

Original Article

Impact of COVID-19 on Postgraduate Residency Curriculum of Internal Medicine and Allied Specialities : Outcomes from A Web-based Cross-sectional Study from India

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Background : Clinically-based Medical Education is the principal source of learning and this has been profoundly impacted by restrictions due to COVID-19.

Methods : A cross-sectional observational study was conducted to assess the impact of COVID-19 on the different aspects of the Postgraduate curriculum among the residents of Internal Medicine and its Allied sub/super-specialties across India. An online semi-structured English language questionnaire was prepared using Google-form platform and the link was shared among the residents through various social media outlets. The questionnaire comprised of seven sections: demographic characteristics, burden of COVID duties, hospital service utilization, academic activity, procedural training, research activity and recommendations for improvement of academic activities. Appropriate statistical tests were carried out to analyze the data obtained. Results: A total of 1857 responses were taken into consideration. A significant reduction in both out-patient and In-patient Department (IPD) attendance was reported by 47% and 35.3% participants respectively. Most of the residents (69.8%) claimed that their magnitude of self-study was less than usual. Bulk of the respondents (75.4%) felt that their clinical training was being grossly hampered. Three-fourths of the participants were involved in online studies. Procedural training was severely affected as opined by 75.9% of respondents. Majority (55.6%) respondents reported their thesis work was severely affected during pandemic.

Conclusion : The findings of this study highlight the grave implications of the current pandemic on various aspects of the Postgraduate Residency Curriculum. Learning methods applying modern emerging online digital technologies will improve our teaching paradigms.

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Key words : COVID-19, Medical education, Postgraduate curriculum, Online study, Research activity.

The WHO declared the COVID-19 outbreak as a pandemic on 11th March, 2020. Lockdowns were implemented in different parts of the world, including India (from 24th March, 2020 up to 31st May, 2020), to prevent widespread dissemination of the disease. Except the emergency health care services, all other non-emergency Out patient Departments in India were shut¹. This development has had serious implications on public Healthcare Institutions and caused a massive disruption in Medical Training and Education Worldwide². Although Postgraduate Residents stand to learn a tremendous

Editor's Comment :

- COVID-19 pandemic has severely compromised the medical postgraduate academic curriculum due to increased burden of COVID related duties, underutilization of hospital services, barrier to academic activities and research.
- Trainees of different specialties have been redeployed to COVID-19 related duties or other specialties, and they have experienced significant reduction in their bedside and clinical exposure.
- Regulatory authorities should revise the existing curriculum and adopt accessible technology to meet the demands of the present times.

amount and can contribute to the care of patients; the more pressing concern among residents is the impact of COVID-19 on the residency programme³.

Experiences from previous disruptions to Clinical Medicine Curriculum and their effects have been described in the literature. Medical students from Severe Acute Respiratory Virus (SARS)-affected (2002-2004) countries were barred from direct in-person patient care. Alternate virtual course work such as e-learning methods, virtual reality simulators and video vignettes were adopted. Similar measures were adopted in certain regions during the Middle Eastern Respiratory Syndrome (MERS) Pandemic^{4,5}.

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Given the social distancing recommendations, the corona virus emergency has led to presence of limited number of on duty residents, cancellation of lectures and educational conferences to adhere to strict social distancing norms. The academic activities including face-to-face teaching have been discontinued and the clinical rotation within the Different Departments of the same institution was interrupted. In addition, the residents are being designated for managing patients in COVID Wards, Fever clinics, Screening blocks and Intensive Care Units (ICU) in apart from their regular duties which have ultimately increased the workload. This has led to an increased prevalence of depression, anxiety and acute stress among the Residents⁶⁻⁸.

Postgraduate Medical Education and training is multifaceted where commitments to clinical education, research, self-study, learning of procedural skills, service provision and preparation for assessments must be finely balanced. Recent publications have assessed the link between the COVID-19 pandemic and clinical training. However, these studies have primarily covered surgical specialties^{9,10}. As the COVID-19 outbreak had a massive impact on the clinical exposure of the residents, this pan-Indian study aimed to assess the impact of COVID-19 on the various aspects of the Postgraduate curriculum of the Residents belonging to Internal Medicine and its Allied Sub/Super-Specialties.

MATERIALS AND METHODS

A cross-sectional observational study planned, after Institutional Ethics Clearance, among Postgraduate residents throughout the India from 23rd July, 2020 to 16th October, 2020. The study subjects were Medical Residents pursuing their training under Non-surgical departments across the Countries. The minimum sample size of this study was 1803. This was calculated using the formula of sample size = $Z^2p(1-p)/(p)^2$, where $Z=1.96$, constant value at 95% confidence interval, p = proportion of perceived burden of duties among Medical Residents during COVID pandemic taken as 50% to achieve maximum sample size, ϵ relative precision of 7% with design effect of 2 and 15% drop out also being taken into consideration.

An online semi-structured English language questionnaire was prepared using Google-form platform (www.googleforms.com). The survey questions underwent face and content validation by three independent Medical experts and pilot tested. Further, any feedback of the experts was discussed by the authors and necessary changes to the questionnaire were made. The link of this questionnaire was shared

among the residents through E-mails, WhatsApp messenger, Telegram and other social media and also requested for link referral for such kind of participants. Thus, the selection of the subjects was planned through snowball sampling method. It started from 23rd September, 2020, 10:00 hours and closed 16th October, 2020, 10:00 hours. On receiving and clicking the link, the participants were auto-directed to be informed with some brief essential information about the study and after that they answered a set of questions on giving informed consent.

The questionnaire consisted of 24 items under seven broad categories: (A) Demographic characteristics (age, gender, type of residency course, year of residency training, enrolled Department of Residency, Type of Training Institute, Geographical Zone of Residency); (B) Burden of COVID duties [place of COVID duty, type of duty, workload during COVID pandemic]; (C) Hospital Service Utilization [Utilization of Departmental IPD for COVID, OPD attendance reduction, IPD attendance reduction]; (D) Academic activity [Effect on Self-study, Effect on Clinical Training, Effect on Departmental Academic Activities, participation in virtual platforms, opinion on pandemic's effect over academic curriculum]; (E) Procedural training [magnitude of procedures being performed, effect on procedural training] (F) Research activity [effect on thesis work, involvement in other research activities, contribution on COVID-19 research] and (G) Opinion regarding recommendations for academic activities and curriculum in COVID pandemic situations.

The data was collected in the linked Google sheet of the Google form. Data was checked for completeness and consistency, and organized using Microsoft Excel 2010. Both quantitative and qualitative analysis of data performed. Descriptive and inferential statistical analysis was performed using SPSS version 20 software. Relationship between the demographic characteristics and other categories of variables were done using chi-square test as test of significance. We considered $p < 0.05$ as significant.

The opinions regarding recommendations for academic activities & curriculum in COVID pandemic situation were analyzed qualitatively through coding of textual data and presented through word cloud using 'Worditout' online platform. Confidentiality and anonymity were strictly maintained.

RESULTS

A total of 1893 responses were received, of which 36 were found to be incomplete for multiple variables and therefore discarded. The final 1857 responses were considered as the study population.

[A] Demography :

The study population showed a predominance of male subjects (1307, 70.4%) that belonged to the age category ≤ 30 years (1542, 83%). The mean age \pm SD and median age (IQR) of the study participants were 28.25 ± 3.49 years and 27³ years respectively. Most of the participants were Postgraduate Students of Government Institution (1353, 72.9%) and pursuing specialization courses (1658, 89.3%). Majority of them were Residents of General Medicine (50.2%). Other demographic characteristics of the study participants have been described in Table 1.

[B] Burden of COVID duties :

Out of the total study participants, 1113 (59.9%) were working outside their parent institution while 1024 (55.1%) were exclusively engaged in COVID related duties. Only 872 (47%) participants perceived workload during COVID pandemic to be more than usual. Place of work engagement and burden of workload were significantly associated with the age group, gender, type of the institution, category of residency courses and year of residency ($p < 0.001$). Types of duty during COVID pandemic was found to be significantly associated with the age group, type of the institution, category of residency courses and year of residency ($p < 0.001$) except gender.

Variables	Frequency (N=1857)	Percentage (%)
Age Group :		
≤ 30	1542	83
31-45	308	16.6
>45	7	0.4
Gender :		
Male	1307	70.4
Female	550	29.6
Type of institution :		
Government	1353	72.9
Non-government	504	27.1
Category of residency course :		
Specialization Courses	1658	89.3
Super-specialization Courses	199	10.7
Year of residency training :		
1st Year	493	26.5
2nd Year	534	28.8
3rd Year	631	34
Post-MD	199	10.7
Geographical zone of residency :		
Central	18	1.0
East (including north-east)	769	41.4
North	170	9.2
South	90	4.8
West	810	43.6
Total	1857	100

[C] Hospital Service Utilization :

Only 681 (36.7%) study participants reported non-conversion of their Departmental IPD (In-patient Department) beds for COVID patients. A massive reduction in both OPD (Out-patient Department) and IPD attendance ($>50\%$) was reported by 872 (47%) and 656 (35.3%) participants respectively. Experience of the utilization of Departmental IPD for COVID patient significantly differed among age group, gender, category of residency courses and year of residency. OPD attendance reduction was significantly associated with age group, gender, type of the institution and category of residency course while IPD attendance reduction was significantly associated age group, type of the institution, category of residency course and year of residency.

[D] Academic Activity :

A large proportion (69.8%) of the participants mentioned that their magnitude of self-study was less than usual. Impact on self-study was significantly associated with age group, gender, category of residency course and year of residency. Majority (1401, 75.4%) participants were of the opinion that their clinical training was being severely affected. Impact on clinical training was significantly associated with the age group, gender, type of the institution, category of residency course and year of residency.

Departmental academic activities remained as unaffected overall, as reported by 624 (33.6%) participants. Almost three-fourths of the participants (74.6%) were involved in online studies. Participation in virtual platforms was significantly associated with the age group, category of residency course and year of of. Majority (1216, 65.5%) were affirmative to COVID pandemic ill-effect on academic curriculum. Opinion on pandemic's effect over academic curriculum was significantly associated with age group, gender, category of residency course and year of residency.

[E] Procedural training :

Most participants (1225, 66%) mentioned a marked reduction in the quantum of procedures performed. Procedural training was severely affected in 1409 (75.9%) participants. This was found to be significantly associated with type of the institution, category of residency course and year of residency.

[F] Research Activity :

Majority (55.6%) of the respondents reported their thesis work was severely affected during pandemic. Effect on thesis work was significantly associated with the age group, gender, category of residency course and year of residency. Large fraction (78.8%)

participants were not involved in any other research activity. About half the respondents (969, 52.2%) wished to contribute to COVID-related research.

The impact of COVID-19 pandemic on postgraduate residency program related variables and bivariate analysis with respect to type of institution have been summarized in Table 2.

[G] Recommendations and suggestions of the participants :

After analyzing all the opinions regarding recommendations for academic activities and curriculum, it became evident that most of them desired online theoretical classes with small group session for clinical and practical classes. Further, they suggested incorporation of a collection of small modules based on formative assignments that would be more time-bound and specific with achievable educational objectivity (Fig 1).

DISCUSSION

The training of the Postgraduate Residents was severely affected during the lockdown and postlockdown period. Besides their institutional duties, most of them were assigned to work in a COVID dedicated Hospital. We found that 416 (22.4%) of the residents were engaged in both COVID 19 related duties and regular Departmental work and 1024 (55.1%) were exclusively COVID related duties. The huge physical and mental stress in treating COVID-19 patients and emergencies besides their scheduled Departmental Duties eventually result into depression^{7,8}.

The goal of the residency training programs is to enhance knowledge and clinical skills of the residents' by giving them exposure to variety of cases. Case exposure based on seeing a variety of patients with varying acuity levels, chief complaints and diagnoses is crucial for the development of comprehensive experience¹¹⁻¹⁵. Additional strain has also been brought about by the need for regular use of hand sanitizers, personal protective equipment (including prophylactic medications) which has led to a multitude of cutaneous and extracutaneous

Table 2 — Impact of COVID-19 pandemic on postgraduate residency program related variables and bivariate analysis with respect to type of institution. (N=1857)*			
Variables	Type of the Institution		p-value
	Government	Non-Government	
Impact on academics			
Effect on self- study:			
<i>Able to study as usual</i>	103 (67.8)	49 (32.2)	0.107
<i>Able to study less than usual</i>	939 (72.4)	358 (27.6)	
<i>Not able to study at all</i>	331 (76.2)	97 (23.8)	
Effect on clinical training:			
<i>Severely affected</i>	1051 (75)	350 (25)	<0.001
<i>Partially affected</i>	262 (64.2)	146 (35.8)	
<i>Not affected</i>	40 (83.3)	8 (16.7)	
Effect on departmental academic activities:			
<i>No academics at all</i>	451 (72.3)	173 (27.7)	<0.001
<i>Partially affected</i>	375 (78.1)	105 (21.9)	
<i>Academic activities in online platforms</i>	511 (71.7)	202 (28.3)	
<i>Unaffected</i>	16 (40)	24 (60)	
Participation in virtual platforms :			
<i>No</i>	340 (72)	132 (28)	0.640
<i>Yes</i>	1013 (73.1)	372 (26.9)	
Opinion on pandemic's effect over academic curriculum:			
<i>Severely affected</i>	906 (74.5)	310 (25.5)	0.057
<i>Moderately affected</i>	351 (70.6)	146 (29.4)	
<i>Not affected</i>	96 (66.7)	48 (33.3)	
Impact on procedure training			
Magnitude of procedures being performed:			
<i>Only lifesaving emergency procedures</i>	317 (74.8)	107 (25.2)	<0.001
<i>After a negative COVID-19 RT-PCR report (reduced capacity)</i>	862 (70.4)	363 (29.6)	
<i>Same as before</i>	174 (83.7)	34 (16.3)	
Effect on procedural training:			
<i>Not affected</i>	78 (81.2)	18 (18.8)	<0.001
<i>Moderately affected</i>	216 (61.4)	136 (38.6)	
<i>Severely affected</i>	1059 (75.2)	350 (24.8)	
Impact on research activity			
Effect on thesis work:			
<i>Severely affected</i>	748 (72.4)	285 (27.6)	0.125
<i>Moderately affected</i>	469 (75.2)	155 (24.8)	
<i>Not affected</i>	136 (68)	64 (32)	
Involvement in other research activities:			
*No	1088 (74.3)	376 (25.7)	0.001
Yes	209 (65.1)	112 (34.9)	
Interest regarding contribution to COVID-19 related research:			
Yes	716(73.9)	253(26.1)	0.001
May Be	390(67.7)	186(32.3)	
No	247(79.2)	65(20.8)	
<i>(Note: all parenthesis shows row percentages. * For Involvement in other research activities N=1785)</i>			

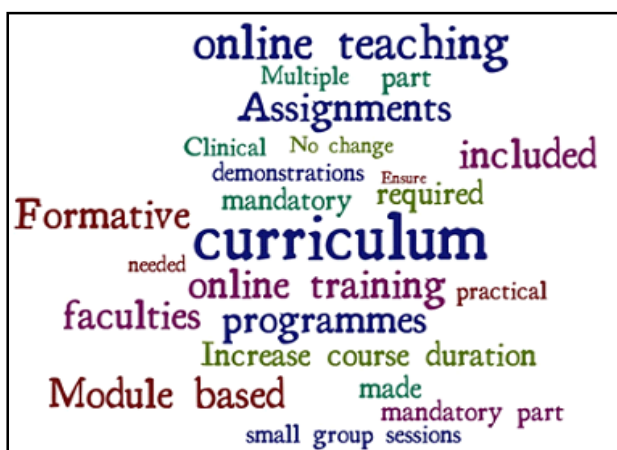


Fig 1 — Word cloud showing summary of the opinions regarding recommendations for academic activities and curriculum in the COVID pandemic situation

problems, apart from being labour intensive¹⁶⁻¹⁸. A high patient volume exposes the trainees to atypical presentations of common diseases and rare diseases. The reduction in the volume of patients and the diversity of disease pathologies during this COVID-19 pandemic has significantly affected the case exposure of the residents. Inadequate clinical exposure will reduce the learning opportunities for the trainees thus, hindering their attainment of clinical competency^{19,20}. Similarly, outpatient volume has drastically reduced during this pandemic and non-urgent outpatient clinic appointments have been cancelled. Fear of having COVID-19 or getting infected by the virus in the hospital could be a reason for reduction in both out-patient and in-patient admissions resulting in a negative impact on residents' clinical learning. Moreover, majority of the in patient beds have been widely re-allocated for the care of COVID patients. The overall reduction in patient volume has reduced opportunities for trainees to perform essential in-patient routine and other special procedures thus reducing their proficiency²⁰.

Medical conferences fulfill a critically important role in the ongoing education which allows trainees to present their research findings in the form of oral or poster presentations. This will help in the future research, publication and receiving expert opinions in their day to day practice. In this COVID-19 era, there is a transition from traditional in-person gatherings to a virtual platform for safe provision of educational content. Via this virtual platform, residents stand to lose the opportunity to communicate with experts in their respective field which seem much easier in face-to-face events. Most of the in-person Medical Classes are now being replaced by recorded lectures or live streams via online platform which do not include traditional physical examination. Physical examination

is an essential skill which can only be mastered by practice^{21,22}.

Dissertation and thesis writing plays a vital role in testing the independent research skills of the residents. Residents have faced difficulties in recruitment of new patients and follow up of previous cases for their proposed research work. In our study 1033 (55.6%) of the residents accepted the fact that they are unable to devote time in thesis work due to increased workload of COVID related duties. Moreover, the immense work pressure and resulting mental stress has diminished their interest in carrying out additional research and academic activities.

Similar types of surveys were conducted amongst the trainees of various fields across the country and they felt that the COVID 19 lockdown has adversely affected their learning and training process¹¹. This COVID-19 pandemic will have a long-term impact on the medical education and learning. Globally, there has been a transition of teaching procedures from face-to-face interactions to virtual meetings, which should be taken in a positive way both by the residents and faculties. An online survey conducted by Mishra D *et al*, Trainee Ophthalmologists across India revealed that 80.7% of the trainees felt that the COVID-19 lockdown had negatively impacted their Surgical Training; 54.8% perceived an increase stress during the COVID-19 lockdown and 75.7% opined that online classes and webinars were very useful at the time of lockdown¹². Another survey among postgraduate orthopaedics Residents of Delhi, India revealed that about 94% of the Trainees felt that COVID-19 has affected their Surgical and Clinical Training, 71.6% had problems in completion of their thesis and 96% had concerns about their Mental Health²³. A study by Odedra D, *et al*. among 460 Resident Members of the Canadian Association of Radiologists revealed that COVID-19 pandemic had a profound impact on various aspects of the Radiology Residency programs, which has been mitigated by various strategies such as virtual teaching rounds, virtual/phone readouts, video lectures and web tools for learning²⁴. Another observational survey among the dermatology residents across India revealed a significant impact on their teaching and education programs²⁵. In a recent review article, the authors assessed perceptions of the Junior Medical Staff and the impact of the current COVID-19 pandemic on their clinical education and training²⁶. As there is increased demands on the Healthcare System due to the pandemic, residents and trainees belonging to one specialty have been redeployed to other specialties or have experienced reductions in their bedside and clinical exposure. This may lead to questionable

expertise on the subject of specialization, which may jeopardize the purpose of residency programs. Addressing potential remedies for the impact on training requirements, in four of these sources (50.0%), greater than 40% of respondents were amenable to an extension of training.

Limitations :

As the participants in our study were selected through snowball sampling, the representation of the selected sample may be compromised. But it was the most feasible way of sample selection throughout the country during COVID pandemic situation. Burden of duty and its effects on Academic curriculum are subjective entity. Adoption of a scored questionnaire would have been helpful to assess these subjective entities.

CONCLUSION

COVID-19 pandemic has severely compromised the Medical Postgraduate Academic Curriculum due to increased burden of COVID related duties, underutilization of Hospital services, barrier to academic activities and research. The pandemic has provided an opportunity to explore the learning methods applying modern emerging online digital technologies. The findings of our study highlight the major impact of the current pandemic on various aspects of the Postgraduate Residency Curriculum. Learning methods applying modern emerging online digital technologies will improve our teaching paradigms. The findings of our study would appropriately serve the National Regulatory Authorities to revise the existing curriculum and adopt accessible technology to meet the demands of the present times.

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