



## COVID information and masking behaviors in U.S. adolescents: Findings from the Adolescent Brain Cognitive Development (ABCD) Study

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### ABSTRACT

Adolescents are particularly vulnerable to health misinformation and are at risk for suboptimal adherence to protective health behaviors in the COVID-19 pandemic. Guided by factors consistent with the theories of planned behavior and rumor transmission, this study sought to analyze the impact of multiple information sources, including social media, television media, internet and parental counseling, on masking behaviors in adolescents. Responses from the December 2020 COVID-19 survey, representing 4,106 U.S. adolescents ages 12–14 from the Adolescent Brain Cognitive Development Study (ABCD) were analyzed. The majority of parents (61.1%) reported counseling their children on the importance of wearing masks all the time in the past week. A minority of adolescents reported more than one hour of daily exposure to COVID-19 related information on social media (9.1%), the internet (4.3%) and television (10.2%). In unadjusted and adjusted models, greater frequency of parental counseling and exposure to COVID-19 television or social media were associated with 'always masking' behaviors. Our findings provide support for the importance of parent counseling and suggest that social media and television may overall support rather than dissuade protective COVID-19 health behaviors in adolescents.

### 1. Introduction

The sudden enforcement of stay-at-home orders in the early pandemic forced adolescents to not only spend more time at home with their parents, but also increased time spent on social media and the internet (Nagata et al., 2022). All of these factors were possible sources of COVID-19 information and misinformation that could influence positive health behaviors, particularly masking behaviors (Al-Zaman, 2021; Baum et al., 2020; Lazer et al., 2021; Melki et al., 2021). This study sought to elucidate the influence of multiple information sources on masking behavior in adolescents during the early pandemic.

The role of parental influence on adolescent adherence to health protective behaviors during the pandemic is evolving, but generally underscores the positive impact of parental influence (Esposito et al., 2014). An analysis of the relationship between parental attitudes and beliefs and parent-for-child mask behavior using the theory of planned

behavior showed that parent intentions and norms were predictors of parent-for-child mask behavior (Coroiu et al., 2021). Early pandemic research showed that parental demographics and characteristics can also influence adherence to health protective behavior (Chen et al., 2020).

While adolescents may receive positive influence from parents to engage with health protective behaviors, they are also vulnerable to COVID-19 misinformation, particularly from online media sources. Trust in information from social media rather than the government is associated with belief in misinformation and COVID-19 myths (Melki et al., 2021). The theory of rumor transmission posits that social media users can be critical (e.g., can critically evaluate information and detect whether it is reliable or unreliable) or uncritical of online content (e.g., lack critical ability and cannot identify misinformation) (Al-Zaman, 2021). Adolescence is a developmental stage characterized by increasing reliance on peers and decreasing attachments to family

*Abbreviations:* ABCD, Adolescent Brain Cognitive Development Study; ARR, adjusted risk ratio; COVID-19, coronavirus-19; RR, risk ratio.

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(Katzman, 2016). The sudden implementation of pandemic stay-at-home orders, which go against the grain of this normal developmental process, may have made it particularly challenging for adolescents to accept parental guidance on health protective behaviors. Second, adolescence is a developmental stage characterized by protracted development of reflective processing and cognitive control (Katzman, 2016). This can impair one’s ability to verify presented information, especially fake news often sensationalist in nature, to have more persuasive power over teens and young adults. In a United Nations Children’s Fund study conducted across 10 countries, up to three-quarters of children reported feeling unable to judge the veracity of the information they encounter online (Howard et al., 2021). Similarly, 61% of Facebook users trust misinformation (Al-Zaman, 2021). Finally, we know that the online media platforms that are popular with adolescents are also breeding grounds for COVID-19 misinformation (Baum et al., 2020). Research shows that COVID-19 misinformation occurs more frequently on social media than on traditional news sources such as television (Bridgman et al., 2020). Spreading patterns of information from both reliable and questionable sources on social media do not differ (Cinelli et al., 2020).

There are multiple potential factors which may influence adolescents’ perception of COVID-related information and their engagement with protective health behaviors during the pandemic. Given the body of literature, we hypothesized that exposure to parent counseling would have a positive effect on adherence to health protective behaviors, while exposure to social media, television media and the internet would have a negative effect. This is the first study which seeks to holistically evaluate the impact of multiple information sources on masking behavior in early adolescence during a period of significant viral spread at the beginning of the COVID-19 pandemic.

**2. Methods**

**2.1. Study population**

Data are from the Adolescent Brain Cognitive Development (ABCD) Study, a large, national, prospective cohort study of brain development and child health in the US with 10 years of planned follow-up. The baseline sample (2016–2018) included 11,878 children 9–10 years-old recruited through a multi-stage probability sample of eligible children from 21 research sites across the US (see Supplemental Appendix for a list of study sites), probability sampling of schools within defined catchment areas for each site, and recruitment of eligible children in each sample school (Garavan et al., 2018). To encourage retention, ABCD participants and their families are compensated for each assessment (Feldstein Ewing et al., 2018). During the COVID-19 pandemic, the ABCD Study developed brief surveys, which were sent electronically to all ABCD Study participants about the impact of the pandemic on their lives. We conducted a secondary data analysis of the December 2020 COVID-19 surveys (COVID-19 Rapid Response Research Release). The analytic sample included 4,106 adolescents ages 12–14 years (35% response rate). Demographic characteristics of participants included versus excluded are shown in the Supplemental Appendix. Centralized institutional review board approval was obtained from the University of California, San Diego. Written informed consent and assent were obtained from a parent or guardian and the child, respectively.

**2.2. Measures**

**Independent variables.** Adolescents self-reported their frequency of checking COVID-19 information in the past week via social media, the internet, and television media coverage (see Appendix for questions and response options). Parents also reported the frequency of counseling their children on the importance of wearing a mask.

**Dependent variable.** Masking behavior was assessed based on self-reported frequency of wearing a mask or protective gear.

**Confounding variables.** Sex, race/ethnicity, household income, and highest parent education were based on parent report from the baseline parent survey. Type of schooling in the past week included online/school-at-home, in person, hybrid, and other. Child COVID-19 infection was based on an affirmative response to the parent question, “Has your healthcare provider ever told you that your child has or might have COVID-19 (coronavirus)?” A list of the 21 study sites are shown in the Supplemental Appendix.

**2.3. Statistical analysis**

Modified Poisson regression analyses with coefficients transformed to risk ratios were used to estimate the associations between COVID-19 information and masking behaviors, adjusting for potential confounders including sex, race/ethnicity, household income, parent education, school type, child COVID infection, and study site (Zou, 2004). Analyses were conducted in 2021 using Stata 15.1, applying sample weighting to approximate the American Community Survey by the US Census (Heeringa and Berglund, 2020).

**3. Results**

The sample (N = 4,106) included 50.6% female and 39.5% racial/ethnic minorities. A minority of adolescents reported viewing/checking

**Table 1**  
Sociodemographic characteristics, COVID-19 information, and masking behaviors among 12–14-year-olds in the Adolescent Brain Cognitive Development Study, December 2020 (N = 4,106).

Sex	
Female	50.6%
Male	49.4%
Race/ethnicity (%)	
White	60.5%
Latino / Hispanic	16.7%
Black	11.3%
Asian	8.2%
Native American	2.1%
Other	1.2%
Household income (%)	
Less than \$75,000	47.7%
\$75,000 and greater	52.3%
Parents’ highest education (%)	
High school education or less	12.8%
College education or more	87.2%
Schooling type in the past week	
Online/school-at-home	65.2%
In person	15.9%
In person some days and online some other days	13.3%
Other	5.7%
COVID-19 infection, parent report of past or current health care provider diagnosis for child	
No	95.6%
Yes	4.4%
<b>Sources and frequency of COVID information</b>	
Checking COVID-related social media activity (e.g. Facebook, Twitter, Instagram, TikTok, SnapChat) almost every hour or more	9.1%
Checking COVID news and updates using the internet (e.g. YouTube) almost every hour or more	4.3%
Viewing COVID television media coverage (e.g., news stations) of coronavirus an hour per day or more	10.2%
Parent counseling on the importance of wearing a mask frequently or very frequently	61.1%
<b>Masking behaviors</b>	
“I wear a mask over my face or protective gear (e.g. gloves, things to cover my clothes)”	
I have not done this in the last week	4.3%
I did this some of the time last week	12.0%
I did this most of the time last week	21.5%
I did this all the time last week	62.3%

ABCD propensity weights were applied based on the American Community Survey from the US Census.<sup>4</sup>

**Table 2**

Associations between COVID information sources and always masking in the Adolescent Brain Cognitive Development (ABCD) Study, December 2020, (n = 4,106).

	Always masking		Adjusted	
	Unadjusted RR	p	ARR	p
Checking COVID-related social media activity (e.g. Facebook, Twitter, Instagram, TikTok, SnapChat?) almost every hour or more	<b>1.15</b> (1.07–1.25)	<b>&lt;0.001</b>	<b>1.09</b> (1.00–1.19)	<b>0.049</b>
Checking COVID news and updates using the internet (e.g. YouTube) almost every hour or more	1.06 (0.94–1.20)	0.312	0.94 (0.83–1.07)	0.377
View COVID television media coverage (e.g., news stations) of coronavirus an hour per day or more	<b>1.17</b> (1.09–1.27)	<b>0.001</b>	<b>1.09</b> (1.01–1.17)	<b>0.033</b>
Parent counseling on the importance of wearing a mask: frequently or very frequently	<b>1.33</b> (1.25–1.41)	<b>&lt;0.001</b>	<b>1.28</b> (1.20–1.36)	<b>&lt;0.001</b>

RR = risk ratio. ARR = adjusted risk ratio. Adjusted models represent the abbreviated output from Poisson regression models with coefficients transformed to risk ratios including covariate adjustment for sex, race/ethnicity, household income, parent education, school type (e.g., in-person, remote, hybrid), child COVID infection, and site in addition to all variables listed. Propensity weights from the Adolescent Brain Cognitive Development Study were applied based on the American Community Survey from the US Census.<sup>4</sup>

COVID-19-related information almost hourly or more on social media (9.1%), the internet (4.3%), or on television (10.2%, [Table 1](#)). A majority of parents (61.1%) counseled their children on the importance of wearing a mask ‘frequently’ or ‘very frequently’ in the past week. A majority of adolescents reported wearing masks all the time in the past week (62.3%), while 4.3% reported not wearing a mask in the past week.

In regression models adjusted for potential confounders ([Table 2](#)), parent counseling about masking (RR 1.28, 95% CI 1.20–1.36) and greater frequency of viewing/checking COVID-19 social media (RR 1.09, 95% CI 1.00–1.19) or television media (RR 1.09, 95% CI 1.01–1.17) were associated with adolescent reports of ‘always masking’. Unadjusted regression models had similar findings.

#### 4. Discussion

Higher frequency of checking COVID-19-related information on television and social media were associated with adolescent reports of always wearing a mask amidst a period of significant viral spread of the COVID-19. However, parent counseling about the importance of masking had the strongest association with reports of always masking, and the effects of checking/viewing social and television media information were attenuated when parent counseling was considered. Interestingly, higher frequency of checking COVID-19 news on the internet was not associated with reports of always masking, although this analysis should be interpreted with caution due to limited sample size.

This was the first study, to our knowledge, to demonstrate the relationship between multiple COVID-19-related information sources and masking behavior in adolescents. Results underscore the importance of parent counseling on positive health behaviors in adolescents, a finding that is consistent with literature from COVID-19 and other adolescent health domains ([Chen et al., 2020](#); [Coroiu et al., 2021](#); [Khurana and Cooksey, 2012](#); [Liu et al., 2021](#)). Prior research has found that the psychosocial state of adolescents influences the directionality of parental counseling on pandemic-related health protective behaviors ([Peplak et al., 2021](#)). Specifically, parent-adolescent conversation frequency predicted health protective behavior adherence when adolescents reported low stress, but not high stress. While the interaction between adolescent psychosocial state and reaction to parental counseling was not explored in this study, it is possible that this interaction played a role in adherence to masking behaviors.

Despite a high prevalence of COVID-19-related misinformation across social media platforms, particularly on WhatsApp, Snapchat, and Facebook ([Al-Zaman, 2021](#); [Baum et al., 2020](#)), the results of our study suggest that among adolescents, higher frequency of checking COVID-19-related information on social media is associated with reports of always masking. It is possible that the impact of any social media-related misinformation is mitigated by the influence of parent counseling, given that the effect of social media was attenuated when parent counseling,

and television media, were considered. Prior studies have found that higher education and trust in information from the government contributed to fewer beliefs in misinformation ([Al-Zaman, 2021](#)). Governments, health care organizations, and scientists have also shared information regarding masking and COVID behaviors on social media, potentially explaining the association between social media and masking. Further, media literacy training contributed to more critical social media posting practices ([Al-Zaman, 2021](#)).

The limitations of this study include the use of self-reported data which could be subject to social desirability bias, a narrow participant age range which could limit its generalizability, and the cross-sectional design which precludes conclusions regarding causality. The measure for the dependent variable included masks or protective gear (e.g., gloves or clothes coverings) so it is not clear if participants wore masks, protective gear, or both. However, mask wearing was more common than glove wearing during the pandemic and both represent protective measures from COVID-19 ([Khubchandani et al., 2020](#)). Although we controlled for several potential confounders, there is the possibility for other unmeasured confounders, as we were limited by the questions that were asked in the ABCD COVID-19 Rapid Response Research survey. Though we controlled for type of schooling (e.g. in-person, online), we did not have information about whether students were in school or on winter break in the past week and if participants were in public settings where masking was recommended. Selection bias may affect the generalizability of the findings. The original ABCD Study sampling strategy involved a multi-stage probability sample; however, the study sites were more likely to be in urban compared to rural areas due to the availability of neuroimaging research centers ([Garavan et al., 2018](#)). We applied the propensity weighting developed by the ABCD Study to approximate the American Community Survey from the US Census Bureau ([Heeringa and Berglund, 2020](#)). Although all ABCD Study participants were invited to participate in the December 2020 survey, the response rate was low (35%) and those who were included were more likely to be White, female, and from higher socio-economic backgrounds.

#### 5. Conclusion

This study aimed to examine the influence of multiple information sources on masking behavior among a nationally representative sample of US adolescents aged 12–14 in December 2020 of the COVID-19 pandemic. Adolescents are particularly vulnerable to health misinformation due to their developmental stage and the media platforms they frequent. Our findings provide support for the importance of parent counseling and suggest that social and television media may overall support rather than dissuade protective COVID-19 health behaviors in adolescents.

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## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2022.101900>.

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