



# Depression, Anxiety, and Stress with and without COVID-19 Infection

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## Abstract

**Objectives** Coronavirus disease 2019 (COVID-19) affects the respiratory system predominantly. However, post-COVID recovery, many manifested neurological and psychological symptoms, unrelated to the respiratory system. We aimed to estimate psychological impairment in individuals who were infected with COVID-19 in comparison with two uninfected control groups, and between different age cohorts.

**Materials and Methods** We compared three groups with respect to COVID-19—those infected, those not infected but witness to someone infected, and those neither infected nor witness to anyone infected, along with age cohort comparison. The standard Depression, Anxiety and Stress Scale - 42 items (DASS 42) questionnaire, with additional questions were answered by 301 participants.

**Statistical Analysis** SPSS was used for analyses, with Mann–Whitney *U* test, Kruskal–Wallis test, and Tukey's post hoc test.

**Results** Significantly higher levels of depression, anxiety, and stress were found in the infected group than in the uninfected groups, and significant difference was found between the older age cohorts (50 and above) of each group. The percentages of the infected group with severe to very severe depression, anxiety, and stress were higher than the other groups.

**Conclusion** There is greater psychological impairment in individuals post-COVID recovery, and there is higher impairment in the older age cohort that is recovered, compared to controls.

## Keywords

- ▶ post-COVID recovery
- ▶ COVID-19 infection
- ▶ depression
- ▶ anxiety
- ▶ stress

## Introduction

On January 30, 2020, the World Health Organization declared coronavirus disease 2019 (COVID-19) as a public health emergency of international concern. On March 11, 2020, the COVID-19 outbreak was declared a pandemic which is still ongoing. India too has been affected largely by this pandemic and till date over 40 million individuals have been infected and more than half a million patients have succumbed to the illness.<sup>1</sup>

Although the virus affects the respiratory system primarily, studies show other organ systems to also be affected like the

cardiac, gastrointestinal, and nervous system, the latter including neuropsychological effects.<sup>2</sup> A plethora of mental health symptoms stemmed from social stigma at the time of testing and diagnosis (often seen in the initial phase of the pandemic) at the thought of being ostracized, and included anxiety, depression, posttraumatic stress disorder (PTSD), and other trauma- and stress-related disorders. This psychological impact might result from the infection itself or taking care of an inflicted individual or witnessing the effect of virus first-hand.<sup>3</sup> Social stigma could be attributed to the novelty of the virus, rhetorical and extensive media coverage of the seriousness of the

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circumstances, insecurity in jobs, uncertainty regarding treatment, and the highly contagious nature of the infection.

The psychological manifestations of the disease continue to affect various population groups—those who were infected and have recovered from the infection, family members and health care workers who have witnessed the effects of the virus on others, and those who have learned about the suffering or loss of family members, or have been exposed to unpleasant details to an extreme degree.<sup>3</sup>

Additionally, there is the aspect of age that is important to consider, as studies have argued that older age is a risk factor for impairment in context of post-COVID symptoms.<sup>4,5</sup> Another study addresses the high susceptibility of older adults who have been infected by COVID-19 in developing mental health issues.<sup>6</sup> Older adults who have recovered from COVID-19 also demonstrate higher mortality rates.<sup>7</sup>

There is still a paucity of original studies on pandemic-related isolation and post-COVID psychological disorders emerging complication, especially in the Indian context. Viral infections causing “post-viral fatigue” is well known, however, post-viral psychological damage is possibly underestimated and underreported. To the best of our knowledge, there are no studies comparing psychological effects among those who were infected and uninfected. This study attempts to demonstrate the psychological impact of COVID-19 on infected individuals well after recovery (infected group) as compared to two other uninfected groups—those who had witnessed or taken care of someone infected (witness group) and those who were neither infected nor had taken care of someone infected (uninfected group) in the Indian context. The study helps provide a better understanding of the psychological impact of this disease, no matter the nature or direction of the results.

The objectives of the study are to (1) evaluate the psychological impact of COVID-19 on individuals either infected or uninfected by the virus, (2) to compare the psychological impact between the groups, and (3) to identify putative post-COVID psychological symptoms specifically in those who have recovered from the COVID-19 infection.

Null hypothesis 1: There is no significant difference between the three groups (those infected by COVID-19, those uninfected but witness to someone being infected, and those uninfected nor witness to anyone infected) in their levels of depression, anxiety, and stress.

Null hypothesis 2: There is no significant difference between the older and younger age cohorts in their levels of depression, anxiety, and stress.

Null hypothesis 3: There is no significant difference between the younger age cohort of each group.

Null hypothesis 4: There is no significant difference between the older age cohort of each group.

## Methods

### Design

This was a comparative, nonrandomized quantitative questionnaire-based study in three participant groups. The independent variables in the study were the state of COVID-19

infection (whether they were infected themselves or were not infected, with or without having witnessed someone being infected). The dependent variables were the levels of depression, anxiety, and stress symptoms.

### Subjects

The targeted sample size was 300, with around 100 from each of the groups. The sample included those who had been infected by COVID-19 (infected group), those who were not infected but had witnessed or taken care of someone infected by COVID-19 (witness group), and those who were neither infected nor directly witnessed anyone infected by COVID-19 (uninfected group). The witness group served as a control group for the other two groups, as it eliminated the infected group's trait of directly being infected and the uninfected group's trait of being influenced by the pandemic without COVID-19 infection.

The procedures and ethical principles followed were in accordance with the Declaration of Helsinki (1964).<sup>8</sup> The study was conducted as part of an undergraduate dissertation, and was presented to the departmental research review committee, wherein it was exempted from requiring institutional review board approval because of the nature of study—it involved no harm or distress to any participant. The participants (adult resident Indians) were informed of the purpose and background of the study, and informed that their results would be kept confidential and that the data will be used for academic purposes only. The data collection was initiated after obtaining informed consent, followed by data analysis. Those diagnosed with a preexisting mental illness were excluded. Data collection was performed by convenience sampling, using the snowball method. Due to COVID restrictions in the current times, we could not personally meet the respondents and had to resort to questionnaire-based assessment. The data collection was performed mostly via a questionnaire-based survey using Google Forms ( $n = 304$ ) and some responses collected via filled soft copies of the questionnaire ( $n = 14$ ).

### Tools

The Depression, Anxiety and Stress Scale - 42 items (DASS 42), which measures the negative emotional levels of depression, anxiety, and stress, were administered to study subjects.<sup>9</sup> The scale is a 42-item self-report questionnaire, with 14 questions for each of the psychological topic at hand (depression, anxiety, and stress). It has a 4-point Likert severity/frequency scale that focuses more on the dimensional conception rather than a categorical one.<sup>10</sup> The scoring of the participants was interpreted from a spectrum of normal to very severe, based on literature (→Table 1).<sup>11</sup> The reliability analysis of this scale shows the internal consistency to be high, with a Cronbach's alpha value of 0.96, 0.89, and 0.93 for Depression, Anxiety, and Stress, respectively. Correlations among the three DASS scales were: Depression-Anxiety = 0.51; Anxiety-Stress = 0.65; Depression-Stress = 0.64.<sup>12</sup> The convergent and discriminant validity of the scale has also been rated highly through correlational analysis.<sup>12</sup>

**Table 1** Categorization of DASS 42 scores based on levels of severity<sup>11</sup>

Levels	Depression	Anxiety	Stress
Normal	0–9	0–6	0–10
Mild	10–12	7–9	11–18
Moderate	13–20	10–14	19–26
Severe	21–27	15–19	27–34
Very severe	28+	20+	35+

Abbreviation: DASS 42, Depression, Anxiety and Stress Scale - 42 items.

### Data Analysis

SPSS statistics version 25 by IBM was used for data analysis, with the help of both descriptive and inferential statistics. As there are three groups to be compared (infected, witness, and uninfected) and age cohort-wise comparison, there was reliability analysis of the subdimensions of the scale, the Kolmogorov–Smirnov normality test, and descriptive analysis, followed by Mann–Whitney *U* test, Kruskal–Wallis test, and Tukey's post hoc test.

### Results

Of a total of 319 respondents, 18 participants were excluded from the study (10 with previously diagnosed mental illnesses and 8 with undiagnosed mental illness symptoms) leaving 301 eligible participants, with 102 from infected, 100 from witness, and 99 from uninfected groups, respectively; there were 174 male (58%) and 127 (42%) female participants ranging from 18 to 83 years ages. Group 1 had a mean DASS score of 36.11 and standard deviation of 34.2, group 2 had a mean score of 22.67 and a standard deviation of 24.5, and group 3 had a mean score of 19.68 and standard deviation of 22.5. The male participants had a mean score of 23.10 and standard deviation of 27.78, and the female participants had a mean score of 30.54 and standard deviation of 28.88.

Based on the interpretation of severity levels (► **Table 1**),<sup>11</sup> the DASS scores of the participants show greater incidence rates in higher severity across the subdimensions seen in

**Table 2** Interpretation of DASS 42 score in data distribution

Group	Subdimensions	Normal (%)	Mild (%)	Moderate (%)	Severe (%)	Very severe (%)
Infected ( <i>n</i> = 102)	Depression	56.86	5.88	15.69	9.8	11.76
	Anxiety	50	7.84	7.84	11.76	22.55
	Stress	46.08	24.51	13.73	9.8	5.88
Witness ( <i>n</i> = 100)	Depression	74	2	12	7	5
	Anxiety	63	14	10	6	7
	Stress	62	19	12	5	2
Uninfected ( <i>n</i> = 99)	Depression	75.76	3.03	14.14	4.04	3.03
	Anxiety	70.71	7.07	9.09	10.1	3.03
	Stress	65.66	17.17	12.12	5.05	0

Abbreviation: DASS 42, Depression, Anxiety and Stress Scale - 42 items.

group 1, as compared to groups 2 and 3 (► **Table 2**). The DASS 42 subdimensions' reliability were analyzed. The Cronbach's alpha value for depression, anxiety, and stress were 0.969, 0.953, and 0.961, respectively, all of which corresponded to high internal consistency.

The data across all three groups was positively skewed, approaching the natural limit. The Kolmogorov–Smirnov test showed that groups 1, 2, and 3 had statistic values of 0.147, 0.178, and 0.191, respectively, and all with *p*-values of 0.000, thus not normally distributed. The kurtosis values of DASS scores for groups 1, 2, and 3 were found to be -0.110, 1.893, and 0.495, indicating that the distribution was lighter-tailed in group 1 and heavier-tailed in groups 2 and 3, compared to the normal distribution. Thus, the analyses proceeded with nonparametric statistics.

The Kruskal–Wallis test showed that the difference in results of the three groups was significant ( $H(2) = 15.410$ , degrees of freedom [df] = 2,  $p = 0.000$ ), as represented in ► **Table 3**. There is a statistically significant difference between the DASS scores of group 1 and group 2, as well as group 1 and group 3, thus rejecting null hypothesis 1. The scores differ between groups 1 and 2 ( $H(2) = 34.28$ ,  $p = 0.015$ ), between groups 1 and 3 ( $H(2) = 46.28$ ,  $p = 0.000$ ), and between groups 2 and 3 ( $H(2) = 12.00$ ,  $p = 0.990$ ), with significances adjusted by Bonferroni correction. There is a statistically significant difference between the mean DASS scores obtained by each group ( $H(2) = 15.410$ ,  $df = 2$ ,  $p = 0.000$ ), with a mean rank of 177.61 for group 1, 143.33 for group 2, and 131.33 for group 3.

In regard to age cohort-wise analyses with Mann–Whitney *U* tests (► **Table 4**), no significant difference was observed

**Table 3** Inferential statistics with Kruskal–Wallis test

Kruskal–Wallis test	<i>H</i>	<i>p</i>
Group 1–Group 2–Group 3	15.410*	0.000
Group 1–Group 2	34.28*	0.015
Group 1–Group 3	46.28*	0.000
Group 2–Group 3	12.00	0.990

Note: Significance adjusted with Bonferroni correction. \* $p < .05$ .

**Table 4** Age cohort-wise tests

		Statistic	p
Mann–Whitney <i>U</i> test	Old-young (overall)	9,936	0.152
	Old-young (infected)	1,246	0.752
	Old-young (witness)	834	0.079
	Old-young (uninfected)	1,075	0.300
Kruskal–Wallis test	Old (group-wise comparison)	11.91*	0.003
	Young (group-wise comparison)	5.80	0.055

\* $p < .05$ .**Table 5** Tukey's HSD post hoc test

(I) Cohort	(J) Cohort	Mean difference (I – J)	Standard error	Significance	95% Confidence interval	
					Lower bound	Upper bound
1	2	13.44 <sup>a</sup>	3.886	0.002	4.29	22.59
	3	16.43 <sup>a</sup>	3.896	0.000	7.26	25.61
2	1	-13.44 <sup>a</sup>	3.886	0.002	-22.59	-4.29
	3	2.99	3.915	0.725	-6.23	12.21
3	1	-16.43 <sup>a</sup>	3.896	0.000	-25.61	-7.26
	2	-2.99	3.915	0.725	-12.21	6.23

Abbreviation: HSD, honestly significant difference.

<sup>a</sup>The mean difference is significant at the 0.05 level.

between older and younger cohorts, overall and for each of the three groups ( $p = 0.152, 0.752, 0.079, 0.300$ ), thus accepting the null hypothesis 2. Between the old cohorts of each of the three groups (→ **Table 4**), the Kruskal–Wallis found that there was a significant difference ( $H(2) = 11.91, p = 0.003$ ) (mean ranks of infected group = 77.38, witness group = 54.42, and uninfected group = 54.28), rejecting null hypothesis 4. Between the young cohorts of the three groups, there was no significant difference found ( $p = 0.055$ ), accepting null hypothesis 3.

Tukey's honestly significant difference test, as represented in → **Table 5**, for multiple comparisons found that the mean value of DASS score was significantly different between groups 1 and 2, and groups 1 and 3 ( $p = 0.002$  and  $0.000$ , 95% confidence interval = [4.29, 22.59] and [7.26, 25.61]). There was no statistically significant difference in mean DASS scores between group 2 and group 3 ( $p = 0.725$ ).

## Discussion

Studies are unraveling long-term psychological effects of COVID-19 arising postrecovery and lasting long after disappearance of the COVID-19 infection.<sup>13</sup> The chief psychological symptoms include depression, anxiety, and stress.<sup>13</sup> These could arise as a component of the post-COVID syndrome in those who were infected, or in those uninfected by virtue of witnessing someone suffering from COVID-19, or the mere experience of the pandemic itself. A study conducted on the psychosocial effects of the pandemic, shows how such effects can stem from quarantines, isolation, lack of human communication, etc., among general public who have

not been infected and also among health care and frontline workers, thus highlighting the second and third groups for comparison in this study.<sup>14</sup>

The COVID-19 pandemic affected populations across the world with many survivors manifesting various nonrespiratory-related complications. One of the complications is the “post-COVID syndrome” which may be associated with neuropsychiatric and psychological impairments in COVID survivors long after recovery from the illness, usually 4 weeks or more.<sup>15</sup> In this questionnaire-based comparative study, all three groups showed varied levels of psychological impairment. Furthermore, the study showed significantly higher levels of depression, anxiety, and stress, in those who had past COVID-19 infection than the other two groups who were not infected.

This study showed that the “infected” group had significantly higher levels of psychological impairment than the “witness” and “uninfected” groups. Across the spectrum of depression, anxiety, and stress, majority of the infected group showed severe to very severe levels, whereas the witness and uninfected groups showed normal to mild levels of these variables. Additionally, the infected group had significant anxiety compared to the witness group, and significant depression, anxiety, and stress compared to the uninfected group. This substantiates the hypothesis that those who have been infected experience psychological symptoms postrecovery. Following this, age-wise comparisons between cohorts (above 50 and below 50 years of age) demonstrated no difference between these cohorts in their depression, anxiety, and stress levels. However, the comparison of the older age cohort between each group showed

significantly higher levels for the infected group, whereas no significant differences were observed for the younger age cohort.

A study on PTSD post-COVID found PTSD in 30.2% of COVID recovered subjects, followed by additional manifestations such as depressive episodes (17.3%), hypomanic episodes (0.7%), generalized anxiety disorders (7.0%), and psychotic disorders (0.2%).<sup>16</sup> Another study classified post-COVID symptoms including psychological symptoms beyond the COVID infectious period into four categories: transition phase (up to 4–5 weeks postrecovery), acute post-COVID symptoms (weeks 5–12), long post-COVID symptoms (weeks 12–24), and persistent post-COVID symptoms (beyond week 24).<sup>17</sup>

Psychological impairment in COVID survivors could be attributed to the neurotropic nature of the virus causing direct injury to the nervous system or maybe a part of the post-COVID syndrome resulting from postinfectious inflammatory pathogenetic mechanisms. Resultant psychological effects include depression, anxiety, posttraumatic symptoms, possible cognitive impairment, and even suicidal tendencies.<sup>18</sup> The elevated levels of depression, anxiety, and stress in the infected group could be attributed to the “direct” effects of the severe acute respiratory syndrome coronavirus 2 affecting the brain and mind.

In regard to age and the finding that the infected group significantly differs for the older age cohort but not the younger, studies substantiate that with seniority, susceptibility to post-COVID psychological symptoms increase, thus making age a risk factor.<sup>6,7</sup> The findings on the significance of younger age differences between cohorts is also substantiated, as a study demonstrates that younger age is more predictive of psychological impairment, in general and not with regard to postrecovery.<sup>19</sup> This explains how the younger age groups did not significantly differ whether infected or witness or uninfected.

Our study highlights the importance of postrecovery holistic follow-up and surveillance well after recovery from COVID. Addressing these mental health issues is important as these are imminently treatable. If left undetected, it may affect the victims' quality of life, professional and personal work spheres, rarely even leading to suicide.<sup>18</sup> While these extreme sequelae might be seen in a small percentage of individuals, the issue in itself is a pressing one if the impact of the COVID-19 infection is this far-reaching. It is imperative to make therapy and counseling services available to the general public.

## Implications

The post-COVID psychological impairment has implications in clinical and social aspects. In the clinical setup, COVID recovered individuals might warrant counseling or therapy. Hence, it is important for therapists to be aware of and identify these late sequelae in those who had COVID infection. With respect to social implications, psychological impairment can affect one's social life, especially due to social stigma associated with the infection. With respect to research implications and since these effects are likely to

continue plaguing populations for quite some time, this study can guide further detailed research on post-COVID recovery psychological effects and psychological effects in uninfected and care givers.

Policy making also plays a significant role in the response to this syndrome and how society at large can help tackle this issue. Psychological impact naturally follows any adverse experience, as with the pandemic, but as the study shows, there is a much higher degree of psychological impairment for those who have recovered from the infection and thus must be focused on.

Overall, if not properly addressed, the long-term effects of COVID-19 can have poor consequences which can impact psychological functioning of individuals. It is thus important to ensure that there is treatment and care available for those who have recovered.

## Limitations

The main limitation of the study is the lack of information regarding severity of the COVID-19 infection, whether the individual had completely recovered from the infection, or how long it had been since they were infected. Also, there could be COVID unrelated factors that could have influenced the psychological impairment such as socioeconomic status or cultural and geographical factors, that were not elicited.

The research on COVID-19 and especially on the post-infectious symptoms is still at its infancy, and there is much scope and relevance in conducting research on this topic. Psychological implications of the COVID-19 infection are yet to be explored and have just arrived at the forefront of this pandemic.

## Conclusion

In conclusion, the study demonstrates significantly higher levels of psychological impairment—comprising of depression, anxiety, and stress levels—among those who had COVID infection compared to witnesses/caregivers and those uninfected, and significantly higher differences between the three groups for the older age cohort.

### Statement

Conducted in accordance with the Declaration of Helsinki (1964). Presented to the departmental research review committee, wherein it was exempted from requiring IRB approval because of the nature of study—it involved no harm or distress to any participant.

### Presentation

Presented (online) at the International Conference on Mental Health and COVID-19 (ICMHC 2022), held by Aligarh Muslim University, on the 25th of November, 2022.

### Authors' Contributions

S.S.: Design, concept, collecting data, collating data, analyzing, writing manuscript, conducting study ethically.



A.J.K.: Design, critically reviewing manuscript, analyzing data.

S.B.: Design, critically reviewing manuscript.

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#### Conflict of Interest

None declared.

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