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Associations between sexual orientation and early adolescent screen use: Findings from the Adolescent Brain Cognitive Development (ABCD) Study

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Abstract

Objective: To assess the association between sexual orientation and screen use (screen time and problematic screen use) in a demographically diverse national sample of early adolescents in the U.S.

Methods: We analyzed cross-sectional data from Year 2 of the Adolescent Brain Cognitive Development (ABCD) Study (N=10,339, 2018-2020, ages 10-14 years). Multiple linear regression analyses estimated the association between sexual orientation and recreational screen time, as well as problematic use of video games, social media, and mobile phones.

Results: In a sample of 10,339 adolescents (48.7% female, 46.0% racial/ethnic minority), sexual minority (compared to heterosexual) identification was associated with 3.72 (95% CI 2.96-4.47) more hours of daily recreational screen time, specifically more time on television, YouTube videos, video games, texting, social media, video chat, and browsing the internet. Possible sexual minority identification (responding "maybe" to the sexual minority question) was associated with 1.58 (95% CI 0.92-2.24) more hours of screen time compared to heterosexual identification. Sexual minority and possible sexual minority identification were associated with higher problematic social media, video game, and mobile phone use.

Conclusions: Sexual minority adolescents spend a disproportionate amount of time engaging in screen-based activities, which can lead to problematic screen use.

Keywords: screen time; LGBTQ+; adolescent

Abbreviations and Acronyms:

ABCD: Adolescent Brain Cognitive Development study

IRB: Institutional review board

MPIQ: Mobile Phone Involvement Questionnaire

SMAQ: Social Media Addiction Questionnaire

U.S.: United States

UCSD: University of California, San Diego

VGAQ: Video Game Addiction Questionnaire

Introduction

Adolescents report increasing use of digital technology and screens [1]. Screen time is associated with several adverse mental and physical health outcomes, such as depression, anxiety, suicide, poor sleep, and cardiometabolic disease [2]. Sexual minority adolescents experience higher rates of bullying, discrimination, and mental health issues [3–5] and may engage in screen-based activities for connection and support to seek refuge from otherwise unsafe or isolating environments.

Little is known about associations between sexual orientation and screen time, particularly in early adolescence when many individuals may still be exploring their sexual identities. One study, using a national sample of Australian adolescents, showed that sexual minority youth spend more time alone, less time in active leisure- and school-based activities, and more time in non-active leisure activities than their heterosexual counterparts [6]. Another study, conducted in Brazil using a cohort of adults, reported sexual minority individuals spend more leisure time in front of a screen than heterosexual individuals [7]. It has been suggested that minority stress may contribute to the nature of activities sexual minority adolescents choose to engage in (e.g., active leisure- and school-based activities versus non-active solitary leisure activities) [6]; however, the lack of data available surrounding associations between

sexual orientation and screen time in adolescence makes it difficult to draw definitive conclusions. Beyond time spent on screens, even less is known about associations between sexual orientation and problematic screen use, which can include elements of addiction, such as mood modification, conflict, tolerance, withdrawal, and relapse [8–10]. Further, there are notable sex differences in screen use (e.g., boys report more time playing video games [11] and more problematic video game use [9] than girls); therefore, there could be sex differences in the association between sexual orientation and screen use.

To address the gaps in the literature, the current study aimed to assess associations among sexual orientation, recreational screen time, and problematic screen use in a demographically diverse national sample of early adolescents in the United States (U.S.). We hypothesized that sexual minority status would be associated with higher screen time and problematic use compared to heterosexual early adolescents.

Methods

We conducted a cross-sectional analysis of data from Year 2 of the Adolescent Brain Cognitive Development (ABCD) study (4.0 release). The ABCD Study is a longitudinal study (baseline 2016–2018) of health and cognitive development in 11,875 children from 21 recruitment sites across the U.S. The ABCD Study participants, recruitment, protocol, and measures have previously been described in detail [12]. Participants were 10–14 years old during the 2-year follow-up, which was conducted between 2018 and 2020. Institutional review board (IRB) approval was received from the University of California, San Diego (UCSD) and the respective IRBs of each study site. Written assent was obtained from participants, and written informed consent was obtained from their caregivers.

Measures

Independent Variable

Sexual Orientation: Participants reported their sexual orientation ("Are you gay or bisexual?"; yes, maybe, no, don't understand the question, decline to answer) [13]. Participants who responded "yes" were considered sexual minority adolescents, "maybe" were considered possible sexual minority adolescents, and "no" were considered heterosexual adolescents.

Dependent Variables

Recreational Screen Use

Recreational screen use for the following modalities was determined using adolescents' self-reported hours of use on a typical weekday and weekend: multi-player gaming, single-player gaming, texting, social media, video chatting, browsing the internet, and watching/streaming movies, videos, or TV [14]. Total typical daily screen use was calculated as the weighted sum ([weekday average x 5] + [weekend average x 2])/7.

Problematic Screen Use

Video Game Addiction Questionnaire (VGAQ): Adolescents responded to the six-question VGAQ to assess problematic video game use. The questions were modeled after the Bergen Facebook Addiction Scale [15], which consists of a unidimensional factor structure questionnaire assessing Facebook addiction. Its application has been extended to broader video game and social media addiction among high school and college students by prior authors [16,17]. Example questions include "I play video games so much that it has had a bad effect on my schoolwork or job" and "I feel the need to play video games more and more." Likert-type scale responses ranged from 1 (never) to 6 (very often). These questions were posed to participants who reported video game use during the week or on weekends.

Social Media Addiction Questionnaire (SMAQ): Adolescents responded to the six-question SMAQ to assess problematic social media use. The questions were also modeled after the Bergen Facebook Addiction Scale [8–10]. Examples include "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). These questions were posed to participants who reported having at least one social media account.

Mobile Phone Involvement Questionnaire (MPIQ): Adolescents responded to the eight-question MPIQ to assess problematic mobile phone use [18]. Examples include "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 was previously used in a study to evaluate smartphone dependence in relation to digital multitasking while doing schoolwork among U.S. high school students [19]. These questions were posed to participants who reported having mobile phones.

Statistical Analyses

Data analyses were performed in 2022 using Stata 15.1 (StataCorp). Multiple linear regression analyses were conducted to estimate cross-sectional associations between sexual minority identification and possible sexual minority identification (compared to heterosexual) and recreational screen time (eight modalities in total) as well as three forms of problematic screen use (video game, social media, mobile phone), adjusting for potential confounders including sex, race/ethnicity, parent education, household income, and study site. Assumptions of linear regression were checked and satisfied. We also show analyses stratified by sex and checked for effect modification of the associations by sex. Propensity weights were applied to yield representative estimates based on the American Community Survey from the U.S. Census.

Results

In a sample of 10,339 adolescents (48.7% female, 46.0% racial/ethnic minority),

4.4% identified as a sexual minority and 3.1% reported that they did not understand the question (Table 1). The average screen time was 7.19 hours per day.

Compared to heterosexual adolescents, sexual minority adolescents reported 3.72 (95% CI 2.96-4.47) more hours of total screen time, 0.51 (95% CI 0.22-0.80) more hours of watching television, 0.94 (95% CI 0.63-1.25) more hours of watching videos, 0.57 (95% CI 0.31-0.84) and 0.36 (95% CI 0.16-0.57) more hours of single and multiple-players video games, respectively, 0.64 (95% CI 0.33-0.96) more hours of texting, 0.46 (95% CI 0.25-0.67) more hours of using social media, 0.24 (95% CI 0.04-0.43) more hours of using video chat, and 0.52 (95% CI 0.33-0.71) more hours browsing the internet per day in adjusted models (Table 2). Among the subset that reported video game use, sexual minority status was associated with a 0.49 (95% CI 0.33-0.64) higher problematic video game use score. Similarly, sexual minority status among the subset reporting social media use was associated with a 0.46 (95% CI 0.32-0.60) higher problematic social media use score ($p < 0.05$), and among the subset reporting mobile phone use, a 0.56 (95% CI 0.41-0.70) higher problematic mobile phone use score ($p < 0.05$). Screen use comparisons for adolescents responding "maybe" to the sexual minority question compared to heterosexual adolescents are shown in Table 3. Sex-stratified models are shown in Appendices A and B.

Discussion

This study used data from a demographically diverse national sample of early adolescents to assess associations between sexual orientation and screen use. We found that sexual minority status (compared to heterosexual) was associated with nearly four hours more total screen time per day, especially more time spent watching YouTube videos. We also found that sexual minority status (compared to heterosexual) was associated with higher video game addiction, social media addiction, and mobile phone involvement. Adolescents who responded "maybe" to the sexual minority question reported 1.58 hours more total screen time and greater problematic screen use compared to heterosexual adolescents, though associations were generally weaker than for sexual minority adolescents. While

prior research has shown that sexual minority adolescents spend more time engaging in non-active leisure activities [6] (e.g., recreational reading, singing, playing musical instruments), this is the first study (to our knowledge) to report associations between sexual orientation and screen time use among a nationally representative sample of U.S. adolescents. Overall, our findings indicate that sexual minority youth are spending a disproportionate amount of time engaging in screen-based activities.

Sexual minority youth are at higher risk for school-based victimization [3] and may be more likely to be excluded from peer groups due to their sexual orientation than heterosexual youth. This may explain why sexual minority adolescents choose to spend less time engaging in traditional school-based social or extracurricular activities and more time engaging in screen-based activities [6]. In contrast, it is possible that virtual social networking through texting, social media, and the internet may provide a resource for sexual minority adolescents to connect with and garner support from other LGBTQ+ youth or adults who may not be present in their local communities [20]. The screen modality with the strongest association with sexual minority status was YouTube videos. YouTube and other resources on the internet may serve as sources of LGBTQ+-focused content for sexual minority youth exploring their identities [21], compared to traditional television.

Sexual minority (compared to heterosexual) identification was more strongly associated with total screen time, videos, single-player video games, and problematic video game use in girls compared to boys. These sex differences could explain some changes in unadjusted compared to adjusted regression models for screen use outcomes.

In terms of implications for policy and guidelines, the American Academy of Pediatrics noted the need for more personalized guidance rather than a one-size-fits-all approach for screen use among young people [22]. The current study can inform more personalized guidance especially for sexual minority adolescent boys and girls. Parents, teachers, and pediatricians should be aware that sexual minority adolescents are more likely to exhibit problematic screen use than their heterosexual peers and look for warning signs for problematic screen use including mood modification, conflict, tolerance,

withdrawal, and relapse [8]. Future research could investigate particular contexts or content of screen use and how these are associated with health risks and benefits to inform screen guidance for sexual minority youth.

Limitations of the study include the use of self-reported data, which could be subject to reporting and recall bias, and the inability to infer causality with cross-sectional data. The small sample size of sexual minority youth (4.4% of the total sample) and the limited number of sexual minority categories should also be noted as limitations. Importantly, the current phrasing of the sexual orientation question assumes all who report "no" to being gay or bisexual are heterosexual, when in fact some may be queer, asexual, pansexual, etc. We did not analyze the response options "don't understand the question" and "decline to answer" in the regression models given the unclear interpretation of those responses. Additionally, given that prior research has shown that the average age of sexual orientation identification is 17.8 years [23] (mean age of 12 years in the current study), it is possible that many adolescents in the current sample may not be out yet or have a clear understanding of sexual orientation. Because of these limitations, our risk estimates of sexual minority status on screen time are likely conservative.

In conclusion, we found that sexual minority identification was associated with greater total screen use and problematic screen use. Future research could examine associations between specific sexual orientations (e.g., gay, bisexual, lesbian) and screen time use. Longitudinal research could examine relationships between sexual orientation, changes in screen use, and health outcomes over time as the cohort ages to later adolescence and young adulthood.

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Competing interests:

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

Ethics approval:

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

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Table 1. Sociodemographic and screen time characteristics of Adolescent Brain Cognitive Development (ABCD) Study participants (N=10,339)

Sociodemographic characteristics	Mean (SD) / %
Age (years)	12.04 (0.67)
Sex (%)	
Female	48.7%
Male	51.3%
Race/ethnicity (%)	
White	54.0%
Latino / Hispanic	20.0%
Black	16.1%
Asian	5.4%
Native American	3.2%
Other	1.5%
Household income (%)	
Less than $75,000	52.5%
$75,000 and greater	47.5%
Parents' highest education (%)	
High school education or less	16.2%
College education or more	83.8%
Sexual minority status (%)	
No	87.4%
Yes	4.4%
Maybe	3.8%
I don't understand the question	3.1%
Decline to answer	1.3%
Screen time	
Total recreational screen time	7.19 (5.83)
Television	1.70 (1.81)
Videos	1.46 (1.91)

Single-player video games	1.02 (1.65)
Multi-player video games	1.16 (1.85)
Texting	0.73 (1.57)
Social media	0.73 (1.63)
Video chat	0.50 (1.35)
Browsing the internet	0.36 (0.79)
Problematic screen use measures	
Video Game Addiction Questionnaire Score[a]	2.10 (1.08)
Social Media Addiction Questionnaire Score[b]	1.85 (0.91)
Mobile Phone Involvement Questionnaire Score[c]	3.11 (1.12)

ABCD propensity weights were applied based on the American Community Survey from the US Census. SD = standard deviation

[a] Asked among a subset who reported video game use (n=7,600)

[b] Asked among a subset who reported social media use (n=5,656)

[c] Asked among a subset who reported mobile use (n=7,367)

Table 2. Screen Use Associations with Sexual Minority Identification (Yes vs No) in the Adolescent Brain Cognitive Development (ABCD) Study

	Unadjusted		Adjusted	
	B (95% CI)	p	B (95% CI)	p
Screen time				
Total recreational screen time	**3.40 (2.64, 4.16)**	**< 0.001**	**3.72 (2.96, 4.47)**	**< 0.001**
Television	**0.55 (0.27, 0.83)**	**< 0.001**	**0.51 (0.22, 0.80)**	**0.001**
Videos	**0.77 (0.47, 1.07)**	**< 0.001**	**0.94 (0.63, 1.25)**	**< 0.001**
Single-player video games	**0.26 (0.02, 0.51)**	**0.034**	**0.57 (0.31, 0.84)**	**< 0.001**
Multi-player video games	-0.11 (-0.30, 0.08)	0.256	**0.36 (0.16, 0.57)**	**< 0.001**
Texting	**0.84 (0.52, 1.16)**	**< 0.001**	**0.64 (0.33, 0.96)**	**< 0.001**
Social media	**0.68 (0.48, 0.88)**	**< 0.001**	**0.46 (0.25, 0.67)**	**0.001**
Video chat	**0.41 (0.22, 0.60)**	**< 0.001**	**0.24 (0.04, 0.43)**	**0.014**
Browsing the internet	**0.50 (0.32, 0.69)**	**< 0.001**	**0.52 (0.33, 0.71)**	**< 0.001**
Problematic screen use measures				
Video Game Addiction Questionnaire Score[a]	0.07 (-0.07, 0.21)	0.343	**0.49 (0.33, 0.64)**	**< 0.001**
Social Media Addiction Questionnaire Score[b]	**0.48 (0.35, 0.62)**	**< 0.001**	**0.46 (0.32, 0.60)**	**< 0.001**

Mobile Phone Involvement Questionnaire Score[c]	**0.58 (0.45, 0.72)**	**< 0.001**	**0.56 (0.41, 0.70)**	**< 0.001**

Bold indicates p<0.05. The estimated B coefficient in the cells represent abbreviated outputs from a series of linear regression models with sexual minority identification (yes vs no) as the independent variable and screen use (row header) as the outcome variable. Thus, the table represents the output from 24 different regression models in total (12 unadjusted and 12 adjusted). ABCD propensity weights were applied based on the American Community Survey from the US Census.
Adjusted models include age, sex, race/ethnicity, household income, parent education, and site.
a Asked among a subset who reported video game use
b Asked among a subset who reported social media use
c Asked among a subset who reported mobile use

Table 3. Screen Use Associations with Possible Sexual Minority Identification (Maybe vs No) in the Adolescent Brain Cognitive Development (ABCD) Study

	Unadjusted		Adjusted	
	B (95% CI)	p	B (95% CI)	p
Screen time				
Total recreational screen time	**1.23 (0.56, 1.90)**	**< 0.001**	**1.58 (0.92, 2.24)**	**< 0.001**
Television	0.20 (-0.02, 0.43)	0.088	0.16 (-0.06, 0.39)	0.155
Videos	**0.60 (0.32, 0.88)**	**< 0.001**	**0.58 (0.34, 0.82)**	**< 0.001**
Single-player video games	-0.06 (-0.20, 0.08)	0.415	**0.19 (0.04, 0.34)**	**0.012**
Multi-player video games	**-0.19 (-0.35, -0.02)**	**0.021**	**0.19 (0.03, 0.35)**	**0.019**
Texting	**0.26 (0.06, 0.46)**	**0.010**	0.15 (-0.04, 0.35)	0.138
Social media	**0.37 (0.15, 0.59)**	**0.001**	**0.28 (0.05, 0.51)**	**0.015**
Video chat	0.004 (-0.12, 0.13)	0.947	-0.06 (-0.20, 0.07)	0.390
Browsing the internet	**0.24 (0.11, 0.36)**	**< 0.001**	**0.26 (0.13, 0.40)**	**< 0.001**
Problematic screen use measures				
Video Game Addiction Questionnaire Score[a]	-0.07 (-0.21, 0.05)	0.260	**0.25 (0.12, 0.39)**	**< 0.001**
Social Media Addiction Questionnaire Score[b]	**0.30 (0.16, 0.43)**	**< 0.001**	**0.34 (0.20, 0.48)**	**< 0.001**
Mobile Phone Involvement Questionnaire Score[c]	**0.45 (0.30, 0.59)**	**< 0.001**	**0.44 (0.28, 0.59)**	**< 0.001**

Bold indicates p<0.05. The estimated B coefficient in the cells represent abbreviated outputs from a series of linear regression models with possible sexual minority identification (maybe vs no) as the independent variable and screen use (row header) as the outcome variable. Thus, the table represents the output from 24 different regression models in total (12 unadjusted and 12 adjusted). ABCD propensity weights were applied based on the American Community Survey from the US Census.
Adjusted models include age, sex, race/ethnicity, household income, parent education, and site.
[a] Asked among a subset who reported video game use
[b] Asked among a subset who reported social media use

[c] Asked among a subset who reported mobile use

Statement of Authors Contributions:
Jason Nagata conceptualized and designed the study, contributed to the data analysis, drafted the initial manuscript, and revised the manuscript.
Christopher Lee drafted the initial manuscript and revised the manuscript.
Joanne Yang performed the data analysis, drafted the initial manuscript, and revised the manuscript.
Abubakr Al-shoaibi performed the data analysis and drafted the revised manuscript.
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The authors have no conflict to declare.

Highlights

- We analyzed data from 10,339 early adolescents 10-14 years old
- Sexual minority adolescents reported more screen time than heterosexual peers
- Sexual minorities reported higher problematic screen use than heterosexual peers