COVID-19 pandemic and its aftermath: Knowledge, attitude, behavior, and mental health-care needs of medical undergraduates

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Background: The undeniable impact of the COVID-19 pandemic on the educational sector has left the students perplexed and uncertain. Infection-related fears, inevitable loneliness, disturbed routine making way for adverse lifestyle habits, stressors such as financial crisis faced by their families, and many more further accentuate their vulnerability to mental health issues. Aim: The aim was to assess the knowledge, attitude, and behavior of medical undergraduate students about the COVID-19 outbreak, and to assess their stress, anxiety, depression, and quality of life (QOL). The study also explored the correlation between the knowledge, attitude, and behavior of the medical undergraduate students about the pandemic and their mental health issues.

Materials and Methods: An online questionnaire-based survey was carried out on medical undergraduate students. The survey tool comprised a semi-structured proforma; General Health Questionnaire-12 items; Depression, Anxiety, and Stress scale-21 items; and European Health Interview Survey-Quality of Life-8 items.

Results: Nearly 61.8% of the students seemed well read and had good knowledge about the medical aspects of the pressing issue of COVID-19, and majority of the students had adaptive attitudes and behaviors toward the pandemic. Almost 23.2% of the students had depression, 20.7% had anxiety, and 13.0% had stress ranging from mild to extremely severe. Nearly 75.1% of the students experienced changes in appetite and 53.6% had changes in appetite. Nearly half of the students expressed excessive worries regarding studies. The mean score of QOL of students was 3.9 ± 0.6. Students with adaptive attitudes and behavior experienced relatively less severe depression, anxiety, and stress compared to their counterparts.

Conclusion: A significant portion of the medical undergraduates are experiencing mental health issues and study related concerns due to the adversity brought by the pandemic. The concerned educational bodies and institutes must take up necessary steps to mitigate the adverse effects of the pandemic on students.

Keywords: Anxiety, attitude, behavior, COVID-19, depression, knowledge, medical students, pandemic, psychiatric morbidity, psychological impact, quality of life, stress

More than 190 countries have temporarily closed the educational institutions in an attempt to contain the spread of the lethal COVID-19 pandemic caused by the novel severe acute respiratory syndrome-coronavirus-2. It is estimated that 1.5 billion students are confined at home worldwide due to the closure of schools and universities, thus making education uncertain at all levels.¹ In India, 993 universities and 39,931 colleges have been shut temporarily, complying with the directives of apex educational bodies, leaving variable impact on 37.4 million students pursuing higher education.²,³ Needless to say that even medical education is interrupted. Not only the bedside learning

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which has been called off to avoid the risk of exposure to the medical trainees but also medical colleges have ceased face-to-face instruction and have switched to e-teaching (online lectures, webcasting, video case vignettes, etc.) as social distancing was warranted to prevent the spread of the contagion.[4]

The consequences of the COVID-19 pandemic have disillusioned the students pursuing various courses at different levels and in different phases of their academic year. Students seeking admission into higher education and fresh graduates on a lookout for job are facing relatively greater adversity than the rest of the students.[5] The students appearing for board/university/entrance/medical-licensing exams in the current academic year are left apprehensive and uncertain about the examination schedules due to indefinite postponement. Worries related to the disruption of current admission cycle, loneliness, and boredom due to total cutoff from the physical company of peers, dissatisfaction/technical difficulties of e-teaching and/or modified academic course/assessment schemes, and financial crisis faced by their families, etc., make them vulnerable to psychiatric morbidities. The prolonged closure of educational institutes and home confinement have made room for adverse lifestyle habits such as physical inactivity, sedentary behavior, excessive screen usage, irregular sleep patterns, and less favorable diets. The interplay between adverse lifestyle changes and psychosocial stressors further increases the likelihood of physical and mental health morbidities.[6,7] Due to the school closure and total shift from face-to-face learning to face-to-screen learning, students may experience reduced motivation toward studies and increased pressure to learn independently.[8] As per a study, worries about academic delays and impact on daily life and economics by pandemic were the factors related to anxiety in students.[9] In a survey on young people, 83% of participants reported that their preexisting mental health issues have worsened during the pandemic because of school closures, loss of routine, and restricted social connections.[10] Students are also at risk of experiencing undue fear of getting infected/isolated/stigmatized or death, obsessions related to germs, disease and/or general lack of cleanliness (fear of contamination), and excessive/compulsive cleaning practices. The media sensationalism and shortage of masks and disinfectants have further compounded anxiety and fear. Lastly, the irresponsible behavior in the society such as reluctance to self-quarantine, mob attacks on COVID-19 carers, and nonadherence to safety measures may lead to anger and frustration.[9,11]

Emerging research assessing the mental health implications of COVID-19 has identified a heightened prevalence of moderate-to-severe self-reported depression and anxiety among the general public, reflecting the adversity of uncertainty and health-related fears. However, further research investigating the disruption in vulnerable population due to pandemic is required.[8,12] The present work was undertaken during the COVID-19 outbreak to assess the knowledge, attitude, and behavior of students to the COVID-19 outbreak and to assess psychological distress, stress, anxiety, depression, and quality of life (QOL) of students. In addition, an attempt was made to understand the correlation between knowledge, attitude, behavior, stress, anxiety, and depression.

**MATERIALS AND METHODS**

This cross-sectional study was conducted in a renowned medical college placed in Bengaluru. Institutional ethics committee clearance was obtained (DRP/IFP534/2020). All the students pursuing the degree of Bachelor of Medicine and Bachelor of Surgery (MBBS) in the institute were considered the potential participants. The purpose, nature, and implications of the study were intimated to all the medical undergraduates through an official mail along with a survey questionnaire developed through Google Forms with an appended consent form on April 23, 2020, at 1.00 p.m. The survey website was actively receiving responses till April 29, 2020, 11.59 p.m. In order to eliminate the chances of incomplete responses, all questions were made mandatory. Necessary settings limited the number of response to one per participant which prevented submission of multiple response forms by a single participant. Two gentle reminders were sent to all the students, 3 days after the first mail, and 1 day prior to the last date of submission. The class representatives of each term of MBBS were contacted by the investigators to explain the study objectives and implications. They were then requested to convey the same to their batch mates and to encourage maximum participation. Participants of the survey could fill the details anonymously without any concerns about the confidentiality. Only investigators had the access to view/analyze the responses. Nonsubmission of the forms at the end of 1 week was taken as unwillingness of the student to participate in the study.

**Tools**

The survey questionnaire had 7 sections. Section 1 had a brief about the background and the need for the survey. Section 2 consisted of informed written consent. Section 3 was an inquiry into sociodemographical details. Section 4 had a semi-structured proforma. Sections 5, 6, and 7 had General Health Questionnaire-12 items (GHQ-12); Depression, Anxiety, Stress Scale-21 items (DASS-21); and the European Health Interview Survey QOL-8 items-(EUROHIS-QOL-8), respectively.
Semi-structured pro forma
A semi-structured proforma was prepared by the investigators to assess the three parameters of interest, namely knowledge, attitude, and behavior, of the students regarding the COVID-19 pandemic. Knowledge was chosen as one of the parameters of interest as, inadequate knowledge, seeking unsubstantiated facts through unauthentic sources may induce stress and panic. In addition, as medical students, they are expected to read and gain knowledge about the novel pathogen and the disease causing the current public health emergency. Attitude and behavior were assessed, as a set of adaptive attitude and behavior serve as deterrents of stress, whereas maladaptive attitudes and behaviors aggravate distress. The semi-structured proforma comprised 27 questions, of which 5 questions were to assess knowledge. A score of ≥3/5 was considered to indicate that students have read and have good fund of knowledge and a score of ≤2/5 to imply poor knowledge. Eighteen questions were to assess the attitude and behavior. Two questions were to know the study-related concerns and two were inquiry into sleep and appetite changes.

General Health Questionnaire-12 items
GHQ-12 is a screening tool assessing the level of functioning and symptoms of anxiety and depression over the past 1 month. Each item has four different responses. The Cronbach's alpha of the GHQ12 is 0.9. The optimal threshold for screening as assessed by receiver operator characteristic analysis was 2/3. This threshold had a sensitivity of 96% ± 7% and a specificity of 90%.\(^{13,14}\)

The Depression, Anxiety, and Stress Scale-21 items
The DASS-21 is a measure of depression, anxiety, and stress during last week. Each item has four responses. The 21-item version has only half the items compared to the original 42-items which promptly reduced the time required for assessment. In addition, it has a cleaner factor structure and smaller inter-factor correlations. The Cronbach's alpha of the depression, anxiety, and stress subscales is 0.94, 0.87, and 0.91, respectively. The Cronbach's alpha of the total scale is 0.93.\(^{15,16}\)

The European Health Interview Survey Quality of Life-8 items
The EUROHIS-QOL-8 is derived from the World Health Organization QOL Instrument-Abbreviated Version BREF. The four domains of QOL, namely physical, psychological, social, and environmental, are represented by two items each. Each item has five different responses. The overall score is the sum of scores on the eight items divided by the total number of items. Higher scores indicate better QOL. The Cronbach’s alpha for the total scale is 0.78.\(^{17,19}\)

Statistical analysis
Ordinal data were expressed as median and interquartile range (IQR) and compared with the Mann–Whitney U-test; categorical variables were expressed as number (%) and compared by Chi-square test. Spearman’s rank-order correlation was used for correlation. A multiple regression analysis was run to predict depression from gender, age, GHQ, anxiety, stress, and QOL. The analysis was performed using SPSS 18 (IBM, Chicago, IL, USA).

RESULTS

Five hundred and thirty students out of the total 649 medical undergraduates of the college took part in the survey, yielding a response rate of 81.6%. Among the 530 participants, 226 (42.6%) were male and 304 (57.4%) were female, with an age range of 17–29 years. The mean ± standard deviation (SD) age of the students was 20.57 ± 1.85 years. A total of 487 (91.9%) students (203 boys and 284 girls) were living with the family and 43 (8.1%) students (23 boys and 20 girls) were living away from the family.

Knowledge about the COVID-19 pandemic
Out of the 530 students, 325 (61.8%) students (142 boys and 183 girls) answered ≥3/5 questions correctly. Performance of the students and the percentage of students giving right answer to each knowledge-based question are shown in Figures 1 and 2, respectively. The study did not find correlation between knowledge on COVID-19 and gender (\(P = 0.54\)) [Table 1].

Attitude and behavior toward the COVID-19 pandemic
Inquiry into the adaptive attitudes and behaviors revealed that 96.6% of the students felt safe at home. Nearly 71.7% of the students remained confined at home with the sense of social responsibility. Almost 97.2% of the students agreed that as priority was to curb the infection, inconveniences caused by the lockdown were justified. Nearly 76.8% of the students truly cherished the time spent at home by embracing adaptive coping strategies. Nearly 99.6% of the students were thoroughly following all the safety precautions whenever the necessity was felt (i.e., in outdoors).

Enumerating the maladaptive attitudes and behaviors, 37% of the students admitted that they felt stuck at home. Nearly 28.3% of the students reported to have stayed at home only because of the legal obligation. Almost 4.2% of the students admitted to have gone out of home during lockdown unnecessarily. Nearly 22.5% of the students reported to have no/negligible fear of contacting illness, whereas 60.4% were extremely afraid of contracting infection and passing it on to their loved ones. Almost 25.3% of the students have been paying undue attention...
Nearly 8.3% of the students were seeking information through unauthentic sources. About 56.6% of the students reported problematic screen usage hindering their studies. Nearly 25.3% of the students admitted that they were panic buying and hoarding the essentials. Nearly 33.8% of the students felt troubled without their usual “vent-outs” such as social gatherings, eat outs, and movies. Nearly 4.0% of the students faced problems due to no/limited access to substances. Almost 3.2% of the students reported to have panicked and consulted family physician more than a couple of times pertaining to upper respiratory symptoms in the last month.

### Table 1: Comparison of knowledge, attitude, and behavior toward the COVID-19 pandemic among boys and girls

| Knowledge, attitude, and behavior toward the COVID-19 pandemic | Type of response | Boys, n (%) | Girls, n (%) | P |
|---------------------------------------------------------------|-----------------|-------------|--------------|---|
| Knowledge on the COVID-19 pandemic                            | Sufficient      | 142 (62.8)  | 183 (60.2)   | 0.54 |
| I feel safe at home                                          | Yes             | 219 (96.9)  | 293 (96.4)   | 0.74 |
| I am thoroughly enjoying being at home with my family, pets, and/or utilizing the time in hobbies, interests, and/or adapting few healthy lifestyle changes | Yes            | 172 (76.1)  | 235 (77.3)   | 0.75 |
| I have been following the WHO/national/state set safety guidelines thoroughly | Yes             | 224 (99.1)  | 304 (100.0)  | 0.10 |
| As the priority at present is to curb the infection, the inconvenience caused by contingency measures are totally justifiable | Yes             | 219 (96.9)  | 296 (97.4)   | 0.75 |
| I have remained confined to home with the sense of social responsibility | Yes             | 149 (65.9)  | 231 (76)     | 0.02* |
| I feel that the COVID-19 pandemic is hyped up and lockdown is unnecessary | Yes             | 15 (6.6)    | 18 (5.9)     | 0.74 |
| I feel stuck at home                                         | Yes             | 95 (44)     | 101 (33.2)   | 0.04* |
| I have remained confined to home only because of legal obligations | Yes             | 77 (34.1)   | 73 (24.0)    | 0.01* |
| I have no fear of contracting the illness at all             | Yes             | 54 (23.9)   | 65 (21.4)    | 0.49 |
| I have often gone out of home unnecessarily during the lockdown as I felt overwhelmed being “homebound” | Yes             | 11 (4.9)    | 11 (3.6)     | 0.48 |
| I have been paying undue attention to the information regarding the COVID-19 pandemic on media to the extent that it is affecting me | Yes             | 71 (31.4)   | 63 (20.7)    | 0.005* |
| I have been hoarding a lot of essentials items such as groceries, personal care items, and/or personal protective equipment | Yes             | 60 (26.5)   | 74 (24.3)    | 0.56 |
| I seek and believe information through social media such as WhatsApp forwards and Facebook/Twitter posts as they are authentic and the information is substantiated | Yes             | 23 (10.2)   | 21 (6.9)     | 0.18 |
| I feel troubled as my usual destressing “vent-outs” such as social gatherings, shopping, eat-outs, movies, and pubbing are prohibited in the lockdown | Yes             | 95 (41.6)   | 85 (28.0)    | 0.001** |
| I am facing problems as there is very limited/no access to cigarettes/alcohol/other substances | Yes             | 16 (7)      | 5 (1.6)      | 0.002* |
| I am spending a significant amount of time over watching TV/Netflix/Amazon Prime/YouTube/WhatsApp/Facebook/Twitter/Instagram/TikTok/Gaming/Pornography/Others to the extent that it is hindering my studies | Yes             | 128 (56.6)  | 172 (56.6)   | 0.99 |
| I am extremely afraid that I may contract the infection and pass it on to the loved ones | Yes             | 86 (38.1)   | 124 (40.8)   | 0.52 |
| I have visited/called the family physician more than two times in the last month as I felt panicky on having mild-to-moderate symptoms of upper respiratory infection | Yes             | 8 (3.5)     | 9 (3.0)      | 0.71 |

* Significant (p ≤ 0.05); ** Highly significant (p ≤ 0.001)
Few attitudes and behaviors differed between genders. More number of girls stayed back with a sense of social responsibility than boys ($P = 0.01^*$). More number of boys felt stuck at home ($P = 0.04^*$), had adversely effect of media ($P = 0.005^*$), and had troubles without vent-outs ($P = 0.001^*$) and substances ($P = 0.002^*$), compared to girls.

**General Health Questionnaire**
The median score of GHQ of students was 1.0 (IQR: 0.0–4.0). A total of 326 (61.5%) students (145 boys and 181 girls) scored ≤ 2 (cutoff score), indicating that they were free from psychological distress. A total of 204 (38.5%) students (81 boys and 123 girls) had a score of > 2, implying the presence of psychological distress, and needed further evaluation. The GHQ score did not vary between the genders ($P = 0.28$).

**Depression, anxiety, and stress**
The median (IQR) score of depression, anxiety, and stress subscales of the DASS were 4.0 (0.0–10.0), 2.0 (0.0–6.0), and 4.0 (0.0–10.0), respectively. Forty (7.5%) students were found to have mild depression, 39 (7.4%) students had moderate depression, 20 (3.8%) had severe, and 24 (4.5%) had extremely severe depression. Thirty-one (5.8%) students had mild anxiety, 48 (9.1%) students had moderate anxiety, 14 (2.6%) had severe, and 17 (3.2%) had extremely severe anxiety. Mild stress was reported by 25 (4.7%) students, 21 (4.0%) had moderate stress, 17 (3.2%) had severe, and 6 (1.1%) students had extremely severe stress [Table 2]. Depression and stress were severe in girls compared to boys ($P = 0.05^*$ and 0.007*, respectively). The severity of anxiety did not differ between genders ($P = 0.15$) [Table 3].

**Quality of life**
The mean ± SD score of EUROHIS-QOL-8 scale was 3.9 ± 0.6. The mean score of boys was 3.8 ± 0.6, and of girls was 3.8 ± 0.6. The study did not find a statistically significant relation between gender and QOL ($P = 0.70$) [Table 3]. Depression ($r = -0.51, P ≤ 0.001^*$), anxiety ($r = -0.44, P ≤ 0.001^*$), and stress ($r = -0.49, P ≤ 0.001^*$) shared an inverse correlation with the QOL.

**Correlation between knowledge on COVID-19 and depression, anxiety, and stress in students**
The study did not find a statistically significant correlation between knowledge and depression ($r = 0.03, P = 0.44$), anxiety ($r = 0.004, P = 0.92$), and stress ($r = 0.53, P = 0.22$) in students.

**Correlation between attitude and behavior of students toward the COVID-19 pandemic and depression, anxiety, and stress scales**
Each of the attitude and behavior was tested for its correlation with depression, anxiety, and stress scales. The severity of depression ($P = 0.001^*$), anxiety ($P = 0.002^*$), and stress ($P = 0.001^*$) was noted to be lower in students who felt safe at home than those who did not. Students who embraced adaptive coping strategies of spending time with family and pets, cultivating hobbies, and adopting healthy lifestyles had low levels of depression ($P = 0.001^*$), anxiety ($P = 0.001^*$), and stress ($P = 0.001^*$) than the rest. Students who chose to remain at home with the sense of social responsibility had less anxiety ($P = 0.005^*$) than those who remained home because of legal obligations. Students with the opinion that the pandemic situation was hyped up and lockdown as unwanted had higher levels of stress ($P = 0.03^*$) than the ones who did not believe so. Students who felt stuck at home had higher levels of depression ($P = 0.001^*$), anxiety ($P = 0.001^*$),

### Table 2: Distribution of depression, anxiety, and stress among the students in the study

|                   | Depression, n (%) | Anxiety, n (%) | Stress, n (%) |
|-------------------|-------------------|----------------|--------------|
|                   | Boys              | Girls          | Total        | Boys          | Girls          | Total        | Boys         | Girls         | Total        |
| Normal            | 177 (78.3)        | 230 (75.7)     | 407 (76.8)   | 179 (79.2)    | 241 (79.3)     | 420 (79.2)   | 200 (88.5)   | 261 (85.9)    | 461 (87)     |
| Mild              | 16 (7.1)          | 24 (7.9)       | 40 (7.5)     | 11 (4.9)      | 20 (6.6)       | 31 (5.8)     | 9 (4.0)      | 16 (5.3)      | 25 (4.7)     |
| Moderate          | 16 (7.1)          | 23 (7.6)       | 39 (7.4)     | 25 (11.1)     | 23 (7.6)       | 48 (9.1)     | 10 (4.4)     | 11 (3.6)      | 21 (4.0)     |
| Severe            | 6 (2.7)           | 14 (4.6)       | 20 (3.8)     | 5 (2.2)       | 9 (3.0)        | 14 (2.6)     | 6 (2.7)      | 11 (3.6)      | 17 (3.2)     |
| Extremely severe  | 11 (4.9)          | 13 (4.3)       | 24 (4.5)     | 6 (2.7)       | 11 (3.6)       | 17 (3.2)     | 1 (0.4)      | 5 (1.6)       | 6 (1.1)      |
| Total             | 226 (100.0)       | 304 (100.0)    | 530 (100.0)  | 226 (100.0)   | 304 (100.0)    | 530 (100.0)  | 226 (100.0)  | 304 (100.0)   | 530 (100.0)  |

### Table 3: Depression, anxiety, stress, and quality of life among boys and girls in the study

| Gender | n     | Depression | Anxiety | Stress | QOL     |
|--------|-------|------------|---------|--------|---------|
|        |       | Median (IQR) | P       | Median (IQR) | P       | Median (IQR) | P       | Means ± SD | P       |
| Boys   | 226   | 2 (0–10)    | 0.05*   | 2 (0–6)    | 0.25    | 4 (0–10)     | 0.007*  | 3.8 ± 0.6  | 0.70    |
| Girls  | 304   | 4 (0–10)    |         | 2 (0–6)    |         | 6 (2–10)     |         | 3.8 ± 0.6  |         |

n - Number; IQR - Interquartile range; SD - Standard deviation; QOL - Quality of life  
* Significant ($p < 0.05$); ** Highly significant ($p < 0.002$)
and stress ($P = 0.001^{**}$) than those who did not. Students who were paying undue attention to the media on the COVID-19 pandemic had higher anxiety ($P = 0.02^*$) than the ones who were not. Students who admitted to have gone out of home without necessity had higher severity of depression ($P = 0.04^*$) than those who did not. Students who felt distressed without “vent-outs” such as social gatherings, eat outs, shopping, and movies had higher severity of depression ($P = 0.001^{**}$), anxiety ($P = 0.001^{**}$), and stress ($P = 0.001^{**}$) than the students who did not mind unavailability of vent-outs. Students who had problem with screen usage had higher levels of depression ($P = 0.001^{**}$), anxiety ($P = 0.001^{**}$), and stress ($P = 0.001^{**}$) than the students who did not. Students who were extremely afraid of getting infected and passing it on to their loved ones had higher severity of depression ($P = 0.003^*$), anxiety ($P = 0.001^{**}$), and stress ($P = 0.001^{**}$) than the rest. Students who panicked and called family physician more than a couple of times pertaining to their upper respiratory symptoms in the last month had higher anxiety ($P = 0.01^*$) than those who did not panic and consult doctor. The study did not find correlations between some attitudes and behaviors and depression, anxiety, and stress levels such as following safety guidelines, understanding the gravity of the situation and accepting the inconveniences, hoarding essentials, seeking information through unauthentic sources, and feeling troubled without substances [Table 4].

**Concerns related to the modified academic schedule**

We found that 57.2% of the students expressed uncertainty about the academic curriculum and examination schedules. Nearly 51.5% of the students expressed worries about missing out on clinical exposure and classroom teaching.

**Changes in sleep and appetite**

We noted that 75.1% of the students reported to have had changes in sleep in one or the other form, 33.3% had increased sleep, 23% had reversal of sleep cycle, 11.3% had changes in sleep quality, and 7.5% had reduced sleep. Almost 53.6% of the students had changes in appetite. In that 26.8% had increased appetite, 15.8% reported reduced appetite, and 11% had craving for sugars and carbohydrates. Figures 3 and 4 represent the changes in sleep and appetite, respectively.

Factors such as living away from the family and upcoming examination during the pandemic were found to have no association with depression, anxiety, and stress levels and QOL of students in this study.

**Multiple regression analyses**

The R (multiple correlation coefficient) has a value of 0.881, which indicates a good level of prediction [Table 5]. The “$R^2$ Square” (coefficient of determination) value of 0.776 indicates that the independent variables explain 77.6% of the variability of the dependent variable, depression. The adjusted $R^2$ value is very close to the $R^2$ square value, implying that our model generalizes well [Table 5]. Table 6 shows that the independent variables statistically significantly predict the dependent variable, $F(8, 521) = 225.546, P < 0.000$ (i.e., the regression model is a good fit of the data). Unstandardized coefficients ($B$) indicate how much the dependent variable varies with an independent variable when all other independent variables are held constant. For instance, “$B$” for age is $−0.07$, indicating that for each 1 year increase in age, there is a decrease in depression of 0.07 [Table 7]. The “Sig.” column in Table 7 shows that GHQ, anxiety, stress, and QOL coefficients are statistically significantly different from 0, though QOL is marginal. Similarly, the standardized beta coefficients imply that GHQ, anxiety, and stress coefficients had more impact than QOL. To summarize, a multiple regression was run to predict depression from gender, age, GHQ, anxiety, stress, and QOL coefficients. GHQ score, anxiety, stress, and QOL coefficients statistically significantly predicted depression, $F(7, 522) = 256.383, P < 0.000, R^2 = 0.776$. All the four variables added statistically significantly to the prediction, $P < 0.05$. 

![Figure 3: Changes in the sleep of the students in the study](image3.jpg)

![Figure 4: Changes in the appetite of the students in the study](image4.jpg)
Table 4: Association of depression, anxiety, and stress levels and various attitudes and behaviors in the study

| Attitude and behavior toward the COVID-19 pandemic | Type of response | Number of students | Depression | Anxiety | Stress |
|-----------------------------------------------|-----------------|------------------|------------|---------|--------|
|                                               |                 |                  | Median (IQR) | P       | Median (IQR) | P  | Median (IQR) | P  |
| I feel safe at home                           | Yes             | 512              | 4 (0-10)    | 0.001** | 2 (0-6)     | 0.002* | 4 (0-10)     | 0.001** |
|                                               | No              | 18               | 4 (0-10)    | 0.001** | 2 (0-6)     | 0.002* | 4 (0-10)     | 0.001** |
| I am thoroughly enjoying being at home with my family, pets, and/or utilizing the time in hobbies, interests, and/or adapting few healthy lifestyle changes | Yes             | 407              | 2 (0-8)     | 0.001** | 2 (0-4)     | 0.001** | 4 (0-8)      | 0.001** |
|                                               | No              | 123              | 8 (2-18)    | 0.001** | 4 (0-10)    | 0.001** | 10 (4-16)    | 0.001** |
| I have been following the WHO/national/state set safety guidelines thoroughly | Yes             | 528              | 4 (0-10)    | 0.42    | 2 (0-6)     | 0.94   | 4 (0-10)     | 0.66  |
|                                               | No              | 2                | 2           |          | 3           |        | 4           |        |
| As the priority at present is to curb the infection, the inconvenience caused by contingency measures are totally justifiable | Yes             | 380              | 4 (0-10)    | 0.09    | 2 (0-4)     | 0.005* | 4 (0-10)     | 0.15  |
|                                               | No              | 150              | 4 (0-16)    |          | 2 (0-8)     | 0.005* | 4 (0-12)     | 0.15  |
| I have remained confined to home with the sense of social responsibility | Yes             | 33               | 1 (0-7)     | 0.18    | 2 (0-4)     | 0.26   | 2 (0-6)      | 0.03* |
|                                               | No              | 497              | 4 (0-10)    |          | 2 (0-4)     |        | 2 (0-6)      |        |
| I feel stuck at home                          | Yes             | 196              | 6 (2-16)    | 0.001** | 2 (0-8)     | 0.001** | 6 (2-14)     | 0.001** |
|                                               | No              | 334              | 2 (0-8)     |          | 2 (0-4)     |        | 4 (0-8)      |        |
| I have remained confined to home only because of legal obligations | Yes             | 150              | 4 (0-16)    | 0.09    | 2 (0-8)     | 0.005* | 4 (0-12)     | 0.15  |
|                                               | No              | 380              | 4 (0-10)    |          | 2 (0-6)     | 0.005* | 4 (0-10)     | 0.15  |
| I have no fear of contracting the illness at all | Yes             | 119              | 4 (0-14)    | 0.36    | 2 (0-6)     | 0.28   | 4 (0-10)     | 0.55  |
|                                               | No              | 411              | 4 (0-10)    |          | 2 (0-6)     |        | 4 (0-10)     |        |
| I have often gone out of home unnecessarily during the lockdown as I felt overwhelmed being “homebound” | Yes             | 22               | 2 (0-2.5)   | 0.04*   | 0 (0-4)     | 0.07   | 2 (0-10)     | 0.34  |
|                                               | No              | 508              | 4 (0-10)    |          | 2 (0-6)     |        | 4 (0-10)     |        |
| I have been paying undue attention to the information regarding the COVID-19 pandemic on media to the extent that it is affecting me | Yes             | 134              | 4 (0-12.5)  | 0.09    | 2 (0-8.5)   | 0.02*  | 4 (0-12)     | 0.15  |
|                                               | No              | 396              | 4 (0-10)    |          | 2 (0-6)     |        | 4 (0-10)     |        |
| I have been hoarding a lot of essentials items such as groceries, personal care items, and/or personal protective equipment | Yes             | 134              | 3 (0-10)    | 0.30    | 2 (0-6.5)   | 0.50   | 4 (0-10)     | 0.14  |
|                                               | No              | 396              | 4 (0-10)    |          | 2 (0-6)     |        | 4 (0-10)     |        |
| I seek and believe information through social media such as WhatsApp forwards and Facebook/Twitter posts as they are authentic and the information is substantiated | Yes             | 44               | 2 (0-11.5)  | 0.31    | 2 (0-6)     | 0.91   | 2 (0-8)      | 0.16  |
|                                               | No              | 486              | 4 (0-10)    |          | 2 (0-6)     |        | 4 (0-10)     |        |
| I feel troubled as my usual destressing “vent-outs” such as social gatherings, shopping, eat-outs, movies, and pubbing are prohibited in the lockdown | Yes             | 279              | 8 (2-16)    | 0.001** | 4 (0-8)     | 0.001**| 8 (2-14)     | 0.001** |
|                                               | No              | 351              | 2 (0-6)     |          | 2 (0-4)     |        | 4 (0-8)      |        |
| I am facing problems as there is very limited/no access to cigarettes/alcohol/other substances | Yes             | 21               | 4 (0-16)    | 0.83    | 4 (0-6)     | 0.29   | 6 (1-15)     | 0.26  |
|                                               | No              | 509              | 4 (0-10)    |          | 2 (0-6)     |        | 4 (0-10)     |        |
| I am spending a significant amount of time over watching TV/Netflix/Amazon Prime/YouTube/WhatsApp/Facebook/Twitter/Instagram/TikTok/Gaming/Pornography/Others to the extent that it is hindering my studies | Yes             | 300              | 6 (2-14)   | 0.001** | 2 (0-8)     | 0.001**| 6 (0-12)     | 0.001** |
|                                               | No              | 230              | 2 (0-6)     |          | 0 (0-4)     |        | 4 (0-8)      |        |

Contd...
Table 4: Contd...

| Attitude and behavior toward the COVID-19 pandemic | Type of response | Number of students | Depression (Median, IQR) | P | Anxiety (Median, IQR) | P | Stress (Median, IQR) | P |
|-------------------------------------------------|------------------|-------------------|--------------------------|---|----------------------|---|----------------------|---|
| I am extremely afraid that I may contract the infection and pass it on to the loved ones | Yes              | 210               | 4 (0-14)                 | 0.003* | 4 (0-8)              | 0.001** | 6 (1.5-12)            | 0.001** |
|                                                | No               | 320               | 4 (0-8)                  |         | 0 (0-4)              |         | 4 (0-8)              |         |
| I have visited/called the family physician more than two times in the last month as I felt panicky on having mild-to-moderate symptoms of upper respiratory infection | Yes              | 17                | 4 (2-10)                 | 0.91 | 4 (2-12)             | 0.01* | 4 (1-10)             | 0.82  |
|                                                | No               | 533               | 4 (0-10)                 |       | 2 (0-6)              |       | 4 (0-10)             |       |

IQR - Interquartile range; *Significant (p ≤ 0.05); **Highly significant (p ≤ 0.001)

Table 5: Multiple regression analysis model summary

| Model | R   | R²  | Adjusted R² | Standard error of the estimate |
|-------|-----|-----|-------------|-------------------------------|
| 1     | 0.881* | 0.776 | 0.773 | 4.21750 |

*Dependent variable: depression; 1Predictors: (constant), stress, living, sex, knowledge, age, QOL, GHQ, anxiety. QOL - Quality of life; GHQ - General Health Questionnaire

DISCUSSION

The main goal of this study was to evaluate the knowledge, attitude, and behavior toward the COVID-19 pandemic, to analyze the mental health issues of students, and to understand the correlation between them.

Knowledge, attitude, and behavior toward COVID-19

In our study, 61.8% of the students answered ≥3/5 questions correctly, implying that they were well read and had fair fund of knowledge on the COVID-19 pandemic. A study of knowledge and practices of 240 Iranian medical students by Taghirir et al.[28] found that 79.6% of students had sufficient COVID-19-related knowledge. An Indian study by Modi et al.[21] with 1562 participants assessing the awareness, knowledge, and infection control practices related to COVID-19 infection among students and faculty from medical, dental, physiotherapy, nursing, nonclinical, and administrative found that awareness of 71.2% of responders was adequate. With an awareness of 74.1%, medical undergraduates’ (517 students) level of awareness was the highest among all the participants. A study by Chang et al.[29] found 69.4% awareness on COVID-19 in college students. Lesser percentage of students with good fund of knowledge in our study compared to other studies is probably explained by the higher level of difficulty of the questions and the difference in the method opted to decide the fund of knowledge as good in our study. Knowledge on COVID-19 did not differ between genders.

In our study, we took into account various attitudes and behaviors (both adaptive and maladaptive) of students toward the COVID-19 pandemic. In our study, majority of the students had adaptive attitudes and behaviors toward COVID-19, which served as deterrents against stress and hence more than 75% of students were free from mental health issues. Few attitudes and behaviors showed significant difference between the gender.

Depression, anxiety, stress, and quality of life

In our study, 23.2% of the students were found to have depression, 20.7% of the students had anxiety, and 13.0% of the students reported stress. Overall findings of depression, anxiety, and stress levels in our study were much lesser than the study by Odriozola-González et al.[23] on mixed student population, probably because of the better understanding of the present situation by medical students. Surprisingly, the multiple regression analysis revealed that knowledge about the virus, gender, age, and place of stay did not predict depression. However, scores of GHQ, anxiety, stress, and QOL significantly predicted depression.

Our findings of anxiety among students was similar to that of studies by Cao et al.[9] Findings of depression and anxiety among students were similar to that of the study by Chang et al.[29] In our study, girls had higher severity of depression and stress compared to boys. However, the severity of anxiety did not vary across gender, which is similar to the finding by Cao et al.[9] The mean score of QOL of the students in our study was in par with reference values of the QOL of few European countries,[17,19] indicative of good QOL. Depression, anxiety, and stress shared an inverse relation with the QOL.

Correlation between knowledge, attitude, and behavior toward the COVID-19 pandemic and depression, anxiety, and stress

The study did not find a significant correlation between knowledge on COVID-19 and depression, anxiety, and stress. Our students being well-informed medical students would have probably made the establishment of relation between the two difficult. To the best of our knowledge, this is the first study to evaluate possible relation between various attitudes and behaviors and depression, anxiety, and stress. Students with the cognition of feeling safe at home and practicing healthy coping strategies were found
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Table 6: Multiple regression analysis ANOVA

| Model | Sum of squares | df | Mean square | F    | Significant |
|-------|---------------|----|-------------|------|-------------|
| Model 1 |               |    |             |      |             |
| Regression | 32,094.793  | 8 | 4011.849    | 225.546 | 0.000<sup>a</sup> |
| Residual  | 9267.177     | 521 | 17.787     |      |             |
| Total    | 41,361.970   | 529 |            |      |             |

<sup>a</sup>Dependent variable: Depression; <sup>b</sup>Predictors: (constant), stress, living, sex, knowledge, age, QOL, GHQ, anxiety. QOL - Quality of life; GHQ - General Health Questionnaire

Table 7: Multiple regression analysis coefficients

| Model 1 | Unstandardized coefficients | Standardized coefficients | t       | Significant | 95.0% confidence interval for B | Collinearity statistics |
|---------|-----------------------------|---------------------------|---------|-------------|--------------------------------|-------------------------|
|         | B              | Standard error | β       |            | Lower bound | Upper bound | Tolerance | VIF |
| Constant| 6.380          | 2.794          | -0.014  | 2.284      | 0.023       | 0.892       | 11.868    |     |
| Age     | -0.07          | 0.108          | -0.014  | -0.651     | 0.515       | -0.282      | 0.142     | 0.888 | 1.126 |
| Sex     | -0.408         | 0.374          | -0.023  | -1.089     | 0.277       | -1.143      | 0.328     | 0.979 | 1.021 |
| Living  | -1.148         | 0.720          | -0.035  | -1.595     | 0.111       | -2.562      | 0.266     | 0.869 | 1.151 |
| Knowledge| 0.078         | 0.174          | 0.009   | 0.450      | 0.653       | -0.263      | 0.420     | 0.979 | 1.022 |
| GHQ     | 0.604          | 0.080          | 0.225   | 7.584      | 0.000       | 0.447       | 0.760     | 0.487 | 2.052 |
| QOL     | -0.789         | 0.363          | -0.057  | -2.176     | 0.030       | -1.501      | 0.077     | 0.625 | 1.599 |
| Anxiety | 0.313          | 0.055          | 0.205   | 5.696      | 0.000       | 0.205       | 0.421     | 0.332 | 3.015 |
| Stress  | 0.564          | 0.046          | 0.508   | 12.151     | 0.000       | 0.473       | 0.656     | 0.246 | 4.061 |

<sup>a</sup>Dependent variable: Depression. QOL - Quality of life; GHQ - General Health Questionnaire; VIF - Variance inflation factor

To have lesser severity of depression, anxiety, and stress than their counterparts. Students who chose to remain at home with the sense of social responsibility had less anxiety than those who remained at home due to legal obligation. Students who did not seem to have understood the gravity of the situation felt more stressed than others. Students harboring a cognition of feeling stuck at home had higher severity of mental health issues. Students adversely affected by media had higher anxiety than others. Students who felt distressed without “vent-outs” had higher levels of depression, anxiety, and stress than the ones who could get accustomed to the changed lifestyles. Students who reported problematic screen usage and extreme fears of infection had higher severity of mental health issues compared to their counterparts. Hence, overall, students with adaptive attitudes and behaviors experienced relatively less severe mental health issues and students with maladaptive attitudes and behaviors had mental health issues of relative greater severity.

Study-related concerns and changes in sleep and appetite

Nearly half of the students had excessive worries related to studies. Three-fourth of the students had changes in sleep. A study by Nicola et al.<sup>24</sup> on university students and workers reported poor quality of sleep and sleep wake rhythm changes in almost half of the students. Nearly 54% of the students had experienced changes in appetite. The study did not find statistically significant relation of living away from family and mental health issues, which is in contrast to the finding by Cao et al.<sup>[9]</sup> wherein students living away from the family during the pandemic experienced more anxiety. Small number of students living away from family would have made the establishment of the relation between the two difficult. The severity of depression, anxiety, and stress did not vary between the exam-going students and nonexam-going students in our study. Clear and frequent communications and reassurances by the institute and university would have played a role in alleviating the anxiety and stress of the exam-going students.

Limitation

1. The study population was limited to the consenting students of a single medical college; inclusion of students from various medical colleges across India would have yielded better results and interpretations
2. Implementing a cross-sectional, prospective study design in the present study would have been better.

Conclusion

As a result of the psychological impact of COVID-19 on students, a significant portion of medical undergraduate students are experiencing mental health issues and study-related concerns.

Implications

The educational bodies/institutes can mitigate the adversity of the present situation on the student community by...
following the steps mentioned below.
1. Understand the needs of students at different levels and stages
2. Provide pragmatic guidance/training for teachers on conducting effective online teaching
3. Make required changes to teach in different ways, and incorporate best suited curricula and assessment plans
4. Update students and parents with frequent communication on arrangements for replacing canceled examinations and modified admission procedures
5. Provide timely crisis-oriented psychological services (helplines and online resources) to address the mental health-care needs of the students.

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