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The Impact of COVID-19 on the Training of Surgical Residents in Greece: Results of a Survey Conducted One Year after the Onset of the Pandemic

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Rezumat

Impactul pandemiei de COVID-19 asupra pregătirii rezidenților de chirurgie generală din Grecia: rezultatele unui sondaj la un an de la debutul pandemiei

Context: Pandemia de coronavirus (COVID-19) este o criză în curs de desfăşurare. În contextul creşterii îngrijorării referitoare la formarea rezidenților de chirurgie, am analizat percepția acestora cu privire la impactul pandemiei asupra pregătirii lor chirurgicale. *Metode:* Studiul are la bază un chestionar online, anonim care cuprinde 15 întrebări cu răspunsuri multiple, diseminat prin e-mail rezidenților educați şi angajați în spitalele din nordul Greciei. Sondajul a avut loc în lunile ianuarie şi februarie din 2021. *Rezultate:* Un total de 124 de rezidenți din diverse specialitați chirurgicale au completat chestionarul. Majoritatea (51,6%) au raportat o scădere semnificativă a numărului de operații efectuate săptămânal în perioada pandemiei. Aproximativ 38% dintre respondenți au declarat că abilitățile lor chirurgicale au fost în mod semnificativ afectate, iar 35,5% au raportat o depreciere moderată a cunoştințelor teoretice. Aproape jumătate dintre aceştia au declarat că sunt mulțumiți de cursurile online şi un total de 67,7% au afirmat nevoia de a-şi prelungi pregătirea clinică.
Concluzii: Obiectivele unei secții chirurgicale includ instruirea de înaltă calitate a tinerilor chirurgi. Impactul pandemiei asupra activităților chirurgicale de rutină a fost dramatic. Rezultatele

acestui studiu indică în mod clar că pregătirea tinerilor chirurgi a fost semnificativ influențată negativ.

Cuvinte cheie: pandemia de COVID-19, pregătire chirurgicală, rezidenți de chirurgie

Abstract

Background: The coronavirus disease (COVID-19) pandemic is an ongoing crisis. In light of mounting concerns about the training of surgical residents, we examined surgical residents' perceptions regarding the pandemic's impact on their training.

Methods: We developed an anonymous online questionnaire comprising 15 multiple-choice questions, which we sent via email to residents educated and employed in northern Greece hospitals. Our survey took place in January and February of 2021.

Results: A total of 124 residents across a broad spectrum of surgical fields completed the questionnaire. The majority (51.6%) reported a significant decline in the number of operations performed weekly during the pandemic. Approximately 38% of the respondents stated that their surgical skills have been negatively affected to a significant extent, and 35.5% reported that their theoretical knowledge had deteriorated to a moderate extent. Almost half of them reported that they were satisfied with the online courses and a total of 67.7% affirmed the need to prolong their clinical training.

Conclusions: The aims and scope of a surgical department include the provision of high-quality training to young surgeons. The impact of the pandemic on routine surgical activities has been dramatic. Our results clearly indicate that young surgeons have been significantly affected in terms of their training.

Key words: COVID-19 pandemic, surgical education, surgical residents

Introduction

The coronavirus disease (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), (1) which was first identified in Wuhan, China, in December 2019, (2) remains an ongoing crisis. Millions of cases of COVID-19 have been reported worldwide, leading to a dramatic increase in the number of deaths. Moreover, barriers to normal social interaction imposed through restrictive government measures have been unprecedented. Within health care system, changes in allocations of material and human resources have induced dramatic changes in hospitals' routine workflows (3). Surgical departments are no exception. Elective surgeries were canceled, and surgical clinics were scaled back drastically to provide infrastructural reserves to meet demands prompted by the pandemic. To mitigate exposure to the virus, medical personnel handling inpatients were retrenched, and surgical residents were reassigned to non-surgical departments. Practical guidelines introduced by state governments only permit emergency surgical procedures, which, has inevitably affected surgical trainees' skills development. Furthermore, educational and academic programs have either have been postponed, or they have been moved to virtual platforms (4-5). However, hands-on surgical training programs, which are essential for surgical residents, could not be feasibly substituted. In light of the above situations, concerns have been raised about the training of surgical residents (6-9). The extent to which standard training and practice have been affected during the pandemic, as well as the

theoretical knowledge base of surgical residents, especially in university teaching hospitals, is this a highly topical issue (10-11). Moreover, the long-term outcomes of the pandemic on surgical training should not be overlooked, as they remain unpredictable (12-13).

Given the above considerations, almost one year after the outbreak of COVID-19 in northern Greece, we attempted to estimate the extent to which the pandemic has affected the training and education of surgical residents in this region. Accordingly, we administered a short, anonymous online survey among surgical residents across university teaching and tertiary hospitals in northern Greece.

Material and Methods

We developed an anonymous online questionnaire comprising 15 multiple choice questions, which we sent by email to residents across a broad spectrum of surgical fields, who were educated and employed in hospitals (university teaching hospitals and tertiary hospitals under the Greek National Health Care System). Specifically, residents from general surgery, orthopedics, urology, plastic surgery, obstetrics and gynecology, ENT, neurosurgery, ophthalmology, thoracic and vascular surgery, pediatric surgery, and maxillofacial surgery departments were invited to participate in the survey.

The demographic questions in the questionnaire included the department's status, the type of hospital implementing the training program (a university teaching or tertiary hospital), and the resident's current year of clinical training. We also assessed the effect of the shift to non-surgical departments; the duration of the shift, if applicable; exposure to COVID-19; and the routine daily workflow, for example, participation in surgical procedures before and during the pandemic. The impact of the pandemic on residents' surgical skills and on their theoretical knowledge base was evaluated using a Likert scale with scores ranging from 0 to 5, where 0 denoted not at all and 5 indicated to a very great extent. This scale was used to assess residents' concerns about their future surgical careers. Moreover, questions about participation in online lectures and satisfaction levels were used to assess the pandemic's impacts on educational processes. Lastly, we included a question on whether or not residents felt their clinical training needed to be prolonged.

The above questions were formulated after we had thoroughly reviewed the existing literature,(14-17) and the questionnaire was converted into an online format (a Google form), which was emailed to surgical residents. A disclosure statement informing respondents that the survey responses would be anonymous and were only intended for research purposes preceded the questionnaire. As the study complied with state law and ethical considerations, an approval statement by an institutional review board or ethics committee was not required. We did not offer the participants any incentives. The survey was implemented in January and February 2021.

Statistical Analysis

The statistical analysis was performed using RStudio version 1.1.442 (RStudio, Inc.). The study population's characteristics were presented as percentages. The survey also contained 6-point Likert-type questions, and the percentages of residents' responses for each of the options were calculated. The differences in the numbers of surgeries and lectures attended before and during the pandemic were estimated using McNemar's test. The significance level was set at 0.05

Results

Residents' Information

A total of 124 residents completed the questionnaire. The majority (71%) were employed in surgical departments of university teaching hospitals. Third-year residents formed the largest group of respondents (21.8%), followed by equal proportions of second- and fourth-year of residents (19.4%). More than half of the questionnaires (56.5%) were completed by

general surgeon interns, while orthopedic interns accounted for 6.5% of the questionnaires. Twenty-five percent of the residents were shifted to COVID-19 wards, with the majority of these residents (51.5%) staying in these wards for less than 4 weeks. *Table 1* presents the residents' demographic data.

Participation in Surgical Procedures

Prior to the pandemic, 51.6% of residents reported that they were participating in 4 to 6 operations weekly, whereas during the pandemic, 67.7% participated in 1 to 3 operations weekly (a statistically significant difference). The number of residents who participated in no operations weekly rose from 2.4% before the pandemic to 29.8% during the pandemic (*Fig. 1*).

Surgical Skills and Theoretical Knowledge

Approximately 38% of the participants stated that their surgical skills were negatively affected to a large extent during the pandemic, and 35.5% reported a decline in their theoretical knowledge base to a moderate extent (*Fig. 2* and *3*). The surgical skills of residents who were shifted to COVID-19 wards were reportedly more negatively affected compared

Table 1. Residents' demographic data

	%	n
Clinic		
Tertiary hospital department	29	36
University teaching hospital department	71	88
Residency year		
1st	15.3	19
2nd	19.4	24
3rd	21.8	27
4th	19.4	24
5th	12.1	15
6th	7.3	9
7th	0.8	1
Extra time	4	5
Specialty		
General surgery	56.5	70
Orthopedics	6.5	8
Urology	4.8	6
Plastic surgery	2.4	3
Gynecology	2.4	3
Otolaryngology	7.3	9
Neurosurgery	5.6	7
Ophthalmology	5.6	7
Thoracic surgery	2.4	3
Vascular surgery	1.6	2
Pediatric surgery	4.8	6
Maxillofacial surgery	-	-
Covid-19 disease		
Yes	31.5	39
No	60.5	75
Do not know	8.1	10
Shift to covid ward		
Yes	25	31
No	75	93
If yes, for how long		
<4 weeks	51.5	18
4-8 weeks	39.4	13
>8 weeks	9.1	3

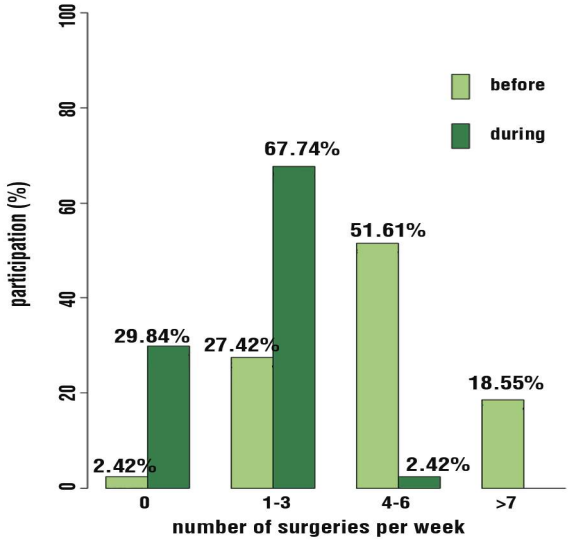

Figure 1. Residents' participation in surgeries before and during the pandemic

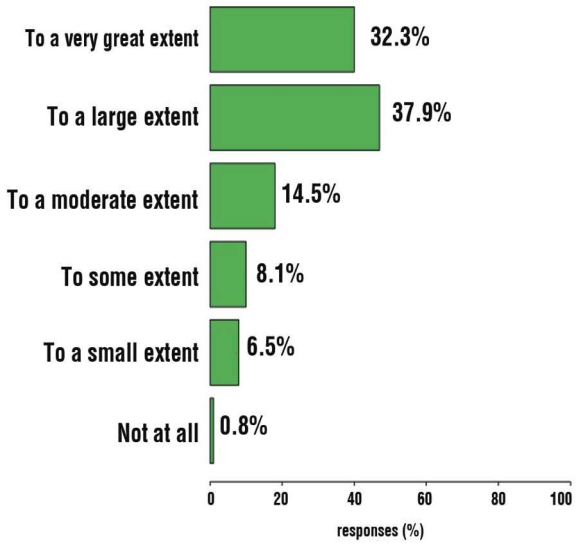

Figure 2. Has the pandemic negatively influenced your surgical skills?

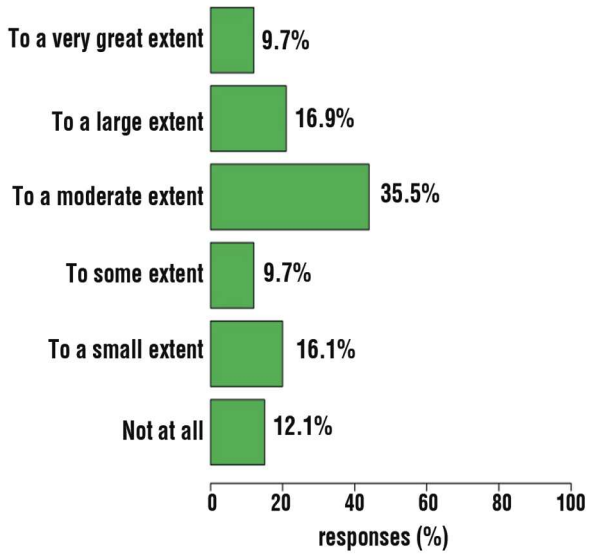

Figure 3. Has the pandemic negatively influenced your theoretical knowledge?

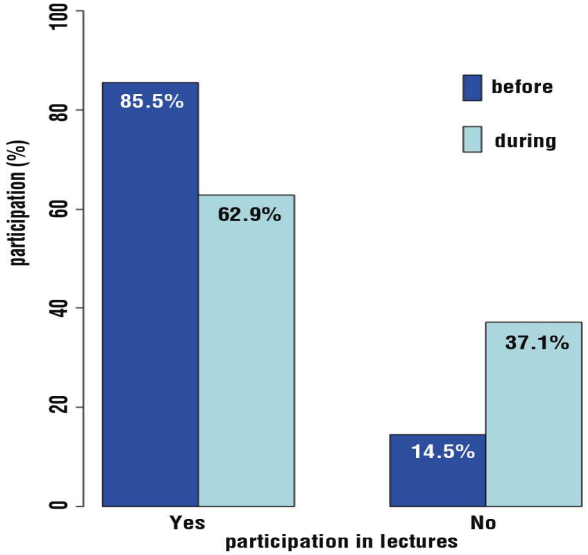

Figure 4. Residents' participation in lectures before and during the pandemic

with those of residents who were not moved. The theoretical knowledge of those who worked at COVID-19 wards also differed significantly from those who did not (*Table 2*).

Residents' Training

Residents were asked whether they were attending lectures before and during the pandemic. Whereas 85.5% of them responded that they were participating in lectures prior to the pandemic, this percentage declined significantly to 62.9% during the pandemic (*Fig. 4*). A total of 49% of the respondents reported that they were satisfied with the online courses that replaced the onsite lectures, and 67.7% of the residents affirmed that prolongment of their clinical training was required. A large proportion of residents (37.1%) reported feeling concerned about their future surgical careers to "a very great extent" (*Table 3*).

Table 2. Influence of transferal to a COVID-19 ward on residents' surgical skills and theoretical knowledge

Transfer to COVID-19 ward		**Yes**	**No**	
	%	**n**	**%**	**n**
Has the pandemic influence your surgical skills negatively?				
Not at all	0	0	0.8	1
To a small extent	0	0	6.5	8
To some extent	2.4	3	5.6	7
To a moderate extent	1.6	2	12.9	16
To a large extent	7.3	9	30.6	38
To a very great extent	13.7	17	18.5	23
Has the pandemic influence your theoretical knowledge negatively?				
Not at all	0	0	12.1	15
To a small extent	2.4	3	13.7	17
To some extent	1.6	2	8.1	10
To a moderate extent	6.5	8	29	36
To a large extent	8.1	10	8.9	11
To a very great extent	6.5	8	3.2	4

Table 3. Residents' training

Were you attending educative lectures before the pandemic?		
Yes	85.5	106
No	14.5	18
Were you attending educative lectures during the pandemic?		
Yes	62.9	78
No	37.1	46
Are you satisfied with online courses that are replacing the onsite lectures?		
Yes	49.2	61
No	21	26
No online courses available	29.8	37
Is the prolongation of the clinical training recommendable?		
Yes	67.7	84
No	32.3	40
Are you feeling confident, referring to your surgical career?		
Not at all	37.1	46
To a small extent	25.8	32
To some extent	21.8	27
To a moderate extent	5.6	7
To a large extent	8.9	11
To a very great extent	0.8	1

Discussion

The coronavirus disease (COVID-19) pandemic has undeniably resulted in the worst healthcare crisis in recent history. Serious concerns have arisen among healthcare professionals regarding the responses of health care systems to this crisis. Available data indicate that residents' training and educational programs have also been affected. In particular, a dramatic decrease in the volume of elective surgical cases has inevitably affected their surgical training. Addressing the issue of how surgical residents could be trained in the absence of patients and how this training could be delivered remotely continue to pose major challenges and remain topics of further scientific discussion (18). Our surgical department is no exception, evidencing a continuing decline in the operative volume to approximately 50% since the implementation of restrictive public health measures. Accordingly, we conducted a survey to assess this situation in the city of Thessaloniki in northern Greece, which was the country's COVID-19 epicenter one year before the commencement of this study.

Our concerns regarding the negative impact of COVID-19 on surgical skills were confirmed. Our results indicate that there are two major causative factors: the postponement of elective operations and the reassignment of surgical residents to non-surgical departments. Only 2.42% of the residents reported participating in more than four operations per week, compared with 51.61% of residents prior to the pandemic. Moreover, 54.8% of those who were shifted to non-surgical departments reported that their surgical skills were negatively affected to a very great extent compared with 24.7% of those residents who were not moved. It is possible that residents in the final years of their training program were less concerned about their surgical skills because the number of operations they had previously performed was sufficient to instill confidence.

A significant difference in theoretical knowledge was also reported. Whereas the number of educational and academic programs conducted through online platforms has been adequate, the number of attendees before and during the pandemic decreased from 85.5% to 62.9%, respectively (a statistically significant difference, $p < 0.001$). Some possible reasons for this decrease could be that surgical residents who were shifted to COVID-19 departments had to be educated on the pandemic's management. Consequently, they had to participate in online courses that focused mainly on the management of COVID-19. A second possible reason is conflicting schedules relating to routine work in non-surgical departments and surgical educational programs. A third possible factor is that 39 out of 124 residents (31.5%) tested positive for COVID-19. However, almost half of the attendees (49.2%) reported being satisfied with the online lectures. This result probably indicates that the use of technology and the rapid switch to virtual education was successful. However, issues such as scheduling and familiarization with virtual education should be considered for improving the overall educational process and satisfaction rate. Notwithstanding such improvements, substitute courses for specific components of surgical training, such as hands-on training, remain to be designed.

Although, there may be no way to replace direct hands-on training in the operating room,

surgical simulators, as well as 3D printed in silicon surgical models have already been applied. Our department is among those, which implement the aforementioned alternatives. Our intension is to evaluate these methods from the surgical residents in a novel survey.

The majority of the participants (67.7%) expressed the need to prolong training programs. Notably, however, this perception was correlated with the year of residency. The percentage of residents who had reached the third year of their training program and who wished to prolong their training program was 78.57%, whereas the percentage of those holding this view who had completed three years of training was substantially lower (57.4%).

Moreover, 37.1% of the participants were concerned to a very great extent about their future surgical careers. However, this concern was correlated with the year of training, as residents who had advanced beyond the third year of their program appeared more confident compared with more junior colleagues. This confidence could be attributed to the larger number of operations performed by senior residents prior to the outbreak of the pandemic.

Need to be mentioned, that none of the participants shift from surgical residency to another one. However, they show an unequivocal intention to be educated on the pandemic's management.

It should be noted that this study had certain limitations that require consideration, some of which are typical of survey-based studies, such as the number of participants and heterogenicity. The response rate of 124 participants could be deemed insufficient. Accordingly, we performed a descriptive statistical analysis. Although the questionnaires were dispatched solely to surgical residents via email, the recipients were from different departments representing a broad spectrum of surgical fields. Moreover, participation in the survey was voluntary, which may lead to selection bias, as residents who were more concerned about educational procedures during the COVID-19 pandemic would be more likely to participate.

Conclusion

The aims and scope of a department of surgery include the provision of high-quality training to young surgeons. Even during the pre-COVID era, continual updates to maintain state-of-the-art procedures and treatments and sufficiently prepare new surgeons were essential components of educational programs. The pandemic's impact on routine surgical practice has been profound. In this context, young surgeons' training has been significantly affected, raising concerns about long-term effects on their abilities to manage surgical patients. In view of the need to enhance and maintain sufficient training programs, innovative educational strategies and components are needed. Furthermore, regular assessments conducted to determine how and to what extent educational programs are being affected and will be affected in the future are essential. Surgical departments seem to adapt to new educational methods, however long-term results to future's surgeons are uncertain and need to be studied.

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Disclosure

The authors report no conflicts of interest that influenced this work.

Ethical Statement

The survey was implemented in compliance with the General Data Protection Regulation (GDPR).

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Appendix. Impact of COVID-19 on surgical training

Q1. Training position:
University teaching hospital
Tertiary hospital (National Health Care System)

Q2. Department:
(General surgery, orthopedics, urology, plastic surgery, obstetrics and gynecology, ENT, neurosurgery, ophthalmology, thoracic and vascular surgery, pediatric surgery, and maxillofacial surgery)

Q3. Year of residency:

Q4. Reassignment to a non-surgical department:
Yes
No

Q5. If yes, period of time:
4 weeks
4–8 weeks
>8 weeks

Q6. Exposure to COVID-19:
Yes
No
N/A

Q7. Participation in surgeries per week before the pandemic:
0
1–3
4–6
>7

Q8. Participation in surgeries per week during the pandemic:
0
1–3
4–6
>7

Q9. Has the COVID-19 pandemic had a negative influence on your surgical skills?
0 Not at all
1 To a small extent
2 To some extent
3 To a moderate extent
4 To a large extent
5 To a very great extent

Q10. Has the COVID-19 pandemic had a negative influence on your theoretical knowledge?
1 To a small extent
2 To some extent
3 To a moderate extent
4 To a large extent
5 To a very great extent

Q11. Participation in lectures before the pandemic:
Yes
No

Q12. Participation in lectures during the pandemic:
Yes
No

Q13. Are you satisfied with virtual education programs?
Yes
No

Q14. Do you feel that your training program needs to be prolonged?
Yes
No

Q15. Are you concerned about your future surgical career?
1 To a small extent
2 To some extent
3 To a moderate extent
4 To a large extent
5 To a very great extent