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Cyberbullying Victimisation Was Associated With Greater Manic Symptoms in Early Adolescence: A Prospective Cohort Study

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ABSTRACT

Aim: Cyberbullying has been linked to various adverse psychological outcomes, but prospective associations with manic symptoms in early adolescents remain unexplored. We examined the prospective relationship between cyberbullying victimisation and manic symptoms in a diverse cohort of American children and adolescents.

Method: We analysed data from the Adolescent Brain Cognitive Development study from the period 2 follow-up (2018–2020) to the period 3 follow-up (2019–2021). Linear regression models estimated the associations between cyberbullying victimisation (lifetime and past 12 months) and manic symptoms. We adjusted for age, sex, race and ethnicity, household income, parental education, manic symptoms, anxiety, depression, total screen time, and study site.

Results: The average age of our 9095 adolescents (51.3% male) was 12.0 ± 0.7 years. The prevalence of cyberbullying victimisation was 9.2% for lifetime and 6.1% for the past 12 months. Adjusting for the covariates, lifetime cyberbullying victimisation was associated with a 0.41 higher manic symptom sum score (95% CI 0.18–0.65, $p = 0.001$), and past 12-month cyberbullying victimisation was associated with a 0.38 higher manic symptom sum score (95% CI 0.11–0.66, $p = 0.007$).

Conclusion: These findings highlight the need for early identification and intervention for adolescents experiencing cyberbullying to mitigate its adverse effects on mental health.

Abbreviations: ABCD, Adolescent Brain Cognitive Development; CI, confidence interval; USA, United States of America.

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Summary

- Cyberbullying victimisation is a prevalent issue among adolescents, yet its prospective association with manic symptoms has not been fully explored.
- This study found that both lifetime and past 12-month cyberbullying were associated with higher manic symptom scores in children and adolescents, even after adjusting for relevant covariates.
- These findings underscore the importance of early identification and intervention among adolescents who experience cyberbullying to mitigate adverse impacts on mental health.

1 | Introduction

Cyberbullying is characterised by intentional harm inflicted through electronic means such as social media, text messages and online platforms. Nearly one in 10 early adolescents in the USA has reported being victims of cyberbullying [1]. As the average American adolescent spends over 8 h on screens per day [2], the potential exposure to cyberbullying has raised significant concerns regarding its impact on youth mental health. Research suggests that cyberbullying is associated with various adverse psychological outcomes, including anxiety, depression, and suicidal ideation [3–5]. However, the extent to which cyberbullying may be prospectively associated with symptoms of mania remains unexplored, particularly among early adolescents [6].

Mania and hypomania, key features of bipolar-spectrum disorders, involve periods of abnormally elevated, expansive or irritable mood [7]. Specific manic symptoms include inflated self-esteem or grandiosity, decreased need for sleep, pressured speech, flight of ideas, distractibility, increased goal-directed behaviour and excessive involvement in pleasurable activities [7, 8]. Adolescence is a critical period for the emergence of bipolar-spectrum disorders, and earlier onset has been associated with worse functional outcomes and greater symptomatic burden [9, 10]. Among psychiatric disorders in adolescence, bipolar disorder is associated with a lower quality of life and the highest risk of death by suicide [11, 12].

Etiological theories of bipolar-spectrum disorders provide context for the potential association between cyberbullying and manic symptoms in adolescents. Studies have suggested that bullying victimisation, such as cyberbullying, contributes to elevated stress sensitivity, which in turn can exacerbate mood dysregulation [13]. This heightened stress sensitivity has been associated with negative affect, increased reactivity, and psychotic experiences, serving as a pathway through which cyberbullying may promote manic symptoms. Cyberbullying in early adolescents has been associated with sleep disturbances, which have been proposed to underlie neurobiological vulnerability to bipolar-spectrum disorders [14, 15]. However, despite these theoretical mechanisms, there has been a lack of prospective research investigating cyberbullying in relation to manic symptoms in youth.

The aim of this study was to bridge current gaps in the literature by examining the prospective relationship of lifetime and past 12-month cyberbullying with manic symptoms 1 year later.

The current study used data from a diverse, nationwide sample of American adolescents aged 10–13 years from the longitudinal Adolescent Brain Cognitive Development (ABCD) study. Our hypotheses were that greater overall cyberbullying, both lifetime and 12-month, would be prospectively associated with greater manic symptoms, adjusting for theoretically relevant covariates.

2 | Participants and Methods

Data were drawn from the ABCD study, a large and demographically diverse prospective cohort study of the health of American adolescents. A total of 11875 children and adolescents aged 9–10 years were enrolled at the overall study baseline, between 2016 and 2018. Data were then collected at annual follow-ups, with the period 1 follow-up between 2017 and 2019, the period 2 follow-up between 2018 and 2020, and the period 3 follow-up between 2019 and 2021. The current investigation primarily utilised data from the period 2 and 3 follow-ups; data for manic symptoms assessed at the period 1 follow-up were also included. We found that 2780 participants were missing data on cyberbullying, mental health symptoms, screen time and sociodemographics, resulting in a final sample size of 9095 adolescents aged 10–13 years for analysis (Appendix A).

2.1 | Exposure

The exposure variables were lifetime cyberbullying and past 12-month cyberbullying, assessed at the period 2 follow up [1]. We assessed the experience of lifetime cyberbullying by asking adolescents if they had ever experienced cyberbullying or if they had experienced someone intentionally trying to harm or be mean to them online, in texts, or on social media. We assessed the experience of past 12-month cyberbullying by asking adolescents if they had been cyberbullied in the past 12 months. Response options included yes or no.

2.2 | Outcome

The study used the 7 Up 7 Down Inventory, which is comprised of the 7 Up mania subscale and the 7 Down depression subscale [16]. In our study, we used the 7-item 7 Up mania subscale, which was administered during the periods 1 and 3 follow-ups. The questions asked the adolescents about prolonged periods of extreme happiness and intense energy that interfered with sleep or affected the perceived vividness of their senses, and if they had prolonged periods when their thinking seemed clearer and quicker than others. Participants responded to these items using a four-point Likert-type scale ranging from never to very often or almost constantly [16]. All the items were summed to create a manic symptom sum score with values ranging from 0 to 21. Internal reliability was acceptable for the 7 Up subscale in the current sample, with an alpha of 0.78.

2.3 | Covariates

Covariates included variables assessed at the baseline, and periods 1 and 2 follow-ups, based on availability and theoretical

relevance of timing. Covariates assessed at baseline were sex, categorised as female or male, race and ethnicity, categorised as Asian, Black, Latino/Hispanic, Native American, White, and other and study site. The only covariate assessed at the period 1 follow-up was the manic symptom sum score, as it was not assessed at the period 2 follow-up. Covariates assessed at the period 2 follow-up were: age, household income, highest parental education, anxiety, depression and total screen time in hours/day. Household income was categorised into six levels, and highest parental education was categorised as high school education or less versus college education or more. These theoretically relevant covariates were adolescent- and/or parent-reported and included in our study to address potential confounding [17].

2.4 | Statistical Analyses

Data analyses were conducted using Stata 18 (StataCorp, College Station, Texas, USA). Descriptive statistics were calculated as the means, standard deviations, and/or percentages for cyberbullying, manic symptom sum scores, and the covariates. One multivariable linear regression model was conducted to estimate the association between lifetime cyberbullying assessed at the period 2 follow-up and manic symptom sum score assessed 1 year later at the period 3 follow-up. A second multivariable linear regression model was conducted to estimate the association between past 12-month cyberbullying at the period 2 follow-up and manic symptom sum score at the period 3 follow-up. We report results for unadjusted models, as well as models adjusted for age, sex, race and ethnicity, household income, parental education, prior manic symptom sum score, anxiety, depression, total screen time and study site. Marginal predicted probabilities were computed following prospective linear regressions to get standardised estimates to aid with the interpretation of the findings. Sampling weights were utilised in the analysis to represent population estimates and were based on the American Community Survey [18]. Statistical significance was based on a two-sided $p < 0.05$.

2.5 | Ethics

The University of California, San Diego, and each of the 21 study sites granted institutional review board approval. Parents and caregivers provided written informed consent, and adolescents provided written assent. All study methods were carried out in accordance with relevant guidelines and regulations.

3 | Results

Descriptive statistics are presented in Table 1. The average age of our 9095 adolescents (51.3% male) was 12.0 ± 0.7 years at the period 2 follow-up. In our sample, 43.7% were from racial and ethnic minorities, and 46.8% came from a household with an annual income of \$75 000 or less. The lifetime prevalence of cyberbullying was 9.2%, and the previous 12 months prevalence was 6.1%. The average daily screen time was 7.3 h per day. The average manic symptom sum score was 2.3 during the period 2 follow-up and 1.8 during the period 3 follow-up.

TABLE 1 | Sociodemographic characteristics of 9095 Adolescent Brain Cognitive Development (ABCD) study participants at the period 2 follow up.

Sociodemographic characteristics	Mean (SD)/(%)
Age (years)	12.0 (0.7)
Sex	
Female	48.7%
Male	51.3%
Race and ethnicity	
Asian	5.3%
Black	14.6%
Latino/Hispanic	19.2%
Native American	3.2%
Other	1.4%
White	56.3%
Household income	
\$24 999 or less	13.9%
\$25 000 to \$49 999	16.4%
\$50 000 to \$74 999	16.5%
\$75 000 to \$99 999	14.9%
\$100 000 to \$199 999	28.1%
\$200 000 or greater	10.2%
Parent's highest education	
High school education or less	10.9%
College education or more	89.1%
Cyberbullying	
Lifetime	9.2%
Past 12-month	6.1%
Anxiety symptoms (CBCL T-score)	53.5 (6.0)
Depression symptoms (CBCL T-score)	53.9 (6.1)
Total screen time (hours/day)	7.3 (7.6)
Manic symptom sum score	
Period 1 follow up	2.3 (2.9)
Period 3 follow up	1.8 (2.5)

Note: Sampling weights were applied to yield representative estimates based on the American Community Survey from the US Census. Abbreviation: SD, standard deviation.

Table 2 presents prospective associations of cyberbullying at the period 2 follow-up with manic symptom sum score 1 year later at the period 3 follow-up. In the unadjusted models, both lifetime and past 12-month cyberbullying were prospectively associated with manic symptoms. In the first adjusted model, the presence of lifetime cyberbullying, versus the absence, was associated with a 0.41 higher (95% CI 0.18–0.65, $p = 0.001$)

manic symptom sum score 1 year later. In the second adjusted model, the presence of past 12-month cyberbullying, versus the absence, was associated with a 0.38 higher (95% CI 0.11–0.66, $p=0.007$) manic symptom sum score 1 year later. Predicted

probabilities computed after the prospective linear regressions are depicted in Figures 1 and 2. Visual examination confirmed that experiences of cyberbullying were associated with higher manic symptom sum scores.

TABLE 2 | Prospective associations of lifetime and past 12-month cyberbullying with manic symptom sum scores 1 year later in the Adolescent Brain Cognitive Development (ABCD) study.

	Unadjusted model		Adjusted model ^a	
	B (95% CI)	<i>p</i>	B (95% CI)	<i>p</i>
Lifetime cyberbullying	0.82 (0.57, 1.08)	< 0.001	0.41 (0.18, 0.65)	0.001
Past 12-month cyberbullying	0.75 (0.44, 1.05)	< 0.001	0.38 (0.11, 0.66)	0.007

Note: Bold indicates $p < 0.05$. Models represent the abbreviated output from four linear regression models with cyberbullying at the period 2 follow up, the exposure variable, and manic symptoms at the period 3 follow up, the outcome variable. Abbreviation: B, coefficient from linear regression model.
^aAdjusted for age, sex, race and ethnicity, household income, parent education, anxiety, depression, total screen time, study site and manic symptom sum score at the period 1 follow-up.

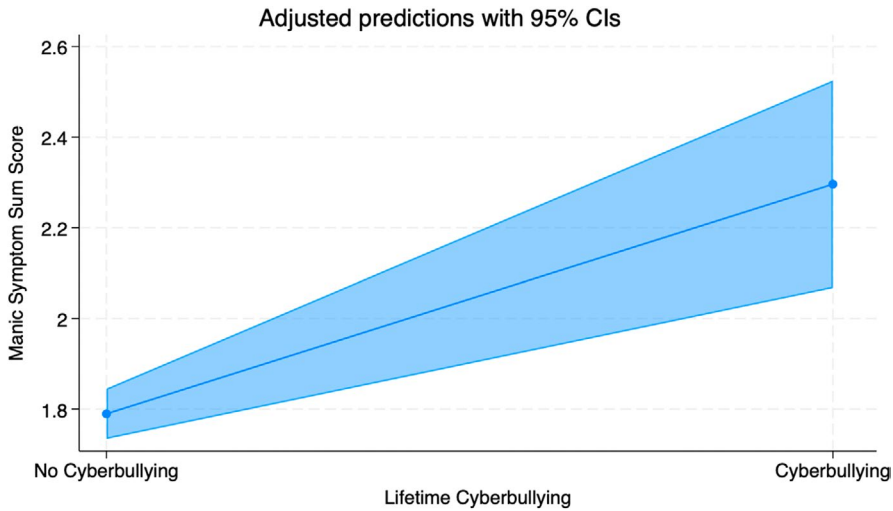


FIGURE 1 | Prospective adjusted predicted scores with 95% confidence intervals of lifetime cyberbullying at the period 2 follow-up and manic symptom sum score at the period 3 follow-up.

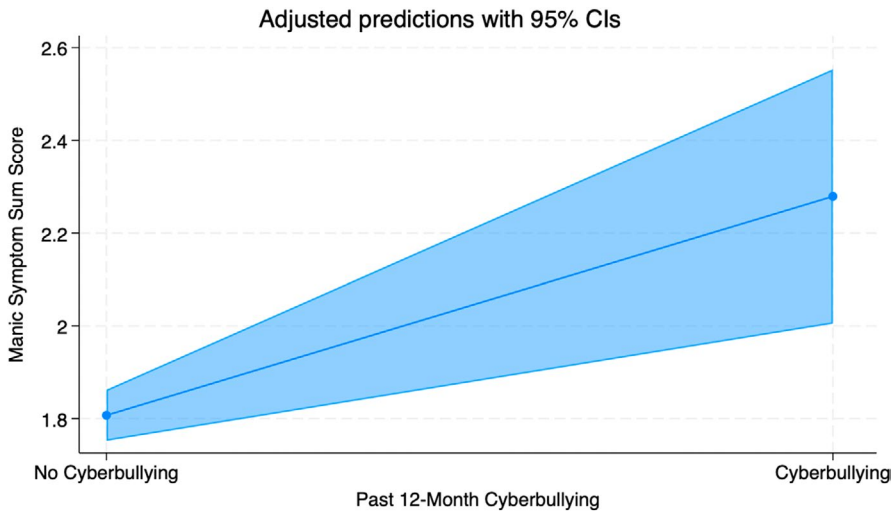


FIGURE 2 | Prospective adjusted predicted scores with 95% confidence intervals of past 12-month cyberbullying at the period 2 follow-up and manic symptom sum score at the period 3 follow-up.

4 | Discussion

In a nationwide sample of American adolescents aged 10–13 years, lifetime and past 12-month cyberbullying were prospectively associated with manic symptoms 1 year later in unadjusted and adjusted models. The results of this study are consistent with etiological theories of bipolar-spectrum disorders, which suggest that heightened stress sensitivity can exacerbate mood dysregulation [13]. Cyberbullying may induce significant psychological stress, thereby triggering or amplifying affective disturbances, including manic symptoms, in vulnerable adolescents. In addition, the current findings may also be explained by disruptions in circadian rhythms and sleep patterns, which have been posited to play a role in the risk for or onset of bipolar-spectrum disorders. Specifically, findings suggest a link between cyberbullying and sleep disturbances, which are known to affect mood regulation and may contribute to manic episodes [15, 19]. The outcomes of cyberbullying, like stress and reduced self-esteem, may create a cycle in which the resulting sleep dysregulation further exacerbates stress. This could collectively amplify the risk of developing manic symptoms [15]. In addition, screen time has been shown to significantly affect mental health, which is why it was included as a covariate in our analysis. Past research has linked excessive screen time to symptoms of anxiety, depression and disruptive behaviours among adolescents [20–22]. Given that manic symptoms have been reported to often co-occur with anxiety and depression symptoms [23], screen time is a crucial factor to consider in mental health research.

4.1 | Strengths and Limitations

The demographic diversity, large sample size and prospective design of the ABCD study strengthen the generalisability of the current findings. However, the present investigation is not without limitations. The reliance on self-reported measures for both exposure and outcome variables may introduce reporting bias. The willingness and ability to accurately report cyberbullying experiences and manic symptoms can vary among adolescents [24]. While a temporal relationship between cyberbullying and manic symptoms was established in this study, it remains unclear whether cyberbullying has a direct or indirect causal impact on manic symptoms. Future research should aim to elucidate the mechanisms underlying the prospective association between cyberbullying and manic symptoms.

5 | Conclusion

This study highlights the prospective association between cyberbullying and increased manic symptoms in early adolescents, emphasising the need for further public health interventions. Our findings suggest that cyberbullying may predispose adolescents to the development of manic symptoms and underscore the importance of addressing cyberbullying to mitigate potential adverse mental health effects in this population. Comprehensive prevention and intervention programmes that address excessive screen time are crucial for promoting the well-being of adolescents in the digital age. The present findings emphasise the

importance of early identification and intervention for adolescents experiencing cyberbullying. Mental health professionals, educators and caregivers should be aware of the potential for cyberbullying to contribute to a broad spectrum of psychological disturbances, including manic symptoms.

Author Contributions

Jason M. Nagata: writing – original draft, writing – review and editing, conceptualization, formal analysis, data curation. **Gabriel Zamora:** conceptualization, writing – original draft, writing – review and editing. **Jennifer H. Wong:** conceptualization, writing – original draft, writing – review and editing, formal analysis. **Abubakr A. A. Al-Shoaibi:** formal analysis, conceptualization, writing – review and editing. **Kyle T. Ganson:** writing – review and editing. **Alexander Testa:** writing – review and editing. **Jinbo He:** writing – review and editing. **Jason M. Lavender:** writing – review and editing. **Fiona C. Baker:** writing – review and editing, formal analysis, conceptualization.

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Conflicts of Interest

The authors declare no conflicts of interest.

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).

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Appendix A

Comparison of Participants Included Versus Excluded in the Adolescent Brain Cognitive Development (ABCD) Study

Sociodemographic characteristics	Included (n = 9095)	Excluded (n = 2780)	p
Age	12.0 (0.7)	12.1 (0.7)	<0.001
Sex (%)			0.565
Female	48.7%	49.4%	
Male	51.3%	50.6%	
Race/ethnicity (%)			<0.001
Asian	5.3%	6.1%	
Black	14.6%	26.0%	
Latino/Hispanic	19.3%	22.8%	
Native American	3.2%	3.0%	
Other	1.4%	1.6%	
White	56.3%	40.5%	
Household income (%)			<0.001
\$24 999 or less	13.9%	23.7%	
\$25 000 to \$49 999	16.5%	22.5%	
\$50 000 to \$74 999	16.5%	14.0%	
\$75 000 to \$99 999	14.8%	9.2%	
\$100 000 to \$199 999	28.1%	23.7%	
\$200 000 and greater	10.2%	6.9%	
Parents' highest education (%)			0.046
High school education or less	10.9%	12.6%	
College education or more	89.1%	87.4%	

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