



Mental health outcome in hospitalized COVID-19 patients: An observational analysis from North Indian tertiary care hospital

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ABSTRACT

Aim: The study investigate the severity of perceived stress and wide domains of psychiatric symptoms reported on initial screening in hospitalized patients of COVID-19 with a second aim to determine the role of socio-demographic factors and coping styles in the hospitalized patients of COVID-19.

Method: Total 224 patients of COVID-19 infection, hospitalized in various isolation facilities were assessed via web-based self-reported questionnaires on perceived stress scale, brief cope inventory, and DSM-5 crosscutting level-1 questionnaire.

Results: Majority of the patients reported moderate level of stress followed by mild and severe. Depression and Anxiety symptoms were most common psychopathologies though the patients have reported greater severity in various domains of psychiatric symptoms. Coping styles explains most of variance (64.8%) of the perceived stress. Similarly total PSS scores, coping styles, COVID-19 status and sociodemographic factors contributed significantly to the variance of all psychiatric symptoms.

Conclusion: Factors like female gender, being married, belonging to nuclear families, service class and urban domicile are the significant factors determining higher risk of stress and developing more psychopathologies. Furthermore, coping styles used by the patients have a greater moderating effect on mental health symptoms and their perceived stress which can be a major area for interventions to reduce the mental health morbidities.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic have serious impact on both physical and mental health. The general public and COVID-19 patients suffered from the spread of the epidemic and the psychological stress caused major social crises, such as virus threats, drug interventions, life changes, and uncertainties. Considering this unprecedented pandemic a stress, its psychological response is widely researched now. A search of the PubMed electronic database and google scholar was undertaken using the search terms 'novel coronavirus', 'COVID-19', 'nCoV', SARS-CoV-2, 'mental health symptoms', 'perceived stress', 'anxiety', 'depression' and 'stress' in various permutations and combinations. A study on biological and social consequences of SARS-CoV-2, showed that COVID-19 patients reported various acute

neurological presentations like stroke, altered state of consciousness, other cerebrovascular diseases and mental health symptoms in the form of depression, anxiety, Post traumatic stress disorder and psychosis. The exact mechanism of how corona virus infest brain is not known, however it can reach brain through olfactory bulb, crossing blood brain barrier and involve ACE2 receptors. Also, biological alterations in brain like microglia activation and cytokine signaling might be associated with mental health symptoms.¹ The perceived stress² and coping mechanisms³ are some of known easily measurable domains which modify individual response and symptom manifestations.⁴

However, the infectiousness of COVID-19 makes it difficult for to reach the patients directly. Studies in the mental health of general populations,⁵ high-risk populations like frontline healthcare workers^{4,6-8} could only be conducted through self-report online measures.

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Studies on patients infected with the virus and having related manifestations are comparatively low.

Some cross-sectional and very short follow-up studies have reported symptoms and disorders like depression, anxiety, posttraumatic stress disorders as common manifestations while some have also reported symptoms of somatization,⁹ stress-related adjustment disorders, obsessive-compulsive disorders, acute psychosis,¹⁰ self-injurious thoughts and behaviours.^{9,11–16} However, these studies on predictors of mental health issues or psychiatric symptoms in COVID-19 patients, conducted in various parts of the worlds are either limited to specific geographic areas or suffer other limitations.^{10–18}

A systematic review was conducted to assess implications of Covid-19 on mental health and reported that the vulnerable population comprising of Health care frontline workers, people with preexisting comorbidity, children and elderly population suffered from stress, denial, anger, insomnia, depression, anxiety and suicidal behavior. There was recommendation for the need of Telemedicine services, toll free numbers for psychological help and developing state specific need-based interventions for vulnerable groups.¹⁹ An Indian study exploring mental health issues and Indian perspective during Covid-19 also advocated increased use of Telemedicine, Telepsychiatry and E-Teaching and use of mobile phones to be in touch with family and friends and maintaining social relationship.²⁰ However, these studies have specifically focused on stress and stress related symptoms like fear, anxiety and depression and not assessed wider domains of DSM-5 symptoms in relation to COVID-19. Some studies including a few systematic reviews, which focused more on long-term effects (post COVID-19 Syndrome), reported that some patients showed clinically significant depressive episodes, cognitive impairment or fatigue, 12 or more weeks following COVID-19. Another qualitative study reported some COVID-19 patients developed more significant post-traumatic stress symptoms compared to age and gender matched psychiatric patients and healthy controls.^{21–23}

Henceforth with the above background, this study aims primarily to investigate the mental health outcome of the COVID-19 pandemic in terms of severity of perceived stress and wide domains of psychiatric symptoms reported on initial screening in hospitalized patients of COVID-19. Another aim of this study was to determine the role of sociodemographic factors and coping styles in the hospitalized patients of COVID-19.

2. Method

2.1. Study sample

A total of 243 patients responded who were hospitalized in isolation wards due to COVID-19 infection out of which 19 responses were excluded due to incomplete and inconsistent responses. Hence 224 responses formed the study sample. They were approached through purposive sampling method. The inclusion criteria were all patients admitted to isolation wards of our hospital; able to understand Hindi or English and have access to device and the internet to fill questionnaires (online); willing to participate in the study.

2.2. Study tools

The questionnaire had five sections: i) description of the study and informed consent, ii) sociodemographic characteristics which included age, gender, marital status, family type, education, occupation and domicile, iii) 10 questions of Perceived Stress Scale (PSS), iv) 14 subscales (2 questions per subscale) of Brief Cope inventory, and v) 23 questions of DSM-5 level-1 cross-cutting questionnaire. In the study we used the term “COVID-19 Status” which was reported by the respondents and referred to “COVID-19 positive or negative status at the time of responding to the study questionnaires”. Data were collected anonymously, with only one response was permitted per person. To ensure pandemic-specific answers, it was explicitly described in the

informed consent and in each section of the questionnaires, and the term “during current COVID-19 pandemic scenario” was used with each question, where it was required.

The Perceived Stress Scale (PSS)² was used to assess stress levels. For example, the PSS asks about feelings and emotions “over the last month”. PSS scores ≥ 10 have a sensitivity of 88% and a specificity of 88% for major Depression and require treatment.

The Brief COPE²⁴ is made up of 28 items divided into 14 subscales. Problem-focused coping and emotion-focused coping is split into two primary four-point Likert scale from the 14 subscales. High scores on the scale mean that a specific coping mechanism is used more often.

The DSM-5 Level 1 Cross-Cutting Symptom Measure,²⁵ a self-administered tool, was used to assess the mental health domains with importance across psychiatric diagnoses. This adult version of the measure consists of 23 questions (of 23 symptoms) that assess 13 psychiatric domains, and screen “Mild” or “Greater” risk of symptoms which need to be further evaluated on Level-2 cross-cutting questionnaire. Each item asks about how much (or how often) the individual has been bothered by the specific symptom during the past two weeks. The measure was clinically helpful and had good test-retest reliability in the DSM-5 Field. For the additional enquiry (i.e. Level 2) it is suggested to count highest scored item in any particular domain in the DSM-5 cross cutting level 1, but here in our study we have scored each items individually as we did not intend to go the DSM-5 level2 assessment.

2.3. Study design and procedure

Data collection was cross-sectional during the period of 1st June to December 30, 2020. Participants were recruited online through an invitation provided on WhatsApp through health care workers of the isolation wards. This approach of online recruitment was selected primarily due to the pandemic situation, which prevented us from collecting data in person. According to the aim of the study, it was necessary for us to capture the mental health status of participants at the time of the pandemic; thus an a posteriori study would not have provided useful and reliable information. Participation was voluntary. All participants were required to read and provide informed consent before beginning the online questionnaire. This paper is part of a large project, “A study of psychological and behavioral mental health aspect of COVID-19” and the institutional ethics committee approved the research at the university (ref.code. II ECM COVID-19 IB/P7, letter no. 281/Ethics/2020). At the beginning of the questionnaire, patients who required emergency treatment and were kept in ICUs isolation were not asked to participate in the study. COVID-19 status was asked along with other sociodemographic data before applying standard questionnaires. Some patients who faced any difficulty in filling the form were assisted telephonically to resolve their queries.

2.4. Data management and analysis

Data were exported from Google Forms to Microsoft Excel spreadsheet and coded. Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) Statistics for Windows, Version 28.0 (IBM Corp., USA, 2021). Normality test was performed using Kolmogorov-Smirnov test and Demographic characteristics we summarized using Chi-square, means and standard deviations. Group differences in distribution of scores of total PSS scores and scores of each symptom of DSM-5 level-1 was seen using Mann-Whitney *U* test using an exact sampling distribution for *U*.²⁶ A multivariable regression analysis was run to investigate the relationship between the individual DSM-5 symptom scores, PSS-10 score and the independent variables (sociodemographic factors and COVID-19 status) to impact the level of perceived stress as well as severity of DSM-5 symptoms. The collinearity assumption was checked prior to running the model, using the tolerance and variance inflation factor (VIF).²⁷ As a rule of thumb, if $VIF > 10$ the assumption is greatly violated. The results indicated that the collinearity

assumption was not violated by any of the independent variables entered in the regression model. The analysis was performed entering the step wise model followed by “Enter” selection method, which identified predictors with a significant ($p < 0.05$) individual association with the outcome. The results were reported as unstandardized coefficients, as recommended by Friedrich.²⁸

3. Results

Sociodemographic details are given in Table 1. Test of normalcy was done for outcome variable (PSS score and DSM-5 symptoms scores and sociodemographic factors, KS test shown that data was not normally distributed (significance was <0.05).

3.1. Level of perceived stress and psychiatric symptoms

The major outcome variable in the study was perceived stress (total PSS scores) and psychiatric symptoms (Scores of each symptom in DSM-5 level-1 cross cutting questionnaire). Table 2 shows the different severity of perceived stress perceived by the study participants. Most of the study subjects had perceived moderate level of stress followed by mild and severe. Proportions of patients of “mild and greater” psychopathologies are given in Table 3. Association of individual sociodemographic factors and COVID-19 status with PSS and DSM-5 symptoms are mentioned below and the observations details are provided in Table 1 in the supplementary materials.

3.1.1. Gender

The study found that perceived stress by females was significantly higher than their male counterparts and they also scored higher on ‘depressive symptoms’, ‘unexplained aches and pains’. While males scored higher on symptom domains of ‘Starting lots more projects than usual or doing more risky things than usual’, ‘hearing voices’, thought phenomenon, problems with memory, ‘unpleasant thoughts, urges, or images’, ‘compulsions’ and use of alcohol, smoking and other substances.

3.1.2. Marital status

Married participants reported higher ‘perceived stress’, ‘depression’, anger, anxiety, ‘unexplained aches and pains’, ‘compulsion’, dissociation and impaired personality function as compared to those who were unmarried.

3.1.3. Family types

Subjects belonging to nuclear family reported significantly higher perceived stress, ‘depressed mood or hopelessness’, ‘new plans or doing risky activity’, anxiety, somatic concerns, problems with memory, impairment in personality functions and using substances other than

Table 1
Sociodemographic profile of COVID-19 patients ($n=224$).

Sociodemographic factors		N	%
Gender	Male	156	69.6
	Female	68	30.4
Marital status	Single	76	33.9
	Married	148	66.1
Family type	Nuclear	132	58.9
	Joint	92	41.1
Domicile	Urban	196	87.5
	Rural	28	12.5
Occupation	Non-working	39	17.4
	Self-employed	62	27.7
	Service	123	54.9
Education	Up to High school	66	29.5
	Graduate	117	52.2
	Postgraduate	41	18.3
Age in years (Mean \pm SD)		35.14 \pm 11.18	

Table 2
Showing categories of perceived stress ($n=224$).

	Mild	Moderate	Severe	Total
Mean	8.15	19.44	30.00	16.73
SD	4.42	3.39	4.18	8.20
N (%)	80 (35.7)	116 (51.8)	28 (12.5)	224 (100)

alcohol or smoking, as compared to those belong to joint family.

3.1.4. Domicile

Subjects with urban domicile perceived higher stress than those with rural and they reported higher scores on depression, decrease need for sleep, suicidal or self-injurious thoughts, hearing voices, compulsion, personality changes, and alcohol use.

3.1.5. Education

People who were graduates reported higher perceived stress as compared to those educated up to high school. All the three-education groups also differed significantly in reports of psychiatric symptoms.

3.1.6. Occupation

Based on occupation the groups did not differ in perceived stress, but they differ in psychiatric symptoms. (For details of group comparisons refer to supplementary material).

3.1.7. COVID-19 status

Those who were COVID-19 positive perceived higher stress ($p < 0.001$) and reported high scores on anxiety, sleep problems, obsessions, and dissociation. While those who become negative reported high in personality impairment.

3.2. The role of sociodemographic variables and coping styles in perceived stress

The first hierarchical multiple regression analysis was run to see the effect of variables^{9,12,14,16–18} known to affect perceived stress. In next step scores of all coping styles were added to the model and lastly a factor of COVID-19 positive status to see their effect on perceived stress scores. All the three models predicted the perceived stress (ANOVA $p = 0.0005$). Coping styles explains most of variance (64.8%, $\Delta R^2 = 0.648$) of the perceived stress and among all coping styles self-distraction, planning, humor, behavioral disengagement, venting, using substance, praying, or having faith in religion, contributed significantly to this variance. COVID-19 status also contributes significantly to the variance of the final model. The final model accounted for a significant proportion of the variance in the level of perceived stress ($R^2 = 0.700$, adjusted $R^2 = 0.669$, F -change (1,2029) = 22.488, $p < 0.001$). (see Table 4 for the model summary and collinearity statistics are provided in the Table 2 of the supplementary materials).

3.2.1. Role of perceived stress (PSS score) on DSM-5 symptoms

Similarly, another hierarchical multiple regression analysis was run to see effect of Total PSS scores on each symptom of the DSM-5 questionnaire, and this model significantly predicted each symptom except the “anhedonia” and “alcohol use”. (Table .5).

3.3. Impact of various coping styles on DSM-5 symptoms

To better understand the role of coping styles in predicting the severity of DSM-5 symptoms, a second multiple linear regression was run. This second model accounted for a larger proportion of the variance in the level of all the symptoms as compared to the previous model (Table .5).

Table 3
Showing proportions of patients showing mild and greater psychopathology (n=224).

Serial no.	Domain name	DSM-5 level-1 Cross-cutting symptoms	Greater (%)	Mild (%)
1.	Depression	1. Little interest or pleasure in doing things?	53.6	46.4
		2. Feeling down, depressed, or hopeless?	39.3	60.7
2	Anger	3. Feeling more irritated, grouchy, or angry than usual?	35.7	64.3
3	Mania	4. Sleeping less than usual, but still have a lot of energy?	44.6	55.4
		5. Starting lots more projects than usual or doing more risky things than usual?	32.1	67.9
4	Anxiety	6. Feeling nervous, anxious, frightened, worried, or on edge?	37.5	62.5
		7. Feeling panic or being frightened?	41.1	58.9
		8. Avoiding situations that make you anxious?	53.6	46.4
5	Somatic symptoms	9. Unexplained aches and pains (e.g., head, back, joints, abdomen, legs)?	30.4	69.6
		10. Feeling that your illnesses are not being taken seriously enough?	32.1	67.9
6	Suicidal Ideation	11. Thoughts of actually hurting yourself?	16.1	83.9
7	Psychosis	12. Hearing things other people couldn't hear, such as voices even when no one was around?	16.1	83.9
		13. Feeling that someone could hear your thoughts, or that you could hear what another person was thinking?	23.2	76.8
8	Sleep problems	14. Problems with sleep that affected your sleep quality over all?	35.7	64.3
9	Memory problems	15. Problems with memory (e.g., learning new information) or with location (e.g., finding your way home)?	21.4	78.6
10	Repetitive thoughts and behaviours	16. Unpleasant thoughts, urges, or images that repeatedly enter your mind?	23.2	76.8
		17. Feeling driven to perform certain behaviours or mental acts over and over again?	30.4	69.6
11	Dissociation	18. Feeling detached or distant from yourself, your body, your physical surroundings, or your memories?	28.6	71.4
12	Personality functioning	Not knowing who you really are or want out of life?	19.6	80.4
		20. Not feeling close to other people or enjoying your relationships with them?	30.4	69.6
13	Substance use	Drinking at least 4 drinks of any kind of alcohol in a single day?	16.1	83.9
		22. Smoking any cigarettes, a cigar, or pipe, or using snuff or chewing tobacco	23.2	76.8
		23. Using any of the following medicines ON YOUR OWN, that is, without a doctor's prescription, in greater amounts or longer than prescribed.	7.1	92.9

3.4. Impact of knowing COVID-19 report on DSM-5 symptoms

We added COVID-19 status (positive/negative) to the previous model and found the Significant F-change in 'decreased need for sleep', anxiety, fear, auditory hallucination, dissociation, and the symptom "not knowing who you really are or what you want out of your life" of indicating impaired personality functioning. The addition of COVID-19 status did not affect the significance of the prediction model of any symptom (Table 5).

3.5. Role of sociodemographic factors on DSM-5 symptoms

Factors like age (years), gender, marital status, family type, domicile, education, and occupation known to affect the psychiatric symptoms and we added these factors in the previous model to understand their effect on overall variance predicted by the previous models. We found that the factors had significant change in the overall variance measured by the previous models except for 'somatic concern'.

We can conclude that this final model accounted for a larger size of the variance in the level of all the symptoms as compared to the previous model and broadly the effect of total PSS score was less on symptoms like "new plans", "psychosis", and "substance use". Effect size of Total PSS score was highest, followed by Coping styles and least by other sociodemographic factors (See Table 5 for the model summary and see supplementary material for further details).

4. Discussion

In the present study, we found that those who belong to female gender, nuclear families, and were married perceived significantly higher stress than their respective counterparts. Our finding is consistent with some large sample studies of recovered patients of COVID-19 showing that being younger than 50 years and female gender was significantly associated with a higher probability of reporting anxiety and depression.¹⁴ A similar large multicentric study conducted in Wuhan¹⁵ showed female gender as higher risk of anxiety, depression and stress but found mid age and elderly as high risk for such mental health symptoms. Similarly, other studies have reported that female gender is vulnerable in facing public health emergencies.²⁹ On one hand aging population have advantage of better emotion-regulation capacities in stressful situation on the other hand they suffer because of higher mortality, increased comorbidities and compromised immune status.^{30,31} We could not find a significant correlation of age and perceived stress. Previous reports about role of age and severe stressful situations have shown mixed results and indicates need for further research.³² Patient who belong to nuclear families were more stressed and the possible reasons may be because they don't have sufficient number of helping hands in their families to take care of their family needs and share responsibilities which may easily be done by members in joint family during such public emergencies.³³ People who were married were more stressed as compared to those who were unmarried, and this can also be explained by the fact that married people have large financial and social responsibility towards their family. Also married and nuclear family man after contracting COVID-19 and getting isolated was concerned about their spouse or kids at home than those who were unmarried and had no such responsibilities. Indian studies during the pandemic have contrasting reports about the marital status as one showing "married status" associated with high fear³⁴ while other studies conducted in health care workers^{8,35} indicate opposite results and find being married as a protective factor. The marital status can be considered as a 'support system' when they are living together while population in the present study, hospitalized and isolated away from their spouse and kids, with fear of infection (in them) and death (of self or their loved ones),³⁶ may act as factors for higher stress. In our study those who belonged to urban setup, high educational status and people who were in job or service perceived higher stress and this finding can be

Table 4

Model summary of Hierarchical regression models (1,2,3) of PSS total as dependent variable and Sociodemographic factors, coping styles and COVID status as predictors.

Model no.	R ²	ΔR ²	Std. Error of the Estimate	F Change	df1	df2	Sig. F Change	Durbin Watson
1	.205	.183	7.417	9.337	6	217	<.001	2.301
2	.680	.648	4.866	21.508	14	203	<.001	
3	.700	.669	4.720	13.800	1	202	<.001	

Dependent Variable: PSSTotal.

Model no. 1. Predictors: (Constant), Family type, Marital status, Occupation, Education, Gender, Age in years.

Model no. 2. Predictors: (Constant), Family type, Marital status, Occupation, Education, Gender, Age in years, Acceptance, Humor, Denial, Instrumental support, Substance, Planning, Venting, Self-Distraction, Religion, Behavioural disengagement, Active coping, Positive Reframing, Self-blaming, Emotional support.

Model no. 3. Predictors: (Constant), Family type, Marital status, Occupation, Education, Gender, Age in years, Acceptance, Humor, Denial, Instrumental support, Substance, Planning, Venting, Self-Distraction, Religion, Behavioural disengagement, Active coping, Positive Reframing, Self-blaming, Emotional support, COVID Status.

attributed to their higher knowledge or awareness and risk of COVID-19 than those who were less educated, living in rural background and non-service population.³⁷ There is contradictory findings in another study³⁴ on Indian population also which revealed that “lower education” was associated with higher stress. It should be noted that those who had positive COVID-19 status were more stressed and showing anxiety symptoms as compared to those who become negative. This finding supports the previous model of disease exposure—severe the disease, more the symptoms.^{38,39} A multinational study that included seven Asian countries had findings similar to our study. According to this study, the risk factors for adverse mental health outcomes were young age and higher educational background, and protective factors were male gender and living with children or more than 6 people in same household. However, this study reported being single/separated as a risk factor, which is different from our finding.⁴⁰

In our analysis, we found that the level of perceived stress was highly contributed by different coping styles followed by factors like age, gender, marital status, type of family, occupation, and place of residence. In next hierarchical regression model, we have also established that DSM-5 symptoms were significantly affected by the level of perceived stress and the effect of coping styles significantly increased the overall variance. Other psychosocial factors do also affect the psychopathology in all the models but compared to coping styles the change in variance was low (but significant). (Tables 4 and 5 in supplementary materials).

In our study we have screened patients for 23 symptoms of 12 domains of DSM-5 diagnoses (details are given in Table 3) which should be interpreted and understood in the light of “transdiagnostic processes”.⁴¹ Mere presence of “mental symptoms” are indicative of broad range of psychiatric diagnosis. By saying transdiagnostic processes we refer to those processes which overlap across multiple diagnoses. These processes may occur at multiple levels for example at symptom level, like insomnia and at cognitive level like ‘attentional bias’, ‘emotional regulation’, ‘hyperarousal states’ at deeper levels. In our study, proportion of people reporting higher psychopathologies are reported which only indicate that they should be further tested on level 2 questionnaire and further diagnostic workup is required. Taking the perspective of COVID-19 hospitalized patients there are symptoms like depression, anxiety, fear, somatic concerns, sleep and memory problems, suicidal thoughts and dissociation which can be considered as direct expression of stress response as discussed in previous studies of COVID-19. While there are other symptoms like “decreased need for sleep”, “new plans or risky activities, auditory hallucination, or thought alienation and compulsion which can be understood as distal manifestations of stress response emerging due to “hyperarousal or behavioural inhibitory processes”, “attentional bias”, “emotion regulation difficulties”. These transdiagnostic approaches may be one possible explanation for our finding at this initial research level which could help further research to focus on these factors for a better and clear understanding. In our study, we also found that perceived stress could not predict symptom of “anhedonia” and “alcohol use” which indicated that these factor in

certain individual be decided by deeper biological vulnerabilities than immediate stress. Addition of coping styles in regression analysis brought highest change in the variance which was maintained high even after adding factors of COVID-19 status and other sociodemographic factors. One can easily see the effect of area under curve is very less in “anhedonia”, “manic symptoms” “psychotic symptoms”, and “substance use”, as these symptoms are representing deeper biological underpinnings as compared to others.

Having large number of populations of hospitalized patients of COVID-19 and use of standardized measures was key strength of this study. However, this study has certain inbuilt limitation with use of self-report surveillance methodology due to quarantine measure during the study. We cannot comment on the directionality and causality in the relationship between the dependent and independent variables as this was a cross-sectional data analysis and there is no non-COVID-19 comparison group. It is quite likely that the common people and/or family members of the infected persons have similar responses as those of the Covid-19 patients. Furthermore, the study has not included the severity of the COVID-19 and comorbidities; hence we cannot account for its effects. Our study includes a small section of population and limited to a single center hence large multicentric or nationwide studies are needed for better prediction of factors leading to mental health consequences in COVID-19 patients.

This study could highlight certain factors like female gender, being married, belonging to nuclear families, service class people and urban domicile are significant factors determining higher risk of stress and developing more psychopathologies. Furthermore, coping styles used by the patients have a greater moderating effect on mental health symptoms and their perceived stress which can be a major area for interventions to reduce the mental health morbidities. These finding also indicates that these interventions can be prioritized for vulnerable sections like females, being married, living in nuclear families, and working in service sectors in urban areas.

Looking at future prospects and utility of this study, our findings, such as risk factors and coping styles, can help in developing treatment modalities of mental health consequences of COVID-19, including non-pharmacological methods. The existing evidence base points to CBT as a treatment option of mental health outcomes and depressive symptoms like sleep disturbances. Moreover, internet based CBT has benefits like reduced risk of infection spread and cost effectiveness.^{42–45}

Declaration for informed consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

Table 5
Model summary of HRM of symptoms of DSM-5.

Dependent variable DSM-5 symptom	Model no.	R ²	ΔR ²	Std. Error of the Estimate	F Change	df1	df2	Sig. F Change
1. Little interest or pleasure in doing things?	1	0.013	0.009	1.681	2.978	1	222	0.086
	2	0.354	0.308	1.404	7.855	14	208	0.000
	3	0.365	0.316	1.396	3.371	1	207	0.068
	4	0.486	0.427	1.278	6.754	7	200	0.000
2. Feeling down, depressed, or hopeless?	1	0.134	0.130	1.344	34.393	1	222	0.000
	2	0.413	0.371	1.143	7.062	14	208	0.000
	3	0.418	0.373	1.142	1.686	1	207	0.196
	4	0.564	0.514	1.005	9.571	7	200	0.000
3. Feeling more irritated, grouchy, or angry than usual?	1	0.360	0.358	1.204	125.116	1	222	0.000
	2	0.612	0.584	0.969	9.652	14	208	0.000
	3	0.616	0.587	0.966	2.150	1	207	0.144
	4	0.678	0.641	0.901	5.439	7	200	0.000
4. Sleeping less than usual, but still have a lot of energy?	1	0.023	0.019	1.427	5.291	1	222	0.022
	2	0.287	0.236	1.259	5.507	14	208	0.000
	3	0.309	0.255	1.243	6.355	1	207	0.012
	4	0.420	0.354	1.158	5.505	7	200	0.000
5. Starting lots more projects than usual or doing more risky things than usual?	1	0.051	0.046	1.245	11.864	1	222	0.001
	2	0.312	0.262	1.095	5.635	14	208	0.000
	3	0.312	0.259	1.097	0.092	1	207	0.762
	4	0.408	0.340	1.036	4.623	7	200	0.000
6. Feeling nervous, anxious, frightened, worried, or on edge?	1	0.413	0.410	1.146	156.100	1	222	0.000
	2	0.548	0.515	1.040	4.424	14	208	0.000
	3	0.558	0.524	1.030	5.043	1	207	0.026
	4	0.616	0.572	0.977	4.286	7	200	0.000
7. Feeling panic or being frightened?	1	0.368	0.366	1.191	129.488	1	222	0.000
	2	0.592	0.563	0.988	8.147	14	208	0.000
	3	0.597	0.565	0.985	2.292	1	207	0.132
	4	0.720	0.688	0.835	12.628	7	200	0.000
8. Avoiding situations that make you anxious?	1	0.381	0.379	1.201	136.850	1	222	0.000
	2	0.562	0.530	1.044	6.126	14	208	0.000
	3	0.592	0.560	1.010	15.239	1	207	0.000
	4	0.662	0.623	0.935	5.921	7	200	0.000
9. Unexplained aches and pains (e.g., head, back, joints, abdomen, legs)?	1	0.241	0.238	1.340	70.675	1	222	0.000
	2	0.522	0.487	1.099	8.705	14	208	0.000
	3	0.522	0.485	1.101	0.236	1	207	0.628
	4	0.583	0.535	1.047	4.128	7	200	0.000
10. Feeling that your illnesses are not being taken seriously enough?	1	0.307	0.304	1.161	98.191	1	222	0.000
	2	0.442	0.402	1.076	3.600	14	208	0.000
	3	0.443	0.400	1.078	0.410	1	207	0.523
	4	0.472	0.411	1.068	1.545	7	200	0.154
11. Thoughts of actually hurting yourself?	1	0.089	0.085	0.951	21.652	1	222	0.000
	2	0.351	0.304	0.830	5.989	14	208	0.000
	3	0.362	0.312	0.825	3.538	1	207	0.061
	4	0.550	0.498	0.705	11.945	7	200	0.000
12. Hearing things other people couldn't hear, such as voices even when no one was around?	1	0.028	0.023	0.592	6.294	1	222	0.013
	2	0.281	0.229	0.526	5.244	14	208	0.000
	3	0.314	0.261	0.514	10.029	1	207	0.002
	4	0.480	0.421	0.456	9.127	7	200	0.000
13. Feeling that someone could hear your thoughts, or that you could hear what another person was thinking?	1	0.144	0.140	1.023	37.245	1	222	0.000
	2	0.391	0.347	0.891	6.028	14	208	0.000
	3	0.391	0.344	0.893	0.082	1	207	0.775
	4	0.582	0.534	0.753	13.018	7	200	0.000
14. Problems with sleep that affected your sleep quality over all?	1	0.267	0.263	1.106	80.663	1	222	0.000
	2	0.452	0.413	0.987	5.035	14	208	0.000
	3	0.453	0.411	0.989	0.345	1	207	0.558
	4	0.574	0.525	0.888	8.130	7	200	0.000
15. Problems with memory (e.g., learning new information) or with location (e.g., finding your way home)?	1	0.032	0.028	1.276	7.448	1	222	0.007
	2	0.337	0.289	1.091	6.826	14	208	0.000
	3	0.337	0.286	1.094	0.082	1	207	0.775
	4	0.440	0.376	1.023	5.261	7	200	0.000
16. Unpleasant thoughts, urges, or images that repeatedly enter your mind?	1	0.284	0.281	1.122	88.093	1	222	0.000
	2	0.436	0.395	1.029	3.993	14	208	0.000
	3	0.436	0.393	1.031	0.236	1	207	0.628
	4	0.521	0.465	0.967	5.017	7	200	0.000

(continued on next page)

Table 5 (continued)

Dependent variable DSM-5 symptom	Model no.	R ²	ΔR ²	Std. Error of the Estimate	F Change	df1	df2	Sig. F Change
17. Feeling driven to perform certain behaviors or mental acts over and over again?	1	0.083	0.079	1.323	20.152	1	222	0.000
	2	0.304	0.254	1.191	4.705	14	208	0.000
	3	0.304	0.250	1.194	0.000	1	207	0.991
	4	0.407	0.339	1.121	4.991	7	200	0.000
18. Feeling detached or distant from yourself, your body, your physical surroundings, or your memories?	1	0.168	0.165	1.240	44.958	1	222	0.000
	2	0.461	0.423	1.031	8.082	14	208	0.000
	3	0.473	0.432	1.022	4.391	1	207	0.037
	4	0.631	0.589	0.870	12.262	7	200	0.000
19. Not knowing who you really are or want out of life?	1	0.065	0.061	1.285	15.406	1	222	0.000
	2	0.311	0.262	1.139	5.316	14	208	0.000
	3	0.348	0.298	1.111	11.771	1	207	0.001
	4	0.581	0.533	0.906	15.872	7	200	0.000
20. Not feeling close to other people or enjoying your relationships with them?	1	0.212	0.208	1.192	59.648	1	222	0.000
	2	0.551	0.519	0.929	11.243	14	208	0.000
	3	0.551	0.517	0.931	0.006	1	207	0.937
	4	0.618	0.575	0.874	5.026	7	200	0.000
21. Drinking at least 4 drinks of any kind of alcohol in a single day?	1	0.002	-0.003	0.775	0.362	1	222	0.548
	2	0.338	0.290	0.652	7.550	14	208	0.000
	3	0.341	0.290	0.652	0.993	1	207	0.320
	4	0.492	0.434	0.583	8.491	7	200	0.000
22. Smoking any cigarettes, a cigar, or pipe, or using snuff or chewing tobacco	1	0.074	0.070	1.000	17.780	1	222	0.000
	2	0.413	0.371	0.823	8.594	14	208	0.000
	3	0.417	0.372	0.822	1.301	1	207	0.255
	4	0.449	0.385	0.813	1.630	7	200	0.129
23. Using any of the following medicines ON YOUR OWN, that is, without a doctor's prescription, in greater amounts or longer than prescribed.	1	0.005	0.001	0.343	1.166	1	222	0.281
	2	0.515	0.480	0.247	15.629	14	208	0.000
	3	0.515	0.478	0.248	0.000	1	207	0.996
	4	0.577	0.528	0.236	4.157	7	200	0.000

1. Predictors: (Constant), PSS Score Total.

2. Predictors: (Constant), PSS Total, Behavioral disengagement, Humor, Denial, Acceptance, Substance, Instrumental support, Self-Distraction, Venting, Religion, Planning, Active coping, Self-blaming, Positive-Reframing, Emotional support.

3. Predictors: (Constant), PSS Total, Behavioral-disengagement, Humor, Denial, Acceptance, Substance, Instrumental support, Self-Distraction, Venting, Religion, Planning, Active coping, Self-blaming, Positive-Reframing, Emotional support, COVID Status.

4. Predictors: (Constant), PSS Total, Behavioral-disengagement, Humor, Denial, Acceptance, Substance, Instrumental support, Self-Distraction, Venting, Religion, Planning, Active coping, Self-blaming, Positive-Reframing, Emotional support, COVID Status, Occupation, Education_cat2, Marital status, Family type, Domicile, Gender, Age (years).

Durbin-Watson value was used to identify co-dependency or independence of residuals between independent factors and was approximately two and the range was 1.641–2.246).²²

Earlier presentation

None.

Ethical approval

The study is approved by the Institutional Ethics Committee of King George's Medical University, Lucknow (Ref. Code:11th ECM COVID-19 1B/P7).

The authors of this article had access to all study data, are responsible for all contents of the article, had authority over manuscript preparation, and decided to submit the manuscript for publication. All listed authors have approved of the submission of the manuscript to the journal.

Declaration

The manuscript has been read and approved by all the authors, that the requirements for authorship as stated earlier in this document have been met, and that each author believes that the manuscript represents honest work.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cegh.2022.101209>.

References

- 1 Szcześniak D, Gładka A, Misiak B, Cyran A, Rymaszewska J. The SARS-CoV-2 and mental health: from biological mechanisms to social consequences. *Prog Neuro-Psychopharmacol Biol Psychiatry*. 2021;104, 110046.
- 2 A global measure of perceived stress [Internet]. APA PsycNET PsycNET; 2021 Dec 7. Available from: <https://psycnet.apa.org/record/1984-24885-001>.
- 3 Baker JP, Berenbaum H. *Emotional Approach and Problem-Focused Coping: A Comparison of Potentially Adaptive Strategies* [Internet]. CognEmot; 2007. Feb 3 [cited 2021 Dec 7]; Available from: <https://www.tandfonline.com/doi/abs/10.1080/02699930600562276>.
- 4 Kar N, Kar B, Kar S. Stress and coping during COVID-19 pandemic: result of an online survey. *Psychiatr Res*. 2021 Jan;295, 113598.

- 5 Krishnamoorthy Y, Nagarajan R, Saya GK, Menon V. Prevalence of psychological morbidities among general population, healthcare workers and COVID-19 patients amidst the COVID-19 pandemic: a systematic review and meta-analysis. *Psychiatr Res*. 2020 Nov;293, 113382.
- 6 A B, L L, M I V, et al. Psychological effects of the COVID-2019 pandemic: perceived stress and coping strategies among healthcare professionals [Internet] *Psychiatr Res*; 2020 Nov [cited 2021 Dec 7];293. Available from: <https://pubmed.ncbi.nlm.nih.gov/32798932/>.
- 7 Jamir L, Najeeb S, Aravindakshan R. COVID-19 preparedness among public and healthcare providers in the initial days of nationwide lockdown in India: a rapid electronic survey. *J Fam Med Prim Care*. 2020 Sep;9(9):4756.
- 8 W W, Jp R, S R, et al. Prevalence and predictors of stress, anxiety, and depression among healthcare workers managing COVID-19 pandemic in India: a nationwide observational study [cited 2021 Dec 7] *Indian J Psychol Med*. 2020 Jul 6;42(4). Available from: <https://pubmed.ncbi.nlm.nih.gov/33398224/>.
- 9 Wang M, Hu C, Zhao Q, et al. Acute psychological impact on COVID-19 patients in Hubei: a multicenter observational study. *Transl Psychiatry*. 2021 Feb 18;11(1):1–9.
- 10 A V, N T, Ma E, et al. Neurological and neuropsychiatric complications of COVID-19 in 153 patients: a UK-wide surveillance study [Internet] *Lancet Psychiatry*; 2020 Oct [cited 2021 Dec 7];7(10). Available from: <https://pubmed.ncbi.nlm.nih.gov/32593341/>.
- 11 Chen Y, Huang X, Zhang C, et al. Prevalence and predictors of posttraumatic stress disorder, depression and anxiety among hospitalized patients with coronavirus disease 2019 in China. *BMC Psychiatr*. 2021 Dec;21(1):1–8.
- 12 Q G, Y Z, J S, et al. Immediate Psychological Distress in Quarantined Patients with COVID-19 and its Association with Peripheral Inflammation: A Mixed-Method Study [Internet]. *Brain Behav Immun*; 2020 Aug [cited 2021 Dec 7];88. Available from: <https://pubmed.ncbi.nlm.nih.gov/32416290/>.
- 13 F I, Jcs B, T B, et al. Post-infection depressive, anxiety and post-traumatic stress symptoms: a prospective cohort study in patients with mild COVID-19 [cited 2021 Dec 7] *Prog Neuro-Psychopharmacol Biol Psychiatry*. 2021 Dec 20;111. Available from: <https://pubmed.ncbi.nlm.nih.gov/33940097/>.
- 14 M K, R V-H, J S. Prevalence of mental health problems and its associated factors among recovered COVID-19 patients during the pandemic: a single-center study [Internet] *Front Psychiatr*; 2021. Mar 31 [cited 2021 Dec 7];12. Available from: <https://pubmed.ncbi.nlm.nih.gov/33868043/>.
- 15 Li L, Wu MS, Tao J, et al. A Follow-Up Investigation of Mental Health Among Discharged COVID-19 Patients in Wuhan, China [Internet]. *Front Public Health*; 2021 [cited 2021 Dec 7];0. Available from: <https://www.frontiersin.org/articles/10.3389/fpubh.2021.640352/full>.
- 16 Matalon N, Dorman-Ilan S, Hasson-Ohayon I, et al. Trajectories of post-traumatic stress symptoms, anxiety, and depression in hospitalized COVID-19 patients: a one-month follow-up. *J Psychosom Res*. 2021 Apr;143, 110399.
- 17 Q X, F F, Xp F, et al. COVID-19 patients managed in psychiatric inpatient settings due to first-episode mental disorders in Wuhan, China: clinical characteristics, treatments, outcomes, and our experiences. *Transl Psychiatry*. 2020 Oct 2;10(1) [cited 2021 Dec 7] <https://pubmed.ncbi.nlm.nih.gov/33009366/>.
- 18 Dobre D, Schwan R, Jansen C, et al. Clinical features and outcomes of COVID-19 patients hospitalized for psychiatric disorders: a French multi-centered prospective observational study. *Psychol Med*. :1.
- 19 Roy A, Singh AK, Mishra S, Chinnadurai A, Mitra A, Bakshi O. Mental health implications of COVID-19 pandemic and its response in India. *Int J Soc Psychiatr*. 2021;67(5):587–600.
- 20 Dalal PK, Roy D, Choudhary P, Kar SK, Tripathi A. Emerging mental health issues during the COVID-19 pandemic: an Indian perspective. *Indian J Psychiatr*. 2020 Sep; 62(Suppl 3):S354–S364, 2020/09/28.
- 21 Onset and frequency of depression in post-COVID-19 syndrome: a systematic review. *J Psychiatr Res*. 2021 Dec;144:129–137. <https://doi.org/10.1016/j.jpsychires.2021.09.054>. Epub 2021 Sep 30. PMID: 34619491; PMCID: PMC8482840.
- 22 Fatigue and cognitive impairment in post-COVID-19 syndrome: a systematic review and meta-analysis. *Brain Behav Immun*. 2021 Dec 29;S0889–1591(21). <https://doi.org/10.1016/j.bbi.2021.12.020>, 00651-00656, Epub ahead of print. PMID: 34973396.
- 23 Hao F, Tam W, Hu X, et al. A quantitative and qualitative study on the neuropsychiatric sequelae of acutely ill COVID-19 inpatients in isolation facilities. *Transl Psychiatry*. 2020 Oct 19;10(1):355. <https://doi.org/10.1038/s41398-020-01039-2>. PMID: 33077738.
- 24 Cs C, Mf S, W Jk. *Assessing Coping Strategies: A Theoretically Based Approach*. *J Pers Soc Psychol* [Internet; 1989 Feb [cited 2021 Dec 7];56(2). Available from: <https://pubmed.ncbi.nlm.nih.gov/2926629/>.
- 25 Online Assessment Measures [Internet]. [cited 2021 Dec 7]. Available from: <https://www.psychiatry.org/psychiatrists/practice/dsm/educational-resources/assessment-measures>.
- 26 Dinneen LC, Blakesley BC. A generator for the sampling distribution of the mann-whitney U statistic. *J R Stat Soc Ser C*. 1973;22(2):269–273.
- 27 Multivariate data analysis. In: Hair JF, ed. *Pearson New Internat*. Harlow: Pearson; 2014:734; vol. 7.
- 28 Defense of multiplicative terms in multiple regression equations on JSTOR [Internet]. Available from: <https://www.jstor.org/stable/2110973>; 2021 Dec 7.
- 29 Kowal M, Coll-Martin T, Ikizer G, et al. Who is the most stressed during the COVID-19 pandemic? Data from 26 countries and areas. *Appl Psychol Health Well-Being*. 2020;12(4):946–966.
- 30 Sun Z-H. Clinical outcomes of COVID-19 in elderly male patients. *J Geriatr Cardiol JGC*. 2020 May;17(5):243.
- 31 W A, Mh M, Ym A, et al. *Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19)* [Internet]. *Intensive Care Med*; 2020 May [cited 2021 Dec 7];46(5). Available from: <https://pubmed.ncbi.nlm.nih.gov/32222812/>.
- 32 Knepple Carney A, Graf AS, Hudson G, Wilson E. Age moderates perceived COVID-19 disruption on well-being. *Gerontol*. 2021 Feb 1;61(1):30–35.
- 33 Js H, Kr L, D U. Social relationships and health [cited 2021 Dec 7] *Science*. 1988 Jul 29;241(4865). Available from: <https://pubmed.ncbi.nlm.nih.gov/3399889/>.
- 34 Doshi D, Karunakar P, Sukhabogi JR, Prasanna JS, Mahajan SV. Assessing coronavirus fear in Indian population using the fear of COVID-19 scale. *Int J Ment Health Addict*. :1.
- 35 Chatterjee SS, Chakrabarty M, Banerjee D, Grover S, Chatterjee SS, Dan U. *Stress, Sleep and Psychological Impact in Healthcare Workers during the Early Phase of COVID-19 in India: A Factor Analysis* [Internet]. *Front Psychol*; 2021 [cited 2021 Dec 7];0. Available from: <https://www.frontiersin.org/articles/10.3389/fpsyg.2021.611314/full>.
- 36 Girdhar R, Srivastava V, Sethi S. *Managing Mental Health Issues Among Elderly during COVID-19 Pandemic*. vol. 4. 2020.
- 37 Hossain MA, Jahid MIK, Hossain KMA, et al. Knowledge, attitudes, and fear of COVID-19 during the rapid rise period in Bangladesh. *PLoS One*. 2020 Sep 24;15(9), e0239646.
- 38 Guan W, Ni Z, Hu Y, et al. *Clinical Characteristics of Coronavirus Disease 2019 in China* [Internet]. *N Engl J Med*; 2020 Feb 28 [cited 2021 Dec 7]; Available from: <https://www.nejm.org/doi/full/10.1056/nejmoa2002032>.
- 39 Sk B, Rk W, Le S, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence [Internet] *Lancet LondEng*; 2020 Mar 14 [cited 2021 Dec 7];395(10227). Available from: <https://pubmed.ncbi.nlm.nih.gov/32112714/>.
- 40 The impact of COVID-19 pandemic on physical and mental health of Asians: a study of seven middle-income countries in Asia. *PLoS One*. 2021 Feb 11;16(2), e0246824. <https://doi.org/10.1371/journal.pone.0246824>. PMID: 33571297.
- 41 S N-H, Er W. *A Heuristic for Developing Transdiagnostic Models of Psychopathology: Explaining Multifinality and Divergent Trajectories* [Internet]. *Perspect Psychol Sci J Assoc Psychol Sci*; 2011 Nov [cited 2021 Dec 7];6(6). Available from: <https://pubmed.ncbi.nlm.nih.gov/26168379/>.
- 42 Registered clinical trials investigating treatment of long COVID: a scoping review and recommendations for research. *Inf Disp*. 2022 Mar 14:1–11. <https://doi.org/10.1080/23744235.2022.2043560>. Epub ahead of print. PMID: 35282780.
- 43 Mental health strategies to combat the psychological impact of COVID-19 beyond paranoia and panic. *Ann Acad Med Singapore*. 2020;49(3):155-160.
- 44 Moodle. The cost effective solution for internet cognitive behavioral therapy (I-CBT) interventions. *Technol Health Care*. 2017;25(1):163–165. <https://doi.org/10.3233/THC-161261>. PMID: 27689560.
- 45 Efficacy of digital cognitive behavioural therapy for insomnia: a meta-analysis of randomised controlled trials. *Sleep Med*. 2020 Aug 26;75:315–325. <https://doi.org/10.1016/j.sleep.2020.08.020>. Epub ahead of print. PMID: 32950013.