

Article

A Longitudinal Examination of Cyberbullying Among Adolescents in the U.S. and India During COVID-19: An Exploratory Cohort Study

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Abstract

Researchers, media outlets, and stakeholders in adolescent well-being have raised concerns that increased reliance on electronic communication during the COVID-19 pandemic may have led to a rise in cyberbullying among youth. This exploratory study examined potential changes in cyberbullying behaviors among adolescents in the U.S. and India using longitudinal survey data collected before and during COVID-19-related shutdowns. This study included 92 participants from the U.S. and 38 from India who took part in a cohort study, reporting on their experiences with cyberbullying perpetration and victimization at two time points. Our preliminary findings suggest that there was no significant increase in cyberbullying involvement in either country following the onset of the pandemic. The findings from our exploratory work offer early insights into adolescent digital engagement during a global crisis and highlight the importance of including youth from diverse contexts in cyberbullying research.

Keywords: cyberbullying; adolescence; COVID-19; longitudinal



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1. Introduction

Cyberbullying is a public health problem that has been defined and operationalized in many different ways but typically includes peer-to-peer aggression that is perpetrated using electronic communication technologies (Mehari et al., 2014; Menin et al., 2021). The construct of cyberbullying encompasses both cyberbullying perpetration, the act of engaging in aggressive behaviors, and cybervictimization, the experience of being targeted by aggressive acts (Modecki et al., 2013). In this paper, we use the term ‘cyberbullying’ to refer broadly to peer-directed aggression via digital means. When referring to specific roles, we distinguish between ‘cyberbullying perpetration’ and ‘cybervictimization.’ In the U.S., estimates of cyberbullying perpetration in adolescents range widely; it is most likely that the actual occurrence falls between 20 and 30% (Mehari & Farrell, 2018; Patchin & Hinduja, 2024). In India, estimates have ranged from 8% in school samples (Sharma et al., 2017) to 53% in online samples (Microsoft Corporation, 2012), while a recent review

study reported the prevalence of cyberbullying among adolescents in India from 3.3 to 60.56% (Vijayarani et al., 2024). The consequences of cyberbullying are far reaching, with both cyberbullying perpetration and cybervictimization linked to a wide array of negative outcomes, including depression, anxiety, substance abuse, and lower academic performance (Kowalski et al., 2014; Morin et al., 2018). These adverse effects emphasize the need for effective interventions to mitigate the harm caused by digital aggression, particularly as young people increasingly navigate their social lives online.

The onset of the Coronavirus disease 2019 (COVID-19) pandemic has exacerbated the challenges youth face in managing online interactions. Following restrictions due to the COVID-19 pandemic, researchers increasingly explored the impacts of global shutdowns on youth, such as social relationships (Kadiri, 2023) and mental health (Ballonoff Suleiman et al., 2022; Christodoulides et al., 2023). As youth are spending an increased proportion of their days on electronic communication technologies, researchers and news media outlets suggest that youth are experiencing a corresponding increase in cyberbullying (Downey, 2020; Micklea, 2020). There was a steady increase in people mentioning cyberbullying on Twitter beginning in March 2020, which may indicate that people became more worried about cyberbullying (Karmakar & Das, 2020). However, empirical findings on cyberbullying prevalence during the pandemic are mixed, especially for adolescents across different global contexts (Sorrentino et al., 2023).

This study leverages a natural experiment to examine changes in cyberbullying perpetration and victimization among early adolescents in the U.S. and India before and during COVID-19-related shutdowns. Drawing on longitudinal data from the U.S. and an exploratory subsample from India, we examined how the pandemic may have influenced adolescents' cyberbullying experiences. While findings from the Indian cohort should be interpreted with caution due to sample limitations, they offer preliminary insights into how systemic disparities may shape youth online experiences in low-resource settings. More broadly, this study contributes to a growing body of work aimed at informing equitable digital safety interventions and crisis-response strategies in an increasingly connected world, insights that remain relevant beyond the pandemic era.

2. Related Work

2.1. Cyberbullying Prevalence and Impact

Cyberbullying is a significant public health concern affecting adolescents globally. While definitions vary, it is generally characterized as peer-to-peer aggression conducted through electronic communication technologies (Mehari et al., 2014; Menin et al., 2021). The construct of cyberbullying encompasses both cyberbullying perpetration, the act of engaging in aggressive behaviors, and cybervictimization, the experience of being targeted by aggressive acts (Modecki et al., 2013). Some researchers emphasize key characteristics such as repetition, intent, and power imbalance (Smith et al., 2012; Olweus, 2012), while others adopt broader definitions that include any form of online harassment or aggression (Hinduja & Patchin, 2019; Zweig et al., 2013). This definitional variability has contributed to wide-ranging estimates of cyberbullying incidence across different populations and methodologies. In the U.S., cyberbullying perpetration rates among adolescents range from 20% to 30% (Mehari & Farrell, 2018; Patchin & Hinduja, 2024), whereas estimates in India vary widely, with studies reporting rates as low as 3.3% and as high as 60.56% depending on sampling methods (Vijayarani et al., 2024).

Variations in internet accessibility, parental oversight, and digital literacy can further complicate cross-national comparisons. For instance, disparities in internet accessibility can complicate cross-national comparisons; while U.S. adolescents benefit from widespread internet access (Anderson et al., 2023), internet availability in India remains uneven, partic-

ularly in rural areas (Basuroy, 2024). These digital divides and technological differences highlight the complexity of comparing cyberbullying trends between countries. Yet, with digital communication becoming central to adolescent life, it is essential to understand cyberbullying in diverse contexts to inform effective interventions and policy responses.

Cyberbullying perpetration and cybervictimization have been shown to be linked to various negative psychological, behavioral, and academic outcomes. Research has established positive associations between cyberbullying involvement and depressive symptoms, anxiety, substance use, and lower academic performance (Kowalski et al., 2014; Morin et al., 2018). A meta-analysis confirmed that cybervictimization is positively related to depression and a significant predictor of suicidal ideation and suicide attempts among adolescents (Hu et al., 2021; John et al., 2018; Kwan et al., 2020; Nixon, 2014; Van Geel et al., 2014); cyberbullying perpetration was linked to poor mental health, such as lowered self-esteem and increased depressive symptoms (Modecki et al., 2013). Moreover, studies indicate that cyberbullying can exacerbate existing mental health issues, particularly for adolescents already experiencing social or emotional challenges (Kumar & Goldstein, 2020). Research has also shown that cyberbullying often coexists with in-person bullying, amplifying its psychological impact (Modecki et al., 2014). Considering these negative consequences, understanding the prevalence and predictors of cyberbullying is essential for informing effective support systems.

2.2. The Impact of COVID-19 on Adolescent Digital Well-Being

The COVID-19 pandemic led to drastic shifts in adolescent socialization and digital media use due to global restrictions, school closures, and stay-at-home mandates. Studies have documented changes in relationships among adolescents, including increased family time but also heightened social isolation from peers (Kadiri, 2023). A systematic review found that adolescents faced significant disruptions in their social interactions, leading to increased loneliness and psychological distress (Singh et al., 2020). Additionally, the pandemic exacerbated mental health challenges among youth, with elevated rates of depression, anxiety, and stress reported across multiple studies (Ballonoff Suleiman et al., 2022; Christodoulides et al., 2023). Emerging research identified a strong link between social isolation, loneliness, and increased risk of depression and anxiety among adolescents, indicating that the longer the period of social isolation, the greater the mental health burden, reinforcing concerns that pandemic-related restrictions had lasting effects on youth well-being (Loades et al., 2020).

At the same time, adolescents have become more reliant on digital technologies for learning, social interaction, and entertainment. With increased reliance on electronic communication technologies for social interaction, learning, and entertainment, researchers and media outlets speculated that cyberbullying incidents would rise (Downey, 2020; Micklea, 2020; Thakur et al., 2020). Public discourse on social media reflected this concern, as evidenced by a rise in cyberbullying-related discussions on Twitter in early 2020 (Karmakar & Das, 2020). Empirical evidence showed that, while adolescents used digital platforms to stay connected, they also experienced heightened stress, disrupted sleep patterns, and greater emotional distress due to prolonged screen exposure; excessive digital engagement did not provide a protective effect against social isolation for all adolescents and, in some cases, exacerbated pre-existing mental health vulnerabilities (Ellis et al., 2020).

In contrast, other studies highlight the positive effects of digital technology on youth, ranging from increased social communication, social support, and self-presentation to decreased depressive symptoms and loneliness, which were particularly salient during the global pandemic (Haddock et al., 2022). Digital platforms enabled youth to maintain friendships, seek mental health support, and participate in online communities that

fostered a sense of belonging, particularly during periods of isolation (Odgers & Jensen, 2020). Similarly, a longitudinal study found that, while screen time increased during the pandemic, it did not necessarily correlate with negative social outcomes for all adolescents (Ellis et al., 2020). Together, these findings highlight a dual burden on adolescents during COVID-19—social isolation intensified feelings of loneliness and mental distress, while increased screen time did not always mitigate these effects and, in some cases, contributed to additional stress.

2.3. Cyberbullying During the COVID-19 Pandemic

Despite widespread concerns, empirical studies assessing the impact of COVID-19 on cyberbullying rates remain limited. The available research has predominantly focused on college-aged populations or broader online hate speech trends rather than peer-targeted cyberbullying among adolescents (Babvey et al., 2021; Karmakar & Das, 2020). Some studies have shown an increase in online aggression during the pandemic, but these findings do not address cyberbullying specifically among adolescents. For example, a study by Barlett et al. (2021) found that, while online aggression increased among young adults, the data did not conclusively show a rise in cyberbullying victimization among younger adolescents. While some studies have focused on adolescents (e.g., Repo et al., 2023; Shin & Choi, 2021; Patchin & Hinduja, 2023), research remains methodologically fragmented and geographically limited. For example, cybervictimization was found to decrease among Finnish adolescents (Repo et al., 2023), while Korean youth experienced a decrease in perpetration but an increase in victimization (Shin & Choi, 2021). In contrast, cybervictimization increased among Asian American adolescents in the U.S. (Patchin & Hinduja, 2023). A recent systematic review revealed that, in general, the prevalence rates of involvement in cyberbullying and/or cybervictimization increased in many Asian countries and Australia and decreased in Western countries (Sorrentino et al., 2023).

These varied findings point to the importance of more comprehensive and context-aware approaches that can better capture temporal shifts in cyberbullying behaviors. While some work has begun to address this area, much of the existing literature relies on cross-sectional data, which can make it difficult to assess whether observed changes in cyberbullying reflect actual trends or broader shifts in media attention and public concern. In addition, while some Asian contexts have been studied, comparative research on cyberbullying, both before and during the pandemic for Indian adolescents is underdeveloped (Vijayarani et al., 2024). This underrepresentation limits our understanding of how digital risk behaviors manifest in a global context.

In this study, we aim to contribute to the emerging literature by exploring potential changes in cyberbullying among adolescents in the U.S. and in an exploratory subsample from India following the onset of COVID-19 restrictions. Leveraging longitudinal data from a natural experiment, we examined how the pandemic may have influenced cyberbullying behaviors in these distinct contexts. While the findings from the Indian cohort are exploratory due to sample limitations, they offer valuable preliminary insights into how digital disparities may shape adolescents' online experiences in low-resource settings. As digital connectivity continues to expand globally, gaining a better understanding of adolescents' evolving online experiences can help inform the development of contextually appropriate strategies to support safer and more positive digital interactions in educational and social settings beyond the pandemic.

3. Materials and Methods

3.1. Participants

The U.S. participants were 307 youth aged 10–14 years ($M = 11.79$; $SD = 1.23$), of whom 51.9% were male. The majority were White (69.9%); 11.4% were Black; 8.8% were Latino/a; and 9.9% reported being another race or ethnicity. The annual household median income was USD 68,500, which is slightly lower than the 2019 median income in the U.S. ([United States Census Bureau, 2020](#)), and 50.0% of children reported receiving free or reduced-priced lunch; a total of 45% of parents reported having a bachelor's degree or higher. Almost all participants in the U.S. (92.3%) had their own cell phone (70.9%), computer (40.2%), or tablet (69.2%). Regarding geographic location, 10.4% of the participants resided in Florida, followed by New York (8.4%), Texas (6.8%), California (5.8%), Pennsylvania (4.8%), Ohio (4.5%), Michigan (3.5%), Arizona, Georgia, Illinois, North Carolina, and Virginia (3.2%, respectively). Regarding residency area, 24.3% lived in rural areas, 45.9% lived in suburban areas, and 29.8% lived in urban areas.

The India participants were 178 youth aged 9–15 years ($M = 12.47$; $SD = 1.23$), of whom 57.1% were male. The majority of youth (89.9%) were Hindu. The annual household median income reported for the Indian participants was approximately USD 1346, which is much lower than the average household income in Delhi ([Unacademy, n.d.](#)). Additionally, 47.3% of children reported receiving free or reduced-price lunch, and 32.6% of the parents reported having a bachelor's degree or higher. Nearly one-third of participants in India (29%) had their own cell phone (12.9%), computer (16.3%), or tablet (12.6%). Regarding geographic location, 11.1% lived in rural areas, 5.8% lived in suburban areas, and 83.0% lived in urban areas, with 79.8% living in an urban area of Delhi. Notably, Delhi is a metropolitan city, ranks 3rd amongst states in India based on per capita income, and is topmost in its internet penetration (69%).

3.2. Procedure

All procedures were conducted in accordance with the Declaration of Helsinki and approved by the institutional review boards of a U.S. and an Indian university. Youth participants provided informed assent, and parents or guardians provided active informed consent. In the U.S., participants were first recruited to participate via a Qualtrics panel in the fall of 2019 (Time 1, T1) and recruited again using direct email contacts from 12 May to 1 June 2020 (Time 2, T2). In the U.S., most states issued a stay-at-home order between the end of March and mid-April 2020, so this recruitment was at least 30 days following the initial shutdown due to COVID-19.

In India, participants were first recruited to participate through five schools in the National Capital Region of Delhi, India, and completed T1 surveys in person during the period from October 2019 to January 2020. The schools were chosen by multistage sampling. At first, three districts were chosen randomly out of the eleven districts in Delhi. Next, from each district, two schools (one public and one private) were selected. Out of the six approached, five schools agreed to participate. Fifty students were randomly selected from the roster of each 6th to 10th grade class (approximate ages 11 to 16 years). The student was invited to participate in the survey on the school premises. In T2, participants were contacted to complete surveys through phone calls using phone numbers provided by the participants' schools from July to September 2020. In Delhi, the first COVID-19 lockdown occurred at the end of March 2020 and was lifted in stages beginning in June 2020.

3.3. Measures

Participants in both countries completed the cyberbullying and cybervictimization, which are subscales of the Problem Behavior Frequency Scales–Adolescent Revised (PBFS-

AR) (Farrell et al., 2020). Participants identified the frequency of their experiences over the past month on a 6-point rating scale from 1 = never to 6 = 20 or more times. Cyberbullying was measured by 11 items (e.g., sent or posted embarrassing photos of someone without their permission). Cybervictimization was measured by 11 items (counterpart of the cyberbullying items). We conducted multiple imputations (25 iterations) at the item level before computing the composites to minimize the risk of systematic missingness affecting the final scores (item missingness in at least one item: 1.9% for cyberbullying and 6.1% for cybervictimization in the US participants; 2.3% and 12.5% in the India participants). Given the small amount of item-level missingness, we opted for this approach to retain statistical power while accounting for potential non-random dropouts. In addition, we included the auxiliary variables (i.e., residency area for the US participants, free or reduced-price lunch for the Indian participants) to account for non-randomness in attrition (see Section 4.1 for details). For the two constructs (i.e., cyberbullying, cybervictimization), we computed composite scores by averaging item-level responses from the participants (cyberbullying: T1 Cronbach's $\alpha = 0.95$ [India]; 0.97 [U.S.]; T2 Cronbach's $\alpha =$ undefined due to near-zero variance [India]; 0.91 [U.S.]; cybervictimization: T1 $\alpha = 0.94$ [India]; 0.98 [U.S.]; T2 Cronbach's $\alpha =$ undefined due to near-zero variance [India]; 0.91 [U.S.]). The prevalence rate for each construct was computed as the percentage of participants whose responses included 2 (1–2 times) or above for at least one item under each construct. In the U.S., surveys were available only in English. In India, surveys were available in both English and Hindi (Hindi scales available upon request).

3.4. Data Analysis

We conducted a series of chi-square tests to assess the association between participant attrition and key demographic factors, such as age, gender, race, parental marital status, residency area, and socioeconomic status (eligibility for free or reduced-price lunch). These analyses helped identify patterns of differential retention that could inform our handling of missing data and interpretation of findings.

To assess whether there were significant differences in rates of cyberbullying and cybervictimization from T1 to T2, we conducted repeated-measures analyses of variance (ANOVAs). We applied the repeated-measures design to account for within-subject correlations over time, while nesting by participant ensures that each participant's responses are appropriately modeled in relation to their previous responses. We also conducted mixed methods nesting analysis by the participant to account for repeated measures and used multiple imputations (25 iterations) to account for item missingness and for any possible non-random attrition.

4. Results

4.1. Retention and Attribution Analysis

For the U.S. participants, the retention rate from T1 to T2 was 30% (analytic sample: $n = 92$). Youth from urban areas were less likely to participate at T2, $\chi^2(2, N = 305) = 6.54$, $p = 0.038$. However, no differences were found in age, gender, race, parental marital status, or free or reduced-price lunch eligibility by attrition patterns. This suggests that, while residency area was a predictor of attrition, other demographic factors were not systematically associated with dropout rates.

For the India participants, the retention rate was 21.3% ($n = 38$), largely due to an absence of working telephone numbers at T2. Youth from lower-income backgrounds, indicated by eligibility for free lunches, were significantly less likely to remain in the study, $\chi^2(1, N = 170) = 8.36$, $p = 0.004$. However, no significant differences were observed based on age, gender, parental marital status, or residency area. The higher attrition in this

sample highlights potential challenges in longitudinal research within socioeconomically disadvantaged populations, particularly in regions with limited technological access.

4.2. Descriptive Statistics and Cyberbullying Trends

Descriptive statistics for the measures are available in Table 1. For the U.S. participants, at T1, 37.4% of youth reported cyberbullying perpetration, while 39.4% reported experiencing cybervictimization in the past 30 days. At T2, both cyberbullying and cybervictimization rates decreased by 32.6%. Among the Indian participants, at T1, 33.9% of youth reported engaging in cyberbullying, and 35.1% reported experiencing cybervictimization. However, at T2, 0% of participants reported cyberbullying or cybervictimization in the past 30 days.

Table 1. Descriptive statistics for cyberbullying and cybervictimization pre-pandemic and during the pandemic.

Variable	T1		T2	
	Mean (SD)	Prevalence	Mean (SD)	Prevalence
U.S. Participants				
Cyberbullying	1.22 (0.65)	37.4%	1.16 (0.43)	32.6%
Cybervictimization	1.27 (0.68)	39.4%	1.25 (0.57)	32.6%
India Participants *				
Cyberbullying	1.40 (0.90)	33.9%	1.00 (0.00)	0%
Cybervictimization	1.37 (0.80)	35.1%	1.00 (0.00)	0%

* Ns = 307 (T1) and 92 (T2) for the U.S. participants; 178 (T1) and 38 (T2) for the Indian participants. Analyses were conducted using multiple imputation with 25 iterations.

4.3. Longitudinal Analysis of Behavioral Changes

For the U.S. participants, repeated-measures ANOVA indicated no significant changes in cyberbullying [$F(1, 91) = 0.62, p = 0.43$] or cybervictimization [$F(1, 91) = 0.04, p = 0.83$] between T1 and T2 (see Table 1 for descriptive statistics). Multiple imputation techniques with auxiliary variables (residency for the U.S. participants, free lunch for the Indian participants) were used to account for potential bias due to non-random attrition, but the results remained robust, reinforcing the stability of these findings.

For the Indian participants, we observed zero variance in cyberbullying and cybervictimization scores at T2, which precluded statistical comparisons across time. However, the complete absence of cyberbullying and cybervictimization suggests that there is no empirical support for the notion that cyberbullying significantly increased among Indian adolescents during the study period. Note that, given the limited sample size and substantial missing data at T2, these findings should be interpreted with caution.

5. Discussion

Overall, there was no evidence to suggest that rates of cyberbullying among adolescents in the United States or India increased during the COVID-19 global pandemic. As noted earlier, due to the limited sample size and substantial missing data at the second wave, particularly within the Indian participants, we interpret our findings with caution. One possible explanation for the stability in cyberbullying rates is the close correlation between cyberbullying and in-person aggression, which is supported by a large body of research (Kowalski et al., 2014). The significant reduction in offline social interactions due to school closures, stay-at-home orders, and social distancing measures likely disrupted this pathway. This disruption may have curtailed opportunities for aggression to transition from physical to digital spaces, thereby stabilizing rates of cyberbullying.

Another explanation for our findings could be associated with improvement in social relationships with family members, close friends, and romantic partners during the pandemic (Ballonoff Suleiman et al., 2022). These strengthened bonds may have served as protective factors, reducing the likelihood of youth engaging in or being targeted by cyberbullying. While some adolescents could have benefited from enhanced family support, others, particularly those in underprivileged or resource-constrained environments (Indian adolescents in our case), could have faced significant challenges in accessing electronic communication technologies. Conversely, adolescents residing in large metropolitan areas such as Delhi may have had better internet access and different exposure to online risks compared to those in rural regions. While urban residency in India may increase access to digital platforms and associated risks, our limited sample size and high attrition at T2, especially among youth from lower-income or non-urban backgrounds, constrain our ability to systematically examine such contextual variations in depth. Future research should consider the role of intra-country variations, such as residency (e.g., urban vs. rural) and regional infrastructure, in shaping adolescents' online behaviors and risk experiences. As such, the findings highlight the multidimensional and complex nature of the pandemic's impact on adolescent well-being (Ballonoff Suleiman et al., 2022).

The stability in cyberbullying rates observed in this study has several important implications. First, our findings point to the persistent digital divide, particularly in low-resource settings. Our findings suggest that infrastructural inequalities in digital access in two countries (Basuroy, 2024; Anderson et al., 2023) may have played a more influential role in shaping adolescents' online experiences during the pandemic. In particular, the steep attrition among Indian participants at T2 likely reflects systemic challenges in maintaining digital connectivity during the pandemic. Adolescents from lower-income households may have lacked consistent access to devices or internet service due to economic hardship, reliance on shared devices, or instability in mobile networks, a problem that was likely intensified by the socioeconomic disruptions of the pandemic (Livingstone & Blum-Ross, 2020). Notably, our findings revealed that, within the Indian participants, youth from lower-income backgrounds, as indicated by eligibility for free or reduced-price lunch, were significantly less likely to remain in the study at T2. These structural barriers may have not only reduced adolescents' exposure to digital risk but also constrained their ability to remain engaged in online longitudinal research.

In contrast, adolescents in the U.S., who generally reported greater device ownership and home internet access, showed relatively stable cyberbullying rates over time. However, this apparent "stability" should not be interpreted as the absence of disruption, as there could have been shifts in peer dynamics due to prolonged school closures and reduced in-person conflict, which can often spill into digital spaces (Kowalski et al., 2014). Taken together, these findings illustrate that the COVID-19 pandemic had profound but contextually distinct effects on adolescents' digital lives in two distinct countries. In the U.S., youth largely maintained access to online spaces, though social and behavioral patterns may have shifted in nuanced ways. In India, the pandemic likely curtailed many adolescents' ability to participate in digital life altogether. This divergence highlights how public health crises such as the COVID-19 pandemic can exacerbate pre-existing digital inequalities, leading to differential vulnerabilities to online risk and/or disengagement.

Second, it underscores the need to move away from pathologizing increased digital technology use among adolescents during the pandemic. While concerns about online risks are valid, it is equally important to recognize the positive roles that online interactions can play in providing social support, fostering belonging, and facilitating learning during times of social isolation (Asghar et al., 2021). Also, the results suggest that interventions targeting cyberbullying should take into account the interplay between online and offline contexts.

By focusing on strengthening offline social relationships and mitigating offline aggression, practitioners may design interventions to indirectly reduce cyberbullying involvement. This integrated approach is particularly relevant during periods of significant societal disruption, such as the COVID-19 pandemic.

While this study provides valuable insights into adolescent cyberbullying trends, several limitations should be acknowledged. First, given the limited sample size and substantial missing data at T2, our findings should be interpreted with caution as an exploratory study. While we refrained from conducting formal statistical analyses, we chose to retain a balanced presentation of both the U.S. and Indian participants to ensure the inclusion of underrepresented populations in cross-cultural cyberbullying research, where perspectives from non-Western contexts are often overlooked (Oguine et al., 2025). Future research with larger, more representative samples is needed to confirm these patterns.

Additionally, while we included attrition-related factors (e.g., urban residency and socioeconomic status) as auxiliary variables in our analyses, we recognized that doing so with our limited T2 sample restricted our ability to incorporate these factors more extensively without increasing the risk of overfitting or further reducing statistical power. As a result, our findings should be interpreted in light of these sample characteristics, as differential attrition may reflect broader structural inequalities that shape adolescents' digital engagement. Future research with larger and more representative samples should consider including such factors more fully to improve the robustness and generalizability of the findings. Similarly, disparities in phone access among Indian adolescents may have influenced our findings. Since mobile access can significantly shape cyberbullying exposure and perpetration, future research should incorporate detailed measures of technology access and digital literacy to better understand these dynamics. Finally, our study focused on individual-level behaviors and did not account for potential clustering within schools, where shared environments, policies, and peer dynamics may shape cyberbullying patterns. Future research should incorporate school-level data and hierarchical modeling to better capture these institutional influences.

At the same time, the unexpected stability in cyberbullying rates observed in this preliminary study raises important questions for future research. First, longitudinal studies examining the long-term effects of the pandemic on adolescents' online behaviors are needed to determine whether the observed trends persist as societies return to pre-pandemic levels of offline interaction. In addition, future studies could explore the protective factors that contributed to the stability in cyberbullying rates, such as improved family relationships or increased digital literacy. Another important area for future research is the exploration of how cultural norms and gender roles shape adolescents' online experiences across different contexts. While our study centered on structural and socioeconomic differences between the U.S. and India, we recognize that cultural expectations around gender, communication, and technology use may uniquely influence how youth engage with digital spaces and experience online risks. Research that integrates cultural and gendered dimensions will be essential for developing more nuanced, contextually grounded understandings of cyberbullying and digital resilience globally. Also, greater attention must be given to the digital divide and its implications for adolescent well-being. Further research should investigate how disparities in access to electronic communication technologies impact adolescents' social, emotional, and educational outcomes, particularly in underdeveloped regions and low socioeconomic settings within developed countries.

Finally, while this study was conducted during the COVID-19 pandemic, its broader implications remain relevant beyond this specific period. The increasing role of digital spaces in adolescent socialization continues to shape online risk behaviors, making historical analyses of digital aggression critical for future prevention strategies. Understanding

how adolescents responded to increased digital engagement during a period of global crisis provides valuable insights into the relationship between online behavior, social isolation, and cyberbullying risks, which continue to be pressing issues in today's digital landscape. Given the ongoing concerns about the impact of digital connectivity on adolescent well-being, particularly in the context of evolving online risks, our work contributes to knowledge that can inform future crisis-response strategies. The lessons learned from this study can help inform policies, interventions, and future research aimed at mitigating cyberbullying and promoting digital well-being in youth populations.

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Abbreviations

The following abbreviations are used in this manuscript:

ANOVA	Analysis of Variance
COVID-19	Coronavirus disease 2019
PBFS-AR	Problem Behavior Frequency Scales–Adolescent Revised

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