

Original Research Article

Impact of COVID-19 pandemic on education and mental health of medical students: a nation-wide survey in India

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ABSTRACT

Background: The purpose of this study was to investigate the impact of COVID-19 pandemic on the education and mental health of undergraduate medical students in India.

Methods: A cross-sectional web-based study was conducted among MBBS students of all five years (n=604) selected by random sampling. Participants were administered questionnaires consisting of perceived stress scale (PSS-10), generalised anxiety disorder (GAD-7) for mental health assessment. A COVID-19 impact on medical education (CIME) questionnaire was developed for evaluating the impact on education. Bivariate logistic regression analyses were performed to examine the socio-demographic correlates.

Results: The mean score of COVID-19 impact on education, stress and anxiety were 26.2±5.2, 24.5±6.0 and 10.7±6.1 and their overall prevalence were 70.1% (66.4-73.8%), 38.9% (35.0-42.9%) and 54.1% (50.1-58.2%) respectively. There was positive correlation between CIME and stress (r=0.382, p<0.01) and anxiety (r=0.321, p<0.01). Internship [aOR=3.5 (1.5-8.3), p=0.003], not having romantic partner [aOR=1.4 (1.1-1.9)], stress [aOR=2.3 (1.4-3.7)] and anxiety [aOR=1.6 (1.1-2.5)] were positive predictors (p<0.05) of severe impact on education.

Conclusions: There was a severe impact of the pandemic on education of majority of the students. The stress and anxiety levels during the pandemic were relatively higher than usual indicating generalized worsening. Poor mental health outcomes and negative impact on education were evident positive predictors and correlates of each other.

Keywords: COVID-19, Medical education, Mental health, Medical students, Survey

INTRODUCTION

Coronavirus disease (COVID-19) caused by the new coronavirus strain SARS-CoV-2, is a deadly disease that continues to affect many countries in the world.¹ The World Health Organization (WHO) declared the COVID-19 outbreak as a pandemic on 11 March 2020.² In India, the number of new cases has been rising rapidly. Even today, COVID-19 outbreak continues to affect Indian lives.³

A nationwide lockdown was ordered by the Government of India from 25th March 2020.⁴ This also led to the stoppage of classroom-based learning and hospital-based clinical rotatory postings for MBBS students. Today, it has almost been one academic year and the duration of face-to-face teaching and hospital based clinical rotatory learning has been almost nil in India. The current implementation of competency based medical education (CBME) mandates exposures ranging from out-patients department and ward postings, where they will have interactive communication with patients and with

teachers during case presentation sessions, thus helping in the enhancement of communication and clinical skills. These have been significantly hampered.⁵

A prospective study conducted on medical students of Chennai showed a significant increase in anxiety and stress due to the COVID-19 pandemic from a prevalence of 21.2% to 33.2% and 20.7% to 24.9% respectively.⁶ Additionally, affected learning, irregular studies, uncertainty about examinations could have added to these levels. A limited pool of evidence showed a significant impact of COVID-19 pandemic on education in terms of students' confidence, preparedness and clinical exposure but all of them were non-Indian studies.⁷⁻⁹ The studies assessing the impact on education of medical students during the pandemic in India are still not available.

Given the unprecedented nature of the current COVID-19 pandemic, there is concern that students have been missing out on meaningful educational experiences and months of clinical training with unknown effects on their current well-being or professional trajectory.¹⁰ It is crucial to analyse the various socio-demographic variables and factors related to medical education and learning on the mental health of medical students in order to form policies regarding medical education and prepare for the possibility of future pandemics.¹¹

This study aimed at investigating the impact of the COVID-19 pandemic on education and learning, and on the mental health of medical students of India.

METHODS

Participants and setting

We conducted a cross-sectional survey to assess the impact of COVID-19 pandemic on education and mental health of undergraduate medical students across India. India offers the bachelor of medicine and bachelor of surgery (MBBS), a 5.5 years undergraduate medical course. A total of 604 MBBS students studying in pre-clinical (1st year), para-clinical (1.5 years after pre-clinical year), clinical (1 year of pre-final year and final year each) and those undergoing 1 year of compulsory rotatory resident internship (CRRI) participated in the study from May 2021 to June 2021, during the second wave of COVID-19 outbreak in India.

We collected the data by employing an anonymous, self-administered, voluntary, web-based survey covering a nationally representative sample from all the five gross regions of India. An informed consent form was administered before the survey and the same was implied by completion of the survey. The survey proforma consisted of various domains. The first domain included information on demographic details like age, gender, residence, year of study etc. Questions on relevant social information like COVID-19 positive history, having a romantic relationship etc. were included in the second

domain. The third domain had the COVID-19 impact on medical education (CIME) questionnaire for assessing impact on education and the fourth domain consisted of perceived stress scale (PSS-10) and generalized anxiety disorder (GAD-7) questionnaire.

Assessment of impact on medical education

A structured COVID-19 impact on medical education (CIME) questionnaire was developed for assessing the impact on education which was based on the study conducted by Harries et al.¹⁰ It consisted of 9 items assessing the self-reported impact based on the past one year of the pandemic. The items were designed to assess the impact on 'learning of clinical skills', 'continuity of self-study due to exams', 'preparation for residency/post-graduation', 'online teaching pattern', 'extra-curricular activities'. The questionnaire was scored based on a 5-point Likert scale. The total score ranged from 0 to 36 with higher score indicating higher negative impact on education. The students with CIME score equal or more than 25 were considered to have a severe impact on their education. The questionnaire was validated by content experts and pilot study among 25 students with content validity ratio 0.7 and Cronbach's alpha 0.82.

Assessment of impact on mental health

Emotional stress was evaluated using the perceived stress scale (PSS).¹² The PSS consisted of 10 items scored between 0 (never) and 4 (very often). The total score ranged from 0 to 40. Higher scores indicate greater perceived stress. We defined scores equal or more than 27 as having stress. We screened for anxiety disorders using the 7-item generalized anxiety disorder scale (GAD-7), which was validated in 2010.¹³ The total score ranges from 0 to 21, and we defined scores of 10 or more as having anxiety.

Ethical considerations

Ethical approval was obtained from the IEC, Government Medical College, Nagpur (2291 EC/Pharmac/GMC/NGP) and Helsinki Declaration for research on human participants was followed.

Statistical analysis

Descriptive statistics was performed for all variables. The scores of CIME, stress and anxiety were expressed as mean $\pm$ standard deviation (SD). We used chi-square test for comparison of proportions and ANOVA test for comparison of means of various variables in order to find out associations. Spearman's correlation was performed among the scores of CIME, PSS-10 and GAD-10. Adjusted binary logistic regression analysis was performed for CIME, stress and anxiety with multiple variables for understanding the predictors and their relationship. The statistical analysis was done in SPSS 26.0 software.

RESULTS

Socio-demographic information

We received a total of 604 responses from undergraduate medical students from all five years (312 males, 282 females and 10 others); the mean age was 21.1 ± 1.74 years. Majority (55.6%) of the students belonged to the western region of India (Table 1).

Table 1: Participant characteristics.

Characteristics	N (%)
Age (Mean$\pm$SD)	21.1 $\pm$ 1.74
Gender	
Male	312 (51.6)
Female	282 (46.7)
Other	10 (1.6)
Year of study	
First	148 (24.5)
Second	90 (14.9)
Third	114 (18.9)
Final	176 (29.1)
Internship	76 (12.6)
Region	
Western	336 (55.6)
Southern	122 (20.2)
Eastern	82 (13.6)
Central	35 (5.8)
Northern	29 (4.8)
Type of institution	
Public	495 (81.9)
Private	109 (18.0)
Residence	
Urban	465 (76.9)
Rural	139 (23.0)
Where do you live?	
College hostel	395 (65.4)
Own house	151 (25.0)
Rented room	58 (9.6)
Have you suffered from COVID-19 disease?	
Yes	150 (24.8)
No	454 (75.2)
Have any of your family members suffered from COVID-19 disease?	
Yes	355 (58.8)
No	249 (41.2)
Are you engaged in a romantic relationship?	
Yes	173 (28.6)
No	431 (71.3)

28.64% were engaged in a romantic relationship. A total of 24.83% themselves had suffered from COVID-19 disease and 58.77% had any of their family members suffered from the same.

Impact of COVID-19 pandemic on education and mental health

The mean score on CIME questionnaire was 26.269 ± 5.245 . The proportion of students with severe impact (CIME score ≥ 25) on education due to COVID-19 pandemic (with 95% confidence interval) was 70.198% (66.4-73.8%) (Table 2).

Table 2: Impact of COVID-19 pandemic on education.

Items in CIME [†] questionnaire	Strong agreement Frequency, % (95% CI)
My medical education has been significantly disrupted by the pandemic	539, 89.2% (86.6-91.6%)
I have been able to find meaningful learning opportunities in spite of the pandemic	212, 35.1% (31.3-38.9%)
My medical college has been doing everything they could to help students adjust	251, 41.6% (37.4-45.4%)
The pandemic has limited my ability to prepare for residency/post-graduation	378, 62.6% (58.4-66.6%)
The pandemic has significantly interfered with my learning of clinical skills	549, 90.9% (88.6-93.2%)
The uncertainty about exams has negatively affected my continuity of self-study and learning	530, 87.7% (84.9-90.4%)
COVID-19 has positively shaped or influenced how I imagine spending my career	234, 38.7% (34.8-42.9%)
Online teaching pattern has not been helpful to me for maintaining my education	442, 73.2% (69.7-77.0%)
The pandemic has disrupted ongoing extracurricular activities and opportunities for overall development	555, 91.9% (89.6-94.0%)

[†]CIME: COVID-19 impact on medical education.

The overall prevalence of stress and anxiety among the students was 38.90% (35.0-42.9%) and 54.14% (50.1-58.2%) respectively. The mean PSS-10 and GAD-7 scores were found to be 24.50 ± 6.04 and 10.73 ± 6.18 respectively.

Relationship between socio-demographic variables and CIME, stress and anxiety

Females had a higher prevalence and mean score of stress and anxiety as compared to males ($p < 0.01$). The clinical years (especially Interns) had a higher impact of pandemic on education ($p < 0.001$), stress ($p < 0.01$) and anxiety ($p < 0.001$) in terms of both mean and prevalence. There was a higher impact of pandemic on education

(both proportion and CIME score) amongst students from rural sector than those from urban ($p < 0.05$), however there was no such association with stress and anxiety.

Other than this, there were no significant associations between socio-demographic variables and mental health and impact on education in this survey (Table 3).

Table 3: Relationship between socio-demographic variables and CIME, stress and anxiety.

Variables	CIME [¶]		Stress		Anxiety	
	Mean±SD [†] frequency (%)	P value	Mean±SD frequency (%)	P value	Mean±SD frequency (%)	P value
Gender						
Male	26.09±5.78, 200 (70.9%)	0.721 0.747	23.17±6.42, 93 (33.0%)	0.00* 0.002*	9.77±6.25, 135 (47.9%)	0.001* 0.002*
Female	26.43±4.73, 218 (69.9%)		25.75±5.48, 141 (45.2%)		11.65±5.98, 189 (60.6%)	
Others	26.40±4.74, 6 (60.0%)		23.30±3.71, 1 (10.0%)		9.20±6.42, 3 (30.0%)	
Year of study						
First	24.22±5.58, 83 (56.1%)	0.000* <0.001*	23.59±6.28, 49 (33.1%)	0.004* 0.012*	9.02±5.95, 64 (43.2%)	0.000* 0.001*
Second	25.31±4.80, 56 (62.2%)		23.77±5.48, 28 (31.1%)		10.21±5.74, 47 (52.2%)	
Third	27.77±4.78, 94 (82.5%)		26.19±5.43, 57 (50.0%)		12.14±5.66, 71 (62.3%)	
Final	26.89±5.31, 127 (72.2%)		24.20±6.80, 65 (36.9%)		10.84±6.89, 92 (52.3%)	
Interns	27.72±4.06, 64 (84.2%)		25.34±4.55, 36 (47.4%)		12.32±5.24, 53 (69.7%)	
Living as						
Hostelite	26.28±5.12, 275 (69.6%)	0.921 0.906	24.43±5.84, 149 (37.7%)	0.496 0.687	10.75±5.96, 218 (55.2%)	0.360 0.608
Localite	26.34±5.10, 108 (71.5%)		24.93±6.12, 63 (41.7%)		11.06±6.62, 81 (53.6%)	
Rented	26.02±6.39, 41 (70.7%)		23.90±7.17, 23 (39.7%)		9.70±6.42, 28 (48.3%)	
Residence						
Urban	26.02±5.32, 317 (68.2%)	0.030*	24.32±6.18, 175 (37.6%)	0.176	10.56±6.25, 248 (53.3%)	0.218
Rural	27.12±4.90, 107 (77.0%)	0.046*	25.12±5.53, 60 (43.2%)	0.241	11.30±5.90, 79 (56.8%)	0.467
Type of institution						
Public	26.19±5.15, 338 (51.3%)	0.402	24.39±6.15, 184 (37.2%)	0.303	10.49±6.26, 254 (51.3%)	0.042*
Private	26.65±5.63, 86 (67.0%)	0.028*	25.05±5.55, 51 (46.8%)	0.062	11.82±5.67, 73 (67.0%)	0.003*
Engaged in Romantic relationship						
Yes	26.02±5.29, 116 (67.0%)	0.0382*	24.01±6.23, 57 (32.9%)	0.032*	10.05±5.91, 82 (47.3%)	0.039*
No	26.98±5.07, 334 (77.4%)	0.0077*	25.20±6.02, 180 (41.7%)	0.044*	11.19±6.29, 247 (57.3%)	0.027*
Suffered from COVID-19						
Yes	26.32±5.18, 320 (70.5%)	0.661	24.54±6.00, 181 (39.9%)	0.783	10.82±6.03, 252 (55.5%)	0.540
No	26.11±5.44, 104 (69.3%)	0.789	24.39±6.19, 54 (36.0%)	0.400	10.46±6.61, 75 (50.0%)	0.241
Family member(s) suffered from COVID-19						
Yes	26.59±4.99, 176 (70.7%)	0.215	24.31±6.02, 97 (39.0%)	0.515	10.28±6.11, 134 (53.8%)	0.134
No	26.05±5.40, 248 (69.9%)	0.828	24.64±6.07, 138 (38.9%)	0.984	11.05±6.21, 193 (54.4%)	0.894

¶COVID-19 impact on medical education †standard deviation *statistical significance ($p < 0.05$), p values mentioned above are for comparison of means by ANOVA test and unpaired t-test and ones mentioned below are for comparison of proportions by chi-square test.

Correlation between scores of CIME, stress and anxiety

The results from correlation analysis of the scores on instruments for impact of COVID-19 on education (CIME), stress (PSS-10) and anxiety (GAD-7) is shown in Table 4. There were significant positive correlations between CIME, stress and anxiety scores. There was a moderate positive correlation between CIME score and stress ($r = 0.382$, $p < 0.01$) and anxiety ($r = 0.321$, $p < 0.01$) indicating that higher impact on education was associated with higher stress and anxiety scores and vice versa. A strong positive correlation was observed between stress and anxiety scores ($r = 0.649$, $p < 0.01$).

Table 4: Correlation between scores of CIME, stress and anxiety.

	CIME [¶]	Stress	Anxiety
CIME	1.000	-	-
Stress	$r^{\dagger} = 0.382$ ($p < 0.001$ *)	1.000	-
Anxiety	$r = 0.321$ ($p < 0.001$ *)	$r = 0.649$ ($p < 0.001$ *)	1.000

Binary logistic regression analysis of CIME, stress and anxiety

The results of binary logistic regression analysis for COVID-19 impact on education, stress and anxiety are

shown in Table 5. Interns were found to be significantly associated with an increase in impact on education [aOR=3.58 (1.54-8.33)], stress [aOR=1.198 (0.548-2.621)] and anxiety [aOR=2.54 (1.15-5.58)] ($p<0.05$). Females were found to be associated with increased stress levels ($p=0.018$). Students who had stress [aOR=2.34 (1.47-3.79)] and anxiety [aOR=1.69 (1.11-2.57)] were

more likely to have higher negative impact on their education ($p=0.001$, 0.015). Stress and anxiety were found to be positive predictors of each other [aOR=7.3 (4.8-11.1)]; $p<0.01$). Students with severe impact of COVID-19 pandemic on education were more likely to be stressed and anxious ($p<0.001$).

Table 5: Binary logistic regression analysis of CIME, stress and anxiety.

Variables	CIME [†]		Stress		Anxiety	
	aOR (95% CI)	P value	aOR (95% CI)	P value	aOR (95% CI)	P value
Gender						
Male	1 (1-1)	-	1 (1-1)	-	1 (1-1)	-
Female	0.77 (0.51-1.15)	0.209	1.03 (0.60-1.76)	0.018*	1.35 (0.91-2.01)	0.127
Others	0.88 (0.22-3.50)	0.862	1.35 (0.83-2.18)	0.196	0.97 (0.22-4.19)	0.968
Year of study						
First	1 (1-1)	-	1 (1-1)	-	1 (1-1)	-
Second	1.58 (0.86-2.88)	0.135	0.71 (0.36-1.39)	0.319	1.77 (0.94-3.35)	0.076
Third	3.22 (1.68-6.18)	<0.001*	1.43 (0.75-2.70)	0.270	1.58 (0.85-2.94)	0.146
Final	2.27 (1.31-3.92)	0.003*	0.97 (0.53-1.76)	0.921	1.30 (0.73-2.30)	0.359
Internship	3.58 (1.54-8.33)	0.003*	1.19 (0.54-2.62)	0.651	2.54 (1.15-5.58)	0.020*
Residence						
Urban	1 (1-1)	-	1 (1-1)	-	1 (1-1)	-
Rural	1.53 (0.92-2.51)	0.100	1.35 (0.83-2.18)	0.220	0.93 (0.57-1.50)	0.776
Type of institution						
Public	1 (1-1)	-	1 (1-1)	-	1 (1-1)	-
Private	1.04 (0.59-1.83)	0.887	1.03 (0.60-1.76)	0.905	1.35 (0.79-2.31)	0.260
Not engaged in romantic relationship	1.42 (1.19-1.96)	0.002*	1.21 (1.02-1.56)	0.035*	1.34 (1.03-1.59)	0.04*
Suffered from COVID-19	0.93 (0.58-1.49)	0.780	0.87 (0.53-1.42)	0.588	0.80 (0.50-1.28)	0.369
Family member(s) suffered from COVID-19	0.87 (0.58-1.83)	0.524	1.02 (0.67-1.55)	0.914	1.06 (0.71-1.60)	0.753
CIME	-	-	2.35 (1.48-3.75)	<0.001*	1.66 (1.09-2.53)	0.017*
Stress	2.34 (1.47-3.73)	<0.001*	-	-	7.35 (4.82-11.20)	<0.001*
Anxiety	1.69 (1.11-2.57)	0.015*	7.31 (4.80-11.12)	<0.001*	-	-

[†]CIME: COVID-19 impact on medical education *statistical significance ($p<0.05$).

DISCUSSION

The COVID-19 pandemic has significantly transformed education at all strata and fields. The medical education is no exception to this. Given that there is an already prevalent poor mental health among medical students of India, especially during the pandemic, these areas needed a comprehensive exploration. The literature grossly lacked the data on impact of the pandemic on these aspects. This study investigated the impact of COVID-19 pandemic on education and mental health of 604 medical students, giving a nationally representative data.

We found a severely high impact of the pandemic on education in 70.1% [95% CI (66.4-73.8%)] of the medical students. More than 87% students reported that the pandemic had significantly disrupted their medical education which was much higher than the US medical

students (74.7%).¹⁰ Although the proportion of students (35.1%) who were able to find meaningful learning opportunities despite the pandemic were considerably high, 73.2% felt that online teaching had not been helpful to them for maintaining their education. This warrants attention to the functioning of online teaching which is still being widely practiced. Evidently, nearly all of the students faced a major interference in their learning of clinical skills and a limitation to the preparation for residency or post-graduation. This indicates possible repercussions on the development of compatible future physicians in India.

The prevalence of stress and anxiety was 38.90% [95% CI (35.0-42.9%)] and 54.14% [95% CI (50.1-58.2%)] respectively. These levels were higher than reported by studies conducted before the pandemic viz. 21.2% and 20.7%, 13.3% and 33.4%, 34.1% 31.0% and 25.0% and

13.3% for stress and anxiety respectively.^{6,14-16} This aggravation in the poor mental health parameters clearly suggest a generalised worsening of mental health due to the COVID-19 pandemic.

The scores of negative impacts of pandemic on education were significantly correlated with the scores of both stress and anxiety in a positive fashion. Both these issues hence, need to be addressed in unison for effectively mitigating the detrimental impact they have on each other. The need for medical colleges to focus on comprehensively improving and maintaining the mental health of their students and not just their education is now more than ever. This when addressed will give better outcomes in students' education and learning as well.

Even though, there was no statistical difference between the impacts on education for different genders, female students were found to have higher levels of stress and anxiety ($p < 0.002$) when compared with other genders. A majority of the students usually living in the college hostels had to stay home at their native places due to the nationwide lockdown. Yet, there was no statistical difference between the impact of the pandemic on both education and mental health of hostel resident and local resident students. The students in clinical years (third, final and internship) experienced a significantly higher impact on education ($p < 0.004$) than those in para-clinical years (first and second). This could be attributed to the fact that most of the learning experiences in para-clinical years are derived from training in the hospital-based postings which were completely shut during the lockdown. Additionally, educators who were also working on the additional clinical burden during the outbreak must have faced difficulties in adapting to unconventional teaching methodologies. In a parallel manner, the levels of anxiety and stress were also much higher in the students of clinical years. Students studying in private institutes reported a higher impact on education and anxiety levels than those in public institutes which could be due to poor management of teaching in those institutes. There was no such difference seen between the students in urban and rural areas except that students in rural areas understandably faced a slightly higher impact on education. These demographic associations were inconsistent with the finding of Saraswathi et al which found no demographic associations of stress and anxiety levels with gender, year of study or residence.⁶

The adjusted bivariate regression analysis revealed a set of factors which were associated with the negative impact on education and worsening of mental health. Internship had much higher odds [aOR = 3.58 (95% CI, 1.54-8.33)] of negative impact on both education and mental health than other years. This could be due to an upfront realisation of lack of clinical skills which were missed out during their final year that was spent in the lockdown. Lack of romantic partner emerged as another significant predictor of impacted education [aOR=1.42 (95% CI, 1.19-1.96)] and stress [aOR=1.21 (95% CI, 1.02-1.56)]

and anxiety [aOR=1.34 (95% CI, 1.03-1.59)]. The feeling of isolation and faded connections could have resulted into worsening of mental health and hence into impairment of learning. This prompts to explore if the generalised lack of companionship among medical students affecting their mental health as well as their education and training. Students or their family members testing positive for COVID-19 had no association with either stress and anxiety or impact on education. Hence, the long-term isolation due to lockdown could be a major factor at play and not the generalised apprehension towards COVID-19 disease per se.

The major strength of this study lies in the fact that this is a structured quantitative assessment of impact of COVID-19 pandemic on medical education. To the best of investigators' knowledge, this is a first study in India which quantitatively assesses the impact on both education and mental health post the span of exactly one academic year. The students who responded to this survey belonged to medical colleges throughout India, giving a representative sample from all the regions of the country. This study lays groundwork for addressing various predictors at play in impact on education and mental health of students and further research on them. It would also help devise better teaching modalities and plans for the maintenance and promotion of mental health in the future waves of the current pandemic and the pandemics to come.

This study comes with its own set of limitations. The assessment of mental health in this study did not include other parameters like depression and sleep quality etc. which could also be impacted. Since the data was collected after almost one year in the pandemic, the mental health status was based on the recent period and not temporally over the pandemic.

CONCLUSION

There was a severe impact of the COVID-19 pandemic on education of majority of the medical students. The stress and anxiety levels during the pandemic were relatively higher than usual, indicating a generalised worsening of mental health. Various factors which emerged as positive predictors for higher impact on education and mental health need to be further researched. Poor mental health outcomes and negative impact on education need to be addressed in a holistic manner. Effective measures to prevent detrimental effects on mental health and education are warranted in order to maintain not only the quality of life of medical students but also the healthcare system. We believe that the findings of this study will help in addressing this impact of the current pandemic and raise preparedness for pandemics in the future.

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