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RESEARCH ARTICLE

Adolescent Emotional Well-Being and Social Media Addiction: The COVID-19 Pandemic's Influence on Mental Health

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ABSTRACT

Currently, many adolescents allocate over three hours daily to their engagement with social media platforms. It is a prevalent practice among adolescents to invest significant time online without complete awareness of the adverse impact it may have on their emotional and social well-being. Considering this, a cross-sectional study was undertaken to assess the evolution of social media addiction in the post-COVID19 era, its repercussions on the emotional well-being of adolescents, and to identify predictive factors for the onset of emotional distress. The study encompassed 848 adolescents, aged 10 to 22, primarily from the United States. Data was collected using various questionnaires including the Bergen Social Media Addiction Scale (BSMAS), Patient-Health Questionnaire (PHQ-9), Generalized Anxiety Disorder (GAD-7), Depression, Anxiety, and Stress Scale (DASS-21), as well as the Pediatric Quality of Life scale (PedsQL). The findings revealed a significant increase in social media addiction scores ($p < 0.0001$) between before and during the pandemic. A slight and statistically insignificant decrease ($p = 0.5481$) was observed during the time of the pandemic to after. Comparing the results during the pandemic with those after, it was evident that adolescents reported lower scores on the PHQ-9, GAD-7, and DASS-21, signifying an enhancement in mental health. The study also identified the use of social media and past experiences of cyberbullying as predictive factors for elevated scores on the PHQ-9, GAD-7, DASS-21, and BSMAS. These findings indicate the utility of these factors in forecasting both social media addiction and declines in mental well-being.

Introduction

According to the United Nations International Children Emergency Fund (2017), individuals aged 15 to 24 represent a significant portion of social media users, with over a third falling below the age of 18¹. However, the impact of technology and social media on young people's lives underwent a profound transformation when the COVID-19 pandemic compelled most students into quarantine and remote learning, as highlighted by Kiss et al. (2023)².

Even prior to 2020, the influence of social media on communication and lifestyle had been well-documented³. Adolescence, marked by significant psychological, biological, and social changes, is a period where self-expression, peer acceptance, self-discovery, and friendships carry paramount importance⁴. It is, therefore, unsurprising that teenagers have turned to social media to satisfy their need for connection with peers of their own age⁵.

Given the growing awareness of the detrimental effects of social media addiction (SMA) on mental health and cognitive development, this study explores how the COVID-19 lockdown has impacted patterns of social media addiction in adolescents both before, during, and after the lockdown. The research aims to unravel the psychological effects on adolescents in this evolving digital landscape.

DEVELOPMENT DURING ADOLESCENCE

Adolescence is a pivotal phase marked by significant character and personality development⁶. During this period, individuals tend to place greater emphasis on forming relationships with peers through group activities and friendships, often valuing these connections more than their family relationships⁷. Consequently, many adolescents prioritize peer interactions over familial ones⁸. Moreover, adolescents tend to engage in more frequent self-comparisons than at other life stages^{9,10}, a behavior that has been amplified by the rise of social media. The accessibility of social media platforms has enabled adolescents to readily compare themselves to others they perceive as socially superior or inferior¹¹. This allows them to assess their social standing, a concept rooted in Festinger's social comparison theory (1954)¹².

With the proliferation of online users, research indicates that online communication has introduced noticeable social pressures on adolescents, intensifying the phenomenon of self-comparison (Ehmke, 2023)¹³. Unfortunately, during the years 2020 through 2021, the onset of quarantine

measures and the shift to remote learning across the United States disrupted the ability of many developing adolescents to form in-person peer group connections. Consequently, social media became the primary medium through which adolescents maintained their connections and continued to foster their external relationships.

INTERNET & SOCIAL MEDIA USE

Social media has emerged as a valuable tool for adolescents, facilitating communication with their peers without constraints of location or time¹⁴. Consequently, a significant proportion of adolescents actively engage with social media daily, with research suggesting that between 93% and 97% of individuals aged 13 to 17 are active on at least one social media platform¹⁵. Additionally, adolescents tend to allocate at least three hours of their day to various social media platforms¹⁶.

However, the extensive use of social media by adolescents comes with its set of repercussions. Recent studies have revealed a correlation between frequent social media usage and various psychological issues, including diminished academic performance, engagement in risky behaviors, diminished self-confidence related to body image, and unhealthy eating habits¹⁷. These psychological challenges result from various factors, such as adolescents' capacity to gauge their social acceptance and their inclination to compare themselves to their peers using social media features like "likes," "comments," "views," "friends," or "followers"^{18,19}.

Furthermore, the absence of significant restrictions from parents on adolescents' social media activities contributes to greater online socialization, which can, in turn, serve as a precursor to addiction⁴.

COVID-19 PANDEMIC & LOCKDOWN

The outbreak of the coronavirus disease 2019 (COVID-19) introduced numerous challenges concerning the mental well-being of adolescents. These young individuals underwent a significant transition, shifting from daily in-person interactions with their peers to relying on social media for maintaining contact²⁰. Amid the lockdown measures, adolescents found their most crucial sources of support in the form of school and family²¹. As restrictions limited their ability to travel and socialize, the prevalence of loneliness stemming from social isolation emerged as a prominent concern²². Studies conducted during this period emphasized the essential role of social connectedness in preserving a healthy psychological

state, as isolation exhibited a notable association with deteriorating mental health²³.

SOCIAL MEDIA USE DURING THE COVID-19 LOCKDOWN

The first year of the COVID-19 pandemic saw numerous studies exploring the multifaceted impact of social media use, revealing both its advantageous and detrimental effects. Adolescents turned to social media to bridge the social isolation gap, enabling communication and connection with their peers²⁴. Prior to the pandemic, research had already demonstrated how social media could foster a sense of belonging and connectedness among adolescents^{25,26}.

However, it became evident that social media use had its drawbacks. Several studies indicated that it could induce stress, primarily stemming from the tendencies of comparison and feelings of rejection^{27,28,29}. Notably, the lockdown period witnessed a 50% increase in the volume of text-based interactions on social media, along with a 70% surge in the time spent on these platforms³⁰. This rise in social media engagement, coupled with the associated adverse effects, contributed to the increased prevalence of social media addiction during the lockdown³¹.

ADOLESCENT SOCIAL MEDIA ADDICTION

The development of social media addiction (SMA) among adolescents is subject to a variety of factors within their lifestyle and environment. Social interactions, including peer-to-peer, parent-adolescent, and teacher-student relationships, often show correlations with SMA³². Nonetheless, certain studies have found that peer relationships may be associated with an increased likelihood of SMA development^{33,34}. This variance can be attributed to the influence and choices made by peers, as some may have a more positive impact compared to others. In contrast, adolescents who enjoy healthy relationships with their parents tend to experience fewer issues related to SMA^{35,36}.

Gap

Research in the past has predominantly concentrated on the relationship between Social Media Addiction (SMA) and the mental health of adolescents during the COVID-19 pandemic. However, there has been a noticeable gap in studies comparing these factors with the pre-lockdown period, and no investigations have explored this dynamic in a post-lockdown adolescent population. This study aims to address this void by examining how the increased use of social media during the COVID-19 lockdown has impacted SMA in the years following the conclusion of quarantine.

Objectives:

- A. Evaluate the mental health status of adolescents after the conclusion of the pandemic.
- B. Analyze the development of social media addiction in adolescents before, during, and after the COVID-19 pandemic.
- C. Identify potential correlations between demographic factors and the mental health/SMA levels of adolescents.

Hypotheses:

1. SMA levels will be ranked from highest to lowest during the lockdown, after the lockdown, and before the lockdown, given that adolescents tend to maintain some of their social media habits post-COVID.
2. The majority of adolescents will report minimal symptoms of depression, anxiety, and stress since they can now engage in frequent face-to-face socialization.
3. Factors commonly employed to predict depression, stress, and anxiety will also predict social media addiction, as these mental health symptoms are often interrelated.

Methodology

SURVEY CONSTRUCTION

The survey employed in this study was crafted utilizing the Google Forms application. IRB approval was granted. The survey encompassed seven distinct sections: two sections focused on capturing participant demographics and behavioral habits, while the remaining five sections aimed to assess the participant's levels of social media addiction, depression, anxiety, stress, and quality of life. The first section, labeled "Demographics," solicited information related to the participant's age, gender, educational level, household income, household size, current country of residence, ethnicity, sibling status, and academic GPA. In the second section, titled "Phone & Social Media Use," respondents provided insights into their social media and mobile phone usage. The third section involved participants completing the Bergen's Social Media Addiction Scale (BSMAS), a tool designed to quantify their addiction to social media. In the fourth section, the PHQ-9 (Patient Health Questionnaire-9) was administered to collect data on the frequency and severity of depressive symptoms. In the fifth section, participants completed the GAD-7 (Generalized Anxiety Disorder-7) to assess their anxiety symptoms. Subsequently, the sixth section featured the DASS21 (Depression, Anxiety, and Stress Scale-21) to gauge stress symptoms among the participants. The survey culminated with the seventh and final

section, where participants provided responses to the Pediatric Quality of Life Inventory (PedsQL), offering insights into their overall quality of life.

PARTICIPANT RECRUITMENT AND SURVEY DISTRIBUTION

Following IRB approval, the Google Form survey was disseminated via Amazon MTURK to eligible individuals using the application. Incentives were offered to motivate participants to complete the survey. The age range of participants encompassed individuals from 10 to 24 years old, a selection in alignment with the World Health Organization's (2019) classification of adolescents.

A total of N=850 individuals were invited to partake in the survey. Upon agreeing to the consent/assent questionnaire, contingent on their age (above or below 18), participants dedicated approximately 25 minutes to complete the survey. To safeguard participants' identities, no personally identifiable information was collected, and individuals were solely identified by their assigned response numbers.

SURVEY DATA ANALYSIS AND MATERIALS

The responses from the survey were initially gathered in a Google spreadsheet and subsequently transferred to an Excel spreadsheet. Following this, responses for each survey question were coded to facilitate analysis using statistical software. The coded data was subjected to a range of statistical tests to extract and interpret the findings.

ANALYSIS OF BSMAS RESPONSES

To analyze the responses to the BSMAS questionnaire, the data was initially organized into three box plot distributions, offering a visual representation of the score results. Subsequently, the responses underwent an ANOVA analysis to

ascertain any variations in social media addiction levels before, during, and after the COVID-19 pandemic.

Additionally, a Linear Mixed Effects (LME) model was applied to determine if there was any significant variance in social media addiction levels over time. To gain deeper insights, the results of the pre-COVID BSMAS questionnaire were individually compared with the outcomes from the BSMAS questionnaire administered during the COVID-19 period and the post-COVID BSMAS questionnaire.

ANALYSIS OF MENTAL HEALTH QUESTIONNAIRES

The outcomes from the GAD-7, modified PHQ-9, modified DASS-21, and modified QoL scales were structured into distributions for comprehensive examination. These distributions allowed for a comparison between the participants' scores and their frequency.

Furthermore, an assessment was made by correlating the results of each questionnaire with queries concerning participants' demographics and their technology usage habits, aiming to identify any notable trends or associations.

ANALYSIS OF CORRELATIONS BETWEEN MENTAL HEALTH QUESTIONNAIRES AND DEMOGRAPHIC & TECHNOLOGY FACTORS

In this analysis, the results of each questionnaire were incorporated into a computer model, alongside other demographic and technology-related variables. Subsequently, the computer model generated three distinct models to assess the variables that exhibited the most substantial relationships with the questionnaire results. These models included the Adjusted R-squared (adjr2), Mallow's Cp (cp), and the Bayesian Information Criterion (Bic) models.

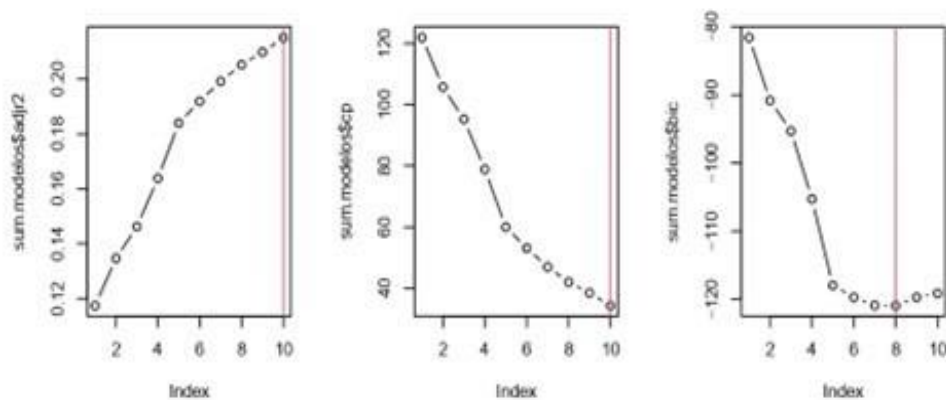


Fig 1 | Computational Model Analysis. Multiple models were used but the model with the lowest sum value was determined to be the best model for the analysis.

The model with the lowest cumulative value was identified as the most suitable approach for assessing the relationships concerning the questionnaire results. Subsequently, all the variables were subjected to a linear model test to identify which variables could best predict the scores on the respective questionnaire. The variables that exhibited a significant relationship with the questionnaire were determined through this test, which was conducted for each questionnaire separately.

All the variables were then run through a linear model test to determine which ones could be used to best predict the scores on the given questionnaire. The variables that demonstrated a significant relationship with the questionnaire scores were identified as the results of the predictive variable analysis. This analysis was conducted individually for each questionnaire.

Results

RESULTS OF DEMOGRAPHICS

Based on the demographic data gathered, it was observed that many participants were aged 19 and older, making up 83.1% of the sample, even though this age group only represents 33% of the potential adolescent ages. In terms of gender

distribution, approximately 53.5% of participants identified as female, 45.2% as male, and the remaining 1.5% identified as non-binary.

Concerning educational status, a significant portion of participants (60.4%) were currently enrolled in college or university, while around 26.6% were not enrolled in any educational institution. The majority of participants were located in the United States (82.3%), with a notable proportion residing in India (5.5%).

Ethnically, a significant majority identified as Caucasian (74.9%), followed by the second most prevalent ethnic group, Asian, at 10.3%. Around half of the participants (51.3%) lived in double-parent households, while approximately one-quarter (24.4%) resided in single-parent households.

Income distribution among participants showed a relatively even spread, with incomes of \$100,000 or more being less common. Most participants reported having at least one sibling (86%), with the most common number of siblings being 1 (47.3%). In terms of academic performance, roughly 20% of adolescents fell within the GPA range of 2.0 to 3.5, while most participants had GPAs above 3.5 (35.2%).

Variable	Response	Percent
Age	Under 13	0.2
	13 to 15	2
	16 to 18	14.7
	19 and over	83.1
Gender	Male	45.2
	Female	53.3
	Non-binary	1.5
Education	Middle School	1
	High School	12.1
	College/University	60.4
	None	26.5
Country	United States	82.3
	India	5.5
	Italy	2.2
	Brazil	0.7
Ethnicity	Caucasian	74.9
	Asian	10.3
	Hispanic	5.3
	Black or African American	5.3
	Native American	2
Household Background	Single-Parent Household	24.4
	Double-Parent Household	51.6
	Live Alone	9.4

Variable	Response	Percent
	Live With Roommate(s)	7.1
	Live With Extended Family	7.6
Household Income	\$39,000 and below	30.1
	\$40,000 to \$79,000	40.8
	\$80,000 to \$149,000	25
	\$150,000 and above	4
Siblings	Yes	86
	No	14
Academic GPA	Below 2.0	3.3
	2.1 to 2.5	17.2
	2.6 to 3.0	22.6
	3.1 to 3.5	21.7
	Above 3.5	35.2

Fig 2 | Results of demographics - The distribution of gender, current education, country of residence, ethnicity, household background, income, number of siblings, and academic grade point average.

VARIABLE RESULTS OF SMARTPHONE USAGE

Most adolescents indicated using their phones several times a day (47%), with an additional 27% reporting even more frequent phone usage. Among the various purposes, social media emerged as the most common use for adolescents, accounting for 38.4% of the respondents.

A notable proportion of participants (38.1%) spent at least 2 hours daily on their phones, and an additional 20.8% used their phones for even longer durations. The evening, spanning from 6:00 pm to

12:00 am, was the most popular time for phone usage, with nearly half (49.6%) of participants reporting engagement during this period. Around one-fifth of adolescents (22.8%) mentioned using their phones only a few times per week.

Cyberbullying was experienced by slightly more than half of the participants (53.5%) at some point in their lives. Notably, a significant portion of respondents (46.3%) believed that social media had a positive impact on their mental well-being.

Variable	Response	Percent
Smartphone Use Frequency	Rarely	7.8
	Occasionally	18.3
	Several Times per Day	47
	Almost Constantly	27
Smartphone Use Purpose	Calling/Texting	20.3
	Browsing the Internet	24.3
	Social media	38.4
	Watching Videos	11.6
	Video Games	3.9
	Work	1.5
Smartphone Use Daily Duration	Under 1 hour	4.1
	1 to 2 hours	23.3
	2 to 4 hours	38.1
	4 hours or more	20.8
Primary Time of Smartphone Use	12:00 am to 6:00 am	5.3
	6:00 am to 12:00 pm	13
	12:00 pm to 6:00 pm	32.1
	6:00 pm to 12:00 am	49.6
Social Media Frequency	Rarely/Never	7.6
	Once a week	13.6
	Multiple times a week	22.8
	Once a day	14.9

Variable	Response	Percent
Experience Being Cyberbullied	Multiple times a day	41.1
	Yes	53.5
	No	46.5
Perceived Effect of Social Media	Positive	46.3
	Neutral	35
	Negative	18.7

Fig 3 | Results of smartphone use. The distribution of smartphone use frequency, purpose, duration of daily use, time of use, cyberbullying experience, and perceived effect of social media on mental health.

LONGITUDINAL ANALYSIS OF SOCIAL MEDIA ADDICTION

The results of the modified BSMAS questionnaire were plotted in a box plot distribution.

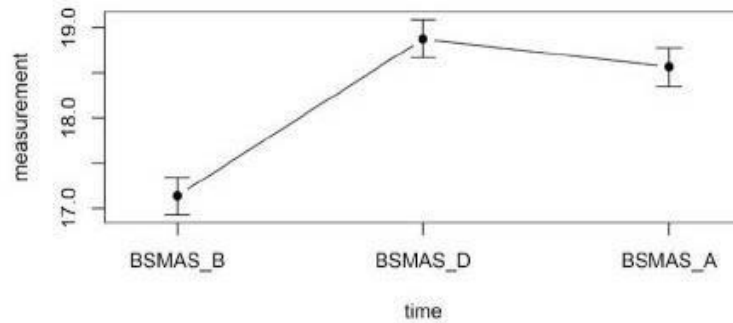
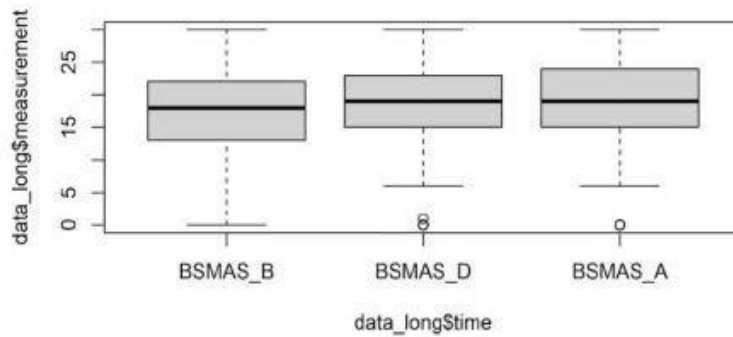


Fig 4 | The comparison shows a significant difference between BSMAS scores before and during the pandemic ($p < 0.001$), but no significant changes are observed before and after the pandemic.

Regarding reports on social media engagement and addiction, we had expected that social media usage would surge during the lockdown phase of the COVID-19 pandemic and subsequently decrease immediately after. To investigate this, the results from the modified Bergen Social Media Addiction Scale (BSMAS) questionnaire were graphically represented in box plot distributions.

Our analysis revealed a marginal increase in social media addiction levels during the lockdown phase

and in the post-lockdown period when compared to the pre-COVID era. Specifically, a significant difference was observed in BSMAS scores between the periods before and during the pandemic ($p < 0.001$), but no significant alterations were detected between the during-pandemic and post-pandemic periods ($p = 0.5481$).

RESULTS OF ADOLESCENT MENTAL HEALTH

The frequencies of the responses to the GAD-7 were determined.

Fig 4 | Item distribution of Generalized Anxiety Scale (GAD-7) questionnaire.

	Gad-7 Proportion	Gad-7 Frequency
Minimal Anxiety	0.25	208
Mild Anxiety	0.29	245
Moderate Anxiety	0.35	297
Severe Anxiety	0.11	90

On the Generalized Anxiety Device (GAD-7) measure, most of the respondents endorsed low relative anxiety with minimal frequency= 208 and mild anxiety= 245, as opposed to

moderate (=297) and severe (=90). The results of the PHQ-9, DASS-21, GAD-7, and PedQL were graphed on distributions.

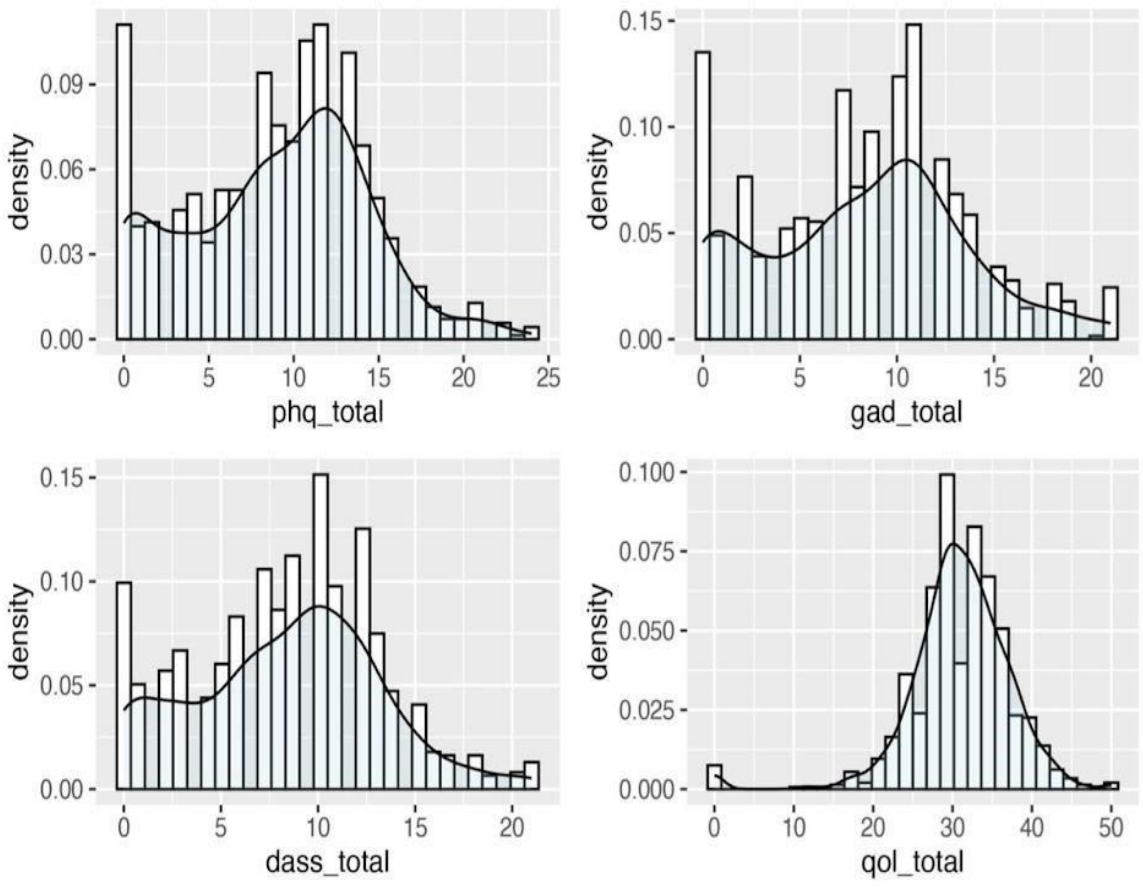


Fig 5 | The distributions of the PHQ-9, GAD-7, DASS-21, and PedsQL scales based on the responses of the survey.

The distributions of responses for the PHQ-9, GAD-7, and DASS-21 are all slightly right-skewed, indicating that participants generally scored lower on these scales. On the other hand, the distribution of results for the PedsQL scale suggests that participants tended to score higher, reflecting that they generally reported higher levels of quality of life.

We had anticipated that the COVID-19 lockdown phase would play a significant role in mental health assessments. Specifically, we expected that postCOVID-19 pandemic data would reveal an increase in symptoms of depression, anxiety, and stress for many adolescents. However, our respondents tended to report low scores on self-report measures of depression, anxiety, and stress, while simultaneously reporting high scores on their perceived quality of life.

In terms of the emotional well-being of adolescents,

ASSOCIATION OF MENTAL HEALTH AND DEMOGRAPHIC & SMARTPHONE USAGE VARIABLES

Fig 6 | Factors determined to predict scores on the BSMAS (Social Media Addiction) questionnaire.

<i>BSMAS Model Fit</i>	<i>T-Value</i>	<i>P-Value</i>
Age (13-15)	-2.292	0.02218
Age (19 and older)	-2.203	0.02789
Education (College/University)	2.350	0.01903
Siblings (Yes)	-2.970	0.00307
Primary Smartphone Use (Entertainment)	2.895	0.00391
Primary Smartphone Use (social media)	4.875	0.00001
Cyberbullied (Yes)	4.378	0.00004
Precepted Influence of Social Media (Positive)	3.098	0.00202

A significant negative trend ($p=0.02218$) was observed among ages falling between 13 and 15 and those aged 19 and above. Additionally, the presence of siblings was identified as a significant ($p=0.00307$) predictor associated with decreased levels of social media addiction.

Conversely, several factors, such as attending college or university, primarily using smartphones for entertainment or social media, having a history of cyberbullying experiences, and perceiving a positive impact of social media, were found to

predict higher levels of social media addiction.

An intriguing discovery pertains to the perception of social media influence, where participants who believed that social media had a positive impact on them reported the highest scores on the social media addiction scale. This observation illustrates a form of cognitive dissonance, suggesting that individuals addicted to social media might not fully recognize the significant influence that social media addiction has on their lives.

Fig 7 | Factors determined to predict scores on the PHQ-9 (Depression) questionnaire.

<i>PHQ-9 Model Fit</i>	<i>T-Value</i>	<i>P-Value</i>
GPA (Between 3.0 to 3.5)	-2.872	0.004184
Primary Smartphone Use (Entertainment)	5.082	0.00001
Primary Smartphone Use (social media)	3.715	0.000218
Smartphone Use Frequency (Multiple Times per Day)	-3.577	0.000368
Cyberbullied (Yes)	7.416	0.00001

It was observed that several factors were associated with higher scores on the PHQ-9 questionnaire, which, in turn, indicated more severe symptoms of depression. These factors included using smartphones primarily for entertainment, using smartphones as the main platform for social media engagement, and any history of cyberbullying experiences. Conversely, maintaining a mid-range GPA, typically around 3.0 to 3.5, and frequent smartphone use were linked to decreased levels of depression.

The data suggests that individuals identifying as male or non-binary tend to exhibit lower scores on the PHQ-9 when compared to those identifying as female, with a significant p -value of $p<0.01$ observed between male and other gender

categories. Females, on the other hand, displayed a positive t -value of 2.437, indicating a tendency to achieve higher scores on the PHQ-9 scale.

Regarding primary smartphone usage, engaging in leisure activities such as watching videos, browsing social media, and playing video games emerged as robust predictors of higher scores on the PHQ-9 scale, each with highly significant p -values of $p<0.0001$. The sole exception to this trend was browsing the internet or engaging in work-related activities, where no significant p -value was found, and the associated t -value was 0.51208.

Furthermore, it was found that using social media primarily for social interaction and entertainment

served as predictors for higher scores on both the PHQ-9 and BSMAS scales. This implies that these factors can be employed to forecast both elevated

symptoms of depression and heightened levels of social media addiction.

Fig 8 | Factors determined to predict scores on the GAD-7 (Anxiety) questionnaire.

GAD-7 Model Fit	T-Value	P-Value
Primary Smartphone Use (Entertainment)	5.205	0.000001
Primary Smartphone Use (Social Media)	2.635	0.00857
Cyberbullied (Yes)	8.835	0.00001

In a manner akin to the prediction of elevated scores on the BSMAS scale, the primary use of smartphones for entertainment and social media demonstrated a significant relationship with high scores on the questionnaire, with p-values of ($p < 0.0001$) and ($p = 0.00857$) respectively.

Likewise, a history of cyberbullying experiences adhered to this pattern, exhibiting a robust positive t-value ($t = 8.835$) and a significant p-value ($p < 0.0001$). While only these factors were identified as predictors for anxiety scores, they were also found to be influential in predicting levels of social media addiction.

Fig 9 | Factors determined to predict scores on the DASS-21 (Stress) questionnaire.

DASS-21 Model Fit	T-Value	P-Value
Primary Smartphone Use (Entertainment)	4.616	0.000001
Primary Smartphone Use (Social Media)	2.792	0.00537
Cyberbullied (Yes)	8.245	0.000001

The same factors that were employed in predicting scores on the GAD-7 also demonstrated their utility in predicting DASS-21 scores. These factors exhibited a consistent relationship with scores on both scales, as well as with the BSMAS questionnaire. Moreover, it is worth noting that the t-value associated with entertainment as the primary smartphone use was higher than that for

social media as the primary use of smartphones, but lower than the t-value for experiencing cyberbullying. This observation implies that the experience of cyberbullying can serve as a predictor for the highest scores on the DASS-21, GAD-7, and the BSMAS questionnaires, followed by entertainment as a predictor, and then social media use.

Fig 10 | Factors determined to predict scores on the PedsQL (Quality of Life) questionnaire.

PedsQL Model Fit	T-Value	P-Value
Age (13 through 15)	-2.872	0.004184
Age (16 through 18)	5.082	0.000001
Age (19 and over)	3.715	0.000218
Smartphone Use Frequency (Once a week or less)	-3.577	0.000368

Age emerged as a significant predictor of questionnaire scores, irrespective of the age groups considered. Interestingly, even within the same age category, adolescents aged 13 to 15 displayed a negative t-value ($t = -2.872$), in contrast to the positive t-values observed for those aged 16 to 18 and 19 and older. This finding supports the notion that older adolescents tended to report higher quality of life scores compared to their younger counterparts, potentially influenced by various factors.

which might have influenced their quality-of-life scores.

One plausible explanation for this distinction relates to the timing of the COVID-19 pandemic. For individuals aged 16 and above, the pandemic unfolded during their teenage years, whereas for the younger age group, it occurred during a period of rapid developmental growth in their behavior,

Conclusion

LONGITUDINAL ANALYSIS OF SOCIAL MEDIA ADDICTION

During the COVID-19 pandemic, adolescents reported elevated scores on the Bergen Social Media Addiction scale compared to pre-pandemic levels. This rise was both notable and anticipated, given adolescents' increased reliance on social media platforms during the pandemic. While one plausible explanation for this surge in scores could be the extended duration spent online, other contributing factors such as heightened stress levels, an area explored more recently, cannot be discounted^{38,39}.

Following the pandemic, adolescents exhibited a significant increase in social media addiction scores compared to pre-pandemic measures, yet no discernible decrease was observed relative to the pandemic period itself. Consequently, definitive conclusions regarding whether adolescents experienced heightened or diminished addiction levels post-pandemic remain elusive. The data suggests a possibility of either a slight decrease or stability in social media addiction levels within this demographic. Nevertheless, these findings deviate from the initial hypothesis, which anticipated a decline between these timeframes.

ADOLESCENT MENTAL HEALTH

The hypothesis was confirmed as all four assessments—depression, anxiety, stress, and quality of life—revealed enhancements in mental well-being. While compelling evidence backed the hypothesis, it's noteworthy that despite social media addiction levels remaining unchanged post-pandemic, adolescent mental health exhibited improvement. During the pandemic for example, depressive symptoms may have been reactive to the context of being afraid of the virus and necessitating social isolation⁴⁰. Given this scenario, investigating the correlation between social media addiction and mental health, particularly among younger demographics, becomes imperative.

MENTAL HEALTH AND SMARTPHONE USAGE ASSOCIATION

This study faced obstacles when trying to pinpoint factors that could predict harmful effects on adolescents' mental health and their tendency towards social media addiction. As a result, there wasn't enough evidence to back the hypothesis that factors contributing to poor mental health could also be linked to social media addiction. Nonetheless, cyberbullying stood out as a significant factor in four out of five questionnaires, indicating its potential to raise scores and negatively impact adolescents. While the association between cyberbullying and adverse effects isn't surprising, it's important to highlight that despite considering more than twenty factors, none consistently predicted negative outcomes across multiple questionnaires. This highlights the pressing need to address cyberbullying as a distinct concern among adolescents, stressing the importance of implementing preventive measures and interventions to support victims. It's worth noting that both cyberbullying and depression show a correlation with frequent and consistent use of social media.

Social media use during and after the COVID-19 pandemic has experienced several shifts and

continues to evolve as circumstances change. With lockdowns, social distancing, and remote work or learning, social media became a primary means of staying connected. Many people turned to platforms like Facebook, Instagram, Twitter, and TikTok for social interaction, entertainment, and news. The consumption of video content, including live streams and short-form videos, surged. Platforms like TikTok and YouTube gained popularity as people sought entertainment and creative outlets. As we emerge in the post-pandemic era, awareness of the potential negative effects of excessive social media use on mental health has increased. Not all individuals are mindful of their online habits and or seek a healthier balance.

There is a fine line between frequent non-problematic habitual use and problematic and possibly addictive use of social media. This research highlighted the role of certain activities and factors that influence social media addiction in adolescents and therefore harm their mental health. Future studies should attempt to apply measures designed to help mediate the factors identified in this study to determine the degree to which these factors negatively impact adolescents.

Finally, it is important to recognize the serious nature of cyberbullying and its potential to cause harm. Addressing cyberbullying involves creating supportive and safe environments for victims, promoting digital literacy and responsible online behavior, and providing access to mental health support for those who have experienced online harassment. Early intervention and support are crucial in mitigating the mental health effects of cyberbullying.

Limitations

Several limitations must be considered in this study. These limitations should be considered when interpreting the study's findings and drawing conclusions.

Modification of the PHQ-9 Questionnaire: Due to constraints on asking participants questions about self-harm, the PHQ-9 questionnaire was adjusted by omitting the final question. This alteration affects the reliability of the grading scale for PHQ-9 results.

Limited DASS-21 Scale Questions: To minimize survey completion time, only questions pertaining to stress from the DASS-21 scale were included. Consequently, the grading scale for this questionnaire may not be employed reliably.

Recall Bias in BSMAS Questionnaire: Participants were required to recall their behaviors and feelings from over two years ago, potentially introducing recall bias into the analysis of the BSMAS questionnaire.

Access Barriers for Lower-Income Households: Participants with lower household incomes may have encountered difficulties in accessing the required devices and internet connections to complete the survey, potentially leading to selection bias.

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