ORIGINAL ARTICLE

Impact of COVID-19 on surgical residency training programs in Mexico City: The third victim of the pandemic. A resident's perspective

Impacto del COVID-19 en los programas de residencias quirúrgicas en la Ciudad de México: La tercera víctima de la pandemia. Perspectiva de los residentes

Mariano Oropeza-Aguilar[1], José de Jesús Cendejas-Gómez[1], Alejandro Quiroz-Compeán[1], Gabriela A. Buerba[2], Ismael Domínguez-Rosado[2], and Carlos E. Mendez-Probst[1]*

[1]Department of Urology; [2]Division of Surgery. Instituto Nacional de Ciencias Médicas y Nutrición. Salvador Zubiran, Mexico City

Abstract

Objective: *The aim of this study is to assess the perceptions of the impact of health-care disruption due to COVID-19 on the academic training and skills of surgical trainees.* **Material and Methods:** *We developed a 32-question survey assessing the clinical and surgical impact of COVID-19 on surgical training programs and proposals to compensate for the decrease in surgical education. We got 453 responses of surgical trainees in Mexico City.* **Results:** *Sixty-six percent of the respondents answered that their centers had converted to the exclusive attention of COVID-19 patients. Ninety-five percent reported a decrease in surgical skills learning and 91.8% reported a decrease to clinical exposure. On proposals, 75.6% reported that it is essential to take the necessary measures to recover the clinical and surgical milestones lost. In the binary logistic regression analysis, we found that the postgraduate year (≥ PG-Y3) was statistically significant factor ($p \leq 0.000$) related to a favorable opinion to developing an academic contingency plan and postponing the end of the academic residency year.* **Conclusion:** *More than 90% of the survey respondents reported having been affected by COVID-19 mitigation strategies. Our data calls for urgent training adjustments by hospital and university program leaders to mitigate downstream educational repercussions.*

Keywords: *COVID-19. Mexico. Surgery. Surgical residency programs.*

Resumen

Objetivo: *Evaluar las percepciones del impacto de la interrupción de la atención médica por COVID-19 en la formación académica y las habilidades de los residentes quirúrgicos.* **Material y Métodos:** *Realizamos una encuesta de 32 preguntas, evaluando el impacto clínico y quirúrgico del COVID-19 en los programas de entrenamiento quirúrgico y propuestas para compensar la disminución de la educación quirúrgica. Obtuvimos 453 respuestas de residentes quirúrgicos en la Ciudad de México.* **Resultados:** *El 66% respondió que sus centros se convirtieron en atención exclusiva de pacientes con COVID-19. El 95% presentó una disminución en el aprendizaje de habilidades quirúrgicas y el 91. 8% presentó una disminución de la exposición clínica. El 75.6% consideró fundamental tomar las medidas necesarias para recuperar las destrezas clínicas perdidas. En el análisis de regresión logística binaria, encontramos que el año de posgrado (> PG-Y3) fue un factor estadística-*

Correspondence:
*Carlos E. Méndez-Probst
Avda. Vasco de Quiroga, 15
Col. Belisario Domínguez Sección XVI Tlalpan
C.P. 14080 Mexico City, Mexico
E-mail: probstmc@hotmail.com

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mente significativo (p <0,000) relacionado con una opinión favorable para desarrollar un plan de contingencia académica y posponer el final del año de residencia académica. **Conclusión:** *Más del 90% de los encuestados fueron afectados por las estrategias de mitigación de COVID-19. Nuestros datos exigen ajustes urgentes por parte de los líderes de programas de hospitales y universidades para mitigar las repercusiones educativas posteriores.*

Palabras clave: *COVID-19. México. Cirugía. Programas de residencia quirúrgica.*

Introduction

Since the beginning of the SARS-CoV-2 pandemic in late 2019[1], worldwide medical care has been dramatically impacted. Medical centers across the globe have adopted multiple coping strategies, either directly prioritizing patients affected with COVID-19, or indirectly by reducing elective surgical procedures[2,3], and the care of patients in outpatient areas. All in a desperate effort to increase the surge capacity to avoid or mitigate the swamping of health-care facilities and also to steward as many scarce resources as possible and reduce the risk of contagion for health personnel and patients[1].

One of the drawbacks of the world's massive response to COVID-19 has been a widespread disruption of medical education. Surgical cases have plunged, leading to very limited hands on training, loss of external rotations, and educational opportunities such as specialty meetings[4-6]. However, residency programs have either partially or totally changed to a remote education, and surgical simulation.

As the pandemic unfolds there is also a growing uncertainty about the future of surgical training and a real potential for future epidemic outbreaks, limited data exist on the residents perception of COVID-19 mitigation measures on the safety, continuity, and efficacy of their training, especially since in some countries academic calendar, the disease has already used up to 30-40% of their academic year (e.g., In Mexico the academic year runs from March to February).

We sought to collect information on surgical trainees, using a qualitative approach to document if a reduced clinical (office consults and operative time) exposure would lead to a decreased perception of surgical preparedness among the different surgical specialty programs in our city. The secondary objective was to explore proposals to compensate for the decrease in learning opportunities of the different surgical specialties and different hospital centers in Mexico City.

Materials and methods

After ethics committee approval (URO-3406-20-21-1), we performed a cross-sectional survey of surgical trainees in Mexico City; the target population was extracted from the 18 surgical programs accredited by the National Autonomous University of Mexico (UNAM), which is the largest university in the state. The study universe comprised 3015 eligible residents or fellows affiliated to a general surgery, gynecology/obstetrics, ENT, orthopedics, vascular surgery, urology, oncological surgery, plastic surgery and pediatric surgery, and related fellowships. A sample size of 341 subjects was calculated using a 95% confidence interval and a 5% margin of error using an online sample size calculator (http://fluidsurveys.com).

We recruited participants through a closed group direct invitation to all the surgical residents and fellows of the UNAM, otherwise the survey was not publicly announced or open on the internet, participation was voluntary, and no incentives were provided for study participation. The survey was administered through electronic means only (Google Forms and Google LLC) and informed consent was tacitly requested at the initial page of the survey, which included an information letter informing the purpose and length of the survey, no personal data or identifiers were collected from the subjects, and the study was performed according to the precepts of the Helsinki Declaration.

The survey was available for response from April 27, 2020, and closed on May 11, 2020.

Survey design

We developed an ad hoc 32-question survey divided into eight domains assessing demographic, outpatient, and emergency care, surgical exposure, and skills development, educational modifications (academic and research), perceptions of the impact of COVID-19 on surgical their training programs and proposals to compensate for the decrease in the learning opportunities due to the COVID-19.

The survey was then uploaded to the survey program for distribution and automatic response collection; this also allowed the use of special features such as adaptive questioning, review, and answer change. The survey was composed of two electronic pages (page 1 informed consent and page 2 actual survey).

Incomplete surveys, from residents from non-surgical specialties and from different states than Mexico City, were excluded from further analysis.

Statistical analysis

Responses were exported from Google Forms to Microsoft Excel database and all statistical analyses were performed with Statistical Package for the Social Sciences 26th version (SPSS, Chicago, IL, USA).

All survey questions responses were coded as binary or categorical variables. Descriptive statistics of the overall cohort were performed. $p < 0.05$ was considered significant.

Results

Demographics

We received 453 (15% of the study universe) survey responses from 18 surgical programs from Mexico City. Of the total participants, 287 (63.4%) were male and 166 (36.6%) were female. The mean age was 29 ± 2 years. Most responses came from general surgery residents (21.4%). An important proportion was junior residents (44.4% post graduate year [PGYs] 1-2). We describe the rest of demographics and details in table 1.

Table 1. Demographics details

Year of residency	Percentage (n)
PGY1	23.2 (105)
PGY 2	21.2 (96)
PGY 3	17.4 (79)
PGY 4	15.2 (69)
PGY 5	9.1 (41)
PGY 6	0.4 (2)
PGY 7	0.2 (1)
1st year Fellow	10.2 (46)
2nd year Fellow	3.1 (14)
Residency program	**Percentage (n)**
General Surgery	21.4 (97)
Fellowship	11 (55)
Neurosurgery	9.5 (43)
Oncology Surgery	7.3 (33)
Gynecology and obstetrics	7.5 (34)
Urology	6.8 (31)
Traumatology and Orthopedics	6 (27)
Plastic Surgery	6 (27)
Pediatric Surgery	6 (27)
Otorhinolaryngology	4.9 (22)
Ophthalmology	2.6 (12)
Vascular Surgery	2.2 (10)
Cardiothoracic surgery	1.3 (6)
Others	7.5 (29)

Impact of the COVID-19 pandemic

Of all the responders 302 (66.7%) answered that their centers had been converted to the exclusive attention of COVID-19 patients (COVID-19 Centers). Only 7% responded that they work normally, the rest are not involved in daily hospital work. Patient care is mostly performed through telemedicine and the majority of elective surgical cases have been canceled. Not surprisingly, the number of Non-COVID-19 cases in the outpatient clinics and in the emergency department has significantly declined, as shown in figures 1 and 2, respectively.

Resident training and academics

A worrisome finding was that most of the residents reported a decrease in surgical skill learning, 275 (60.8%) felt completed affected and 154 (34.1%) as partially affected (Figure 3). In addition, the vast majority (91.8%) reported a decrease in clinical exposure (Figure 4). Only (41.2%) of the respondents were practicing surgical skills in simulators outside of hospital settings (e.g., at home), and just 53% of the responders use their time to research activities.

All respondents reported discontinuation of in-person conferences, with most (82.4%) transitioning to distance learning through virtual platforms (e.g., Zoom, WebEx, Google Meets, or Hang outs), this last scenario had a positive impact with 70.4% of respondents reporting at least the same or an increased quality of virtual classes compared to traditional ones.

As a perception of the negative downstream effects on surgical training programs, most residents reported being in agreement with the statement indicating that converting into COVID-19 centers had negatively impacted their surgical training.

Proposals and alternatives to reach the objectives in the academic programs

Due to negative concerns about their training, 75.6% of the surveyed cohort reported that it is essential to take necessary measures to recover the clinical and

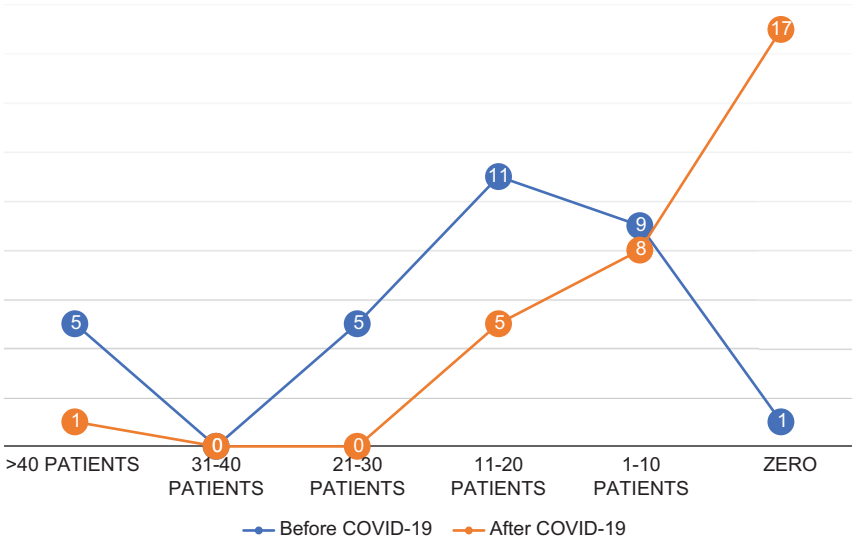

Figure 1. *Comparison between the patient volume in outpatient clinics before and after COVID-19 pandemic.*

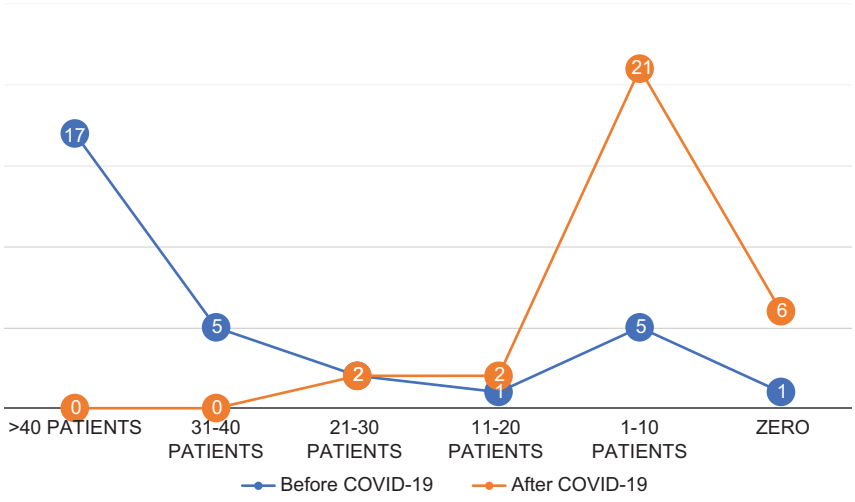

Figure 2. *Comparison between the patient volume for non COVID-19 cases in emergency department before and after COVID-19 pandemic.*

surgical milestones lost during pandemic. The most common expressed proposals were related exclusively to recovering surgical exposure (48.7%), and (34.1%) related to recovering surgical exposure and increasing theoretical learning (Figure 5). Drastically 52% of the responders though that the most feasible alternative to achieve this is to postpone the end of the academic residency year.

Inferential analysis

Since almost a quarter of the trainees were not in favor of developing an academic contingency plan and slightly < ½ of the respondents were against extending the academic year, we performed univariate and multivariate binary logistic regression analysis looking for factors that correlated with this choice, we found that the PGY was the only statistically significant factor (Tables 2-5).

Discussion

We report a survey of surgical residency programs assessing the modifications and their impact on trainees. Our main findings show that 66% of the surveyed programs had undergone conversion to COVID-19

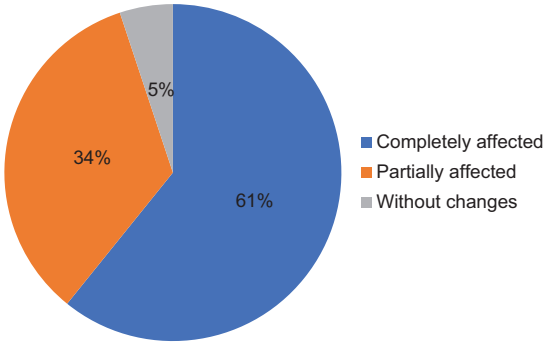

Figure 3. *Impact on surgical skill learning.*

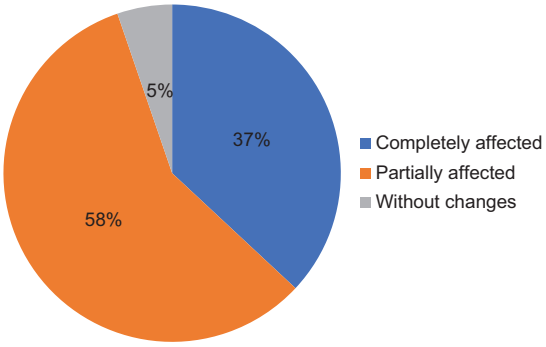

Figure 4. *Impact on theoretical learning.*

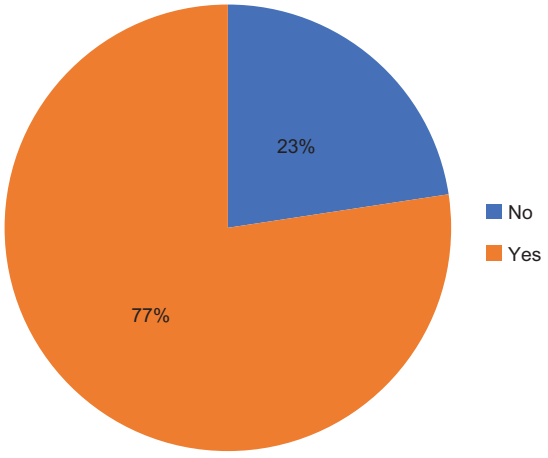

Figure 5. *Residents in favor of the extension in the academic year of residence.*

Table 2. Predictive factors to agreeing to the question: that some measures should be taken to recover the objectives. Results of the univariate analysis of binary logistic regression

Factors	p value	OR	95% CI
Sex Male (reference) Female	0.376	0.813	0.513-1.287
Age dicotomical ≥29 years (reference) ≤ 28 years	0.057	0.653	0.422-1.012
Year of residency dicotomical ≥PGY 3 (reference) PGY 1/PGY2	**0.000**	**0.366**	**0.233-0.574**
COVID-19 Centre No (reference) Yes	0.530	1.157	0.733-1.826

Table 3. Predictive factors to agreeing to the question: that some measures should be taken to recover the objectives. Results of the multivariate analysis of binary logistic regression

Factors	p value	OR	95% CI
Sex Male (reference) Female	0.381	0.808	0.768-1.995
Age dicotomical ≥29 years (reference) ≤ 28 years	0.637	0.891	0.696-1.809
Year of residency dicotomical ≥PGY 3 (reference) PGY 1/PGY2	**0.000**	**0.378**	**0.234-0.611**
COVID-19 Centre No (reference) Yes	0.307	1.279	0.487-1.54

only centers, the respondents felt that this had impacted their surgical training, either by partially/totally disrupting their surgical skills (94.9%), or their clinical exposure and theoretical learning (91.8%). During the pandemic, many of the surveyed surgical residents have been assigned to provide first-line care for patients with suspected SARS-CoV2 at their emergency departments. All national and international meetings and hands-on courses have been so far canceled, this data allow us postulate that surgical residents have become the third major victim of the COVID-19 (after patients and health-care workers respectively).

Recent studies have shown similar findings, a study at a tertiary care hospital in Pakistan evaluated the impact of surgical residency programs on 112 surgical residents from all departments of surgery. They observed that 86.6% stated that their surgical exposure duration was adversely affected by the pandemic[5]. In addition, in a survey of urological training programs in the United States, 26% reported being asked to

Table 4. Predictive factors for agreeing to postpone residency graduation. Results of the univariate analysis of binary logistic regression

Factors	p value	OR	95% CI
Sex Male (reference) Female	0.627	0.909	0.619-1.335
Age dicotomical ≥29 years (reference) ≤ 28 years	0.126	0.745	0.512-1.086
Year of residency dicotomical ≥PGY 3 (reference) PGY 1/PGY2	**0.000**	**0.419**	**0.286-0.612**
COVID-19 Centre No (reference) Yes	0.716	0.930	0.628-1.376

Table 5. Predictive factors for agreeing to postpone residency graduation. Results of the multivariate analysis of binary logistic regression

Factors	p value	OR	95% CI
Sex Male (reference) Female	0.792	1.055	0.636-1.412
Age dicotomical ≥29 years (reference) ≤ 28 years	0.960	1.011	0.669-1.528
Year of residency dicotomical ≥PGY 3 (reference) PGY 1/PGY2	**0.000**	**0.419**	**0.278-0.630**
COVID-19 Centre No (reference) Yes	0.934	0.983	0.656-1.474

redeploy residents. Nearly all urology programs were willing to send residents for redeployment if needed, with the corresponding impact in clinical and surgical exposure.

Our data also parallels the Italian experience, where surgical training was also several affected. All weekly lessons were suspended, as well as seminars, workshops, and practical courses (e.g., suture courses, laparoscopic simulators, and cadaver lab). Moreover, due to the interruption of the elective surgery (mostly benign pathology), which are most frequently performed by residents as the operator, there was a failure in achieving the minimum number of interventions required for surgical certification[7]. In our study, we found that only the 41% of responders practice their surgical skills with simulators. Nowadays, the use of simulators training (e.g., laparoscopic or virtual reality) can provide a safe and standardized method for training in surgery without the risks that come with operating on real patients during this pandemic[8,9].

One of the possible solutions could be the use of technology to continue clinical and academic tasks, such as virtual lectures or in real-time videoconferencing, journal clubs, and watching surgical videos followed by discussing the surgical steps with the attending professors. We found that the 87.9% of the residents are taking virtual lectures to attain the theoretical goals of their different residency programs.

In this era of competency based certification, the pandemic has the potential to derail the current trainees cohort (PGY 4-5), by making surgical milestones unattainable, although each surgical residency program has its own objectives and requirements[10-12], surgical authorities like the American Board Of Surgery in United States[6,13], require that candidate applicants have had performed at least 200 surgical procedures during their senior year. Furthermore, this may also impact downstream cohorts as well, since it also requires that trainees perform at least 850 operative procedures as the surgeon over 5 years, and at least 250 operations (including as operating surgeon or first assistant) by the beginning of PGY-3 year[13].

Our study has some limitations. As a survey study, it is subject to response bias, although we accrued a robust sample size, the study population only comprises 15% of the resident population currently training to become a surgical specialist, our target population was limited to a geographical region (the State of Mexico City) so our findings might not apply to surgical programs outside this area; however, this region comprises most of the surgical infrastructure and academic programs of the country as well as hospital beds, making it by far the mayor medical hub nation-wide. The strengths of our study are that we exceeded our calculated sample size thus can conclude that our sample was a representative portion of the surgical residents currently undergoing training in the state of Mexico City.

As the long-term effects of this outbreak on worldwide health systems are still unknown, we believe it is crucial to incorporate the trainee's worldview. Our data serves as a potential guide for education policy makers, as it reflects the worries and anxieties of the

COVID-19 surgical resident. New strategies involving trainees should be developed that consider the training needs of the residents. Appropriate modifications to the format and timing of the current residency paradigm should be considered, including restructuring the academic programs (e.g., adapting and extending the academic year program or replacing the time-based standards with volume-based or competency-based standards).

Despite this pandemic, many programs have not established plans for the post-COVID-19 world. Faculty leaders, universities and governing bodies (Health authorities) should consider options to compensate the missed hands-on exposure, providing didactic resources (e.g., medical simulators and access to on-line content, in addition to personal, and workplace safety).

Conclusions

During the spring and summer of 2020 due to the COVID-19 pandemic, surgical residency programs in Mexico City underwent significant modifications, including a marked decrease in surgical procedures. More than 90% of the survey respondents report having been affected by these mitigation strategies, mostly by the lack of surgical, academic, and clinical exposure, thus surgical residents have become the pandemic's third casualty. Our data calls for urgent training adjustments by hospital and university program leaders to mitigate downstream educational repercussions.

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Conflicts of interest

The authors declare that they have no conflicts of interest in this manuscript.

Ethical disclosures

Protection of human and animals subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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