

Analysing Mental Health Problems of Adults During COVID Using a MIMIC Model: Evidence from Indian Metropolitan Cities

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Research Article

Keywords: Anxiety, COVID-19, Depression, MIMIC model, Stress, India.

Posted Date: November 30th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-1044572/v1>

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Abstract

Given reduced social interactions and economic distress, mental health has emerged as an important concern during COVID-19. This study estimates the prevalence of mental health problems during the first wave of COVID and identifies its determinants among the general population of Indian metropolitan cities.

The study uses a Multiple Indicators Multiple Causes model to measure depression, anxiety and stress using observed indicators of these latent constructs, and to identify the socio-economic groups at risk of these disorders. The data was collected from 1,275 adults randomly selected from the list of mobile phone users in Bengaluru, Chennai, Delhi, Kolkata, Mumbai and Hyderabad. The Depression Anxiety Stress Scale was administered to the study participants.

About 46, 24 and 48 percent of respondents reported symptoms of anxiety, depression and stress, respectively. Single respondents, members of minority groups, less educated and those belonging to large households are identified to be at-risk. Results also indicate a positive relationship between economic stress and mental illness.

Although COVID has increased the psychological burden of the population, all persons reporting psychological disorders may not require clinical attention. While community-based support may be sufficient in general, monitoring is required to identify at risk persons who may require clinical support.

1. Introduction

Past pandemics had been known to create panic and a sense of threat to individual security, which is manifested in psychological disorders [1]. COVID-19 is no exception. In the absence of vaccination during the first wave of COVID-19, the measures used by governments to control the spread of the pandemic reduced social interaction. Simultaneously, the unpredictable and uncertain nature of the pandemic, lack of information about appropriate treatment, conflicting messages from the authorities, high mortality, stigma and overrun of medical facilities created a mass fear of COVID [2]. 'Coronaphobia' interacted with social isolation, infringement of personal freedom, financial losses and economic stress to generate mental distress.

Studies have reported varying levels of anxiety, stress and depression between 10 to 50 per cent during COVID in countries like the USA [3], UK [Pierce et al., 2020], Italy [7], Spain [González-Blanco et al., 2020], Portugal [11], Germany [12, 13], China [Huang & Zhao, 2020; Ren et al., 2020; Yunhe Wang et al., 2021], Bangladesh [18], Japan [19] and other countries. There have also been several studies of mental health problems among the general public in India [20–24].

A large proportion of these studies have merely reported the prevalence of mental health symptoms among the general public and sub-groups formed based on socio-demographic variables like gender, education level, marital status, and economic status. Statistical analysis, if any, has been restricted to

univariate statistical tests of mean differences [11, 15, 20, 21], and tests of association using correlation. The studies that have undertaken multivariate analysis have generally estimated Ordinary Least Square models [Giallonardo et al., 2020; Varshney et al., 2020], or formed binary or multiple categories using scores of mental health to run logistic [9, 17, 24] or multinomial regression models [González-Blanco et al., 2020]. Most of the studies ignore the fact that anxiety, depression and stress are latent unobserved variables captured through specific indicators. Causal relations between observed indicators and the latent variables are best captured through Structural Equation Models (SEM). This has not been attempted to our knowledge in studies on COVID-19.

This study examines the prevalence of mental health problems during the first wave of COVID and its determinants among the general population in Indian metropolises which had seen a high incidence of active cases and deaths. It is based on primary data collected through a telephonic survey and using the DASS-21 protocol [28]. India had experienced one of the longest and most stringent lockdowns during the first wave, generating substantial social and economic costs [29], so that considerable mental health issues may be expected. In this analysis we will use a class of SEM, called the Multiple Indicators Multiple Causes (MIMIC) model to model the simultaneous measurement of the latent constructs using observed indicators, and the structural relationship between the latent variables and their determinants.

The paper is structured as follows: Section 2 describes the data collection, sample profile and method to undertake statistical analysis. Findings are presented in Section 3 and is followed by a section discussing the results. Section 5 summarises the results and states the policy implications of the analysis.

2. Materials And Methods

2.1 Survey design and instrument

The data used in the study was collected from a randomly selected sample of 1,275 mobile phone users in the six Class 1 metropolises of India— Bengaluru, Chennai, Delhi, Kolkata, Mumbai and Hyderabad. These cities had seen a high number of active cases (22.30% of all cases), and deaths due to COVID-19 (37.99% of all cases), and the shortage of medical facilities (Supplementary Table S1). Respondents were residents of the city, aged between 21 and 60 years—randomly selected from a list of mobile telephone users. The survey was undertaken during the months of August and September 2020, when the lockdown had ended, but COVID cases and deaths were rising rapidly.

Given the restrictions on social interaction, self-reported scales tailored to detect COVID-related mental health issues [like Fear of COVID-19 scale, Corona anxiety scale, COVID stress scale, and Obsession with COVID scale] are used to measure mental health problems.

“(S)elf-report scales might prove useful as they are short, easy to administer [through paper or a digital platform], and feasible to be used when in self-isolation or quarantine. However, these scales may have limited potential to measure outcome parameters of interventions as the findings may not be aligned with objective assessment and be more prone to response bias” [32].

Moreover, the new scales generally focus on one dimension, or at most two, and are unable to discern depression related to COVID-19, or incorporate negative socio-economic consequences of the pandemic has also been noted [33]. Finally, their reliability in different socio-cultural contexts, across different age groups, and exposure groups is not known [32].

Therefore, the survey was administered using the abridged shorter version of the DASS questionnaire, DASS-21 [28]. This is an accepted survey instrument used to measure mental health issues related to anxiety, depression and stress, with good internal consistency [34, 35]. It has been validated in different geographical and socio-cultural contexts, and for different socio-economic and demographic groups [36–38]. It has also been used in research related to SARS [39], and COVID-19 [10, 16, 21, 24, 40]. As anxiety, depression and stress symptoms are commonly reported during COVID-19 in the studies cited earlier, DASS-21 appears an appropriate survey instrument to measure mental health during the current pandemic.

2.3 Compliance with ethical standards

The Institutional Ethics Committee, Presidency University (the institute hosting the study) approved human ethical clearance to conduct the study (PU/IEC(H)/PROV CL/M-01/2020 dated 12/9/2020). The study did not use clinical trials or experiments; nor did it seek any sensitive information. The study and analysis was undertaken adhering to the Indian Council of Medical Research guidelines relevant for ethical research on humans: respect for participants, informed consent, voluntary participation with the right to withdraw, disclosure of funding sources, no harm to participants, avoidance of undue intrusion, no use of deception, preservation of anonymity, participant's right to check and modify a transcript, confidentiality of personal matters and data protection. The authors have no conflict to declare. The study was not funded.

2.4 Sample profile

The sample profile is given in Table 1. The mean age of the respondents is 37 years, with most of them in the 21 to 50 years' age group. Females outnumber male respondents marginally. About 40 percent of the respondents belong to the Hindu General category, while Hindus Other Backward Castes comprise 30 percent of the sample. About 81 per cent of the respondents are currently married. Only 15 percent per cent of the respondents are graduates. About 56 percent of the respondents are from households whose main earning member earns a fixed income; about a third of the respondents are from households with self-employed main earners. The average monthly per capita expenditure is about USD 80, and median value is USD 59. About 68 percent respondents have monthly per capita expenditure less than USD 80. While 40 per cent of the respondents reside in bungalow type houses, 17 per cent are slum dwellers. 40 percent of the respondents belong to the households comprises of 4 members, while more than one-fourth of the respondents are from the households consisting of less than 4 members. About 27 per cent of the households have an aged member (viz. aged 60 years or more). Every third respondent has a family member, relative or friend who had COVID, while one out of ten respondents have suffered bereavement due to COVID.

2.5 Statistical analysis

Estimates of Cronbach's alpha indicate a high level of reliability of responses. The value of alpha is 0.8947 for anxiety, 0.8802 for stress, and 0.8720 for depression. The statistical analysis of the data starts with an exploratory analysis of the mean scales across different socio-demographic groups to identify vulnerable groups. It is followed by a confirmatory analysis using the SEM model. It is a type of confirmatory factor analysis used to measure the value of latent constructs (measurement model); in addition, the model identifies the exogenous causes of the latent variables (structural values). Thus, the observed variables (Y) result from the latent factors (F), while the latent factors themselves are caused by other exogenous variables denoted by X. The model may be described using a path diagram (Figure 1).

The model is described as follows:

$$F_{k'1} = bY_{m'1} + e \quad [1]$$

$$F_{k'1} = dX_{n'1} + v \quad [2]$$

when b and d are matrices of appropriate dimensions, and e and v are vectors of error terms. Equation 1 describes the relationship between the latent variable and the observed indicators and is called the measurement model. As the 'indicators' are ordered categorical variables, the observed indicators have been linked to the latent dimension using an ordered probit model. It is depicted on the right-hand side of Figure 1. The structural part expresses the relationship between the exogenous determinants of the latent variables. It is portrayed on the left-hand side of the path diagram and is described in equation 2.

The vector Y gives the responses to appropriate questions in the DASS-21 schedule. The vector X comprises of the following exogenous variables:

Age of respondents, gender of respondent, whether currently married, socio-religious identity, whether respondent has at least graduate level of education, household size, employment status of main earning member, whether resides in owned house, residence type, and whether faced COVID cases.

Occupation of respondent (or main earning member) and per capita expenditure were not included as they were highly correlated with education, employment status and residential ownership and type. The details of variables are given in Supplementary materials.

3. Findings

3.1 Prevalence levels of mental health problems

The mean of the raw scores for anxiety, stress and depression are 10, 12 and 12, respectively. The mean of the *sum* of the three raw scores (referred to as DASS-21 score subsequently) is 11. Table 2 reports the summary statistics of these scores after normalising. Normalised mean scores have, by construction, mean values of zero; the standard errors are similar and quite small. The confidence interval ranges from

-0.05 to 0.05 in all cases. The median value is the highest for anxiety, and the lowest for the aggregate DASS-21 score. All scores are positively but mildly skewed [have a long right tail], and mesokurtic (having value < 3).

Another way of examining the distribution of the normalised scores is by using kernel densities. It is a non-parametric method used to estimate the probability density function. Kernel densities are useful if we wish to use a finite sample to make inferences about the population. Kernel densities are plotted for each score in Figure 2. They reveal a similarity in the nature of distribution of the anxiety, stress and depression scores; the DASS-21 score is also similar but is shifted to the right. The densities reveal that the distribution of scores is bimodal. There are two peaks—one at a low value of the scores (representing normal scores), and another much smaller peak at a higher value of score (just over 1 for the three scores, and over 2 for the DASS-21 score). The latter peak indicates the presence of moderate to severe mental health issues among a sub-section of the population.

The findings are confirmed by the analysis of distribution of respondents across categories of mental health status (Table 3). Using the cut-off values suggested by Lovibond and Lovibond [28] we have formed five categories of mental health status for anxiety, depression and stress. We have been unable to identify any validated cut-off values for DASS-21 scores. Moreover, the precise form of mental health problem is clinically more relevant and important than an arbitrary aggregative score. So we have not created categories for DASS-21 scores.

The majority of the respondents have a 'normal' mental health score. The proportion of respondent's stress and anxiety is higher than that of depression. About 6-10 percent report mild symptoms of mental health. About one in five respondents report mild or moderate depression, and 15 percent report severe or extremely severe depression. The proportion of respondents reporting moderate (11 percent) and extremely severe (23 percent) anxiety issues is high. While 16 percent report moderate stress levels, about 22 percent reports severe or extremely severe stress. The levels of anxiety and stress reported in the study is higher than that reported on an average in other countries; the reported level of depression, however, is similar.

3.2 Variation over socio-demographic and economic correlates

Table 4 reports the mean normalised scores of anxiety, depression and stress for sample groups grouped on the basis of socio-demographic and economic characteristics. Respondents who are middle aged [with age between 31 and 40 years], belongs to the Hindu General caste group, has per capita monthly expenditure levels above USD 100 and whose family members, relatives and friends had COVID but had recovered have lower scores. Economic status is also an important determinant of mental health. Respondents with fixed income, monthly per capita expenditure levels in the range USD 25.01-40.00, residing in bungalows or residential complexes, and having at least two bedrooms report lower scores for all three indicators of mental health.

3.3 Confirmatory analysis

Table 5 reports the results of the MIMIC model for anxiety depression and stress. The estimates for the measurement model, indicating how well the indicators capture a particular dimension of mental health, is given in the top panel. All the indicators are positive and statistically significant at one percent level. It indicates that the indicators used in the study are able to measure the associated dimension of mental health successfully.

The results for the structural model, identifying the determinants of mental health scores, is given in the bottom panel of Table 5. Mental health scores are not associated with the age of respondents, nor with marital status. Females are likely to have a lower depression and stress score, but there is no gender difference in anxiety scores. Respondents from the minority groups significantly more likely to have higher scores compared to respondents belonging to different Hindu social groups. Depression scores are significantly lower for respondents with at least graduate level of education. Respondents belonging to the households whose main earning member is self-employed are significantly more likely to report higher depression, anxiety and stress cores compared to families whose main earner has a fixed or variable income. Respondents belonging to larger households are more likely to report higher level of anxiety and stress compared to their counterparts residing in smaller households. Respondents residing in owned flats [vis-à-vis residents of rented flats], and in slums or in bungalows (compared to residents of standalone flats) are more likely to have high scores for all the three dimensions of maternal health problems assessed here. Respondents are also more likely to have a high depression, anxiety and stress score if any household member, relative or friend had been affected by COVID, or died from the infection. City fixed effects are observed to be significant.

We have also estimated a MIMIC model relating DASS-21 scores to its indicators (Depression, Anxiety and Stress scores) and determinants. The results are reported in Table 6. The measurement model reveals that mental health is measured satisfactorily by depression, anxiety and stress scores. The results of the structural model indicate the presence of gender differences in mental health, with males being more at risk. It is also observed that risk of mental health problems is higher among members of minority communities, self-employed respondents, those residing in standalone flats, and who have household members, relatives of friends affected by COVID, and is lower among respondents with at least graduate level of education, currently married and those residing in self-owned flats.

4. Discussion

A national level study undertaken by National Institute of Mental Health and Neurosciences in 2016 [41] had reported that 10.6 percent of the sample had any mental health disorder. Using the International Classification of Diseases (ICD-10), the study estimated that 2.7, 3.0 and 0.2 percent of the population was suffering from depression, anxiety and stress, respectively. Given the home isolation, economic uncertainties, and fear of being infected (with associated treatment related problems), the incidence of mental health problems reported during the pandemic is expected to be higher. Our study, in line with similar studies undertaken in India [20,21,23,24,42,43], found the incidence and severity of mental illness to be higher during COVID. A review of studies on mental health during COVID [44] also reports high levels

of mental illness during the pandemic in other countries. Moreover, the high level of co-morbidity found between different forms of psychological disorders [45] is also observed in our study [Table 7]. It implies that the psychological disorders may reinforce each other.

Our study indicates that male respondents, members of minority communities, respondents with low levels of education, currently unmarried, belonging to larger households and those facing economic vulnerabilities, indicated by self-employed face high risk of being psychologically affected by COVID. By and large this finding corresponds to those of other studies in India and other countries. While most Indian studies report males to be more at risk of psychological distress [21,42,43], studies in Spain [46], China [17,40] and UK [6] report otherwise. Similarly, studies report currently unmarried respondents [20,42] and minorities [6,42] to be more likely to report higher mental health scores. Although age has been identified to be an important predictor of mental health [47], our study could not find any such association.

The negative relationship between economic stress and mental health is one of the “most consistently replicated findings in the social sciences” [48]. Economic stress impacts mental health through multiple mechanisms—unemployment, financial threat, indebtedness, economic hardship, volatility in income, deterioration in living standard and decreased levels of welfare support [49–52]. The psychological impact of economic stress increases under times of economic recession and macroeconomic shocks [49,52], manifesting itself in increased levels of depression, anxiety and depression [53]. However, this relationship has been mainly examined in the context of European and North American countries [50].

The outbreak of COVID-19, the associated lockdown and disruptions in global supply chains had accentuated the slowdown of the global economy, while the failure to provide a social security net in developing countries like India had created economic insecurity [29]. These circumstances may be expected to increase the incidence of mental health problems, particularly among vulnerable sections [6,54].

The result of our study reveals that households whose main earning member is self-employed is more likely to report higher scores for depression, anxiety and stress. Given that the economic shock of the national lockdown took time to cascade throughout the economy, the impact on mental health is likely to be higher at the time of the survey, compared to the onset of the pandemic. It may explain the higher incidence of anxiety and depression reported in this study compared to that in other countries (Table 3). Respondents residing in rented houses vis-à-vis owned houses are also likely to face psychological problems.

On the other hand, slum dwellers are less likely to report high values of depression, anxiety and stress scores. This is somewhat surprising as slum dwellers are considered to be a high risk group [55] given the difficulties in maintaining social distancing or hygiene standards and shared communal facilities including toilets in slums [56]. Positional objectivity [57] may be a possible reason. Slum dwellers had been badly hit by demonetisation and the slowdown of the Indian economy; the incremental impact of the pandemic was marginal. Further,

“The severity and importance of health problems were controlled more by the capacity to deal with problems than by the problems themselves. This ability was associated with retaining traditional rural-urban dual social structure such as strong family support, traditional family-based caring, well-built social and kin network ties” [58].

5. Conclusion

Our study estimates that the onset of COVID increased the levels of psychological disorders in India compared to normal times. We found that 34, 46 and 48 percent of respondents reported symptoms of depression, anxiety and stress. We also find presence of co-morbidity between depression, anxiety and stress, with correlations ranging between 0.85 to 0.95. The study identifies single respondents, members of minority groups, less educated and those belonging to large households to be significantly at risk. Results indicate that the relationship between economic stress and mental illness may be more complex than reported in studies for Western societies.

While studies show a peak in the incidence of psychological problems, all such people may not require clinical attention. People are resilient and find new strengths in adversity [59]; community level efforts may also provide the necessary level of support. However, certain sections are more vulnerable and need to be monitored for possible clinical support. However, COVID has curtailed the clinical monitoring and supporting of at risk persons [59]; telemedicine is also limited in India. Therefore, we recommend:

- i. scaling up emergency services for at risk groups;
- ii. creating mechanisms to continue delivery of such services on a long term to combat Post Traumatic Stress Disorders arising from exposure to COVID-related trauma, and
- iii. use local authorities to identify and deliver services to groups most at need [60].

Further, given the psychological impact of economic distress, social safety measures targeting the economically vulnerable households should be made a key component of post COVID recovery programmes [6].

Finally, we point out certain limitations of our study. The survey was undertaken over telephone. Despite the pervasive spread of mobile phones, it is possible that we have missed certain sections of the society; further, investigators were unable to cross validate responses. Studies have also noted that the level of psychological distress changes over time—peaking at the onset of the pandemic, it tends to decrease as people start to adjust to the ‘new normal’. Such temporal fluctuations need to be captured through a longitudinal survey.

Declarations

Acknowledgement

The authors are grateful to Dr. Soumitra Sankar Datta, Tata Medical center, Kolkata for his suggestions.

Author contribution

Data cleaning and editing was undertaken by all authors. Analysis was undertaken by ZH, MD, KC and SG. The first draft was prepared by ZH, and revised by all authors.

Competing interests

The author(s) declare no competing interests.

Ethical considerations

Ethical clearance for the study was obtained from the Institutional Ethical Clearance Committee of Presidency University. Verbal consent was obtained from all respondents.

Data availability

Husain, Zakir; Ghosh, Saswata; Dutta, Mousumi; Chaudhuri, Kausik; Chakrabarti, Anindita (2021), "Mental Health in Indian metro cities: 2020", Mendeley Data, V1, doi: 10.17632/jtzpkhw3mk.1

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Tables

Table 1: Sample profile

Variables	Total
Age group	
Mean age	38
21-30	26.90
31-40	39.92
41-50	21.96
51-60	11.22
Gender	
Male	48.94
Female	51.06
Socio-religious identity	
Hindu General	43.45
Hindu OBC	29.33
Hindu SC&ST	18.51
Minority	8.71
Marital status)	
Currently unmarried	19.06
Currently married	80.94
Education	
Below Graduate	85.18
Graduate & above	14.00
Employment status	
Self employed	36.24
Fixed income	58.82
Variable income or part time	4.94
Per capita monthly family expenditure	
Mean per capita monthly family expenditure	79.59
USD 25.00 or less	9.44
USD 25.01-40.00	15.18

Variables	Total
USD 40.01-60.00	25.96
USD 60.01-80.00	17.70
USD 80.01-100.00	11.64
Above USD 100.00	20.06
Ownership of residence	
Rented	44.16
Owned	55.84
Residential Pattern	
Slum	16.94
Bungalow	39.61
Standalone Flat	21.33
Residential Complex	22.12
Number of bedrooms in the house	
No bedroom	4.98
1 bedroom	44.38
2 bedrooms	39.56
3 or more bedrooms	11.08
Number of family members	
0 to 3 members	26.51
4 members	39.53
5 members	21.65
6 or more members	12.31
Number of family members 60 years and above	
No such member	72.94
At least one such member	27.06
Whether affected by COVID	
Not affected	58.43
COVID cases with recovery	32.00

Variables	Total
COVID deaths	9.57
Total Sample	1275

Note: USD = Rs.73.5042, the average of the exchange rate at the start and end of our survey (Accessed from <https://bit.ly/3zgB3ox> on 18/09/2021).

Source: Estimated from primary data.

Table 2: Summary statistics of normalised mental health scores

Indicator	Mean	Std. Err.	Conf. Int.	Median	Skewness	Kurtosis
Depression	0.00	0.03	-0.05 0.05	-0.34	0.73	2.43
Anxiety	0.00	0.03	-0.05 0.05	-0.41	0.95	2.82
Stress	0.00	0.03	-0.05 0.05	-0.38	0.73	2.41
Aggregate	0.00	0.03	-0.05 0.05	-0.32	0.80	2.47

Note: N = 1275 for all indicators. Confidence Interval is for 5% level.

Source: Estimated from primary data.

Table 3: Distribution of respondents by severity of mental health status

Health status	Depressed		Anxiety		Anxiety	
	Number	Number	Number	Percentage	Number	Percentage
Normal	840	65.88	687	53.88	664	52.08
Mild	102	8.00	83	6.51	126	9.88
Moderate	144	11.29	140	10.98	206	16.16
Severe	146	11.45	69	5.41	141	11.06
Extremely severe	43	3.37	296	23.22	138	10.82
Any symptom	435	34.11	588	46.12	611	47.92
Estimates from meta-reviews						
(Necho et al., 2021)		34.31		38.12		37.54
(Wu et al., 2021)		31.90		31.40		41.10

Note: Any symptom is the sum of mild, moderate, severe and extremely severe categories.

Source: Estimated from primary data.

Table 4: Variations in mean scores of mental health symptoms across correlates

Variables	Depression	Anxiety	Stress
Age group			
21-30 years	11.81	10.12	12.24
31-40 years	10.2	8.85	10.76
41-50 years	12.61	11.21	12.77
51-60 years	13.31	12.15	13.82
Gender			
Male	12.3	10.68	12.66
Female	10.76	9.51	11.25
Socio-religious identity			
Minority	21.66	18.97	20.41
Hindu General	9.94	7.81	10.65
Hindu OBC	10.74	10.4	11.41
Hindu SC & ST	11.64	10.75	11.84
Marital status			
Currently unmarried	11.65	9.28	11.78
Currently married	11.48	10.27	11.98
Education			
Below Graduate	12.1	10.64	12.51
Graduate & above	8.13	6.88	8.68
Employment status			
Self employed	12.46	10.92	12.68
Fixed income	10.8	9.39	11.4
Variable income	13.05	12.13	13.08
Per capita monthly family expenditure			
USD 25.00 or less	11.8	10.98	13.65
USD 25.01-40.00	14.69	13.45	14.72
USD 40.01-60.00	13.31	12.08	13.24
USD 60.01-80.00	12.26	10.68	13.1

USD 80.01-100.00	9.89	8.14	10.43
Above USD 100.00	7.06	5.22	7.35
Residential Pattern			
Slum	12.57	12.34	12.32
Bungalow	10.14	9.1	10.55
Standalone Flat	15.6	13.07	16.93
Residential Complex	9.21	7.23	9.33
Number of bedrooms in house			
No bedroom	15.11	13.68	14
1 bedroom	13.8	12.8	14.06
2 bedrooms	9.68	8.08	10.52
3 or more bedrooms	6.39	3.7	6.91
Number of family members			
0 to 3 members	10.72	8.28	10.57
4 members	11.53	10.61	12.35
5 members	11.43	10.36	11.83
6 or more members	13.31	11.77	13.78
Number of family members 60 years and above			
No aged member	11.65	10.4	12.18
least one aged man	11.14	9.23	11.31
Covid cases among Family, relatives of friends			
None	11.95	10.78	12.32
Had COVID but recovered	10.29	8.65	10.97
Died from COVID	12.89	10.59	12.92
Total Sample	1275	1275	1275

Note: USD = Rs.73.5042, the average of the exchange rate at the start and end of our survey (Accessed from <https://bit.ly/3zgB3ox> on 18/09/2021).

Source: Estimated from primary data.

Table 5: Results of MIMIC model for anxiety, depression and stress

Variables	Depression		Anxiety		Stress	
	Beta	Z-ratio	Beta	Z-ratio	Beta	Z-ratio
Measurement model						
I1	1		1		1	
I2	0.93	16.50***	0.97	14.88***	1.53	12.86***
I3	1.32	14.10***	1.17	14.66***	2.00	13.18***
I4	1.06	13.31***	0.86	14.27***	1.58	13.31***
I5	1.10	14.64***	0.69	12.89***	1.58	12.28***
I6	1.52	13.05***	1.05	13.56***	2.12	13.02***
I7	1.45	11.44***	0.83	12.46***	1.77	13.41***
Structural model						
Age groups (31-40 years)						
21-30 years	0.08	1.09	0.08	0.89	0.08	1.69*
41-50 years	0.07	1.01	0.06	0.72	0.04	0.81
51-60 years	0.06	0.73	0.12	1.18	0.05	0.81
Marital status (Currently not married)						
Currently married	-0.10	-1.29	-0.04	-0.43	-0.03	-0.64
Female	-0.12	-2.21**	-0.07	-0.99	-0.09	-2.31**
Socio-religious group (Minorities)						
Hindu General	-0.59	-6.01***	-0.69	-5.64***	-0.31	-4.31***
Hindu OBC	-0.44	-4.11***	-0.54	-4.12***	-0.25	-3.30***
Hindu SC&ST	-0.66	-5.92***	-0.69	-5.16***	-0.38	-4.96***
Education (Below graduate)						
Above graduate	-0.14	-1.70*	-0.16	-1.56	-0.08	-1.34
Employment status of main earner (Self-employed)						
Fixed income	-0.14	-2.60**	-0.17	-2.51**	-0.08	-2.12**
Variable income or part time	-0.21	-1.86*	-0.26	-1.74*	-0.16	-1.92*
Household size	0.02	0.91	0.05	1.94*	0.02	1.76*
Residence type (Flat)						
Slum	-0.60	-6.64***	-0.64	-5.75***	-0.57	-8.40*

Bungalow	-0.46	-5.80***	-0.60	-6.21***	-0.41	-7.36***
Residential Complex	-0.03	-0.36	-0.08	-0.77	-0.22	-3.72***
House ownership (Rented)						
Owned	-0.22	-3.84***	-0.19	-2.73**	-0.15	-3.69***
Faced COVID case (No)						
Only COVID cases	0.18	2.94***	0.41	4.92***	0.18	3.92***
COVID deaths	0.25	2.27**	0.62	4.20***	0.25	2.95***
City Fixed Effects (Bengaluru)						
Chennai	0.32	3.35***	0.08	0.67	0.14	2.03**
Delhi	-1.18	-10.68***	-2.40	-13.33***	-0.79	-9.76***
Hyderabad	-1.04	-8.00***	-1.06	-7.68***	-0.71	-8.30***
Kolkata	-1.09	-8.09***	-2.52	-13.19***	-1.00	-9.95***
Mumbai	0.24	2.77**	0.08	0.69	0.19	2.87***
var(e)	0.87	0.10	0.87	0.10	0.31	0.04

Notes: 11-17 corresponds to questions for measuring depression, anxiety and stress in the DASS-21 schedule.

***, ** and * denotes Prob. < 1%, 5% and 10% level, respectively.

Source: Estimated from primary data.

Table 6: Results of MIMIC model for DASS-21 score

Measurement model	Beta	Z-ratio
Anxiety	1	
Depression	1.10	8.35***
Stress	1.11	9.90***
Structural model		
Age groups (31-40 years)		
21-30 years	0.17	1.05
41-50 years	0.22	1.47
51-60 years	0.24	1.23
Female	-0.24	1.94*
Socio-religious group (Minorities)		
Hindu General	-1.48	6.24***
Hindu OBC	-1.00	4.06***
Hindu SC&ST	-1.67	6.33***
Education (Below graduate)		
Above graduate	-0.33	1.90*
Employment status of main earner (Self-employed)		
Fixed income	-0.28	2.19**
Variable income or part time	-0.51	1.89*
Household size	0.07	1.53
Marital status (Currently not married)		
Currently married	-0.32	1.76*
Residence type (Flat)		
Slum	-1.77	-7.85***
Bungalow	-1.30	-7.08***
Residential Complex	-0.50	-2.67**
House ownership (Rented)		
Owned	-0.58	4.34***
Faced COVID case (No)		

Only Covid cases	0.55	3.57***
Covid deaths	0.78	3.00***
City Fixed Effects (Bengaluru)		
Chennai	0.66	2.89***
Delhi	-3.14	8.48***
Hyderabad	-2.21	7.60***
Kolkata	-2.86	7.85***
Mumbai	0.58	2.63**
var(e)	3.61	0.51

Notes: ***, ** and * denotes Prob. < 1%, 5% and 10% level, respectively.

Source: Estimated from primary data.

Table 7: Correlation between mental health scores

	Anxiety	Stress	Depression	DASS-21 score
Anxiety	1.00			
Stress	0.85	1.00		
Depression	0.85	0.88	1.00	
DASS-21 score	0.95	0.95	0.96	1.00

Note: All correlations are significant at 1% level.

Figures

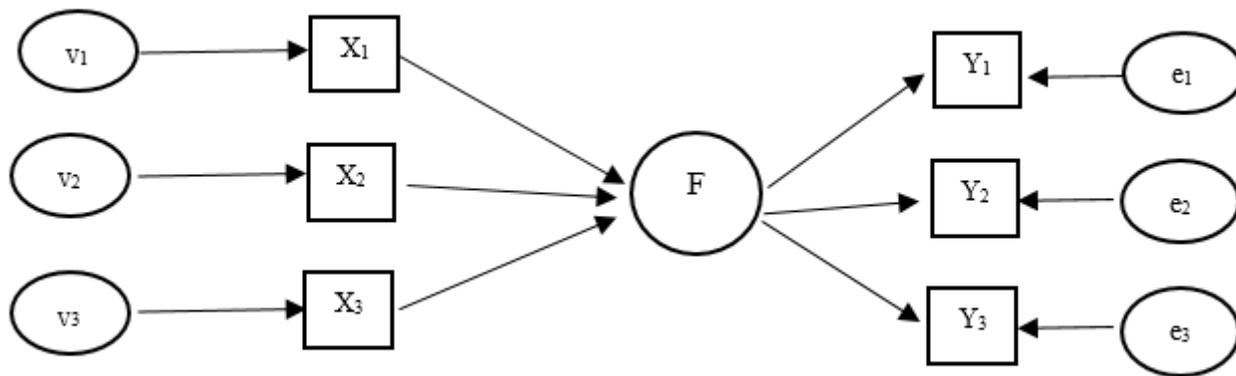
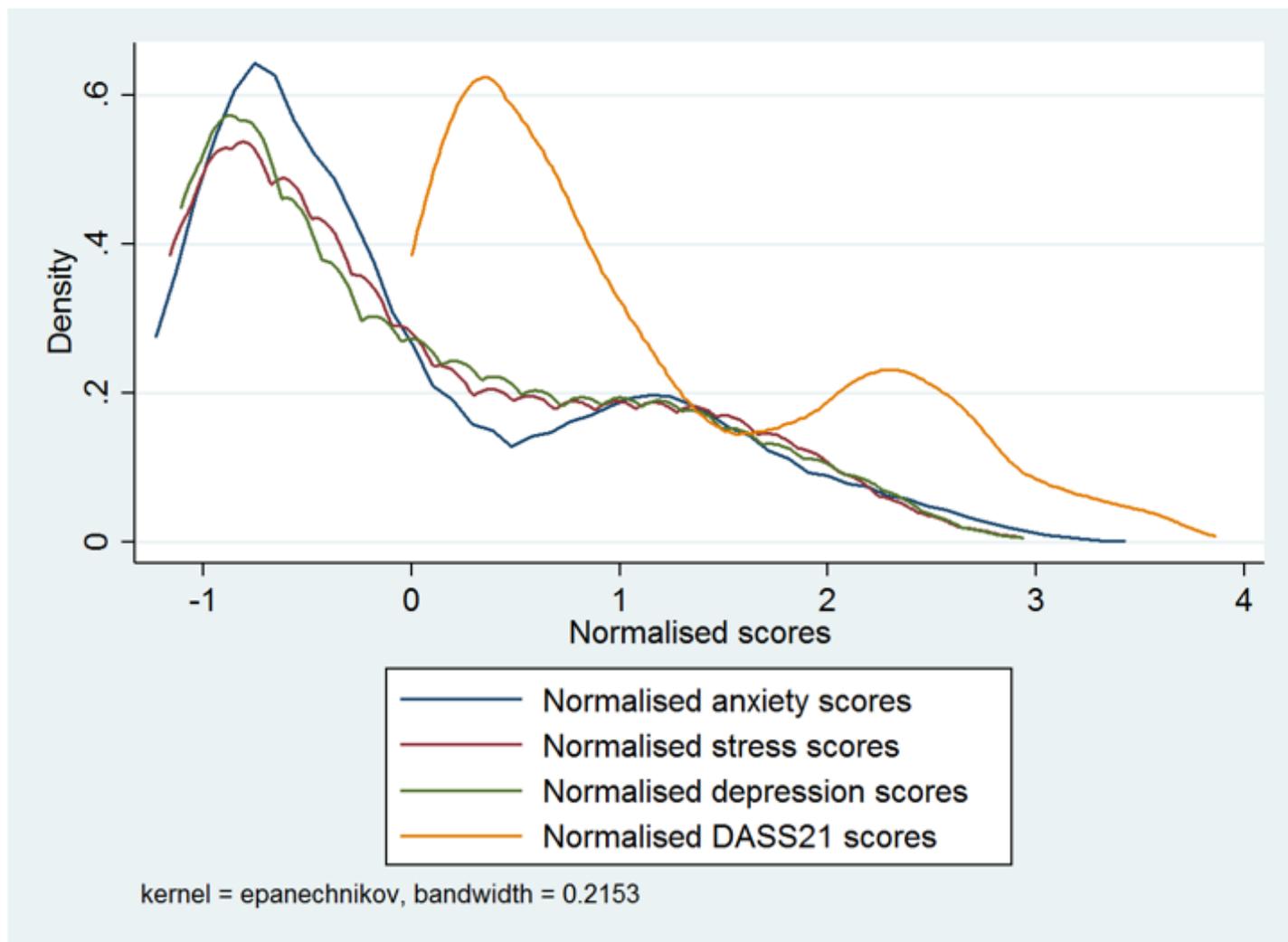


Figure 1

MIMIC model



Source: Estimated from primary data.

Figure 2

Kernel densities of normalised scores for mental health

Supplementary Files

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