

Nationwide impact of COVID-19 pandemic on postgraduate medical teaching, research, and mental stress: A cross-sectional online questionnaire-based survey

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Abstract

Background and Aims: Coronavirus disease-2019 (COVID-19) pandemic has affected postgraduate medical education, training, and ongoing research work across specialties. Our survey aimed to analyze the effect of COVID-19 on challenges in pursuing research and academics and ascertain the stressors on residents across medical specialties.

Material and Methods: The questionnaire was validated by 10 experts and following ethical approval, this google form-based survey was circulated to postgraduates across specialties across the country through social media platforms over 1 month (22 August 2020 to 21 September 2020). On clicking the link, the participants received brief information regarding the survey followed by the questionnaire. Weekly reminders were sent to the nonresponders till the desired sample size was attained, after which the survey was closed, and responses were analyzed.

Results: Four hundred and nineteen of 900 residents completed the survey (46.6% response rate). Majority (88.8%) admitted that the inability to conduct the thesis and break in academics caused a significant amount of mental stress upon them. Though classes had resumed through online platforms for most residents (75.4%), the residents reported that lack of bedside learning (65.4%), inadequate progress tests (26.4%), and delay in thesis topic allotment (84.6% among those not allotted thesis) correlated with increased stress. Fear of extension of the course (53%; $P = 0.019$) and getting infected with COVID-19 (46.6%; $P = 0.019$) were most cited reasons for significant stress in most of the residents. Many residents (26%) were unable to sleep properly and 22.1% were unable to concentrate on academics. Majority believed that extension of the submission deadline, reduction in sample size, and change in topic would help to complete thesis.

Conclusion: The present survey revealed that there is a major impediment to research and academics of medical postgraduates during COVID-19 pandemic which has markedly increased their stress levels.

Keywords: Anxiety disorders, COVID-19, education, graduate, learning, sample size, sleep

Introduction

The novel severe acute respiratory syndrome coronavirus 2 (COVID-19) pandemic has challenged the healthcare

providers (HCP) worldwide. One of the main burdens of the COVID-19 pandemic seems to be borne by the educational programs including the post-graduate medical education of all specialties across the board be its impact on their teaching

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Quick Response Code:	Website: https://journals.lww.com/joacp
	DOI: 10.4103/joacp.JOACP_673_20

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How to cite this article: Gupta A, Haritha D, Ramachandran R, Subramaniam R, Sai GM, Chikoti G, *et al.* Nationwide impact of COVID-19 pandemic on post graduate medical teaching, research, and mental stress: A cross-sectional online questionnaire-based survey. *J Anaesthesiol Clin Pharmacol* 2022;38:S34-45.

Submitted: 17-Dec-2020

Revised: 18-Mar-2021

Accepted: 03-Apr-2021

Published: 18-Nov-2021

curriculum, examinations, training, or ongoing thesis research work.

The reduced footfall of patients in our teaching hospitals due to the pandemic has also hampered the ongoing postgraduate (PG) research projects across all clinical disciplines. Because these courses are time bound, the decrease in available number of patients to be recruited may prevent the attainment of the desirable sample size and affect the statistical validity of the research work.^[1]

The unprecedented challenges mounted by the pandemic have directed us towards search for innovative solutions to continue with teaching and trainings for postgraduate trainees pursuing speciality and super-speciality courses while maintaining physical distance. Online digital platforms like Zoom, GoTo meeting and social media platforms like WhatsApp and others are ubiquitously being applied in COVID era to continue with educational activities.^[2,3] A salient drawback of these virtual teaching platforms is that they lack natural human face to face communications which are enriched with gesture, body language, and expressions that enhance learning during the traditional teaching methodology.^[4,5]

The pandemic has resulted in an increased workload and emotional stress related both to academics and the risk of contracting infection to self and to the family members have had a great bearing to the resident doctors. Working in isolation, loss of social support, changes in the ways of working, stressful working conditions, and hectic working hours in COVID areas has added to the woes of our PGs who are already concerned about the state of their academics and thesis. Based on a recent systematic review, it appears that our HCPs have also become vulnerable to various psychological issues and need support to enhance their abilities to face the pandemic and its repercussions.^[6]

We therefore decided to undertake this nationwide electronic survey among the students of the postgraduate and super speciality courses across specialities to ascertain the nature and extent of impact of the COVID-19 pandemic on the conduct of thesis and teaching activities along with the resultant stress. We have also made an endeavor to identify the possible stressors and countermeasures to minimize their impact on academic curriculum and thesis work. Our survey has tried to find out the present lacunae in academic activities and thesis-related work of postgraduate trainees pursuing speciality and super-speciality courses across all medical specialities and its impact on their stress levels.

Material and Methods

The survey was approved by our Institutional Ethics Committee (IEC-84507.08.2020, RP-25/2020) and

enrolled postgraduate (MD, MS) and superspeciality trainees (DM, Mch) from different medical colleges across the country over one month from 22 August to 21 September 2020.

Online semi-structured questionnaire was developed to assess the challenges faced by the postgraduates in pursuing teaching and research activities related to their PG tenure, the level of stress being faced due to the deficiencies which have arisen during the pandemic and the strategies being adopted to overcome those challenges [Annexure 1]. The questionnaire was sent out to 15 experts for validation. Ten experts across the diverse specialities responded to our request and graded it as per the instructions provided. The mean of item-wise content validity index for relevance, simplicity, clarity, and ambiguity was 0.99, 0.99, 0.94, and 0.96 respectively. In our study, the Kappa statistic of each question in relevance, simplicity, clarity and ambiguity was between 0.75-1 which was excellent as per strength of agreement classified by Cicchetti.^[7] Content Validity Index (CVI) method was used to calculate content validity quantitatively. The content validity index for individual items (I-CVI) is defined as the number of experts giving the rating of “very relevant” for each questionnaire item divided by the total number of validating experts. The content validity index of overall scale (S-CVI) is the proportion of items given a rating of ‘very relevant’ by all the specialists involved. I-CVI was 0.80 and S-CVI/Average was 0.9 which fully satisfied validation process.^[8] After validation, this questionnaire was transformed into an online google form and its link was shared to these students through emails and social media platforms such as WhatsApp, Facebook and Telegram. A Snowball sampling technique was used, and the participants were encouraged to roll out the survey to as many people as possible. Teaching faculty members in the social circle of the investigators from all specialities belonging to different medical colleges across the nation circulated the google form to the PGs of their institute using the above platforms. On clicking the link, the participants received a brief information regarding the need for the survey followed by a participant consent. After they consented to take the survey, a set of several mandatory questions appeared sequentially which the participants had to answer. The survey did not contain any question that would disclose the subject’s or the institute’s identity and the results were kept confidential. Weekly reminders were sent to the non-responders till the desired sample size was attained (4 weeks), after which the survey was closed and total responses received were pooled, categorized, charted, and analyzed.

Statistical analysis

The categorical variables were expressed as number and percentage. Associations were calculated using the

Chi-square test. A *P* value of less than 0.05 was considered significant. We expected that 50% of the postgraduate research will be affected by COVID-19. Taking 5% absolute margin of error with 95% confidence level the sample size of 384 was estimated. We decided to include at least 410 participants to account for incomplete forms in 5% cases. Statistical analysis was conducted using SSPS version 20 (Armonk, NY: IBM Inc.).

Results

This google form-based survey was circulated via various social media platforms and colleagues to 900 PG students. A total of 419 responses were received with a response rate of 46.6%. Of these, 39 (9.3%) were pursuing super specialty degrees and the rest were pursuing post-graduation. Majority of the responses i.e., 84.2% were from government institution. Majority of the postgraduates (96.6%) that responded had thesis in clinical settings which is anticipated to be much more affected by the pandemic due to suspension of the routine health care services [Table 1].

Of 419 residents, only 30 (7.1%) had submitted their thesis, 354 (84.5%) were yet to submit and the topic was not assigned to 26 (6.2%) residents. The major concerns regarding the thesis included fear of extension 179 (42.7%), risk of infection 150 (35.8%), and inability to publish the thesis 147 (35.1%) [Table 2]. The inability to submit the thesis 318 (75.9%) and lack of topic allotment 23 (5.5%) were cited as a reason for significant stress in most of the residents. Three hundred and seventy-three (88.8%) residents admitted that the lack of thesis and break in academics caused a significant amount of mental stress upon them [Figure 1]. However, majority of them 147 (35.1%) believed that they will be able to complete thesis with the extension of the date of submission. Other prominent suggestions included reduction in sample size 44 (10.5%) and change in topic 27 (6.4%). A vast majority of the residents were posted in the COVID area 277 (66.1%) and this was responsible for additional stress [Table 3]. The mental stress was more

in second-year PGs (*P* = 0.032) and those with clinical thesis (*P* = 0.005) [Table 3].

Another major concern during the pandemic was lack of skill-based training due to suspension of routine services [237/419 (56.5%), *P* = 0.329]. The other concerns brought up were fear of extension of the course [206/419 (49.2%), *P* = 0.01], delay in plans made for future [205/419 (45.1%), *P* = 0.03], fear of getting infected with COVID-19 [182/419 (43.4%), *P* = 0.01], prolonged duty hours [103/419 (24.5%), *P* = 0.12], lesser job opportunities due to economic slowdown [90/419 (21.4%), *P* = 0.17] and inability to pursue further studies abroad [67/419 (15.9%), *P* = 0.60] [Figure 2].

One hundred four students (26%) expressed the concern that they are unable to sleep properly, while 83 students (19.8%) admitted that they were unable to concentrate properly on academics and thesis [Table 3 and Figure 3].

The classes had resumed through online platforms for most (75.4%) residents. But the residents largely reported that a lack of bed side learning (60.6%, *P* = 0.002) and the lack of progress tests (26.4%, *P* = 0.011) due to ongoing pandemic caused significant stress. The other concerns that they expressed included decreased interaction with seniors (54.4%, *P* = 0.75), reduced impetus to learn due

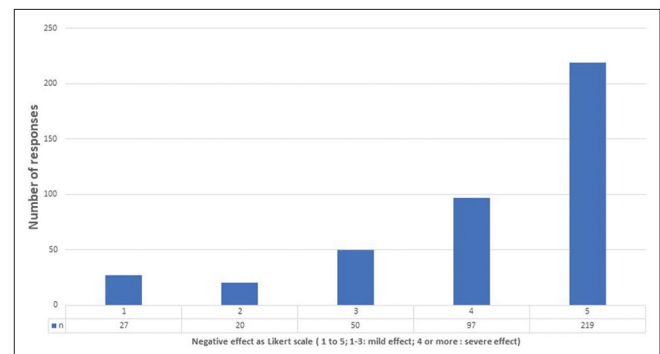


Figure 1: Negative effect of COVID-19 on conduct of thesis of postgraduate students

Table 1: Demographic characteristics

Variable	No of residents (n=419)
Degree of pursuit (Postgraduation/superspeciality)	380 (90.7%)/39 (9.3%)
Institute (Government/Private/Autonomous)	324 (77.3%)/57 (13.6%)/38 (9.1%)
Year of pursuit (First year/second year/third year)	69 (16.5%)/188 (44.9%)/162 (38.6%)
Thesis type (Clinical/Non-clinical)	404 (96.4%)/15 (3.6%)
Speciality (Medical/Surgical/Pre and para clinical)	337 (80.4%)/49 (11.7%)/33 (7.9%)
Status of thesis (Thesis not assigned/ongoing/not yet submitted)	354 (84.5%)/30 (7.1%)/26 (6.2%)
Present area of posting (COVID area/Non COVID area)	277 (66.1%)/142 (33.9%)
Sample size (<100/>100)	271 (64.7%)/148 (35.3%)
Classes continued (Y/N)	322 (76.9%)/97 (23.1%)

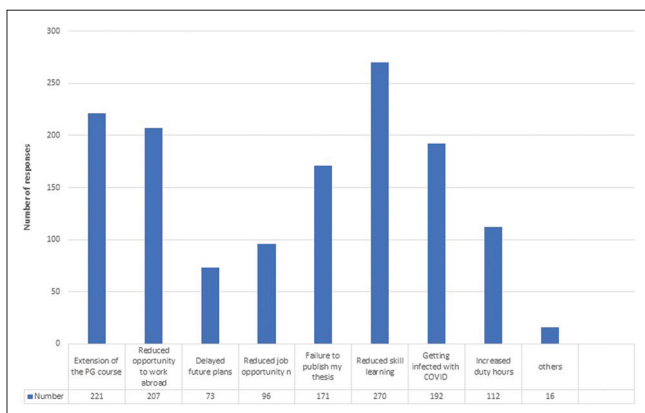
Table 2: Association of NRS Negative with various study parameters during COVID pandemic

Variable	Categories	Minimal (n=97)	Neutral (n=97)	Severe (n=322)	Odds ratio (95% CI)	P
Degree	Postgraduation	88 (90.7)		292 (90.7)	1.0	0.991
	Super speciality	9 (9.3)		30 (9.3)	1.0 (0.5-2.2)	
Institute	Govt.	76 (78.4)		248 (77.0)	1.0	0.232
	Autonomous	16 (16.5)		41 (12.7)	0.8 (0.4-1.5)	
	Pvt	5 (5.0)		33 (10.2)	2.0 (0.8-5.4)	
Year of pursuit of degree	First year	14 (14.4)		55 (17.1)	0.4 (0.2-0.8)	P<0.001
	Second year	15 (15.5)		173 (53.7)	1.0	
	Third year	68 (70.1)		94 (29.2)	0.1 (0.06-0.22)	
Thesis type	Clinical	91 (93.8)		313 (97.2)	1.0	0.125
	Non-clinical	6 (6.2)		9 (2.8)	0.44 (0.15-1.26)	
Speciality	Medical Specialties	77 (79.4)		260 (80.7)	1.0	0.029
	Surgery Specialties	7 (7.2)		42 (13.0)	1.78 (0.77-4.11)	
	Others	13 (10.3)		20 (4.0)	0.46 (0.22-0.96)	
Present status of the thesis	Not yet submitted	73 (75.3)		281 (87.3)	1.0	<0.001
	Submitted	17 (17.5)		11 (3.4)	0.17 (0.08-0.37)	
	Topic not assigned	4 (4.1)		22 (6.8)	1.43 (0.48-4.28)	
	Others	3 (3.1)		8 (2.5)	0.69 (0.18-2.68)	
Present Area of posting	COVID	56 (57.7)		221 (68.6)	1.60 (1.01-2.55)	0.047
	NON-COVID	41 (42.3)		101 (31.4)	1.0	
Sample Size	<100	57 (57.7)		214 (66.5)	1.0	0.164
	>100	40 (42.3)		108 (33.5)	0.72 (0.45-1.15)	
Present recruited	< 50%	43 (44.3)		253 (78.6)	4.61 (2.85-7.45)	<0.001
	>50%	54 (55.7)		69 (21.4)	1.0	
Response of institution	Yes	47 (48.5)		241 (75.1)	0.35 (22-0.57)	<0.001
	No	50 (51.5)		80 (24.9)	1.0	
Suggestions to solve this crisis	Extension	45 (46.4)		103 (32.2)	0.54 (0.34-0.86)	0.010
	Reduction in sample size	7 (7.2)		37 (11.5)	1.67 (0.72-3.87)	0.229
	Electronic submission	3 (3.1)		24 (7.5)	2.52 (0.74-8.57)	0.125
	Change in topic	4 (4.1)		23 (7.1)	1.79 (0.60-5.03)	0.288
	Assurance	18 (18.6)		24 (7.5)	0.35 (0.18-0.68)	0.001
	None	28 (31.1)		183 (57.7)	3.34 (2.04-5.47)	<0.001
Major concerns in this pandemic in relation to the thesis and academic	Extension	44 (45.4)		179 (55.6)	1.51 (0.96-2.38)	0.077
	Abroad	20 (20.6)		54 (16.8)	0.78 (0.44-1.38)	0.384
	Plan	41 (42.3)		164 (51.2)	1.42 (0.90-2.24)	0.135
	Less job	20 (20.6)		77 (23.9)	1.21 (0.70-2.11)	0.500
	Publish	30 (30.9)		147 (45.7)	1.88 (1.16-3.04)	0.010
	Skill	59 (61.5)		204 (63.6)	1.11 (0.70-1.78)	0.651
	COVID infection	46 (47.4)		150 (46.6)	0.97 (0.61-1.52)	0.885
	Duty	19 (19.6)		92 (28.9)	1.64 (0.94-2.87)	0.079
Effect of psychological stress	Nervous	12 (12.5)		43 (13.4)	1.09 (0.55-2.16)	0.802
	Sleep	20 (20.8)		92 (28.8)	1.54 (0.89-2.66)	0.125
	Irritable	9 (9.3)		57 (17.7)	2.10 (1.00-4.22)	0.046
	Doom	11 (11.3)		46 (14.3)	1.33 (0.66-2.69)	0.458
	Mood	12 (12.4)		44 (13.7)	1.12 (0.57-2.20)	0.743
	Concern	18 (18.6)		75 (23.3)	1.33 (0.75-2.37)	0.325
	Fatigue	14 (14.4)		62 (19.3)	1.41 (0.75-2.37)	0.280
	Memory	11 (11.3)		30 (9.3)	0.80 (0.39-1.67)	0.557
How are the class being continued	Online	77 (80.2)		240 (74.8)	0.76 (0.44-1.32)	0.329
	None	17 (17.5)		80 (24.8)	1.56 (0.87-2.78)	0.134
	Video	4 (4.1)		30 (9.3)	2.39 (0.87-2.78)	0.101
	Notes	3 (3.1)		20 (6.2)	2.08 (0.60-7.14)	0.237
	Simulation	2 (2.1)		21 (6.5)	3.31 (0.76-14.39)	0.091
	Offline	1 (1.0)		2 (0.6)	0.60 (0.05-6.69)	1.00

Contd...

Table 2: Contd..

Variable	Categories	Minimal_Neutral (n=97)	Severe (n=322)	Odds ratio (95% CI)	P
Problems faced in pursuing academic	Lack of Beside classes	58 (59.8)	217 (67.4)	1.39 (0.87-2.22)	0.167
	Reduced interaction with seniors	53 (54.6)	202 (62.7)	1.40 (0.88-2.21)	0.152
	Impetus	38 (39.2)	155 (48.1)	1.44 (0.91-2.29)	0.121
	Lack of Progress test	21 (21.6)	90 (28.0)	1.40 (0.82-2.41)	0.218
	Less frequent classes	32 (33.0)	105 (32.6)	0.98 (0.61-1.59)	0.944
Suggestions to improve the teaching conditions	Connectivity issues	27 (27.8)	121 (37.6)	1.56 (0.95-2.57)	0.078
	More classes	49 (50.5)	147 (45.7)	0.82 (0.52-1.30)	0.400
	Use paid app	4 (4.1)	10 (3.1)	1.64(0.94-2.87)	0.747
	Offline	29 (29.9)	97 (30.1)	1.01 (0.62-1.66)	0.966
	handout	15 (15.5)	50 (15.5)	1.01 (0.54-1.88)	0.988
	simulation	23 (23.7)	86 (26.7)	1.17 (0.69-1.99)	0.555
	webinar	10 (10.3)	48 (14.9)	1.52 (0.69-1.99)	0.250
none	2 (2.1)	15 (4.7)	2.32 (0.52-10.33)	0.256	

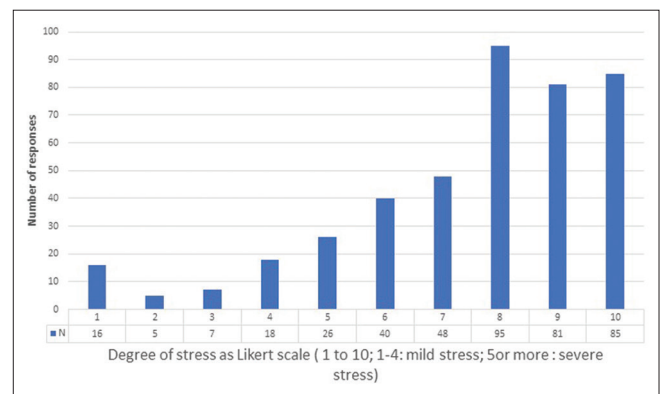
**Figure 2:** Major concerns highlighted by postgraduate students in relation to research and academics during COVID-19

to ongoing pandemic (41.5%, $P = 0.49$), lesser frequency of scheduled classes (30.3%, $P = 0.09$) and connectivity issues (31.9%, $P = 0.46$) [Figure 4].

Discussion

The present google form-based survey revealed that major challenges were being faced by postgraduate students during planning and conduct of the thesis. Academics were also significantly affected across all disciplines, mainly due to diversion of the clinical workforce to the COVID-19 care areas and connectivity issues with use of online platforms. This resulted in high levels of stress and anxiety among the students in majority of the cases. We found that only in 30.3% cases, the institutions had taken some measures with respect to the challenges being faced with thesis conduct.

Most of the thesis are planned on electively admitted patients and often require the support of diagnostic laboratory and imaging services. Social distancing norms to curb COVID-19 transmission and conversion of many institutes to dedicated COVID centers has resulted in suspension of elective hospital

**Figure 3:** Mental stress among postgraduate students with respect to thesis during COVID-19

services, reduced the availability of participants, and has affected most of the thesis-related research activities.^[9] Our survey found hindrance in thesis conduct in 75.9% cases. Haldar *et al.*^[10] reported a lower prevalence (55.29%) of difficulty in carrying out thesis than our study probably because their study was conducted in relatively early phase of pandemic when the possibility of it lasting for such protracted period would not have been imagined. The other concerns elicited in our survey such as delay in plans made for future due to extension of the course, inability to publish the thesis, lesser job opportunities, reduced opportunities to work abroad and getting infected with COVID – 19 have heightened the fears and increased the stress.

In our study, majority of the respondents had not submitted their thesis. The responsibility of thesis submission itself was responsible for majority of the pessimism and distress amongst the students as there was no correlation with their sample size or level of completion of thesis [Table 2]. Surprisingly, the institutional response in this regard was seen in only 30.3% cases and included permission to change the topic or sample size and extension of the last date of thesis submission.

Table 3: The relation of NRS for Stress with various study parameters during COVID pandemic

Variable	Categories	Minimal	Neutral (n=46)	Severe (n=373)	Odds ratio (95% CI)	P
Degree	PG	41 (89.1)		339 (90.9)	1.0	0.699
	Super speciality	5 (10.9)		34 (9.1)	0.82 (0.31-2.22)	
Institute	Govt.	29 (63.0)		295 (79.1)	1.0	0.043
	Autonomous	11 (23.9)		46 (12.3)	0.41 (0.19-0.88)	
	Pvt	6 (13.0)		32 (8.6)	0.52 (0.20-1.36)	
Year	First year	13 (28.3)		56 (15.0)	0.35 (0.15-0.98)	0.032
	Second year	14 (30.4)		174 (46.6)	1.0	
	Third year	19 (41.3)		143 (38.3)	0.61 (0.29-1.25)	
Thesis type	Clinical	41 (89.1)		363 (97.3)	4.43 (1.44-13.58)	0.005
	Non-clinical	5 (10.9)		10 (2.7)	1.0	
Speciality	Medical Sp.	32 (69.6)		305 (81.8)	1.0	0.089
	Surgery Sp.	7 (15.2)		42 (11.3)	0.63 (0.26-1.52)	
	Others	7 (15.2)		46 (7.0)	0.39 (0.16-0.97)	
Present status	Not yet submitted	36 (78.3)		318 (85.3)	1.0	0.332
	Submitted	6 (13.0)		22 (5.9)	0.42 (0.16-1.09)	
	Thesis topic not assigned due to COVID	3 (6.5)		23 (6.2)	0.87 (0.25-3.03)	
	Others	1 (2.2)		10 (2.7)	1.13 (0.14-9.10)	
Present Area of posting	COVID	26 (56.3)		251 (67.3)	1.58 (0.85-2.95)	0.145
	NON-COVID	20 (43.5)		122 (32.7)	1.0	
Sample Size	< 100	26 (56.3)		245 (65.7)	1.0	0.220
	> 100	20 (43.5)		128 (34.3)	0.68 (0.37-1.26)	
Present recruited	< 50%	29 (63.0)		267 (71.6)	1.48 (0.78-2.80)	0.230
	> 50%	17 (37.0)		106 (28.6)	1.0	
Respond of	Yes	45.7 (45.7)		106 (28.5)	0.47 (0.26-0.88)	0.017
	No	25 (54.3)		26.6 (71.5)	1.0	
What is your suggestion in order to solve this crisis	Extension	19 (41.3)		129 (34.8)	0.76 (0.41-1.42)	0.382
	Reduction in sample size	3 (6.5)		41 (11.0)	1.77 (0.53-5.96)	0.351
	Electronic submission	3 (6.5)		24 (6.4)	0.99 (0.29-3.41)	0.982
	Change in topic	5 (10.5)		22 (5.9)	0.51 (0.19-1.43)	0.195
	Assurance	7 (15.2)		35 (9.4)	0.58 (0.24-1.39)	0.216
	None	19 (41.3)		192 (53.2)	1.62 (0.87-3.01)	0.129
Major concerns in this pandemic in relation to the thesis and academic	Extension	17 (37.0)		206 (55.2)	2.10 (1.12-3.96)	0.019
	Abroad	7 (15.2)		67 (18.0)	1.22 (0.52-2.85)	0.645
	Plan	16 (34.8)		189 (50.9)	1.95 (1.03-3.69)	0.039
	Less job	7 (15.2)		90 (24.1)	1.77 (0.77-4.01)	0.176
	Publish	8 (17.4)		169 (45.3)	7.72 (3.47-17.19)	<0.001
	Skill	26 (56.5)		237 (63.9)	1.36 (0.73-2.53)	0.329
	COVID infection	14 (30.4)		182 (48.8)	2.18 (1.13-4.21)	0.019
	Duty	8 (17.4)		103 (27.9)	1.84 (0.83-4.08)	0.128
Effect of psychological stress	Nervous	3 (6.5)		52 (14.0)	2.34 (0.70-7.81)	0.157
	Sleep	8 (17.8)		104 (28.0)	1.80 (0.81-4.00)	0.143
	Irritable	8 (17.8)		58 (15.5)	0.88 (0.39-1.97)	0.746
	Doom	5 (10.9)		52 (13.9)	1.33 (0.50-3.52)	0.566
	Mood	10 (21.7)		46 (12.3)	0.51 (0.24-1.09)	0.077
	Concentrate	10 (21.7)		83 (22.3)	1.03 (0.49-2.16)	0.937
	Fatigue	10 (21.7)		66 (17.7)	0.77 (0.37-1.64)	0.502
	Memory	5 (10.9)		36 (9.7)	0.88 (0.33-2.36)	0.793
How are the class being continued	Online	38 (82.6)		279 (75.2)	0.64 (0.29-1.42)	0.267
	None	8 (17.4)		89 (23.9)	1.49 (0.67-3.31)	0.326
	Video	0 (0.0)		34 (9.1)	-----*	0.033
	Notes	1 (2.2)		22 (5.9)	2.82 (0.37-21.43)	0.295
	Simulation	2 (4.3)		21 (5.6)	1.31 (0.30-5.79)	0.719
	Offline	0 (0.0)		3 (0.8)	-----*	0.542

Contd...

Table 3: Contd...

Variable	Categories	Minimal (n=46)	Neutral (n=373)	Severe (n=373)	Odds ratio (95% CI)	P
What is problems faced in pursuing academic	Lack of Beside classes	21 (45.7)	254 (68.1)	2.54 (1.37-4.72)	0.002	
	Reduced interaction with seniors	27 (58.7)	228 (61.1)	1.11 (0.59-2.06)	0.750	
	Impetus	19 (41.3)	174 (46.6)	1.24 (0.67-2.31)	0.493	
	Lack of Progress test	5 (10.9)	106 (28.4)	3.26 (1.25-8.46)	0.011	
	Less frequent classes	10 (21.7)	127 (34.0)	1.86 (0.89-3.87)	0.093	
Suggestions to improve the condition	Connectivity issues	14 (30.4)	134 (35.9)	1.28 (0.66-2.49)	0.462	
	More class	23 (50.0)	173 (46.4)	0.87 (0.47-1.60)	0.643	
	Use paid app	3 (6.5)	11 (2.9)	0.44 (0.12-1.62)	0.203	
	Offline	17 (37.0)	109 (29.2)	0.70 (0.37-1.33)	0.280	
	handout	11 (23.9)	54 (14.5)	0.54 (0.26-1.13)	0.095	
	simulation	15 (32.6)	94 (25.2)	0.70 (0.36-1.35)	0.280	
	webinar	10 (21.7)	48 (12.9)	0.53 (0.25-1.14)	0.100	
none	1 (2.2)	16 (4.3)	2.02 (0.26-15.72)	0.493		

*Cannot be computed due to zero cell count

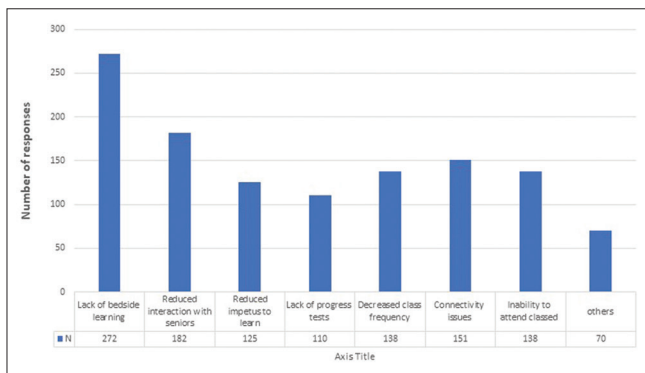


Figure 4: Problems faced by postgraduate students in academics during COVID-19

During the initial phase of COVID pandemic, the teaching activities were stopped because of lockdown, which affected academics severely in majority of the students (88.3%). Nonetheless, majority had continued academics in some form via virtual online digital platforms like Zoom, GoTo meet, etc. These platforms may enhance student participation by providing flexible scheduling and allow convenience of attending irrespective of the place and time.^[5,11] The Accreditation Council for Graduate Medical Education (ACGME) had also advocated the use of tele-platforms for continuing educational activities during the present pandemic.^[12] However, these platforms have limitations like lack of familiarity and knowledge of their usage, accessibility problem, connectivity issues, poor voice clarity, background noise and cybersecurity concerns.⁵ However they cannot fully replace traditional classroom teaching which provides real-time instant feedback, interaction and involvement of the students, collaborative learning, critical thinking, and ensures sincerity in class. Moreover, increased screen time consequent to their use has recently been found to aggravate eye-related problems among students.^[13] In our study, many PGs (36%) reported connectivity issues while 29% reported lack of interest in online classes as the hindrances to the e-learning.

Srivastava *et al.*^[14] in their cross-sectional survey found that majority of the general surgery residents gave favorable response to online teaching. However, a recent Cochrane review revealed little to no difference between electronic learning methodology and traditional learning while other studies have found it to be beneficial.^[15-17] Regarding skill training, simulation-based competency training is a feasible substitute to bed-side clinical teaching but even this option would be not freely available to everyone considering the cost concerns and social distancing norms.

The postgraduates are our next-generation health professionals and are expected to handle cases independently post training. They are expected to be trained in a wide variety of locations to gain clinical experience and develop a wide variety of skills. Many PGs (64.5%) believed that the learning of essential skills was being hampered. Reduction in number of elective services (both outpatient and inpatient) had affected the usual rotation schedules of PGs and reduced the probability of gaining experience in the clinical bedside teaching in all fields in their limited tenure. Previous survey among urology residents had similarly demonstrated compromise in procedural skill learning among residents.^[18] Similarly, case load and variety has got severely affected and has led to major hindrance to the conduct of research work. This has adversely affected their competency and confidence.

Majority of the residents (73%) in our survey expressed to be having severe negative impact of the pandemic on their life in form of sleep disturbances, inability to concentrate on the academics and had memory issues leading to constant irritation and feeling of doom. This may be due to fear of contracting COVID-19 (45.7%) during direct involvement in care of COVID-19 patients, simultaneous pressure to keep pace with their studies and continue thesis work. In addition, longer working hours in personal protective gear, staying away from

home due to restriction in travel, fear of carrying infection to the parents and lack of social life due to decrease in group meetings and classes may have been responsible for severe impact on the psychological state of the residents.^[19] This situation worsened over period and has become more stressful for residents because of loss of full year of teaching curriculum into the pandemic and no one can estimate till how long this would continue. Furthermore, the PGs working in COVID-19 care areas were quarantined or isolated (in case of contracting the disease) as decided by institutional policy.^[20] The restrictions during quarantine period could be an additional reason responsible for disruption of the PG academic and thesis-related activities. The American Board of Anesthesiology has exempted the time spent in quarantine from leaves for all trainees.^[21] The present survey revealed that 8.8% of the students had been isolated and lost their 7-28 working days (or more in few cases). Furthermore, 45.7% PGs quoted the fear of getting affected with COVID-19 as a major hindrance to the pursuance of their research assignments and training. Previous studies have elucidated that HCWs working in COVID-19 care areas were at higher risk of developing psychological stress and anxiety due to the uncertainties regarding its transmission, high infectivity and lack of standard treatment protocols or vaccine.^[19,22] A recent survey elucidated that younger anesthesiologists who were posted in COVID-19 care areas were at increased risk for development of psychological stress.^[23]

It was noteworthy that the second-year residents perceived increased negative effect of the pandemic in relation to their research work because the second year is the main period during which thesis cases are completed. Most of the first-year residents are yet to start or have just started recruiting the thesis cases while the final year residents have generally completed recruitment of study subjects.

The effect of the pandemic on the residents must be addressed properly and appropriate measures to be taken to mitigate it because residents from a major part of the health care system and are necessary for proper functioning of the health care system. We believe that usual teaching patterns are unlikely to return soon, and an increased reliance on telemedicine, simulation, and interactive web-based educational programs, including tele mentoring are viable innovative strategies to tackle the present humongous task of ensuring quality academics and research work for our trainees. In addition, offline classes should be regularly scheduled along with online classes with social distancing in batches. Though most of the institutes have come up with their own ingenious solutions regarding academics, thesis work is mostly being neglected barring few relaxations in the submission deadlines. There is a strong need to formulate uniform national-level guidelines to ensure that our students do not bear the main brunt of the pandemic and

our fraternity at large does not end up guilty of not lending our helping hand to them during their hour of need.

Our survey has certain limitations. Responses could not be collected from every state of India, but we focused on collecting responses from the major university medical colleges of all the zones (east, west, north, south, and central) of the country. Hence, the data is a reasonable estimate of the present situation in various parts of the country. Since it was a convenience sampling, anesthesiology residents constituted the main bulk of the total responses. The survey was directed to the students directly instead of faculties as we thought that those who are directly facing the wrath of COVID-19 would be the best judge of the situation. The strength of our study is that the response rate was high, our survey was all-encompassing as diverse medical specialities were assessed regarding the impact of pandemic and the mitigatory measures were directly sought from those who were suffering.

Conclusion

Our survey revealed that research and academics of postgraduate students have undergone major setback during COVID-19 pandemic. Since the pandemic is here to stay for an unforeseeable future, there is urgent need to devise solutions and reorganize the PG training curriculum, frame standardized regulations regarding thesis submission and deliberate upon the teaching methodologies to curtail the impact of situation upon the curriculum and research of our trainees. We believe that the survey results would help the regulatory bodies to take note of the gravity of the situation and can serve as a foundation for formulation of education, training and research related policies in the present pandemic and any future such events which disrupts traditional teaching.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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Annexure 1

Questionnaire on Impact of COVID-19 pandemic and Postgraduate medical education, research and stress

Email address:

1. Degree: MD/MS/DNB/DM/MCh
2. Institute Government/Private Autonomous (e.g., AIIMS, PGI, SGPGI etc)/Other
3. Year of pursuit of the degree: First year/Second year/Third year
4. Thesis-type: Clinical/Non-clinical/mannequin/others
5. Speciality
 - a. Preclinical (anatomy/biochemistry/physiology)
 - b. Paraclinical (pharmacology/pathology/microbiology/forensic)
 - c. Anesthesia and critical care medicine
 - d. Medicine and allied specialties
 - e. Surgery and allied specialties
 - f. Super Speciality (medicine and allied)
 - g. Super Speciality (surgery and allied)
6. What is the present status of the thesis?
 - a. On going
 - b. Just assigned
 - c. In the process of recruitment

- d. Completed recruiting but yet to be analyzed
 - e. yet to be written
 - f. written to be submitted
 - g. Thesis topic not yet assigned due to COVID-19 Submitted
 - h. Others
7. Present area of posting
- a. COVID area
 - b. Non COVID area
 - c. Operation theatre based
 - d. ICU based
 - e. Other
8. What is the sample size of your thesis?
9. What percentage of total cases of your thesis has been recruited till now?
- a. <25%
 - b. 25-50%
 - c. 50-75%
 - d. >75%
 - e. completed recruitment
 - f. Thesis not started yet due to COVID
10. How much the present pandemic negatively affected the conduct of your thesis on a scale of 1 (least likely) to 5 (very much) ?
11. In what manner is the conduct of your thesis affected? (Can choose multiple options)
- a. Difficulty in recruiting due to fear of infection to me (need to wear PPE)
 - b. Difficulty in recruiting patients due to patient's fear of infection with COVID
 - c. Reduction in non-urgent procedures/the number of patients posted for specific surgery
 - d. Difficulty in getting the diagnostic tests or other support services required for thesis
 - e. Patients turning out to be COVID suspects or positive patients
 - f. Closure of the pain clinic and other nonoperating room procedure areas
 - g. Involving an Aerosol Generating Procedure (AGP)
 - h. Thesis topic is related to COVID and it has helped me complete it in short time
 - i. Others
12. Did you get COVID infection during this pandemic? If yes, how many working days lost due to isolation?
- a. NO
 - b. Yes, 14 days
 - c. Yes, 14-28 days
 - d. yes, >28 days
13. Is there any kind of response from the institution with respect to the challenges being faced with thesis conduct? (Yes/No/ others)
14. In what manner has the institute management/university intervened? (you can choose multiple options)
- a. Ensured that appropriate action will be taken at the time of submission as relevant
 - b. Extension of the date of thesis submission
 - c. Reduction in the sample size with assurance that the project may be continued after thesis submission
 - d. Change in thesis topic to the one feasible in current scenario
 - e. Allowed electronic submission instead of physical copies
 - f. No action yet
 - g. Not applicable
 - h. Other:
15. What are your suggestions in order to solve this crisis with regards to thesis work? (you can choose multiple options)
- a. Extension of the date of thesis submission
 - b. Allow a reduction in the sample size
 - c. Allow a change of methodology
 - d. Allow change in patient population

- e. Allow a change in thesis topic to the one feasible in current scenario
 - f. Allowed electronic submission instead of physical copies
 - g. Allow submission of the only the data collected till now
 - h. Allow change of study to observational instead of randomized controlled trial
 - i. No penalties or extension of PG tenure in case of inability to submit on time
 - j. Allow PG to be completed without thesis submission for the current batch
 - k. Other:
16. On a scale of 1 to 10, 1 being no worry at all and 10 being always worrisome, how do you grade your mental stress with respect to your thesis?
17. What are your major concerns in this pandemic in relation to the thesis and academics?
- a. Extension of the PG course
 - b. Delay in plans made for future
 - c. Reduced opportunity to work outside the country
 - d. Reduced job opportunity in future due to economic slow down
 - e. Failure to publish my thesis
 - f. Reduced opportunity to learn hands on skill
 - g. Getting infected with COVID
 - h. Increased duty hours
 - i. Others
18. What are the effects of the psychological stress being faced by you due to the pandemic affecting the conduct of your study and hampering academics
- a. Lack of proper sleep
 - b. Getting nightmares
 - c. Fatigue
 - d. Impaired concentration
 - e. Impaired memory
 - f. Mood Changes
 - g. Feeling nervous
 - h. Feeling irritable at all times
 - i. Feeling of doom/fear of unknown
 - j. Others
19. Do you think your academics have been affected by the pandemic?
- a. Yes
 - b. No
 - c. Cannot say
20. Is there a way your classes are being continued during the pandemic?
- a. Yes
 - b. No
21. How are the classes being continued?
- a. Online platforms (zoom, GoTomeeting, Meet etc)
 - b. Recorded Video lectures
 - c. Notes from seniors
 - d. Video call
 - e. virtual rounds
 - f. WhatsApp chat groups
 - g. Simulation based skill learning
 - h. Classes suspended till further notice
 - i. Others
22. What are problems faced in pursuing routine academic activities during COVID pandemic? (you can choose multiple options)
- a. Lack of clinical bedside learning
 - b. Reduced interaction with seniors

- c. Reduced interaction due to online platforms
 - d. connectivity issues with online platforms
 - e. Reduced impetus to learn due to ongoing pandemic
 - f. Lack of regularly scheduled progress tests
 - g. Decreased frequency of scheduled classes
 - h. lack of interest among students due to decreased interaction in online platforms
 - i. Other
23. Suggestions to improve the condition of the above aspects of postgraduates
- a. Continue with more regularly scheduled online classes
 - b. Use paid version of online platforms
 - c. Start physical classes in batches with social distancing
 - d. Distribute handouts to students
 - e. Focus on simulation based teaching in batches with social distancing
 - f. Attend online webinars
 - g. No need for any change
24. Thank you for your response. Remarks if any, are welcome