Original Research Article

Assessment of COVID-19-related new onset of Depression and Anxiety: A Comparative Cross-Sectional Study

Rakesh Kumar Singh[1], Pragati Pragya[2], Seema Singh[3]

[1]Professor and Head of Department of Psychiatry, Adesh Medical College Hospital, Ambala, Haryana, India

[2]Research Scholar, AIIMS, New Delhi, India.

[3]Clinical Psychologist, Ambala, Haryana, India

Abstract

Aim: The aim of the present study assessment of new-onset depression and anxiety associated with COVID-19. **Methods:** This analytical, cross-sectional study was done the Department of Psychiatry Adesh Medical College Hospital Ambala Haryana, India for 10 months. By using Google Form platform contained validated online survey among Indian population which includes all adult males and females during or post COVID-19 infection and compared to the non-COVID-19 population as a control group. **Results:** 38% of participants were male while 62% are females. 26% of participants were married while 70% were single. 60% of participants are students and 38% are employed while 2% are retired. Regarding the COVID-19-positive and COVID-19-negative participants, 25% of participants reported having been diagnosed with COVID-19. Scores of PHQ-9 ranged from 0 to 27 (the mean is and the standard deviation is 6.12). Depression prevalence in our sample was 40%. Scores of GAD-7 ranged from 0 to 21 (the mean of 8.99 and the standard deviation is 5.33). Anxiety prevalence in our sample was 41%. The model shows a significant overall effect of gender [$F_{(489)} = 39.02$, $p < 0.001$], a non-significant effect of COVID-19 infection [$F_{(489)} = 1.88$, $p = 0.177$] and a trending effect of the interaction between gender and COVID-19 [$F_{(489)} = 3.25$, $p = 0.069$]. Since the effect is not significant, we did not run any post hoc analyses. **Conclusion:** Significant levels of depression and anxiety were observed among the study population. The high levels of depression and anxiety may have masked the differences between those with or without COVID-19.

Keywords: Anxiety, Depression, COVID-19

Introduction

In December 2019, in the city of Wuhan, China, unusual cases of patients with pneumonia caused by the new Coronavirus (COVID-19) were reported[1], and the spread of the virus swiftly became a global health threat[2].

There have been several viral diseases in the past 20 years including Severe Acute Respiratory Syndrome (SARS) in 2003, influenza virus with the H1N1 subtype in 2009, Middle East Respiratory Syndrome (MERS) in 2012, and Ebola virus in 2014[3-5].

Although COVID-19 is a new strain of coronaviruses, it is known to cause diseases ranging from cold to more severe illnesses such as SARS and MERS[5]. Symptoms of the Coronavirus infection include fever, chills, cough, sore throat, myalgia, nausea and vomiting, and diarrhea. Men with a history of underlying diseases are more likely to be infected with the virus and would experience worse outcomes[6]. Severe cases of the disease can lead to heart, and respiratory failure, acute respiratory syndrome, or even death[7]. In addition to the physical impacts, COVID-19 can have serious effects on people's mental health[8]. A wide range of psychological out- comes have been observed during the Virus outbreak, at individual, community, national, and international levels. At the individual level, people are more likely to experience fear of getting sick or dying, feeling helpless, and being stereotyped by others[9]. The pandemic has had a harmful effect on the public mental health which can even lead to psychological crises[10]. Early identification of individuals in the early stages of a psychological disorder makes the intervention strategies more effective. Health crises such the COVID-19 pandemic lead to psychological changes, not only in the medical workers, but also in the citizens, and such psychological changes are instigated by fear, anxiety, depression, or insecurity[11].

Nervousness and anxiety in a society affect everyone to a large extent. Recent evidence suggests that people who are kept in isolation and quarantine experience significant levels of anxiety, anger, confusion, and stress[12]. At large, all of the studies that have examined the psychological disorders during the COVID-19 pandemic have reported that the affected individuals show several symptoms of mental trauma, such as emotional distress, depression, stress, mood swings, irritability, insomnia, attention deficit hyperactivity disorder, post-traumatic stress, and anger[12-14]. Research has also shown that frequent media exposure may cause distress[15]. Nevertheless, in the current situation, it is challenging to accurately predict the psychological and emotional con- sequences of COVID-19. Studies conducted in China, the first country that was affected by this recent Virus spread, show that people's fear of the unknown nature of the Virus can lead to mental disorders[16].

Material and Methods

This analytical cross-sectional study was done the Department of psychiatry Adesh Medical College Hospital Ambala Haryana, India for 10 months.

By using Google Form platform contained validated online survey among Indian population which includes all adult males and females during or post COVID-19 infection and compared to the non-COVID-19 population as a control group. Data were gathered from this group using validated online questionnaires (PHQ-9; Patient Health Questionnaire-9 and GAD-7; General Anxiety Disorder-7)[17], in addition to questions about demographic data and medical history.

Statistical analysis

Descriptive data were analyzed using suitable tool such as t-test, chi-squared test, ANOVA test, and binary logistic regression for univariate analyses and multivariate analysis. *P-value* less than 0.05 is considered statistically

significant. The analysis of data was performed using SPSS Statistic v21.0.

Results

The data were collected from 108 Indian adults through a self-administrated electronic questionnaire. Our final sample consisted of 100 participants after the exclusion of 8 participants.

The age of participants ranged from 18 to 65 years old with a median of 22 years and a standard deviation of 9.5 (Table.2). 38% of participants were male while 62% are females. 26% of participants were married while 70% were single. 60% of participants are students and 38% are employed while 2% are retired. Regarding the COVID-19-positive and COVID-19-negative participants, 25% of participants reported having been diagnosed with COVID-19.

Scores of PHQ-9 ranged from 0 to 27 (the mean is and the standard deviation is 6.12). Depression prevalence in our sample was 40%. Scores of GAD-7 ranged from 0 to 21 (the mean of 8.99 and the standard deviation is 5.33). Anxiety prevalence in our sample was 41%.

Regarding the overall effect of COVID-19 infection on depression and anxiety, we compared the scores of the two populations using an independent samples t-test and did not find a significant difference in GAD-7 and PHQ-9 scores between COVID-19 positive population and COVID-19 negative populations (all $ps > .1$; Table.3).

We then asked if those differences in PHQ-9 and GAD-7 scores are different within males and females. To answer this question, we first conducted an analysis of variance (ANOVA) with PHQ-9 scores as the dependent variable while the independent variables were gender and COVID-19 infection (Table.4). We observed an overall effect of gender [$F(1, 489) = 40.10$, $p<0.001$], no effect of COVID-19 infection [$F(1,489) = 0.69$, $p=0.412$], and most noticeably, a significant interaction between gender and COVID-19 infection [$F(1, 489) = 4.24$ $p=0.029$]. To understand this interaction, we conducted a series of post hoc Student's t-tests with all possible pair wise comparisons between COVID-19-positive and COVID-19-negative population and gender. Post hoc t-tests show that PHQ-9 scores are significantly lower in females who are COVID-19 negative compared to the females who are COVID-19 positive [$t(489) = -2.124$, $p=0.018$]. Furthermore, this difference is not observed in men as PHQ-9 scores are not significantly different within males who are COVID-19 positive from those who are COVID-19 negative [$t(489) = 0.748$ $p= 0.479$]. Those outcomes show that PHQ-9 is affecting fe-males who had COVID-19 more than males who had COVID-19. For the GAD-7 scores, we also conducted ANOVA analysis with GAD-7 scores as the dependent variable and with gender and COVID-19 infection as in-dependent variables (see Table.5). The model shows a significant overall effect of gender [$F(489) = 39.02$, $p<0.001$], a no significant effect of COVID-19 infection [$F(489)=1.88$, $p=0.177$] and a trending effect of the interaction between gender and COVID-19 [$F(489) = 3.25$, $p=0.069$]. Since the effect is not significant, we did not run any post hoc analyses (Table.5).

Table 1: Questions about demographic data and medical history. PHQ-9 Patient Health Questionnaire-9 and GAD-7 General Anxiety Disorder-7 that is included in the questionnaire

S. No.	Questions	Options
1.	Age	Open question
2.	Gender	Male, female
3.	Marital status	Single, Married, Divorced, Widower/ Widow
4.	For females: are you pregnant?	Yes, No
5.	Nationality	Saudi, Non-Saudi
6.	Job-status	Student, government sector employee, private sector employee, freelancer, retired, unemployed
7.	Have you been diagnosed with COVID-19?	Yes, No
8.	Do you know anyone of your relatives or friends is infected with COVID-19?	Yes, No
9.	Have you been diagnosed with any psychiatric disorder and are you using medication for it?	
10.	Over the last two weeks, how often have you been bothered by any of the following problems? (Or four weeks after you've been diagnosed with COVID-19)	

GAD-7					
S. NO.		**Not all**	**Several days**	**More than half the days**	**Nearly every day**
1.	Feeling nervous, anxious or on edge?	0	1	2	3
2.	Not being able to stop or control worrying?	0	1	2	3
3.	Worrying too much about different things?	0	1	2	3
4.	Trouble relaxing?	0	1	2	3
5.	Being so restless that it is hard to sit still?	0	1	2	3

6.	Becoming easily annoyed or irritable?	0	1	2	3
7.	Feeling afraid as if something awful might happen?	0	1	2	3
8.	Over the last two weeks, how often have you been bothered by any of the following problems? (Or four weeks after you've been diagnosed with COVID-19, if you've already been infected)				
PHQ-9		**Not all**	**Several days**	**More than half the days**	**Nearly every day**
1.	Interest or pleasure in doing things?	0	1	2	3
2.	Feeling down, depressed, or hopeless?	0	1	2	3
3.	Trouble falling or staying asleep, or sleeping too much?	0	1	2	3
4.	Feeling tired or having little energy?	0	1	2	3
5.	Poor appetite or overeating?	0	1	2	3
6.	Feeling bad about yourself - or that you are a failure or have let yourself or your family down?	0	1	2	3
7.	Trouble concentrating on things, such as reading the newspaper or watching television?	0	1	2	3
8.	Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual?	0	1	2	3
9.	Thoughts that you would be better off dead, or of hurting yourself in some way?	0	1	2	3

Table 2: Descriptive data included all participants in our analytic sample

Age in years Median (SD: range)	22 (18 to 65)
Gender	
Male	38%
Female	62%
Marital status	
Single	70%
Married	26%
Divorce	4%
Occupation	
Student	60%
Governmental sector	25%
Private sector	13%
Retired	2%

COVID-19-positive cases	25%
GAD-7	
Average (SD)	9 (7)
PHQ-9	
Average (SD)	6.12

Table 3: Statistical comparisons between GAD-7 and PHQ-9 among COVID-19 positive and COVID-19 negative

Measure	COVID-19 negative (N=60)	COVID-19 positive (N=40)	Student's t-test p-value
GAD-7	9.55 (5.69)	8.67(5.49)	0.137
PHQ-9	10.78(7.02)	11.02 (7.06)	0.578

GAD-7 General Anxiety Disorder-7, PHQ Patient Health Questionnaire-9, SD standard deviation

Table 4: Analysis of variance (ANOVA) of the effect of gender and COVID-19 infection on the scores of PHQ-9

	Sum of squares	df	Mean square	F	p
Gender	1563.7	1.2	1563.7	40.109	< .001
COVID-19	28.6	1.2	28.6	0.687	0.412

Table 5: Analysis of variance (ANOVA) of the effect of gender and COVID-19 infection on the scores of GAD-7

	Sum of squares	df	Mean square	F	p
Gender	918.5	1.2	918.5	39.02	< .001
COVID-19	43.0	1.2	43.0	1.88	0.177

GAD-7 General Anxiety Disorder-7, df degrees of freedom

Discussion

This study aims to assess the new-onset depression and anxiety disorders in COVID-19 patients in India during the pandemic. In this study, we sought the association between COVID-19 infection and new-onset mental health disorders such as depression and anxiety in COVID-19 patients, especially females. Though there is no significant difference in the prevalence of anxiety and depression among COVID-19-positive or negative- populations reported in this study, we found the females are more affected by COVID-19 than males in depression scores and to a moderate extent in the anxiety scores. While we cannot identify the underlying causal mechanisms, previous studies reported that COVID-19 infection, or coronaviruses infections, may increase the risk of anxiety and depression. For example, in a systematic search that included 3559 studies, it was found that depressed mood and anxiety were common symptoms among patients admitted to the hospital for SARS or MERS during the acute illness or the post-illness stage.[18] In another study that analyzed 69 million health records from over 62,000 people diagnosed with COVID-19, it showed that 6% of COVID-19 patients experienced mental health disorders such as depression and anxiety within 3 months of diagnosis compared to 3.4% of non-COVID-19 patients[19] from a molecular biology perspective, different pathogenesis mechanisms have been described as central nervous system affection by SARS-CoV-2. However, the exact

pathogenesis mechanism associated with neuropsychiatric symptoms in COVID-19 patients is currently unknown and needs to be elucidated. Some previous reports highlighted the ability of Corona virus to penetrate the brain through the olfactory canal, retrograde neural pathway, or by induce a significant inflammatory response through activation of the inflammatory pathway and release cytokines into the body. The blood-brain barrier is likely to be damaged as a result of increased pro-inflammatory factors in the bloodstream making functional damage possible[20]. Moreover, different pathways of indirect infection of the CNS have been suggested, including host immune response against the virus, pre-existence of acute toxic encephalopathy, or as a side effect of COVID-19 medical treatment[20].

In the current study, we also found that females with COVID-19 are at high risk for mental disorders compared with males (Tables 4 and 5). This result is consistent with many other studies. For example, in one follow-up study, after 1 month of hospital treatment, which was done on 402 adult patients who were diagnosed with COVID-19 (66% male, mean age 58), it has been found that 42% of patients reported anxiety while 31% of patients reported depression (among many other mental conditions) and, furthermore, females have experienced more anxiety and depression than males[21]. Another study on 76 patients who were quarantined in fever-isolation wards with suspected COVID-19 to investigate anxiety and depression has found that female patients are more likely to experience depression and anxiety than male[22]. Another study investigated the gender differences in depression, anxiety, and the associated factors during the COVID-19 epidemic among Chinese social media users. The

findings suggested that the increased prevalence of depression and anxiety during the COVID-19 epidemic among the Chinese population. Furthermore, females showed more severe anxiety symptoms than males[23] another study, conducted in Kuwait, aimed to assess the prevalence of anxiety and depression symptoms in Kuwaiti nationals and expats. The study's secondary objective was to highlight the association between physical activity (PA) engagement and sociodemographic characteristics, with mental health disorders such as anxiety and depression during the COVID-19 pandemic. A web-based cross-sectional survey was used to examine the sociodemographic characteristics and PA engagement and generalized anxiety and depression symptoms. The results showed that anxiety was reported in more than 50% of the sample, and depressed mood reported in approximately 60% of the sample during COVID-19 outbreaks. Moreover, women and younger individuals with lower PA and education were more likely to develop anxiety symptoms while depressive symptoms were more prevalent among women, people with lower PA and education, elderly, and married people[24]. Overall, the patterns in this study are largely consistent with those reported in the literature. Notably, the prevalence of anxiety and depression in our study was relatively higher than the national rates[25]. The national rates were based on Saudi National Health and Stress Survey which has been conducted many years before the corona virus outbreak while our survey has been conducted amid the outbreak, a likely factor that inflated anxiety and depression. While we do not know of any current estimates of the prevalence of anxiety and depression disorders, the prevalence in our sample is similar to other studies conducted in similar populations. For example, in a study conducted in

Kuwait[24], anxiety prevalence was reported to be 50% while depression was reported to be 60% during the outbreak[22,24].

Conclusion

In conclusion, we found very high levels of depression and anxiety among the sample. The high levels of depression and anxiety may have masked the differences between those with or without COVID-19. However, we found that females diagnosed with COVID-19 had a higher prevalence of depression and anxiety compared to males diagnosed with COVID-19. The impact of COVID-19 on psychological wellbeing is highly significant, especially in females.

Reference

1. Bai Y, Yao L, Wei T, Tian F, Jin D-Y, Chen L, et al. Presumed asymptomatic carrier transmission of COVID-19. JAMA. 2020;323(14):1406–7.
2. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. Lancet. 2020;395(10223):470–3.
3. Feldmann H, Jones S, Klenk H-D, Schnittler H-J. Ebola virus: from discovery to vaccine. Nat Rev Immunol. 2003;3(8):677–85.
4. Team N-O, Dawood F, Jain S, Finelli L, Shaw M, Lindstrom S, et al. Emergence of a novel swine-origin influenza a (H1N1) virus in humans. N Engl J Med. 2009;360(25):2605–15.
5. Ashour HM, Elkhatib WF, Rahman M, Elshabrawy HA. Insights into the recent 2019 novel coronavirus (SARS-CoV-2) in light of past human coronavirus outbreaks. Pathogens. 2020;9(3):186.
6. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395(10223):507–13.
7. Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, et al. First case of 2019 novel coronavirus in the United States. N Engl J Med. 2020; 382:929–36.
8. Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 epidemic in China: a web-based cross- sectional survey. MedRxiv. 020; 288:112954.
9. Hall RC, Hall RC, Chapman MJ. The 1995 Kikwit Ebola outbreak: lessons hospitals and physicians can apply to future viral epidemics. Gen Hosp Psychiatry. 2008;30(5):446–52.
10. Xiang Y-T, Yang Y, Li W, Zhang L, Zhang Q, Cheung T, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. Lancet Psychiatry. 2020;7(3):228–9.
11. Zhang J, Lu H, Zeng H, Zhang S, Du Q, Jiang T, et al. The differential psychological distress of populations affected by the COVID-19 pandemic. Brain Behav Immun. 2020; 87:49–50.
12. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet. 2020. 14;395(10227):912–20.
13. Wang Y, Xu B, Zhao G, Cao R, He X, Fu S. Is quarantine related to immediate negative psychological consequences during the 2009 H1N1 epidemic? Gen Hosp Psychiatry. 2011;33(1):75–7.
14. Rubin GJ, Wessely S. The

psychological effects of quarantining a city. BMJ. 2020;368:m313.

15. Neria Y, Sullivan GM. Understanding the mental health effects of indirect exposure to mass trauma through the media. JAMA. 2011;306(12):1374–5.

16. Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: mental health consequences and target populations. Psychiatry Clin Neurosci. 2020; 74(4):281.

17. Sawaya H, Atoui M, Hamadeh A, Zeinoun P, Nahas Z (2016) Adaptation and initial validation of the Patient Health Questionnaire - 9 (PHQ-9) and the Generalized Anxiety Disorder - 7 Questionnaire (GAD-7) in an Arabic speaking Lebanese psychiatric outpatient sample. Psychiatry Res. 239:245– 252.

18. Rogers JP, Chesney E, Oliver D, Pollak TA, McGuire P, Fusar-Poli P, Zandi MS, Lewis G, David AS (2020) Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. Lancet Psychiatry. 7(7):611–627.

19. Taquet M, Luciano S, Geddes JR, Harrison PJ (2021) Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. The Lancet Psychiatry 8(2):130-140.

20. Desforges M, Le Coupanec A, Dubeau P, Bourgouin A, Lajoie L, Dubé M et al (2019) Human coronaviruses and other respiratory viruses: Underestimated opportunistic pathogens of the central nervous system? Viruses. 12(1):14.

21. Mazza MG, De Lorenzo R, Conte C, Poletti S, Vai B, Bollettini I, Melloni EMT, Furlan R, Ciceri F, Rovere-Querini P, Benedetti F (2020) Anxiety and depression in COVID-19 survivors: Role of inflammatory and clinical predictors. Brain, Behavior, and Immunity 89:594-600.

22. Li X, Dai T, Wang H, Shi J, Yuan W, Li J, Chen L, Zhang T, Zhang S, Kong Y, Yue N, Shi H, He Y, Hu H, Liu F, Yang C (2020) Clinical analysis of suspected COVID-19 patients with anxiety and depression. Zhejiang Da Xue Xue Bao Yi Xue Ban. 49(2):203–208.

23. Hou F, Bi F, Jiao R, Luo D, Song K (2020) Gender differences of depression and anxiety among social media users during the COVID-19 outbreak in China:a cross-sectional study. BMC Public Health. 20(1):1648.

24. Alsharji KE. Anxiety and depression during the COVID-19 pandemic in Kuwait: the importance of physical activity. Middle East Curr Psychiatr [Internet]. 2020;27(1).

25. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators (2018) Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990- 2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 392(10159):1789–1858.

175