

Cross-Sectional and Longitudinal Mental Health Status Prevailing among COVID-19 Patients in Mumbai, India

Arjun Gurmeet Singh, Hitesh Singhavi¹, Florida Sharin², Muffazal Lakdawala³, Sharayu Mhatre⁴, Jayita Deodhar, Pankaj Chaturvedi, Rajesh Dikshit⁴

Tata Memorial Centre and HBNI, ¹Department of Head and Neck Oncology, Fortis Hospital Mulund, ²Department of Head and Neck Oncology, Tata Memorial Hospital, ³Department of Head and Neck Oncology, Digestive Health Institute, ⁴Centre for Cancer Epidemiology and HBNI, Mumbai, Maharashtra, India

Abstract

Introduction: The aim was to determine the prevalence and predictors of depression among less symptomatic COVID-19 patients. **Methods:** A questionnaire-based assessment was conducted among asymptomatic or mildly symptomatic COVID-19 patients when admitted in a COVID-19 facility (T1) and after 6 months (T2). Interviews were conducted using the Patient Health Questionnaire-9 instrument. Socio-demographic details and length of facility stay were recorded. Changes in scores between the two-time points T1 and T2 were compared. Factors predicting depression were determined using Chi-square and Mann-Whitney *U* test during facility stay, and those predicting worsening over time were obtained using multivariate regression models. **Results:** Among the 91.4% ($n = 450$) participants, prevalence of depression was 38.4% (95% confidence interval [CI] = 34.0–43.0) with a significant increase of 7.8-fold (95% CI = 4.8–12.8) in depression as the duration of stay increased beyond a median of 5 days. A significant association was observed between higher income and lower depression (odds ratios = 0.6, $P = 0.03$). 84% ($n = 378$) responded at the second timepoint assessment after a median of 6.62 months (T2). There was a significant difference observed between the 2.6% ($n = 6$) that worsened into depression at T2 and the 73.8% ($n = 107$) that improved out of depression at T2 ($P \leq 0.001$). Age >45 years ($P = 0.007$), males ($P = 0.011$) and reinfection ($P = 0.039$) significantly led to worsening of depression. **Conclusion:** There is a need for actively detecting and managing depression in institutionally quarantined survivors, considering limiting such quarantine to no more than a week, and providing routine screening and care for depression beyond this period.

Keywords: Coronavirus, COVID-19, depression, India, mental health

INTRODUCTION

The ongoing severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) pandemic has not only impacted the financial economy but also the psychological health of the population. This effect would be rightfully exaggerated in those who have contracted the virus because of the ambiguity surrounding its prognosis, looming shortage of resources, and conflicting tests and treatment protocols. The incidence of COVID-19 confirmed cases in India is one of the highest globally.^[1] The state of Maharashtra has contributed the highest number of cases and mortality to the country's tally.^[1] In the absence of effective treatment, widespread contact tracing strategies have further resulted in a large part of the asymptomatic or mildly symptomatic population testing positive for SARS-CoV-2, making it difficult to rationalize the term "patient" being used for these individuals. Various containment measures have been undertaken in addition to case-based quarantines and total

lockdowns since March 2020. Although deemed essential, long periods of social restrictions can create challenges with psychological health and incite fear, both of which are known risk factors for immediate and long-term depression.^[2] With over a year now into the pandemic, many rules have been introduced and changed a number of times, giving a sense of uncertainty. Given this, our study aimed to determine the mental health status and evaluate the predictors of depression and anxiety among less symptomatic COVID-19 patients and evaluate its long-term effect.

Address for correspondence: Dr. Pankaj Chaturvedi, 1227, Homi Bhabha Block, Tata Memorial Hospital, Mumbai, Maharashtra, India.
E-mail: chaturvedi.pankaj@gmail.com

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METHODS

Design and participants

This was a prospective questionnaire study that aimed to evaluate the severity of mental depression and anxiety and its long-term effects prevailing among the COVID-19 patients. This longitudinal survey was conducted at the dedicated COVID-19 hospital. This facility, like many other across the city, is managed by the Municipal Corporation of Greater Mumbai and the State of Maharashtra, India. The study protocol was approved by the Institutional Review Board and registered with the Clinical Trial Registry of India. Self-consenting participants between the ages of 18–65 years were enrolled if they were currently infected with COVID-19, diagnosed by reverse transcriptase–polymerase chain reaction test, and asymptomatic or mildly symptomatic (as per the World Health Organization and the Ministry of Health and Family Welfare guidelines). Patients with any prior history of depression, mental illness, or taking any mood-altering medications were excluded. In line with the facility's minimal contact policy, the participant was identified and verbal consent was obtained before the questionnaire was administered. Further, it was mentioned in the questionnaire introduction brief that implied consent was obtained if the participant completed the questionnaire.

Data collection

The Patient Health Questionnaire 9 item (PHQ-9) instrument was used in the current study.^[3] It is a part of the PHQ scale that contains five modules assessing depression, anxiety, somatoform, alcohol, and eating disorders. The nine-question depression scale was chosen for this study as the intent was to determine the incidence of depression and anxiety in a relatively short duration of time. It usually takes <3 min to complete and the total score can be used to diagnose depression in accordance with the Diagnostic and Statistical Manual of Mental Disorders-IV criteria. The nine-item instrument has been validated in a number of studies and has excellent discriminative validity with good internal consistency, inter-and test-rater reliability. There is a tenth question which is not factored into the final score and has been used here to gauge the participant's opinion of the level of impairment caused by their mental health. The interviews were obtained at two-time points. The first time point (T1) was when these individuals were in the facility. Demographic details, monthly income (in Indian Rupees, INR), education, comorbid conditions as well as the length of stay in the facility at the time of questionnaire administration were recorded. Interviews were conducted at the facility by healthcare facilitators through glass barriers. Electronic devices were used to manage the data to minimize any risk of fomite transmission. The same participants were approached after a minimum gap of 6 months (T2) to respond to the same questionnaire again.

Statistical analysis

The PHQ-9 score was computed as per the standard procedure generating a total score for each participant, ranging from 0 to

27.^[3] Patients with a PHQ-9 score ≥ 10 were considered to be suffering from depression.^[4] Patients' characteristics according to the presence/absence of depression were compared using the Chi-square test for categorical variables and the Mann–Whitney U test for continuous variables. Changes in scores during the study were calculated and compared using the McNemar test for the differences between the scores recorded when institutionally quarantine (T1) and at last follow-up after a gap of minimum of 6 months (T2). All analyses were two-sided. Odds ratios (OR) and corresponding 95% confidence intervals (95% CI) were estimated by applying an unconditional univariate and a stepwise multivariate logistical regression model, retaining variables with a $P < 0.05$. In the multiplicative model, age was considered as a continuous variable while gender, days in the facility, total household income were considered as categorical variables. All tests were performed on the R software (R Foundation) and IBM SPSS Statistics version 24 (IBM Corporation) (IBM Corp., Armonk, N.Y., USA).

RESULTS

Of the 492 participants screened, 450 (91.4%) consented to participate by completing the questionnaire. The median age was 44 ± 13.19 years (range-18–65 years) with 66.4% male and 33.6% female participants. More than a third (40.4%, $n = 183$) of the participants had some form of comorbid condition, the most common being hypertension alone followed by diabetes mellitus alone and their combination. Multiple comorbidities were present in 10.4% ($n = 47$) of the participants. Depression was seen in 43.8% ($n = 14$) and 39.3% ($n = 11$) of the cases having only hypertension (OR - 1.26, 95% CI 0.61, 2.61, $P = 0.52$) and only diabetes (OR - 1.03, 95% CI 0.47, 2.27, $P = 0.92$), respectively, compared to the absence of the specific comorbidity. In the presence of cancer, 46.5% ($n = 20$) of the individuals were depressed, compared to the absence of cancer (OR - 1.44, 95% CI 0.76, 2.71, $P = 0.25$). The prevalence of depression among the participants was 38.4% ($n = 173$, 95% CI 34.04, 43.04). There was a significant correlation between higher monthly income (≥ 10000 INR) and lower rate of depression (OR = 0.6, $P = 0.03$). There was a significant increase of almost 8-fold in depression rates (OR - 7.8, 95% CI 4.77, 12.75, $P \leq 0.0001$) when the facility stay increased beyond a median of 5 days. A log-linear relation was observed in depression scores as the duration of stay in the facility (as a continuous variable) increased beyond 8 days [Figure 1]. No significant association was observed with gender, age, symptomology, comorbidities, and education [Table 1]. Out of the 450 initial participants, 84% ($n = 378$) responded at the second timepoint assessment done at after a median of 6.62 months (T2). The reinfection rate was 11.5% ($n = 43$) among the responders. On comparing the change in total scores between T2 to T1, 73.8% ($n = 107$) of the initially depressed participants improved and 2.6% ($n = 6$) worsened

Table 1: Cross-sectional data on the mental health and illness in coronavirus disease-2019 patients when admitted in an isolation facility

Variable	Depression absent (n=277), n (%)	Depression present (n=173), n (%)	Univariate model				Multivariate model			
			OR	95% LCI	95% UCI	P	OR	95% LCI	95% UCI	P
Age (per year increase)			0.9	0.9	1.0	0.61	1.00	0.98	1.02	0.60
Age (years), median, SD	45±13.3	43±13.0								
Gender										
Female (n=151)	94 (62.2)	57 (37.8)			Reference				Reference	
Male (n=299)	183 (61.2)	116 (38.8)	1.0	0.6	1.56	0.82	1.00	0.64	1.56	0.99
Income household per month (INR)										
≥10,000 (n=310)	186 (60)	124 (40)			Reference				Reference	
<10,000 (n=140)	91 (60)	49 (35)	0.80	0.53	1.22	0.31	0.60	0.38	0.95	0.03
Days in facility (median)										
<5 (n=181)	155 (85.6)	26 (14.4)			Reference				Reference	
≥5 (n=269)	122 (45.3)	147 (54.7)	7.18	4.44	11.60	≤0.00	7.80	4.77	12.7	≤0.00
Education (%)										
High school and above (n=236)	156 (66.1)	80 (33.9)			Reference				Not considered for the multivariate regression model	
Less than High school (n=214)	121 (56.5)	93 (43.5)	1.49	1.02	2.19	0.03				
Co-morbidities										
No (n=267)	160 (59.9)	107 (40.1)			Reference					
Yes (n=183)	117 (63.9)	66 (36.1)	0.84	0.57	1.24	0.39				
Symptoms										
Asymptomatic (n=219)	129 (58.9)	90 (41.1)			Reference					
Mildly symptomatic (n=231)	148 (64.1)	83 (35.9)	0.80	0.54	1.17	0.26				

Patients with PHQ-9 score ≥10 were considered to be suffering from depression. PHQ-9: Patient Health Questionnaire 9 item, SD: Standard deviation, OR: Odds ratio, LCI: Lower confidence interval, UCI: Upper confidence interval

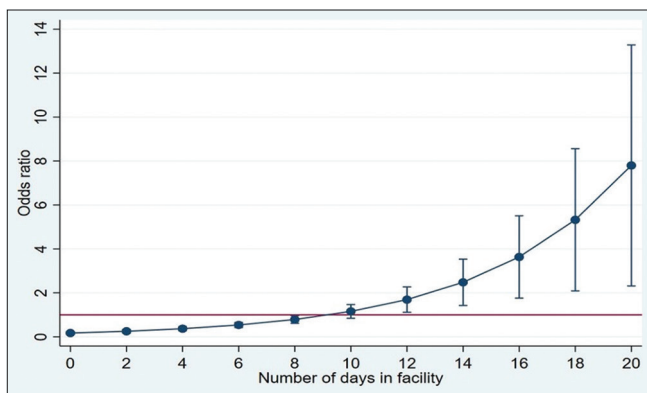


Figure 1: A log-linear relation between depression scores and duration of stay in COVID isolation facility

needing some form of intervention ($P \leq 0.001$). In the multivariate model, the factors that led to worsening of scores or remaining unchanged were age >45 years ($P = 0.007$), male gender ($P = 0.01$) and if there was reinfection with SARS-CoV-2 virus requiring re-isolation, either at a facility or at home ($P = 0.03$) [Table 2]. The risk of worsening of mental health at T2 was almost double in males (OR - 1.8, 95% CI 1.149, 2.918, $P = 0.01$). There was a significant change in the scores of the tenth question between T2 and T1, with 10.6% ($n = 30$) participants finding their mental health becoming impairing compared to 57.3% ($n = 308$) participants who reported improvement ($P = 0.009$).

DISCUSSION

In the past two decades, the world has faced challenging infectious epidemics including the SARS-CoV-1, Swine flu, Middle East respiratory syndrome coronavirus, avian influenza, Ebolavirus.^[5] All of these resulted in highly varied case fatality rates and morbidity, and although relatively regional, they also introduced restrictive community health measures like isolation and quarantines to stop or slow down the transmissions. While considerable efforts have been made to rely on the protective and treatment measures of these epidemics, very little attention has been given to the mental health problems that arise consequentially on the general public, health-care workers, and survivors of infectious diseases (survivors). From the literature that does exist, a significantly higher rate of psychiatric disorders, dementia, and insomnia among those infected during SARS and MERS epidemics has been shown.^[4] All of these studies have been performed among the symptomatic. Based on the above evidence, it would be reasonable to hypothesize that the ongoing pandemic had a negative impact on mental health and well being of the community at large. One of the major contributors to these apprehensions is the strict social isolation measures recommended once a person gets infected. Like most parts of the world, Mumbai was struggling to accommodate the idea of isolation for its overpopulous inhabitants who barely had a roof over their head. Learning from the struggles of the countries that were affected early on in the pandemic, large shelters were rapidly built to house the infected— regardless

Table 2: Comparison of the change of total scores from first assessment inside the facility (T1) to after 6 months (T2)

Variable	Mental health improved (n=266), n (%)	Unchanged or worsened (n=112), n (%)	Univariate model, P	Multivariate model			
				OR	95% LCI	95% UCI	P
Age (years)							
Below 45 (n=193)	147 (76.2)	46 (23.8)	0.01		Reference		
Above and 45 (n=185)	119 (64.3)	66 (35.7)		0.53	0.33	0.84	0.00
Gender							
Female (n=129)	80 (62)	49 (38)	0.013		Reference		
Male (n=249)	186 (74.7)	63 (25.3)		1.83	1.14	2.91	0.01
Reinfection							
No (n=335)	242 (72.2)	93 (27.8)	0.03		Reference		
Yes (n=43)	24 (55.8)	19 (44.2)		0.49	0.25	0.96	0.03
Education							
High school and above (n=196)	130 (66.3)	66 (33.7)	0.09	Not considered for the multivariate regression model			
Less than high school (n=182)	136 (74.7)	46 (25.3)					
Income household per month (INR)							
≥10,000 (n=261)	187 (71.6)	74 (28.4)	0.46				
<10,000 (n=117)	79 (67.5)	38 (32.5)					
Co-morbidities							
No (n=222)	154 (69.4)	68 (30.6)	0.64				
Yes (n=156)	112 (71.8)	44 (28.2)					
Number of co-morbidities							
None (n=222)	154 (69.4)	68 (30.6)	0.54				
Single (n)	85 (73.9)	30 (26.1)					
Multiple (n)	27 (65.9)	14 (34.1)					
Symptoms							
Asymptomatic (n=188)	140 (74.5)	48 (25.5)	0.09				
Mildly symptomatic (n=190)	126 (66.3)	64 (33.7)					

Patients with PHQ-9 score ≥ 10 were considered to be suffering from depression. PHQ-9: Patient Health Questionnaire 9 item, OR: Odds ratio, LCI: Lower confidence interval, UCI: Upper confidence interval

of their symptoms. This is the first study to measure the mental health consequences that the COVID-19 institutional quarantine has had on the asymptomatic/mildly symptomatic patients in Mumbai, at both immediate and 6 months after infection.

In the current cohort of asymptomatic/mildly symptomatic individuals requiring institutional quarantine, we found a 38.2% depression rate, a reality that was particularly visible beyond 1 week of quarantine. Even with mental health and wellness being actively addressed at this particular study center, the prevalence of depression was over ten times that reported in the general community as per the National Mental Health Survey.^[6] Using a similar instrument as our study, the CURES-70 rural-urban population study conducted in the prepandemic time reported depression rates more than 2.5 times lower than our findings reported during the pandemic.^[7] Previous studies have confirmed that hospitalization, self-isolation, and home quarantine adversely affect mental health but none have shown such high rates.^[8] In fact, epidemics have been shown to negatively impact the mental health of the general public in various ways such as instilling a fear of being infected, worries about the health of loved ones and their loss, and the consequences of protective measures like mass quarantining, social restrictions and economic loss.^[9]

These experiences have been no different, if not more, during the current pandemic and has elicited feelings of anxiety, anger, loneliness, grief, boredom and leading to high rates of serious mental health. To add to this, the sensational mass media coverage, sometimes controversial, during such health crises also contributes to amplify uncertainty and unhealthy mental state.^[2,10] Moreover, the finding that comorbidities including cancer, have no effect on depression scores further underscores the independent impact of the COVID-19 diagnosis and quarantine on the mental state. Past studies have shown that low socioeconomic status has been associated with higher depression status across many countries.^[11] As those quarantined may face an adverse impact on their income and experience increased monetary and other pressures, predictably an inverse association between household income and the presence of depression was observed. Similar findings have been reflected in a study among the US population comparing the prevalence of depression during and before the COVID-19 pandemic.^[12] They found that individuals with <5000 US\$ savings were vulnerable to higher depression symptoms. Since the majority of the healthcare expenditure in India is out of pocket, the anticipated medical expenses in the unforeseeable future along with negligible business and employment rates during the pandemic can substantially contribute to the high depression rates seen in the population.

After a median period of 6 months, we found that the rate of depression improved in a large proportion of the previously quarantined patients. The factors that led to worsening of depression scores included older individuals above 45 years, males and those that were re-infected. We also found that 10.6% of participants found their mental health becoming impaired compared to 57.3% of participants who reported an improvement in impairment. Older individuals might be more affected in the long-term due to the constant vulnerability to contract the virus and higher mortality rates reported among those ages. In addition, it would be understandably difficult for them to adapt to the new lifestyles such as work from home, social distancing, etc., Interestingly, the risk of depression worsening was almost double in males. Epidemiologic reports across the world indicate a gender gap with higher morbidity and mortality among males. Possible factors that have been discussed include (i) higher expression of angiotensin-converting enzyme-2 (receptors for coronavirus) in males than females, (ii) gender-based immunological differences driven by hormones and the X chromosome, (iii) specific gender lifestyle with higher levels of tobacco use and drinking among men compared to women, and (iv) women having a more responsible attitude toward the COVID-19 pandemic than men that reversibly affects their undertaking of preventive measures.^[13]

With depression being the third-leading cause of disability in India across all ages,^[3,14] the pandemic will substantially add to the existing morbidity in mental health. Besides the mental health consequences, COVID-19 is likely to be accompanied by substantial neuropsychiatric symptoms such as anxiety, depression, and posttraumatic stress symptoms as a host immunologic response to the infection.^[15] Along with the ongoing medical research to find a cure for COVID-19, access to sound psychological health is critical to overcoming this illness, especially when isolation is experienced.^[16,17] Our findings highlight the need for actively detecting and managing depression among persons in institutional quarantine, considering limiting such quarantine to no more than a week, and providing routine screening and care for depression beyond this period. Accurate health information (local outbreak updates, etc.), social support, and coping strategies focusing on precautionary measures are needed to be protective.^[17-20] Thus, adequate information policies around public dissemination in media is essential to promote protective measures in society.^[5,21] In the same vein, monitoring is essential of higher-risk groups such as older individuals, males and those reinfected that may be more vulnerable to psychological impairments.^[22] Routine public mental health e-monitoring can be achieved by feedback obtained through self-monitoring of mood, sleep or medication adherence, as well as patterns determined through artificial intelligence integrated in device applications predicting relevant psychiatric outcomes.^[23-25] Finally, it is important to address the needs of special subpopulations such as people with preexisting mental illness, people lacking resources, families that might be victims of domestic violence and the elderly,

that are often neglected.^[26,27] While the pandemic continually unfolds itself, more and more awareness is rising on its mental health impacts and healthcare administrators need to establish a sound support system for the community going forward.

CONCLUSION

Given the world is currently being confronted with restrictions that are making societies conform to the new realities, there is an urgent need for policymakers to actively detect and manage depression present in the institutionally quarantined survivors of COVID-19. It is also important to consider limiting the period of quarantine to no more than a week, either at home or in institutions and simultaneously provide routine screening and care for those beyond this period.

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Conflicts of interest

There are no conflicts of interest.

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