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Cross-Sectional Study

Impact of COVID-19 on surgical residency programs in Pakistan; A residents' perspective. Do programs need formal restructuring to adjust with the “new normal”? A cross-sectional survey study

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ABSTRACT

Background: Due to high-risk exposure of surgical residents to coronavirus, surgical residency programs have changed their training methods and working hours drastically. The purpose of this study is to find out the positive and negative impacts of the pandemic on surgical residency programs and on the lives of surgical residents.

Materials and methods: A cross-sectional study was conducted on 112 surgical residents of a tertiary care hospital in Pakistan, with a mean age of 30.5 years from all the departments of surgery using a self-made, validated 40-point questionnaire comprising three sections. The last section also included modified Maslach Burnout inventory.

Results: Of all the residents, 97 (86.6%) stated that their surgical hands-on duration is adversely affected by the pandemic. As for clinical exposure, 92 (82.1%) trainees responded that their clinical exposure is affected too. Among all the subjects, 69 (61%) were concerned about transmitting it to their family members and 43 (38.4%) affirmed on being afraid of dying because of their direct exposure.

On the brighter side, the average number of working hours per week for surgical residents were reduced from 81.10 ± 6.21 to 49.16 ± 6.25 ($p < 0.001$) due to the outbreak. Modified Maslach Burnout inventory score was 8.33 ± 2.34 after the outbreak, showing statistically significant reduction in burnout among the surgical residents ($p < 0.001$).

Conclusion: The changes in the surgical residency programs amidst the pandemic has reduced the working hours, hands-on and clinical exposure of the surgical residents. Moreover, the situation has provided an opportunity to explore efficient methods of learning that can lead to lesser burnout. However, psychological burdens of surgical residents like fear of acquiring the infection should be appropriately addressed.

1. Introduction

Coronavirus disease 2019 (COVID-19), the public health emergency that emerged from the city of Wuhan of China in 2019, has been declared a pandemic in March 2020 by the World Health Organization (WHO) [1]. Health care workers (HCW) are on the frontline to fight the disease that can easily be transmitted through aerosols. They are particularly at high risk of being infected due to direct and indirect exposure with COVID-19 positive individuals [2,3] and also due to limited availability of personal protective equipment (PPE) [4,5]. The rapid dissemination of the disease and influx of patients not only increased

the workload, but also disrupted the surgical residency training programs [6,7]. The academic curriculum that was designed to enhance surgical skills is facing several problems ranging from reduction of team meetings to reduced clinical and hands-on exposure to limit physician-patient encounters and ensure the safety of the team [7,8]. The loss of normalcy and element of fear within the professional and personal lives can lead to physical, mental, and emotional exhaustion of the HCW and is associated with multiple psychiatric problems [9]. A recent study in China that was conducted to assess psychiatric symptoms among physicians and nurses revealed an alarming prevalence of moderate to severe distress, depression, anxiety and insomnia (ranging from 8 to 35%)

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[10]. However, a similar type of study in Singapore revealed relatively low prevalence of psychiatric issues among HCW, which the author attributed to their previous experience with the 2003 severe acute respiratory syndrome (SARS) outbreak making them physically and mentally prepared [11]. While sharing borders with highly affected countries like China and Iran, Pakistan still managed to keep the cases under 15,000 (as of April 28, 2020) [12] by taking timely measures and creating emergency isolation centers [13]. However, as the number of cases increase day by day, the expectations from frontline HCW have increased exponentially. The purpose of this study conducted on surgical residents in one of the largest tertiary care hospitals of Karachi, Pakistan is to find out the positive and negative impacts of the pandemic on surgical residency programs in general and on the lives of surgical residents on a professional and personal level. We believe that it will provide the data necessary to anticipate future concerns regarding the residency programs and workforce.

2. Materials and methods

A cross-sectional study was conducted on 112 surgical postgraduate trainees of a tertiary care hospital of Karachi, Pakistan after obtaining IRB approval from our hospital's ethical review committee. The sample size was calculated using the OpenEpi software and the confidence interval (CI) of 95% was assumed. The work has been reported in line with the STROCSS criteria [14]. The research registry unique identifying number is researchregistry5558.

2.1. Inclusion criterion

The postgraduate trainees from the department of surgery and allied (including general surgery, orthopedic surgery, neurosurgery, plastic surgery, cardiothoracic surgery, paediatric surgery and urology) of a tertiary care hospital were a part of this study. Attendings and medical students were excluded from the study. Participation was voluntary and verbal consent was obtained before dispensing the questionnaire. The residents' identity was concealed, and a single investigator collected the data to maintain the participant's anonymity.

2.2. Datapoints, stratification and outcomes

A 40-point questionnaire was used comprising three sections. The questions were generated through focus group discussions with 7 general surgery residents and 2 attending general surgeons after which two pilot interviews were conducted with two general surgery residents. The first section included demographic factors (age and gender), year of residency, and specialty. The questions in second and third sections were asked as two different scenarios (i.e. how was the situation before COVID-19 pandemic and how is the situation now after the pandemic?).

The second section included inquiries about average number of working hours per week, number of patients and surgeries in ED and Elective basis, specific fears in residents' mind during the COVID-19 pandemic, change in clinical exposure, hands-on experience, didactics, and COVID-19 affecting the life of residents in general. The third section consisted of Maslach Burnout inventory (MBI) [15] that was modified according to the design of study. Each question of individual component (depersonalization, emotional fatigue and personal fulfillment) was asked as 'YES' or 'NO'. 'Yes' was considered as '1' point and 'No' as '0' points. The score of 22 components was calculated by simple addition.

2.3. Statistical analysis

In our analysis, continuous parametric data was reported as mean with standard deviation and categorical data as proportions. The difference between the categorical variables was assessed using the chi square, while student's T-test was used to evaluate the variance in

Table 1

Age (years), mean \pm SD	30.50 \pm 3.58
Gender	
Male, n (%)	67 (59.8%)
Female, n (%)	45 (40.2%)
Year of residency	
1st year, n (%)	17 (15.2%)
2nd year, n (%)	21 (18.8%)
3rd year, n (%)	25 (22.3%)
4th year, n (%)	25 (22.3%)
5th year, n (%)	24 (21.4%)
Surgical specialty	
General Surgery, n (%)	48 (42.8%)
Neurosurgery, n (%)	18 (16.0%)
Orthopedic surgery, n (%)	12 (10.7%)
Plastic Surgery, n (%)	10 (8.9%)
Cardiothoracic Surgery, n (%)	4 (3.6%)
Paeds Surgery, n (%)	6 (5.4%)
Urology, n (%)	14 (12.5%)

continuous parametric variables. Alpha was set at 5% and p-value < 0.05 was considered statistically significant. The analysis was done on SPSS (Version 24; SPSS, Inc., Chicago, IL).

3. Results

A total of 112 postgraduate trainees matched the inclusion criteria and were selected for the analysis. The mean age was 30.50 \pm 3.58 years. Of the 112 subjects, 67 (59.8%) were male and 45 (40.2%) were female. There were 25 (22.3%) participants from 3rd and 4th post graduate year each. A total of 48 (42.8%) of the interviewees were general surgery residents. Table 1 describes the demographics in detail.

Table 2 demonstrates the factors adversely affecting the surgical residency program and life of the residents. When asked about the reduction of hands-on exposure, 97 (86.6%) of the residents stated that their surgical hands-on exposure is adversely affected by the pandemic as there has been a reduction of about 56% in elective surgeries ($p < 0.001$), and approximately 39% reduction in Emergency operative procedures ($p = 0.005$). As for clinical exposure, 92 (82.1%) trainees responded that their clinical exposure is affected, owing to the decrease of approximately 64% of patients in clinics ($p < 0.001$) and about 48% fall in patient volume in the emergency department (ED) ($p = 0.002$). Among all the subjects, 74 (66.1%) claimed that the fear of acquiring the infection from the patient was interfering with their clinical skills while attending the patient in ED or in clinics. Among all the subjects, 69 (61%) were concerned about transmitting it to their family members and 43 (38.4%) affirmed on being afraid of dying because of their direct exposure. For further results, please see Table 2.

Table 3 describes the factors with positive impact on residents during this pandemic. The average number of working hours per week for surgical residents were reduced from 81.10 \pm 6.21 to 49.16 \pm 6.25 ($p < 0.001$) due to the outbreak, thus 88 (78.6%) trainees had more time for research work and 102 (91.1%) had more time for self-study. Maslach Burnout inventory was modified as described in the methods for the sake of simplifying the questionnaire. According to this, the average score before pandemic was 14.75 \pm 3.54 and it was reduced to 8.33 \pm 2.34, showing statistically significant reduction in burnout among the surgical residents ($p < 0.001$).

When the subjects were asked about grading the overall effect of COVID-19 pandemic on their life in general on a scale of -10 to $+10$, with -10 being severely adversely affected and $+10$ being a massive positive impact, the mean score was found to be -4 ± 1.73 .

Each of the 22 questions of MBI was asked in two scenarios i.e. before the disruption that was brought about by the pandemic and after the pandemic. Those who responded "Yes" to the questions before and after the pandemic were compared as shown in Table 4.

Table 2

Question	n (%)	p-value
Reduction in hands-on surgical experience		
Yes	97(86.6%)	–
No	15(13.4%)	
If you were scrubbing in 10 elective operative procedures per week before pandemic, how many procedures are you scrubbing now?	mean ± SD 6.10 ± 1.84	0.005
If you were scrubbing in 10 emergency operative procedures per week before pandemic, how many procedures are you scrubbing now?	mean ± SD 4.44 ± 0.23	< 0.001
Reduction in clinical exposure		
Yes	92 (82.1%)	–
No	20 (17.9%)	
If you were attending 100 patients in clinics per week before pandemic, how many are you attending now?	mean ± SD 36 ± 17.20	< 0.001
If you were attending 100 patients in emergency per week before pandemic, how many are you attending now?	mean ± SD 52 ± 17.67	0.002
Do you have proper PPE for work?		
Yes	80 (71.4%)	–
No	32 (28.6%)	
Is the fear of acquiring infection affecting your clinical skills while attending the patient?		
Yes	74(66.1%)	–
No	38 (33.9%)	
Do you fear of transmitting infection to your family members?		
Yes	69 (61.6%)	–
No	43 (38.4%)	
Do you fear of transmitting infection to your patients?		
Yes	57 (50.9%)	–
No	55 (49.1%)	
Do you fear of dying from COVID-19?		
Yes	43 (38.4%)	–
No	69 (61.6%)	

Table 5 demonstrates the comparison of means of total scores of each of the three components of MBI. The decrease found in the scores of each section was statistically significant ($p < 0.05$). See Table 5 for further details.

4. Discussion

Each residency program has a unique curriculum, working hours, workload and number of residents. While hands-on and adequate clinical exposure are considered necessary to train surgeons for tomorrow, the associated risks now are too high [16]. Amidst the chaos and uncertainty that is brought by COVID-19, a method of organization is required that will allow the residency programs to train the residents on academic, social, professional and personal levels. Cleveland clinic's urology residency program has put forth a frame-work which involves limiting the clinical exposure and daily virtual learning [17]. Italian researchers from a hospital in Bergamo also highlighted the importance of social distancing to prevent further catastrophe [18]. Our surgical residency programs have also updated their curriculum in which the hands-on opportunities, elective procedures, time in clinics and surgical emergency duties are decreased (see Table 2). Moreover, academic conferences are now preferred on virtual platforms like Zoom. The daily virtual meetings to stay up to date regarding recent developments in response to COVID-19 and to remain on top of the cases admitted in the ward are so far getting positive reviews from the residents and attendings.

Another concern for every HCW is availability of PPE. The sheer volume of patients and limited supply of PPE to keep everyone safe have significantly affected training programs [4,5]. Most of the surgical cases in the department of neurosurgery at Cleveland medical center are limited to a single resident to preserve PPE [19]. As per WHO guidelines on optimizing the supply of PPE when the facility's PPE

Table 3

What is the average number of your working hours per week before pandemic? mean ± SD	81.10 ± 6.21	$p < 0.001$
What is the average number of your working hours per week after pandemic? mean ± SD	49.16 ± 6.25	
Are you now getting more time for research work?		
Yes, n(%)	88 (78.6%)	–
No, n(%)	24 (21.4%)	
Are you now having more time for self-study?		
Yes, n(%)	102 (91.1%)	–
No, n(%)	10 (8.9%)	
Modified MBI score before pandemic mean ± SD	14.75 ± 3.54	$p < 0.001$
Modified MBI score after pandemic, mean ± SD	8.33 ± 2.34	

capacity is threatened [20], we cancelled non-urgent procedures and favored home care rather than hospitalization when appropriate. Moreover, we are prioritizing the use of PPE for the highest risk conditions (eg, surgeries, isolation ward duties) and minimizing face-to-face encounters, all of which has helped us in maintaining stable supply of PPEs (Table 2). Despite all the preventive measures, our study reports a high percentage of fear of acquiring infection among the residents to a point that it could possibly affect their clinical encounter. It is understandable as the thought of experiencing once in a century pandemic itself is scary, but the inquisitiveness surrounding the virus is doing more harm than good [21]. Because if the infection is interfering with the clinical skills of the physicians, the risks of delaying the diagnoses or misdiagnoses are high. Other concerns that were found among the residents are transmission of infection to family members and possibility of full-blown infection resulting in death (Table 2). These are similar to the concerns of the residents rotating in VA Boston Healthcare System, MA [22]. These fears may be sufficient enough to affect the critical thinking and decision making of the physicians during clinical encounters as well as during surgery where eyes, hands and mind should be working concurrently.

However, there is a silver lining for the surgical residents in the change that is brought along with the pandemic. According to our findings, the average number of working hours per week for surgical residents are significantly reduced. It may be due to a number of causes. First, as discussed previously, the duty hours are shortened to decrease the risk of exposure. Secondly, the timely measures brought about by the government are so far helping in keeping the number of COVID-19 patients less, due to which surgical residents are not yet required to expand the workforce of emergency departments or isolation centers. The bottom line is that most of the surgical residents got enough time to catch up on their research projects and studies. The findings are similar to that observed in an orthopedic residency program in Georgia [23] and several others [17,19]. In addition, the components of emotional fatigue, personal fulfillment and depersonalization that are known to be associated with burnout were more likely to be present before the pandemic among the surgical residents which could be due to several reasons like increased working hours, hours spent in commute, heavy patient load, increased numbers of procedures, etc. [24]. Though there is a potential for recall bias, it seems that the direct effect of the pandemic on these factors resulted in significant reduction of the burnout among surgical residents after the outbreak (Table 5).

We have a few limitations to the study. First, we did not assess how effective are the virtual conferences and lectures. Further studies conducted in this regard should include this point. Second, this study is a single public sector institution survey, amidst this pandemic more extensive multi-institutional surveys involving both private and public sector institutions should be performed. Third, this study did not consider the factors that could have been potential confounders on residents' well-being such as financial constraints or domestic issues, we propose to analyze these factors in future studies conducted.

Table 4

	Before Pandemic (Yes)		After Pandemic (Yes)		p-value
	n	%	n	%	
Emotional fatigue					
1. Do you feel emotionally drained at work?	68	60.7	42	37.5	0.84
2. Do you feel used up at the end of the workday?	92	82.1	55	49.1	0.01
3. Do you feel fatigued when you wake up in the morning to face yet another day at work?	88	78.6	49	43.8	0.01
4. How often do you feel that dealing with patients all day long is a stress for you?	90	80.4	51	45.5	0.33
5. Do you feel that you are frustrated by your job?	94	83.9	51	45.5	0.03
6. Do you think that you have difficulty creating a relaxed working environment at work?	75	67.0	42	37.5	0.04
7. Do you feel a lack of energy at work?	87	77.7	43	38.4	0.22
8. Do you feel that you are unable to accomplish worthwhile things from your work?	64	57.1	47	42.0	0.22
9. Do you think that this job is hardening you emotionally?	46	41.1	36	32.1	0.61
Personal fulfilment					
10. Do you feel like you are at the end of the rope?	89	79.5	64	57.1	0.001
11. Do you feel like you are too hard on your job?	78	69.6	51	45.5	< 0.001
12. Do you feel like you do not care what is happening to some of your patients?	61	54.5	44	39.3	< 0.001
13. Do you think that you are unable to bring a positive change in other people's life through your work?	88	78.6	54	48.2	< 0.001
14. Do you think that you have difficulty dealing with emotional problems calmly?	88	78.6	55	49.1	< 0.001
15. Do you feel that working with people all day long is a strain for you?	54	48.2	41	36.6	< 0.001
16. Do you feel that you treat some patients as if they are impersonal objects?	75	67.0	40	35.7	0.002
17. Do you feel that you have become callous towards people since you have taken this job?	67	59.8	48	42.9	< 0.001
Depersonalization					
18. Do you feel burned out from work?	46	41.1	19	17.0	0.008
19. Do you feel that the patient will blame you for anything that goes wrong in their treatment?	60	53.6	18	16.1	0.48
20. Do you think that you have difficulty understanding how your patients feel about things?	76	67.9	24	21.4	0.06
21. Do you think that you have difficulty dealing with the patients' problems?	80	71.4	32	28.6	0.004
22. Do you feel a lack of enjoyment while working with your colleagues?	74	66.1	19	17.0	0.06

Table 5

	Before pandemic (mean ± SD)	After pandemic (mean ± SD)	p-value
Emotional fatigue	6.31 ± 1.62	3.77 ± 1.08	0.008
Personal fulfillment	5.33 ± 1.44	3.56 ± 1.21	0.002
Depersonalization	3.10 ± 1.06	1.00 ± 0.80	< 0.001
Total MBI	14.75 ± 3.54	8.33 ± 2.34	< 0.001

5. Conclusion

This international public health challenge has undoubtedly served as an eye-opener and will likely have long-lasting effects on the requirements and framework of surgical residency programs. While the situation has globally affected the professional and personal lives of surgical residents, it has also provided us to explore efficient methods of didactics, virtual learning and communication methods that have the potential to generate more savings when it comes to health care money and potentially even leading to less burnout. However, the limited hands-on experience and lesser clinical exposure are worrisome for which a substitute or a balanced midpoint is needed. Lastly, the fears of acquiring infection and of transmission of infection to family members are real and this psychological burden should be addressed using appropriate means. We propose the colleges of graduate medical education around the globe to formulate appropriate guidelines to help surgical residency programs continue their didactics and curricular activities with least possible harm to their structure by this wave of COVID-19 and to cope up with this “new normal”.

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Approval was obtained from our hospital's ethical review committee.

CRedit authorship contribution statement

Muhammad Osama: Conceptualization, Methodology, Validation, Formal analysis. **Farhan Zaheer:** Conceptualization, Validation, Supervision, Project administration. **Hasham Saeed:** Methodology, Resources, Writing - original draft, Visualization. **Khadija Anees:** Investigation, Data curation. **Qirat Jawed:** Resources, Writing - review & editing. **Sohaib Hasan Syed:** Investigation, Data curation. **Bashir A. Sheikh:** Supervision, Project administration.

Declaration of competing interest

None.

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