



# Problematic Smartphone use and Emerging Indian Adulthood during Covid-19: A Structural Equation Model

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## Abstract

Smartphone addiction is a recent phenomenon in India owing to the economic development, technological advancements in telecommunications and the reduction in high-speed data prices, especially with the Introduction of jio info comm in September 2016, offering free 4G data services for more than six months. Indian youth are quick adopt to these new technologies changes and taking advantage of low cost high-speed data services because of their experimental nature. Today it is a common sight to see the Indian youth immersed in their mobile communication devices (smartphone) leading to Smartphone addiction and various kinds of Depression (Nino G, 2020). Smartphone addiction is still underdiagnosed and potentially a severe and widespread form of addiction (Antounc, 2018). The current study aims to ascertain the degree of problematic Smartphone use and its relationship to Depression and obsessive-compulsive disorder among emerging Indian adults between 18 and 25, who are in an important stage of personality development and growth during the COVID-19 pandemic.

A web-based survey is being used for the cross-sectional research of emerging Indian Adults (18–24). The survey includes demographics, various Smartphone use patterns, validated MPPUS-10, and screening questions for Depression using PHQ-9 and questions measuring obsessive-compulsive disorder using BOCS. The study took into account a sample of college students from a variety of ethnic backgrounds (N=413, Mage =18-24, SD age =between 4 and 5, 32% female). Using R software and the lavaan package, descriptive statistics, path analysis, Confirmatory factor analysis, Exploratory analysis and mediation analysis were done.

The study's findings reveal the changes in the path direction between the Time spent on smartphone, problematic smartphone use, depression, OCD and how the depression levels during the pandemic affected the smartphone usage behaviour among the Emerging adults.

**Keywords:** Problematic Smartphone usage, Depression, Obsessive Compulsive Disorder, Covid-19, Emerging Adulthood.

## Introduction

India is the world's second-largest smartphone market after China, with an estimated 493 million users as of 2021 (Richter, 2022), which constitutes only 36 per cent of the Indian population and it increased to 54 per cent in 2022, while the penetration rate was only 23 per cent in 2016, it has grown more than double in the past six years and estimated to reach 96 per cent by 2040 (Sun, 2022). There is a rapid decrease in the digital divide due to the

digital policy of India and the data wars between the major telecom networks, which began with the Introduction of jio telecom network in to the telecommunication market in September 2016. To increase the subscriber rate, jio info comm provided free 4G data to its users for more than six months and another six months for a nominal fee. As a result, the competitors were forced to lower the data tariffs, and some networks even went out of business, resulting in low data tariffs (IFC, 2018). Despite being a developing country, India has the third lowest data tariff in the world, which costs a nominal 0.17\$ per 1GB of 4G Data after Israel and Italy (Fleck, 2023) proving to be a rich ground for a smartphone driven data culture among the Indian youth. Apart from digitization, lower data tariffs, demonetization, and economic growth are the other factors which increased smartphone adoption.

The covid-19 pandemic occurred during the tremendous technological progress in telecommunication. Smartphones, with their multifunctionality, were already in much use all over the world. The covid -19 pandemic only enforced and increased our dependency on mobile-mediated communications during the pandemic, mediating personal relationships, finances, healthcare, education, entertainment and much more during the covid-19, making it an essential information and communication tool and has become an irreplaceable necessary prosthetic for most of us. The active use of this communication technology has many benefits, including optimization of Communication between individuals, systems and health-related behavioural modification through mobile apps like dietary management, physical activity promotion, chronic disease management and increased use of mobile phones can lead to problematic usage and have negative effects on physical and mental health (Joël Billieux, 2015). Neck pain, back pain, eye strain, weight gain, weariness, lack of sleep, and headaches are all issues that have a direct detrimental effect on physical health (Muhammad Daniyal, 2022). Direct negative effects on mental health include user depression, loneliness, difficulties in cognitive emotion regulation, impulsivity, impaired cognitive function, addiction to social networks, shyness, low self-esteem and poor cognitive control (Yehuda Wacks, 2021).

Although it is possible that excessive smartphone use can lead to smartphone addiction, smartphone addiction has not yet been considered a clinical diagnosis; findings from the study (Christiane Eichenberg, 2020) suggest that clinicians think about problematic smartphone use as a possibility of psychopathology-related maladaptation (such as Depression and anxiety), as smartphone addiction is not mentioned in the DSM-5 either (Association, 2022) or the International Classification of Diseases, 11<sup>th</sup> revision (organization, 2022).

Among the smartphone users in India, more than 37 per cent are in the age between 16-24 years (Sun, Smartphone users across India in 2019, by age group, 2022), which is an essential stage of personality development in which The average person sees an improvement in their emotional stability, Conscientiousness, agreeableness. and self-esteem (Jantje Hinrika De Vries, 2021). An average smartphone user between the age 18-25 years spend about five to six hours a day on a Smartphone, which constitute over 35 per cent of smartphone users in India (Sun, Time spent on smartphones India 2019, by age group, 2021) which considered not healthy by health experts (E.Brody, 2015).

Previous studies used the MPPUS-10 to measure smartphone addiction in adults between the ages of 18 and 65 (Nahas, Hlais, Saberian, & Antoun, 2018) and a comparative study of smartphone usage before and during covid-19 (Khansa et al., 2022) indicated that the age group between 18-24 spends the most of their Time on their smartphones during the pandemic. Screen time has increased during the covid-19 which led to less physical activity, in turn impacting physical and mental health as Conscientiousness and agreeableness, two of the main five personality traits, seem to be relatively stable and keep growing as people become older; the level of openness to experience, whether they are doing it online or offline, appear to change in an inverted U-shape function, which goes from 18 to 22 and from 60 to 70 (McCrae, 2008). Further, users of this age group engage in social networking sites and social media through their smartphones for online social validation and worry a lot about their online reputation, which leads to anxiety and fear of missing out (A.Knight, 2016). With the increased use of smartphones during the covid-19, the prevalence of smartphone addiction among emerging adults (18-25) becomes essential as they are in a crucial stage of personality development.

This study investigates the prevalence of problematic smartphone use among Emerging Indian Adults during the covid-19 and how it is related to the amount of Time spent on Smartphone. The study further investigates the relationship between problematic smartphone usage, Depression and Obsessive-compulsive disorder by administering MPUSS-10, PHQ9 and BOCS scales among emerging Indian Adults during Covid-19. Further The study considers depression as an independent variable rather than the dependent variable as in most of the smartphone use studies.

### **The present study**

This study investigated how Depression caused by the events of the pandemic impact the Smartphone use and how the time spent on the smartphone during the pandemic is relates to Problematic Smartphone use measured by MPPUS-10 scale, and how the problematic smartphone use affects Obsessive Compulsive disorder (OCD). This study expands the current research in several ways. First, This is one of the few studies that test a complete path between smartphone use and various psychological disorders(Depression and OCD). However, previous research suggested that excessive smartphone use leads to problematic Smartphone use (Nahas, Hlais, Saberian, & Antoun, 2018), but few studies explicitly tested it. Second, this is the first study that we are aware of that tests the path between smartphone use, problematic Smartphone, Depression and OCD. Third, this is the only study to test the relationship between these four variables during the covid-19 pandemic. Fourth, this is the first study considering Depression as the Independent variable rather than the outcome or dependent variable in smartphone usage studies.

There are different possibilities for the sequential ordering of Time spent on Smartphone, Depression and compulsive disorder. Our central hypothesis is that fear of infection, restrictions and other phenomena during the covid-19 pandemic drives Depression to increase Time spent on Smartphone, leading to problematic smartphone use and could trigger OCD. In particular, it is expected that people with higher levels of Depression spend more Time on smartphones. After one starts to spend more and more Time on the Smartphone, it leads to problematic smartphone use(PSU), and PSU leads to Depression and Depression leads to OCD.

Alternatively, more Time spent on Smartphones leads to problematic smartphone use, causing Depression and Depression leading to OCD. The current study tests two opposing possibilities.

Hypothesis 1A: Higher levels of Depression and time spent on smartphone positively predict problematic smartphone use, which subsequently predicts OCD along with depression levels during the covid-19.

Hypothesis 1B: Time spent on Smartphone positively predicts higher levels of Problematic smartphone use, which predicts higher levels of Depression, which in turn predicts OCD.

In addition, The possibility of OCD arising due to the covid-19 pandemic is considered, and the pathway is tested as an exploratory analysis.

H1C: more significant levels of OCD passively predict Time spent on Smartphones predicts problematic smartphone use, which in turn predicts higher levels of Depression.

## Method

This is a cross-sectional study of 457 college-going Emerging adults(18-24) to measure the prevalence of problematic smartphone use. The final sample size of 413 was calculated based on problematic smartphone use of 18.9%, a margin error of 5% and a confidence level of 95%. A survey among college-going students was conducted using google forms consisting of 44 questions. The survey instrument has questions related to demography, type of smartphone use during the covid-19, validated MPPUS-10(Mobile Phone Problematic Use Scale), PHQ9(Patient Health Questionnaire) scale to measure Depression and BOCS(Brief Obsessive-Compulsive Scale) consisting of 15 items. The demography section included Gender, Age, place of stay, and family income. Questions related to smartphone usage included whether they own a smartphone?, how much Time is spent on a Smartphone in a day?, whether their smartphone usage increased during covid-19, on what they spend most of their Time using Smartphones.

Depression was screened using the PHQ9 scale, a widely used and validated instrument for screening Depression ( Kroenke, Spitzer, & Williams, 2001). Uses a 10-point Likert scale from 0(not at all) to 10(nearly every day). Obsessive-compulsive disorder is measured using the BOCS scale consisting of 15 questions related to obsessions and compulsions; the scale has the following options; not at all, several days, more than half the days, nearly every day.

### Data collection and Participants

The survey considers Emerging Indian Adults between the ages of 18 and 24 who currently reside in India who have access to a smartphones with High-speed 4G internet connectivity and have various mobile applications in their mobile. 93.8% of Emerging Indian Adults own a Smartphone through which they access various internet-related services, and 6.2% do not have their Smartphone and access through someone else Smartphone from the family. Google forms are used to record the survey responses, which are administered online through email, WhatsApp and other messaging and networking sites, as there was no scope for offline administration due to the

covid-19 restrictions in the state. The data collected is converted into an excel sheet and imported in to R studio. Data cleaning and scrubbing is performed in excel. The questionnaire was in English and not translated into the local languages as the college-going students in India are well versed in English, as English is a popular language of Communication in the urban India and medium of instruction in colleges and Universities in India.

The institutional review board of Osmania University, India, approved the study.

## Measures

### 1.1MPPUS-10

MPPUS-10 is a shortened scale of MPPUS-27, which is constantly used in measuring problematic mobile phone use (Olatz, Luisa, Montserrat, & Gibson, 2014). It was selected as the questionnaire included other scales, and the inclusion of MPPUS-27 made it lengthy. MPPUS-27 is validated in most countries and widely used. It is designed for Adults to evaluate symptoms such as Smartphone addiction, withdrawal symptoms, and adverse effects on health (Bianchi & Philips, 2005). MPPUS-10, the shortened scale, highly reflects the original MPPUS, and the internal consistency of MPPUS-10 was good with Cronbach's alpha of 0.85 (Foerster, Roser, Schoeni, & Rösli, 2015). The maximum score on each question is ten, and the maximum total score is 100. There is no clear cut-off score to determine problematic smartphone use (Foerster, Roser, Schoeni, & Rösli, 2015). However, a score of 160 on the MPPUS-27 was found to be highly sensitive to smartphone addiction using as a standard of psychiatric measure and extrapolating the same for MPPUS-10 gives a score of 59 (Nahas, Hlais, Saberian, & Antoun, 2018). The same score of 59 indicates smartphone addiction in the present study. A Confirmatory factor analysis is done for the scale, which demonstrated acceptable fit,  $\chi^2(5) = 30.631, p < 0.001, CFI = 0.932, RMSEA = 0.054, CI [0.076, 0.151] SRMR = 0.032$ .

### 1.2PHQ9

PHQ9 is a self-administered questionnaire consisting of nine questions measuring Depression which scores each of the nine DSM-IV criteria as "0"(not at all) to "3"(nearly every day) and has been validated for use in primary care. This scale has been used during the covid-19 lockdown time and has regular reports of loss of life, fear of catching the virus, and repetitive messages of precaution to prevent oneself from catching the virus. By measuring the level of Depression and problematic smartphone use, the study considers the external factors that can induce Depression in emerging adults and makes an effort to study whether Depression mediates problematic smartphone use during the covid-19. Each item of PHQ9 represents one of the diagnostic criteria for a major depressive episode (Fiske & Owsiany, 2022).

The PHQ9 has good reliability and construct validity (Rahman, Dhira, Sarkar, & Mehareen, 2022). Further confirmatory analysis is done, which showed an acceptable fit  $\chi^2(27) = 72.359, p < 0.001, CFI = 0.929, RMSEA = 0.064, CI [0.046, 0.082] SRMR = 0.045$ .

### 1.3BOCS

The Brief Obsessive-compulsive Scale (BOCS) is derived from the Yale-Brown Obsessive Compulsive Scale (Y-BOS), and the children's version(CY-BOCS) is the short self-report scale used to aid in the assessment of Obsessive-compulsive symptoms and diagnosis of Obsessive-compulsive disorder (OCD) (Bejerot et al., 2014). The scale is widely used throughout child, Adolescent and Adult Psychiatry but has not been validated. The scale can discriminate OCD from other non-OCD-related psychiatric disorders, and studies provide strong support for the utility of BOCS in Assessing Obsessive-Compulsive symptoms. This particular scale is included in the questionnaire, assuming that the covid-19 situation can induce and impact the level of OCD in people. Studies show an increase in the severity of OCD during the covid-19 among people (Jelinek, Moritz, Miegel, & Voderholzer, 2020).

### Analytical Approach

R software (version R-4.2.2, **lavaan** package) is used to specify a set of path models, investigate a pathway between composites of Time spent on a Smartphone, MPPUS-10(problematic smartphone use scale), PHQ-9(depression scale), BOCS(OCD measure). Only students who completed all scales were included in the study. After removing the Duplicate responses, the sample is 413(N = 413). Maximum likelihood estimation and bootstrapping methods are used to specify the models.

### Results

#### Hypothesized Models

Descriptive statistics are shown in table 1. To test hypothesis 1A, a path model was tested with Depression predicting Time spent on Smartphone, Time spent on smartphones predicting Problematic smartphone use and problematic smartphone use predicting OCD was tested (Figure 1). the Model fits well, *the model test user model*  $\chi^2(1) = 0.090$ ,  $p = 0.764$ ,  $p > 0.05$  therefore the null hypothesis is rejected,  $CFI = 1.000$ ,  $TLI = 1.034$ ,  $RMSEA = 0.000$ ,  $CI [0.000, 0.088]$   $SRMR = 0.004$ . (indirect effect via problematic smartphone use and Depression,  $\beta = 0.0$ ,  $p < 0.001$ ), Depression and Problematic smartphone use fully mediated the associations between Time spent on Smartphone and Obsessive-compulsive disorder, Supporting Hypothesis 1A

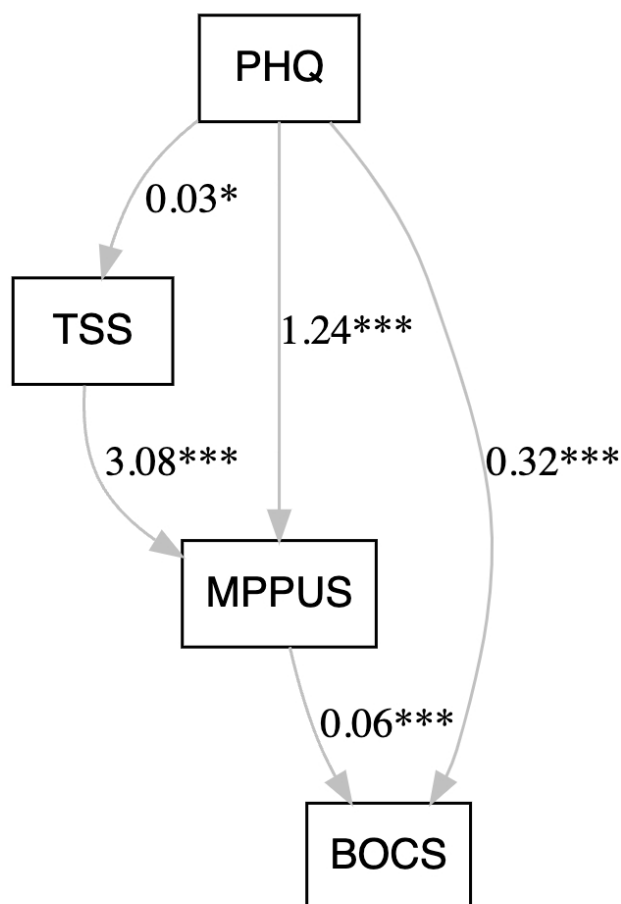
To test hypothesis 1B, a mediation path model in which Time spent on Smartphones predicting problematic smartphone use, problematic smartphone use predicting Depression, and predicting OCD . The model fit was poor  $\chi^2(1) = 59.294$ ,  $p = 0.000$ ,  $CFI = 0.642$ ,  $TLI = -1.149$   $RMSEA = 0.376$ ,  $CI [0.298, 0.460]$   $SRMR = 0.117$ . therefore hypothesis 1B was rejected. To test hypothesis 1C, a mediation model was tested in which OCD predicting Depression, Depression predicting Time spent on a Smartphone, and Time spent on a Smartphone predicting problematic smartphone use. This model fit was poor,  $\chi^2(1) = 33.885$ ,  $p < 0.001$ ,  $CFI = 0.798$ ,  $TLI = -0.212$ ,  $RMSEA = 0.282$ ,  $CI [0.205, 0.367]$   $SRMR = 0.088$ . Furthermore, Hypothesis 1C was rejected.

Table 1. Descriptive Statistics and Correlations

	Mean(SD)	1	2	3	4
1. TSS -Time spent on smartphone(in hours)	4.5(1.48)	1			
2. MPPUS – problematic Smartphone use.	51.37(18.17)	0.288**	1		
3. PHQ- Depression.	8.03(5.18).	0.109*	0.379**	1	
4. BOCS- Obsessive Compulsive Disorder.	16.2(5.97).	0.073*	0.297**	0.347**	1

Note: N =413,

\*\*p<.001, \*p>.01



$\chi^2(1) = 0.090, p = 0.764, CFI = 1.000, TLI = 1.034,$

$RMSEA = 0.000, CI [0.000, 0.069] SRMR = 0.004$

Indirect effect:  $\beta = 0.14, p < 0.001$

Figure 1. hypothesis 1A Mediation path model.

Note. \*p < .01

### Exploratory Models

Sensitivity analysis was performed to assess the robustness of the Model, as shown in Hypothesis 1A. First, the Model held when controlling for age 18 to 20 years,  $\chi^2(1) = 0.196, p = 0.658, CFI = 1.000, TLI = 1.043, RMSEA = 0.000, CI [0.000, 0.113] SRMR = 0.007.$  and for ages 21 to 25,  $\chi^2(1) = 1.624, p = 0.203, CFI = 0.987, TLI = 0.923, RMSEA = 0.084, CI [0.000, 0.309] SRMR = 0.035.$  for gender, male  $\chi^2(1) = 0.151, p = 0.698, CFI = 1.000, TLI = 1.092, RMSEA = 0.000, CI [0.000, 0.142] SRMR = 0.008.,$  female  $\chi^2(1) = 0.033, p = 0.855, CFI =$

1.000,  $TLI = 1.054$ ,  $RMSEA = 0.000$ ,  $CI [1.000, 0.098]$   $SRMR = 0.003$ ., Moreover, smartphone use (i.e., the amount of Time spent on a Smartphone in a day). The Model has also been tested for people in different places of stay, i.e., Urban  $\chi^2(1) = 0.001$ ,  $p = 0.972$ ,  $CFI = 1.000$ ,  $TLI = 1.049$ ,  $RMSEA = 0.000$ ,  $CI [1.000, 0.000]$   $SRMR = 0.001$ ., Rural  $\chi^2(1) = 0.001$ ,  $p = 0.975$ ,  $CFI = 1.000$ ,  $TLI = 1.310$ ,  $RMSEA = 0.000$ ,  $CI [1.000, 0.000]$   $SRMR = 0.001$ ., and Semi-Urban  $\chi^2(1) = 0.496$ ,  $p = 0.481$ ,  $CFI = 1.000$ ,  $TLI = 1.137$ ,  $RMSEA = 0.000$ ,  $CI [1.000, 0.270]$   $SRMR = 0.023$ .

Finally, separate analyses were conducted on what they spend the most of their Time on Smartphones (twitter, Instagram, OTT platforms, YouTube, online games, and others) rather than aggregate use. Each Model showed an acceptable fit (Table 2). Path coefficient for YouTube watching on smartphones was the strongest predictor of problematic smartphone use ( $\beta = 0.195$ ,  $p < 0.05$ ), followed by Instagram ( $\beta = 0.185$ ,  $p < 0.05$ ), which is the strongest predictor of Depression indicating. All the other path coefficients were similar except for users playing online games on their Smartphones and watching content on OTT platforms using smartphones.

Table 2. kind of smartphone use Fit statistics

	N.	chi-square	CFI	RMSEA.	SRMR
1. Instagram	355	$\chi^2(1) = 0.500$ $p = 0.479$ .	1.000	0.000	0.015
2. Twitter	166	$\chi^2(1) = 0.279$ $p = 0.597$ .	1.000.	0.000.	0.042
3. YouTube	312	$\chi^2(1) = 0.016$ $p = 0.898$ .	1.000.	0.000.	0.004
4. OTT	247	$\chi^2(1) = 0.003$ $p = 0.955$ .	1.000	0.000.	0.002
5. Online games	252	$\chi^2(1) = 0.902$ $p = 0.342$ .	1.000.	0.000.	0.048
6. Others	315	$\chi^2(1) = 0.227$ $p = 0.634$ .	1.000.	0.000	0.018

Note: All models used the same path model, as shown in Figure 1.

## Discussion

The Results showed that the depression caused by the pandemic positively predicted the amount of time spent on smartphone, excessive usage of Smartphones positively predicts problematic smartphone usage, which was associated with Depression and Obsessive Compulsive disorder amid the covid-19 pandemic. This study extends the previous research (Nahas, Hlais, Saberian, & Antoun, 2018) by examining the links between the amount of Time spent on Smartphones, problematic smartphone use, Depression and OCD.

The covid-19 pandemic is one of the biggest global crises faced by the world in the recent past, which had far-reaching effects on health systems, economies and societies. Covid-19 times have seen countless deaths due to a shortage of medicine, oxygen and medical care. Governments worldwide imposed complete lockdowns restricting social interaction and insisting on preventive measures, which had an enormous impact on the physical and mental health of the individual. Many people have reported psychological distress, anxiety and symptoms of Depression during covid-19 (Organization, 2022).

A new survey (LaBerge, O'Toole, Schneider, & Smaje, 2020) found that Covid-19 has accelerated the adoption of digital technologies for several years and that many of these changes could last for a long time. The Smartphone has become the most important Communication and digital technology that has mediated personal and social



relationships, education, commerce, health and a wide range of things amid the covid-19 pandemic, the depression caused by the tragic events and fear of infection etc lead to an increase in the amount of Time spent on Smartphone, 95% of the respondents have reported that there is an increase in the amount of Time spent on Smartphone during the covid-19 pandemic and more than 50% of the respondents have spent greater than four hours on Smartphone in a day. Researchers have previously suggested that an increase in the amount of Time spent on Smartphone positively correlates with problematic smartphone use, which might lead to Depression (Nahas, Hlais, Saberian, & Antoun, 2018). Problematic smartphone use has not been considered a mediating variable for smartphone use and Depression as well as OCD. Our findings support this path, and the Model tested fits well, with problematic smartphone use mediating time spent on smartphones, Depression and OCD.

Our Model was consistent for various types of smartphone use except for those who used their smartphones primarily for playing online games and for people who watch different entertainment content, such as web series and movies on OTT platforms on their Smartphones. The model fit was perfect for smartphone users who used their Smartphones mostly to watch user-generated content on the social media platform YouTube, indicating that as the Time spent on watching YouTube increases leads to an increase in problematic smartphone use which leads to the increase in levels of Depression and increases in the levels of OCD. The model fit was good for the users who used their Smartphones to access social networking sites such as Instagram, social media and others. In all the models, there was no positive association between the amount of Time spent on Smartphone and OCD. Moreover, there was a weak association between Time spent on Smartphone and Depressive symptoms, the depression caused by the pandemic lead to a drastic increase in the time spent on smartphone use and lead to the problematic smartphone use during the covid-19 pandemic.

The Model tested held true regardless of age, gender, or smartphone usage pattern of emerging adults. A few exceptions existed. First, despite the fact that all demographic characteristics show a positive correlation between Time spent per day on a smartphone and problematic smartphone use, the link between problematic smartphone use and Depression appeared to be moderate for men and stronger for women. Second, the relationship between problematic smartphone use and Depression and obsessive-compulsive disorder was minimal for people aged 21 to 24 but strong for those aged 18 to 20. Finally, for people living in rural and semi-urban areas of India, there was a high correlation between problematic smartphone use and Depression and OCD, but not for people living in Urban areas.

It is important to highlight that the study had several limitations. First, this study is cross-sectional; longitudinal and experimental research is required to ascertain the causal relationship between the constructs under investigation. Second, the generalizability may be limited because only a convenience sample of college students was used. Finally, since the presentation of the measures should have been balanced, the survey order may have impacted the outcomes. Further, our assessment of smartphone use, Depression and OCD consisted of self-reported, single open-ended items about the demography, how much Time is spent on Smartphones in a day and BOCS, PHQ scales and various kinds of smartphone use. Fifth, PHQ-9 and BOCS scales are not calibrated for the Indian population; even though the PHQ-9 scale is widely accepted in academia, the same applies to BOCS for measuring OCD.

Ultimately, these findings suggest that problematic smartphone usage mediates Time spent on the Smartphone, Depression and OCD. The results highlight no significant association between the amount of Time spent on Smartphone and symptoms of OCD. Further, the study indicates an enormous increase in the Time spent on Smartphone throughout the pandemic.

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