9 public day care centers. The sample consisted of 276 children (girls: 135 [48.9%]; mean [SD] age, 52.4 [9.6] months). The test lasted a median (IQR) of 6.74 (4.22-9.26) minutes per child. The rate of "I don't know" responses was 3.1% (n = 781), and 551 responses (2.2%) were "Quit the experiment." The global correct response rate was 68.8%: 70.6% without face mask vs 66.9% with face mask (χ^2_1 = 37.783; P < .001; V, 0.0385 [95% CI, 0.0266-0.0515]), with a difference for joy (94.8% vs 87.3%; χ^2_1 = 140.260; P < .001; V, 0.1301 [95% CI, 0.1090-