



## Letter to the editor

**A national snapshot of U.S. adolescents' mental health and changing technology use during COVID-19**

## ARTICLE INFO

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Preliminary reports suggest that during COVID-19, adolescents' mental health has worsened while technology and social media use has increased. Much data derives from early in the pandemic, when schools were uniformly remote and personal/family stressors related to the pandemic were limited. This cross-sectional study, conducted during Fall 2020, examines the correlation between mental well-being and COVID-19-related changes in technology use, along with influence of COVID-19-related stressors, school status (in-person versus remote), and social media use for coping purposes, among U.S. adolescents.

From September 23 to December 16, 2020, English-speaking adolescents (ages 13–17) residing in the United States were recruited using Instagram for an online survey, with approval from the Institutional Review Board. Assent was waived, with approval from the Institutional Review Board. Self-report measures (adapted from Pew Internet Survey [1]) assessed average daily duration of technology use (social media, phone/video calls, video games, TV/movie/videos) 30 days before initial COVID-19-related school closures versus past week. Standard measures for past week anxiety and depressive symptoms (PROMIS) [2], well-being (WHO-5) [3], and cybervictimization [4] were used. Use of social media for coping through social connection was assessed using an adapted measure for the purpose of the present study. School status (open full-time or hybrid versus closed) was determined through the use of the COVID-19 US State Policy Database [5]. COVID-19-related stressors [6], perceived importance of social media [7], and demographics were also assessed.

Generalized linear models were used to examine associations between changes in technology use and current mental health outcomes, adjusting for COVID-19-related stressors and importance of social media (identified as confounders in preliminary analysis); potential moderators were examined.

We recruited 978 youth from 42 states (Supplementary Table 1). All forms of technology use significantly increased from pre-COVID until the time of assessment (Supplementary Table 2). After adjustment for confounders, self-reported increases in social media use were associated with higher anxiety and depressive symptoms (Table 1). The extent of use of social media for coping through social connection moderated the association between social media use and depressive symptoms ( $b =$

$0.15$ ,  $SE = 0.07$ ,  $p = .02$ ). Results indicated that among those who report infrequent use of social media for coping, greater increases in social media use were associated with higher depressive symptoms ( $b = 0.16$ ,  $SE = 0.07$ ,  $p = .02$ ). However, among those who report frequent use of social media for coping, there were no associations between changes in use and depressive symptoms ( $b = 0.04$ ,  $SE = 0.06$ ,  $p = .48$ ). Increases in video gaming and TV/movie watching were also associated with higher depressive symptoms, and video gaming was associated with higher anxiety.

There were no associations between changes in any form of technology use and overall well-being or cybervictimization. Neither local school status, nor level of COVID-19-related stressors, nor self-perceived importance of technology, were significant confounders or moderators of the observed effect.

In this geographically diverse sample of adolescents across the United States, self-reported daily social media and technology use increased significantly from prior to COVID-19 through Fall 2020. Increased social media use was significantly associated with higher levels of anxiety and depressive symptoms regardless of other theoretical moderators or confounders of mental health (e.g., demographics, school status, importance of technology, COVID-19-related stress). Despite literature suggesting that remote learning may result in adverse mental health outcomes [8], we did not find local school reopening to be associated with current depressive/anxiety symptoms, nor with COVID-19-related increases in technology use. Self-reported use of social media for coping purposes moderated the association between increased social media use and depressive symptoms, such that an association between these constructs was found *only* for individuals who infrequently use social media for coping purposes. It is therefore possible that greater use of social media for certain purposes may have protective effects [9]. Although much prior research has focused on social media use as a marker of stress, we also found that increased video gaming and TV/movie watching were also associated with internalizing symptoms, in accordance with others' work [10]. Future research should explore in more granular detail what, if any, social media and technology use is protective during a pandemic, and for whom, to help tailor prevention efforts. Importantly, the use of a cross-sectional design limits our ability

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**Table 1**

Adjusted effects of changes in technology use on mental health outcomes.

	Anxiety symptoms	Depressive symptoms	Well-being	Cybervictimization
Change in time on social media	b = 0.07, SE = 0.03*	b = 0.11, SE = 0.03*	b = -0.21, SE = 0.13	b = -0.06, SE = 0.08
Change in time on phone or video calls	b = 0.02, SE = 0.03	b = 0.02, SE = 0.03	b = 0.07, SE = 0.12	b = -0.08, SE = 0.07
Change in time on video games	b = 0.09, SE = 0.03*	b = 0.06, SE = 0.03*	b = -0.03, SE = 0.14	b = 0.12, SE = 0.09
Change in time on TV, movies, videos	b = 0.06, SE = 0.03	b = 0.10, SE = 0.03*	b = -0.05, SE = 0.15	b = -0.06, SE = 0.09

Note. Changes in technology time reflect differences: past 7 days – one month before school closures; Models adjusted for COVID-19-specific stressors and importance of social media; b = unstandardized regression coefficient; SE = standard error.

\*  $p < .05$ .

to disentangle the directionality of associations between technology use and mental health symptoms. Additional limitations include use of some non-validated measures, reliance on self-report of technology use, and use of a national database to assess school status.

In conclusion, our study shows that, although adolescents' self-reported technology use increased from prior to the pandemic until Fall 2020 and was associated with poorer mental health, the relationship may be more nuanced than previously reported.

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### Author contributions

Dr. Ranney and Dr. Burke conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Dunsiger carried out the initial analyses and drafted the results section, and reviewed and revised the manuscript.

Ms. Kutok collected data and drafted the methods section, and reviewed and revised the manuscript.

Dr. Riese, Dr. Nugent, and Mr. Patena reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

### Conflicts of interest disclosures

Dr. Ranney holds stock in Moderna and has received money for consultation from Medscape for talks on COVID-19 testing. Drs. Ranney, Dunsiger, and Nugent have NIH and CDC grants for other projects.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.genhosppsych.2021.05.006>.

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