

# The Impact of Covid-19 on Surgical Training and Outcomes: A Multicenter Experience (Greece and Romania)

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**ABSTRACT:** Background. The COVID-19 pandemic has posed unprecedented challenges to health systems worldwide-in delivering care to patients and in maintaining training of their care providers. Surgical specialties have particularly struggled to maintain sufficient levels of training as we have seen significant reductions in the number of surgical beds, operating lists and redeployment of surgical staff to COVID-19 departments or Intensive Treatment Units. Methods. Comparison of the number of surgical operations performed between January 1st 2019 and December 31st 2020 in 3 surgical departments in Romania (Craiova, Timisoara and Bucharest) and 1 surgical department in Thessaloniki, Greece. Cases were compared on a month to month basis, both elective and emergency operations were included and divided into three main categories based on severity (Minor, Medium, Major). Results. Between 2019 and 2020, there was a 37.04% decrease in the number of surgical procedures, 36.95% for open procedures and 37.20% for laparoscopic procedures. Statistically significant overall reduction was observed in all three centers for both open and laparoscopic operations. In all centers, a statistically significant reduction in medium severity procedures was also observed. Conclusion. Globally felt detrimental effect on surgical training, patient contact and mental well-being reflected similarly across surgical specialties in both countries.

**KEYWORDS:** Covid19, surgical training, medical education, surgical operations.

## Introduction

The COVID-19 pandemic has claimed about 5 million lives and has reached over 220 million cases worldwide since first appearing in early 2020.

Almost two years later, health care systems are continuing to strive to maintain services and training while also catering to health personnel mental health needs arising from their experiences during the pandemic.

Surgical specialties have faced multiple challenges that have a potentially underestimated long-term effect on the future of surgery [1].

Issues faced worldwide included a significant reduction in the number of surgical beds, a reduction in operating lists, including periods of complete halt of elective cases, and

redemption of surgical trainees and consultants to intensive treatment units (ITUs) and COVID-19 wards.

These changes lead not only to exhausted trainees and Consultants but also discouraged existing trainees from continuing their career in surgery and new trainees from entering one.

Surgical training opportunities are certainly very limited-for a longer time than expected-as reflected from experience and international literature.

The aim of this study is to analyze and compare the decrease in surgical operations performed in four General Surgical Departments (three in Romania and one in Greece) between 2019 and 2020, as well as to discuss the impact of the pandemic on surgical training, academic work, patient contact, and well-being.

All the above have led to the need for alternative training methods during and potentially after the COVID-19 pandemic.

## Methods

### Data Sources

The study included data collected between January 1st 2019 and December 31st 2020 by 3 General Surgery Departments in tertiary referral centres-one (Centre A) in Thessaloniki, Greece, EU and 2 (Centre B and Centre C), in Romania, EU.

Unfortunately, due to a lack of specific information on the procedures and their classification as minor, medium, or major, the data from the fourth center could not be statistically analyzed.

The number of surgical procedures performed in these centres along with the procedure type and date, were analysed and compared between the years 2019 and 2020.

The procedures were classified as Minor, Medium and Major based on their severity (Table 1).

**Table 1. Surgical procedure categorisation according to severity.**

Minor	Medium	Major
Lipoma excision	Arteriovenous fistula surgery	Thyroidectomy
Sebaceous cyst excision	Superficialisation of basilic vein	Total mastectomy+axillary lymphadenectomy
Nevus excision	Arteriovenous fistula closure/Excision arteriovenous fistula aneurysm	Total hysterectomy+bilateral adnexectomy
Ingrown toe nail excision	Long-Term hemodialysis catheter placement/removal	Sigmoid colectomy
Pilonidal cyst excision	Saphenectomy/Vein stripping	Transverse colectomy
Seroma/Hematoma drainage	Parathyroidectomy	Right hemicolectomy
Fissurotomy/Fissurectomy	Tracheostomy	Left hemicolectomy
Perianal abscess drainage	Breast sectorectomy	Hartmann's procedure
Granuloma excision	Appendectomy	Low anterior resection of the rectum
Superficial lymphadenectomy	Cholecystectomy	Abdominoperineal resection of the rectum
Colonoscopic polypectomy	Adnexectomy	Adrenalectomy
Cystectomy+biopsy	Pleural drainage	Excision/drainage of hepatic cyst/abscess
Thoracocentesis	Gastrostomy/PEG	Small bowel resection
Bronchoscopy+biopsy	Peritoneal dialysis catheter placement/removal	Total/Subtotal gastrectomy
Double J-stent placement/extraction	Temporary colostomy	Nephrectomy
Lithotripsy	Open/Laparoscopic inguinal hernia repair	Total/Subtotal Cystectomy
	Open/Laparoscopic umbilical hernia repair	Pancreatectomy
	Open/Laparoscopic linea alba hernia repair	Splenectomy
	Open/Laparoscopic incisional hernia repair	Biliodigestive anastomosis
	TUR-V/TUR-P	Exploratory Laparotomy/Laparoscopy
	Nephrostomy	Lung lobectomy /Pneumectomy
	Soft tissue sarcoma excision	Thoracoscopy

A questionnaire assessing how COVID-19 affects young surgeons' training and well-being was also distributed.

However, the sample size was quite small (less than 50 people), and the results were not reliable enough to be evaluated.

The opinion of the Ethics Committees of participating institutions was that no written consent was needed, as no medical data pertaining to patients was used in the analysis.

All doctors accepted freely the participation in the study.

### Statistical Analysis

Categorical variables were presented as percentages.

Statistical comparison for categorical variables was performed using the chi squared test.

Numerical variables were tested for normal distribution using the Shapiro-Wilk test, as per usual protocols [2].

Normally distributed continuous variables were represented as mean [+/-SD], while non-normally distributed continuous variables were represented as median [25th-75th percentile].

Statistical comparison for normally distributed variables was performed using the Student's t-test while for non-parametric numerical variables the Spearman's rank correlation coefficient was calculated.

All statistical analysis was conducted using R version 4.1.1 of the R Foundation for Statistical Computing in the R Studio version 1.4.1717.

### Results

An overall 37.04% reduction in the number of surgical procedures was observed between years 2019 and 2020, 36.95% in open procedures and 37.20% in laparoscopic procedures.

The measures of centre for the data are available in Tables 2 and 3.

The percentile reduction concerning each centre can be found in Table 4.

**Table 2. Measures of centre according to procedure type for each Surgical Centre.**

Centre	Procedure Type	Year	Median	25th-75th Quantile
A	Open	2019	16.5	4.00-21.00
A	Laparoscopic	2019	0.00	0.00
A	Open	2020	3.50	1.00-14.00
A	Laparoscopic	2020	0.00	0.00
B	Open	2019	11.0	0-20.00
B	Laparoscopic	2019	0.00	0-9.00
B	Open	2020	6.00	0-12.5
B	Laparoscopic	2020	0.00	0-9.00
C	Open	2019	3.50	0-12.00
C	Laparoscopic	2019	1.00	0-11.00
C	Open	2020	2.00	0-10.50
C	Laparoscopic	2020	1.50	0-9.00

**Table 3. Measures of centre according to procedure severity for each Surgical Centre.**

Centre	Procedure Severity	Year	Mean	Standard Deviation
A	Minor	2019	6.17	2.66
A	Medium	2019	16.67	6.17
A	Major	2019	24.33	4.58
A	Total	2019	59.67	7.54
A	Minor	2020	6.67	7.61
A	Medium	2020	16.67	6.17
A	Major	2020	15.08	9.84
A	Total	2020	38.42	21.82
B	Minor	2019	25.58	15.92
B	Medium	2019	58.33	10.49
B	Major	2019	38.75	6.82
B	Total	2019	122.67	13.94
B	Minor	2020	15.92	8.36
B	Medium	2020	31.75	13.06
B	Major	2020	27.42	9.92
B	Total	2020	75.08	28.16
C	Minor	2019	16.67	5.00
C	Medium	2019	144.00	18.97
C	Major	2019	19.92	6.14
C	Total	2019	180.58	21.83
C	Minor	2020	16.67	5.00
C	Medium	2020	105.50	39.07
C	Major	2020	14.25	8.14
C	Total	2020	136.00	53.04

**Table 4. Percentile surgical procedure reduction from the year 2019 to 2020 per Centre.**

Procedure	Centre A	Centre B	Centre C	Total
Overall	36.59%	43.93%	24.57%	37.04%
Open	39.02%	43.93%	11.83%	36.95%
Laparoscopic	22.64%	43.94%	33.61%	37.20%

Results of the Spearman correlation indicated that the observed reduction of surgical procedures was statistically significant.

For Centre A, a strong positive association was observed ( $p < 0.001$ ) for both open and laparoscopic procedures.

For Centre B, a very strong positive association was observed ( $p < 0.001$ ) for both open and laparoscopic procedures

For Centre C, a moderate positive association was observed ( $p < 0.001$ ) for open procedures and a very strong ( $p < 0.001$ ) for laparoscopic (Table 5).

**Table 5. Spearman Rank correlation coefficient of the number of the conducted Open or Laparoscopic procedures between years 2019 and 2020.**

Centre	Procedure Type	Rs	p
A	Open	0.82	<0.001
A	Laparoscopic	0.82	<0.001
B	Open	0.94	<0.001
B	Laparoscopic	0.9	<0.001
C	Open	0.65	<0.001
C	Laparoscopic	0.91	<0.001

Furthermore, surgical procedures were compared between years 2019 and 2020 according to severity category, as was defined in Table 1, by month.

A statistically significant reduction was observed in medium severity procedures across all centres while reduction in minor procedures was not statistically significant for centres A ( $p=0.833$ ) and C ( $p=0.917$ ).

For centre C the reduction in major severity category procedures was also not statistically significant ( $p=0.068$ ).

The full results can be found in table 6.

All data and analysis are available upon request.

**Table 6. Student's t test results of the number of the conducted procedures according to procedure severity category between the same month of years 2019 and 2020.**

Centre	Procedure Severity	t	p
A	Minor	-0.215	0.833
A	Medium	3.902	0.001
A	Major	2.953	0.009
A	Total	3.189	0.006
B	Minor	3.492	0.002
B	Medium	5.497	<0.001
B	Major	3.2602	0.004
B	Total	5.247	<0.001
C	Minor	0.105	0.917
C	Medium	3.071	0.007
C	Major	1.926	0.068
C	Total	2.693	0.017

## Discussion

The COVID-19 pandemic has posed unprecedented challenges for surgical practice and training worldwide.

Our results confirm the expected and very significant reduction in the number of surgical procedures as well as the uncertainty about surgical training and its future.

A secondary outcome of this study was to assess whether the impact of the pandemic on surgical numbers was similar between two different countries and health systems.

Our results confirm the expected statistically significant reduction in surgical operations was seen across both countries and all centres involved in the study.

Such reductions have been mentioned in international literature [1] in both high-and low-income countries and indicate that the coping mechanisms of most health systems were poor in terms of maintaining surgical services and training regardless of their resources [3,4].

More specifically, due to the increased number of patients infected with Sars-Cov2, the majority of surgical clinics were converted into COVID-19 wards, and many departments were consolidated, sharing the remaining beds for non-COVID-19 cases.

Another issue worth mentioning is the high rate of medical staff resignation due to challenging working conditions, redeployment, and lack of surgical training, leaving surgical departments understaffed.

Face-to-face outpatient appointments largely stopped in 2020 and re-commenced in 2021, causing already lengthy waiting lists for elective operations to become even longer and levels of frustration among patients to peak.

An added constant fear of contracting and transmitting the virus on top of the aforementioned considerations about personal and professional development caused a large number of medical staff rising levels of anxiety and burnout.

As a result, communication and a mutual relationship of trust between the surgical patient and the surgeon became especially challenging.

It is recognized that with such significant reductions in operating numbers follows reduced opportunity for surgical training.

Our data reflects that the operations most affected by reductions are elective medium severity procedures that would usually be performed by trainees under senior supervision.

Training has been a central concern in discussions among surgeons worldwide as it has seemingly halted.

The long-term effects on surgical training and how it shapes the future face of surgery remains to be seen.

Despite the challenges, latest technological advances allow for a degree of compensation through remote training.

Webinars, online tools, virtual conferences and courses have become frequent since the emergence of the COVID-19 pandemic but are yet to prove their efficacy in training, especially in comparison to traditional training methods [1,3].

Virtual lectures, alternative learning tools, and simulation could help to overcome perceived training inadequacies.

For work-life balance and personal growth, free time can be channeled towards other activities.

It is certain that it is an area worth exploring, given the ongoing uncertainty about the duration of the effects of the pandemic on surgical practice and training.

### Limitations of the Study

Unfortunately, data from the fourth centre could not be evaluated due to a lack of information on the particular type of surgery, date, and severity classification.

According to the limited data available, the number of surgical procedures performed in the fourth center decreased by 34% between 2019 and 2020.

Furthermore, less than fifty people responded to the questionnaire, making evaluation difficult due to the small sample size.

However, the majority of participants feel that there were fewer opportunities for surgical training and that their well-being suffered as

well. Many were also redeployed to COVID-19 departments or ITUs.

### Conclusion

The Covid-19 epidemic has had a significant impact on daily surgical practice.

The considerable decrease in surgical procedures reflects the global limitation of surgical training opportunities.

Alternative training approaches may represent an option, but we know very little about their long-term effectiveness.

In order to assess the long-term influence of the pandemic on educational gaps in surgical training, future qualitative and quantitative research on these approaches will be required through retrospective studies.

Last but not least, extending the time required for mandatory training is also a good idea for all surgical trainees who would like to get additional surgical opportunities.

### Acknowledgments

None

### Conflict of interests

None to declare.

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