

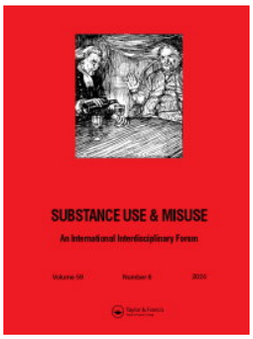
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Social Media Use and Alcohol Sipping in Early Adolescents A Prospective Cohort Study

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ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/isum20

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To cite this article: Jason M. Nagata, Omar M. Sajjad, Natalia Smith, Gabriel Zamora, Sanya Dhama, Abubakr A. A. Al-shoaibi, Kyle T. Ganson, Alexander Testa, Megan A. Moreno, Orsolya Kiss, Fiona C. Baker & Dylan B. Jackson (2024) Social Media Use and Alcohol Sipping in Early Adolescents: A Prospective Cohort Study, Substance Use & Misuse, 59:6, 971-976, DOI: 10.1080/10826084.2024.2310501

To link to this article: https://doi.org/10.1080/10826084.2024.2310501

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SUBSTANCE USE & MISUSE
2024, VOL. 59, NO. 6, 971–976
https://doi.org/10.1080/10826084.2024.2310501

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Social Media Use and Alcohol Sipping in Early Adolescents: A Prospective Cohort Study

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ABSTRACT

Background: Social media can influence alcohol initiation behaviors such as sipping, which can lead to future adverse alcohol-related outcomes. Few studies have examined the role of problematic social media use, characterized by addiction, mood modification, tolerance, withdrawal, conflict, and relapse, especially in early adolescence. *Objective:* To examine the prospective association between social media use and sipping alcohol in a nationwide sample of early adolescents, and the extent to which problematic social media use mediates the association. *Methods:* We analyzed prospective data from the Adolescent Brain Cognitive Development Study ($N = 7514$; ages 9–10 years at baseline; 2016–2018) to estimate associations between social media time (Year 1) and alcohol sipping (Year 3) using modified Poisson regression, adjusting for confounders and testing problematic social media use (Year 2) as a mediator. *Results:* Social media time (Year 1) was prospectively associated with 1.31 (95% confidence interval 1.20–1.43) times higher risk of new-onset sipping (Year 3). The association between social media time and new-onset alcohol sipping was partially mediated by problematic social media use at Year 2 (25.0% reduction in the association between the former two factors after adding problematic social media use, $p = 0.002$). *Conclusions:* Time spent on social media was associated with a higher risk of alcohol sipping in a diverse national sample of early adolescents, and the association was partially mediated by problematic social media use. Media literacy education and family media use plans could advise early adolescents about exposure to alcohol content on social media and warning signs for problematic use.

KEYWORDS
Social media; alcohol; sipping; adolescent; substance use

Introduction

Underage drinking results in over 4000 deaths in the United States each year (Murphy et al., 2021). Initiation of alcohol use often begins with sipping, defined as taking a sip of alcohol without consuming a full standard drink (Donovan, 2007). Children who sip by sixth grade are at higher odds of getting drunk, consuming a full drink, and drinking heavily (3+ drinks per occasion) by ninth grade (Jackson et al., 2015). Ninety-one percent of children and adolescents who initiated alcohol consumption had begun with sipping, with an average of 3.6 years between these behaviors (Donovan & Molina, 2014). Childhood sipping, as a predictor of subsequent alcohol use, may be an early indicator of adverse alcohol-related outcomes (Jackson et al., 2015).

Social media use is ubiquitous and often begins in early adolescence, like alcohol sipping. Adolescents report that 60% of their peers and 31% of their friends post alcohol-related content on social media (Meisel et al., 2022). Social media may influence alcohol sipping based on the Media Practice Model, which suggests that adolescents choose and interact with media based on who they desire to be in the moment; thus, an adolescent who is considering trying alcohol may seek out social media content related to alcohol (Brown, 2000).

Prior studies have shown that social media is linked to alcohol use but have focused on later adolescence and young adulthood rather than early adolescence, which is considered a sensitive window for the effects of social media (Orben et al., 2022). In contrast to the cross-sectional design of most previous studies, the current study presents a prospective

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/10826084.2024.2310501.

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design. Furthermore, few have studied problematic social media use, which can include elements of addiction, such as conflict, mood modification, tolerance, withdrawal, and relapse, in relation to alcohol sipping (Andreassen et al., 2012; Nagata et al., 2022).

The current study aims to investigate the prospective association between social media and sipping alcohol among a large sample of early adolescents. We hypothesized that time spent on social media would be associated with alcohol sipping and that problematic social media use would partially mediate the association.

Methods

We analyzed prospective data from the Adolescent Brain Cognitive Development (ABCD) Study (Years 1–3; 5.0 release), a large diverse nationwide sample of 9–10-year-olds at baseline (2016–2018) from 21 research sites across the U.S. Further details about the ABCD Study® participants, recruitment, protocol, and measures have been previously described (Barch et al., 2018). Participants with missing data for social media use and alcohol sipping were excluded ($n=4361$; Appendix A). Centralized institutional review board (IRB) approval was received from the University of California, San Diego (UCSD). Study sites obtained approval from their local IRBs. Caregivers provided written informed consent, and each child provided written assent.

Measures

Independent variable

Time spent on social media was collected using children's self-reported hours of typical time (hours and minutes) spent on social media, separately for weekdays and weekend days. Total daily social media time was calculated as the weighted sum ([weekday average × 5] + [weekend average × 2])/7 (Nagata et al., 2022). Self-reported screen use demonstrated a significant moderate positive correlation with an objective, passively sensed smartphone app in the ABCD Study ($r=0.49$, $p<0.001$) (Wade et al., 2021).

Dependent variable

Participants in the ABCD study completed an adapted version of the Timeline Follow-Back (TLFB) instrument, which is a retrospective, calendar-based self-report instrument for measuring the use of alcohol and other addictive substances (Lisdahl et al., 2018; Sobell & Sobell, 1992). This instrument is psychometrically sound (Robinson et al., 2014), exhibits high test-retest reliability as well as discriminant and convergent validity with other measures (Fals-Stewart et al., 2000), and has been validated in adolescents (Harris et al., 2016; Levy et al., 2004). Further, studies have demonstrated the reliability and validity of self-reported data on alcohol use in children (Donovan et al., 2004; Smith et al., 1995). The current analysis used the question on the TLFB asking whether children had tried a sip of alcohol such as beer, wine, or liquor (rum, vodka, gin, and whiskey) since the last visit, which was assessed at Years 1 through 3.

Table 1. Sociodemographic and behavioral characteristics of Adolescent Brain Cognitive Development (ABCD) Study participants ($N=7514$).

Sociodemographic and behavioral characteristics	Mean (SD)
Age (Year 1, years)	10.93 (0.64)
Sex (%)	
Female	49.8%
Male	50.2%
Race/ethnicity (%)	
White	57.2%
Latino / Hispanic	18.8%
Black	14.3%
Asian	5.3%
Native American	3.1%
Other	1.3%
Religiosity (%)	
Religious	74.2%
Not religious	25.8%
Household income (%)	
Less than $75,000	46.1%
$75,000 and greater	53.9%
Parents' highest education (%)	
High school education or less	14.9%
College education or more	85.1%
Depression symptoms (Year 1)	54.1 (6.2)
Anxiety symptoms (Year 1)	53.7 (6.3)
Social media	
Time spent on social media, hours per day (Year 1)	0.22 (0.59)
Problematic social media use score (Year 2)	5.9 (6.6)
Have had a sip of alcohol since past visit (%)	
Yes (Year 1)	9.3%
Yes (Year 3)	8.7%

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

Mediator variable

The Social Media Addiction Questionnaire (SMAQ), comprised of six items modeled after the Bergen Facebook Addiction Scale, measured problematic social media use (Andreassen et al., 2012) amongst participants who reported having at least one social media account. The averages of each item, including questions capturing mood modification, salience, relapse, conflict, and tolerance, were calculated. Internal consistency (Cronbach's alpha = 0.82) and test-retest reliability ($r=0.83$) were sound (Andreassen et al., 2012). The single-factor model of the SMAQ demonstrated adequate fit in a confirmatory factor analysis (Bagot et al., 2022).

Covariates

Potential sociodemographic and mental health confounders for the association between screen time and childhood sipping were selected based on the literature (Lees et al., 2020; Watts et al., 2023). We adjusted for age, sex (female, male), race/ethnicity (White, Latino/Hispanic, Black, Asian, Native American, other), household income (greater than or less than $75,000 US dollars, which approximates the U.S. household median), highest parent education (high school or less vs. college or more), child religiosity (religious/non-religious), depressive and anxiety symptoms (Child Behavior Checklist (Achenbach & Rescorla, 2000) t-score), and study site.

Statistical analysis

Statistical analyses were conducted in 2022–23 using Stata 18 (StataCorp). Multiple modified Poisson regression

Table 2. Social media associations with alcohol sipping in the Adolescent Brain Cognitive Development (ABCD) Study ($N = 7514$).

	Alcohol sipping (Year 3)					
	Model 1		Model 2		Model 3	
	Risk Ratio (95% CI)	*p*	Risk Ratio (95% CI)	*p*	Risk Ratio (95% CI)	*p*
Independent variable						
Social media time, hours (Year 1)	**1.31 (1.20, 1.43)**	**<0.001**	–	–	**1.21 (1.10, 1.33)**	**<0.001**
Mediator variable						
Problematic social media use score (Year 2)	–	–	**1.03 (1.03, 1.05)**	**<0.001**	**1.03 (1.02, 1.04)**	**<0.001**
Confounding variables						
Age (years)	**1.34 (1.21, 1.48)**	**<0.001**	**1.33 (1.20, 1.46)**	**<0.001**	**1.28 (1.16, 1.42)**	**<0.001**
Sex						
Female	Reference	–	Reference	–	Reference	–
Male	0.97 (0.86, 1.11)	0.986	0.98 (0.86, 1.12)	0.770	1.01 (0.88, 1.15)	0.894
Race/ethnicity (%)						
White	Reference	–	Reference	–	Reference	–
Latino / Hispanic	**0.76 (0.59, 0.98)**	**0.034**	**0.72 (0.56, 0.94)**	**0.017**	**0.73 (0.56, 0.94)**	**0.017**
Black	**0.47 (0.36, 0.62)**	**<0.001**	**0.46 (0.35, 0.60)**	**<0.001**	**0.44 (0.34, 0.58)**	**<0.001**
Asian	**0.34 (0.22, 0.55)**	**<0.001**	**0.35 (0.22, 0.56)**	**<0.001**	**0.35 (0.22, 0.56)**	**<0.001**
Native American	0.93 (0.60, 1.43)	0.733	0.91 (0.60, 1.39)	0.677	0.89 (0.58, 1.36)	0.595
Other	1.15 (0.61, 2.17)	0.664	1.05 (0.52, 2.12)	0.884	1.07 (0.54, 2.11)	0.826
Religiosity (%)						
Religious	Reference	–	Reference	–	Reference	–
Not religious	1.12 (0.97, 1.29)	0.123	1.11 (0.96, 1.28)	0.159	1.11 (0.96, 1.28)	0.143
Household income (%)						
Less than $75,000	Reference	–	Reference	–	Reference	–
$75,000 and greater	0.87 (0.74, 1.02)	0.094	0.86 (0.74, 1.02)	0.078	**0.84 (0.72, 0.99)**	**0.042**
Parents' highest education (%)						
High school education or less	Reference	–	Reference	–	Reference	–
College education or more	**0.67 (0.49, 0.91)**	**0.011**	**0.66 (0.49, 0.88)**	**0.006**	**0.66 (0.49, 0.88)**	**0.006**
Depression symptoms (Year 1)	1.01 (0.99, 1.02)	0.148	1.01 (0.99, 1.02)	0.195	0.99 (0.98, 1.02)	0.356
Anxiety symptoms (Year 1)	0.99 (0.98, 1.01)	0.368	0.99 (0.98, 1.01)	0.377	1.00 (0.99, 1.02)	0.400
Alcohol sipping (Year 1)	**3.53 (3.09, 4.03)**	**<0.001**	**3.40 (2.98, 3.88)**	**<0.001**	**3.39 (2.96, 3.87)**	**<0.001**

Note: **Bold** indicates $p < 0.05$. ABCD propensity weights were applied based on the American Community Survey from the US Census.
All models adjusted for age, sex, race/ethnicity, household income, parent education, child religiosity, study site, depression symptoms, anxiety symptoms, and alcohol sipping at Year 1.

Table 3. Direct and indirect effects of associations of social media time and alcohol sipping through problematic social media use.

	Direct effect			Indirect effect through problematic social media use score			Proportion mediated	
	B (SE)	95% CI	*p*	B (SE)	BC 95% CI	*p*	% (95% CI)	*p*
Social media time	0.03 (0.009)	(0.01, 0.05)	0.001	0.011 (0.0021)	(0.007, 0.016)	<0.001	25.0 (11.0, 39.3)	0.001

Note: BC = Bias corrected confidence intervals after running 5000 bootstrap samples.

analyses transformed into risk ratios (Zou, 2004) were conducted, adjusting for covariates listed above and controlling for alcohol sipping at Year 1 in three models including: Model 1: social media time (independent variable) on sipping alcohol (dependent variable); Model 2: problematic social media use (mediator variable) on sipping alcohol (dependent variable); and Model 3: social media time (independent variable) and problematic social media use (mediator variable) on sipping alcohol (dependent variable). We used generalized structural equation modeling (GSEM) to assess the mediating effect of problematic social media use on the association between social media time and sipping alcohol. Bias Corrected (BC) 95% CIs for the indirect effects were constructed using 5000 bootstrap samples, and statistical significance was considered if the CI values did not cross zero (Preacher & Hayes, 2008). Propensity weights were applied to match key sociodemographic variables in the ABCD Study to the American Community Survey (Heeringa & Berglund, 2020). Two-sided alpha was set at $p < 0.05$.

Results

Of the 7514 participants who met our inclusion criteria, 49.8% were female and 42.8% were racial/ethnic minorities (Table 1). At Year 3, 8.7% reported sipping alcohol in the prior year.

In modified Poisson regression models (Table 2), social media time (Year 1) was associated with sipping alcohol (Year 2, Model 1). Problematic social media use (Year 2) was associated with sipping alcohol (Year 3, Model 2). When social media time (Year 1) and problematic social media use (Year 2) were included in the same model (Model 3), the association between social media time and new-onset alcohol sipping (Year 3) remained significant. Problematic social media use mediated 25.0% of the association between social media time and alcohol sipping (Table 3).

Discussion

In this prospective analysis of a demographically diverse sample of early adolescents in the U.S., more time spent

on social media was associated with a higher risk of alcohol sipping. The association was partially mediated by problematic social media use. Our study confirms prior findings in older adolescents and young adults, while uniquely focusing on early adolescents using a prospective study design. Associations between social media and alcohol sipping are conceptually supported by the Media Practice Model (Brown, 2000), which underscores how observing and interacting with peers on social media can influence adolescents' alcohol-related behaviors. Social networking sites account for the highest frequency of alcohol use depictions viewed by children online (Winpenny et al., 2014). Research suggests alcohol posts on social media instill societal norms within children (e.g., behavior modeling) which may influence them to start drinking earlier (Boers et al., 2020). Additionally, children on social media are subject to depictions of substance use from influencers or peers (Hendriks et al., 2020); a 2017 study concluded that exposure to friends' alcohol-related social media content predicted underage drinking initiation a year later (Nesi et al., 2017).

We build upon prior literature by showing that problematic social media use partially mediates the association between time spent on social media and alcohol sipping. Problematic social media use can include addiction, tolerance, conflict, withdrawal, and relapse (Andreassen et al., 2012), which may be salient for alcohol-related behaviors. Problematic social media use can also involve extreme use and being overly concerned about social media (Moreno et al., 2022); therefore, adolescents with problematic social media use could be especially sensitive to friends' "likes," reactions, and comments (Meisel et al., 2022). Alcohol-related social media content is often depicted in a positive social context (Hendriks et al., 2018), which promotes adolescents' propensity to initiate alcohol sipping. Alcohol advertisements on social media are marketed to adolescents despite prohibitions (Barry et al., 2015, 2016), and advertising algorithms may be especially effective among adolescents with problematic use patterns.

Limitations worth noting include the use of self-reported data, which can be subject to recall or social desirability bias, the lack of information on alcohol-specific social media content, and potential residual confounders such as genetic factors. In addition, we did not control for affiliation with peers who engage in risk behaviors, as this could be a mediator of the link between social media and alcohol sipping. For instance, an adolescent's use of social media could expose them to peers who engage in risk behaviors, which could lead to alcohol sipping. Peer variables in the ABCD Study do not currently specify if the peers are on social media or not. Future research could examine whether online (e.g. social media) or offline social behaviors contribute to alcohol sipping. Strengths of the study include a diverse, national sample with a prospective study design that focused on early adolescence, an important and sensitive window for social media and alcohol sipping.

Conclusion

Adolescents who drink alcohol before age 15 are six times more likely to develop alcohol use disorder later in life compared with those who wait until the legal drinking age of 21 (Boden et al., 2019; Yuen et al., 2020). Given that early adolescent alcohol sipping is a risk factor for subsequent heavy alcohol use, understanding risk factors for early adolescent sipping can inform policies, guidance, and prevention efforts. For instance, policies that protect early adolescents on social media from exposure to alcohol-related content, such as more robust age verification and enhancement of parental controls and privacy settings, should be implemented (Radesky et al., 2020). Pediatricians can encourage parents to develop a family media use plan which could involve regular discussions with their children about online activities, privacy settings, limits on social media use, and prevention of problematic use (Reid Chassiakos et al., 2016). Future studies could examine how early adolescent exposure to alcohol-specific social media content may be related to problematic social media use and alcohol initiation.

Acknowledgments

The authors wish to thank Levi Cervantez, Zain Memon, and Anthony Kung for their editorial assistance. A full list of supporters is available at https://abcdstudy.org/nihcollaborators. A listing of participating sites and a complete listing of the study investigators can be found at https://abcdstudy.org/principal-investigators.html. ABCD consortium investigators designed and implemented the study and/or provided data but did not necessarily participate in the analysis or writing of this report. 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.

Declaration of interest

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

Funding

J.M.N. was funded by the National Institutes of Health (K08HL159350 and R01MH135492) and the Doris Duke Charitable Foundation (2022056). The ABCD Study was supported by the National Institutes of Health (Bethesda, Maryland) and additional federal partners under award numbers U01DA041022, U01DA041025, U01DA041028, U01DA041048, U01DA041089, U01DA041093, U01DA041106, U01DA041117, U01DA041120, U01DA041134, U01DA041148, U01DA041156, U01DA041174, U24DA041123, and U24DA041147.

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Data availability statement

Data used in the preparation of this article were obtained from the ABCD Study (https://abcdstudy.org), held in the NIMH Data Archive (NDA). Investigators can apply for data access through the NDA (https://nda.nih.gov/).

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Appendix A. Comparison of sociodemographic characteristics for participants included versus excluded

	Included ($n=7514$)	Excluded ($n=4361$)	
Sociodemographic characteristics	Mean (SD)	Mean (SD)	*p*
Age (years)	10.9 (0.66)	11.0 (0.64)	0.176
Sex (%)			0.191
Female	49.8%	48.3%	
Male	50.2%	51.7%	
Race/ethnicity (%)			<0.001
White	57.2%	38.9%	
Latino / Hispanic	18.8%	23.7%	
Black	14.3%	25.8%	
Asian	5.3%	6.3%	
Native American	3.1%	3.4%	
Other	1.3%	1.9%	
Religiosity (%)			0.065
Religious	74.2%	76.1%	
Not religious	25.8%	23.9%	
Household income (%)			<0.001
Less than $75,000	46.1%	30.2%	
$75,000 and greater	53.9%	69.8%	
Parents' highest education (%)			<0.001
High school education or less	14.9%	33.8%	
College education or more	85.1%	66.2%	

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