Adaptations to general surgery resident education in response to COVID-19

Vivian Ma, MD
Tracy Scott, MD, MHPE
Michael Ott, MD, MSc
Ahmer Karimuddin, MD, MAEd

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Correspondence to:
V. Ma
Department of Surgery
Faculty of Medicine
2775 Laurel St, 11th floor
Vancouver BC V5Z 1M9
vivianma@alumni.ubc.ca

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Background: The COVID-19 pandemic led to many new provincial public health measures to reallocate resources in response to an impending surge of cases. These necessary decisions had several downstream effects on general surgery training. We surveyed the actions taken by Canadian general surgery training programs in response to the COVID-19 pandemic.

Method: A mixed-methods survey was sent to all general surgery program directors to assess various domains in surgical education and modifications made because of the pandemic. Responses were quantified as proportions or qualitative narratives describing those changes.

Results: Most programs (13/15) recalled residents from planned rotations and redistributed them to rotations considered as core required services, including acute care surgery, trauma surgery and intensive care. Many programs also restructured their acute care surgery models to allow for a group of “reserve” residents to replace trainees who became infected with SARS-CoV-2. In terms of clinical experience, there was a reduction in both clinical and operative exposure among trainees. The reduction in clinical exposure disproportionately affected junior residents, whose involvement in COVID-19 cases was restricted. Formal educational sessions were maintained, but delivered virtually. Many programs instituted a program of increased frequency of communication with trainees.

Conclusion: Many programs embraced using virtual platforms for teaching. The demonstrated utility of virtual teaching may lead to rethinking how training programs deliver didactic teaching and expand teaching opportunities. However, many programs also perceived a decrease in clinical and procedural exposure, primarily affecting junior residents. More information is needed to quantify the deficit in learning incurred as a result of the pandemic as well as its long-term effects on resident competency.

Contexte : La pandémie de COVID-19 est à l’origine de plusieurs nouvelles mesures de santé publique à l’échelle des provinces qui ont permis de réassigner les ressources et de prendre en charge la hausse des cas anticipée. Ces décisions inévitables ont eu différentes répercussions en aval, sur la formation en chirurgie générale. Nous avons pris connaissance des initiatives prises par les programmes canadiens de formation en chirurgie générale en réponse à la pandémie de COVID-19.

Méthodes : Une enquête multiméthode a été menée auprès de tous les directeurs de programmes de chirurgie générale pour évaluer différents secteurs de la formation en chirurgie et les modifications qui y ont été apportées en raison de la pandémie. Les réponses ont été enregistrées sous forme de proportions ou de descriptions qualitatives de ces modifications.

Résultats : La plupart des programmes (13/15) ont remplacé les stages prévus de leurs résidents par une réassignation vers les services dits essentiels, soit chirurgies d’urgence, traumatologie et soins intensifs. Plusieurs programmes ont aussi restructuré leurs modèles de chirurgie d’urgence pour constituer un groupe de résidents « réservistes » capables de remplacer ceux qui contractaient le SRAS-CoV-2. Pour ce qui est de l’expérience clinique, on a noté une baisse de l’exposition des résidents aux situations cliniques et chirurgicales. La réduction de l’exposition aux situations cliniques a pénalisé les résidents juniors de façon disproportionnée car leur rôle auprès des cas de COVID-19 était restreint. Les formation magistrales ont été maintenues, mais offertes sous forme virtuelle. Plusieurs programmes ont instauré un système de communications plus fréquentes avec leurs résidents.

Conclusion : De nombreux programmes ont adopté des plateformes d’enseignement virtuelles. L’utilité avérée de l’enseignement à distance pourrait forcer la réflexion sur la façon d’offrir l’enseignement magistral et diversifier les façons de livrer la matière. Par contre plusieurs programmes ont aussi perçu une diminution de l’exposition aux situations cliniques et aux interventions affectant surtout les résidents juniors. Il faudra recueillir plus de données pour quantifier le déficit d’apprentissage encouru en raison de la pandémie et ses effets à long terme sur la compétence des résidents.
ARS-CoV-2 is the novel respiratory virus responsible for the global COVID-19 pandemic. While symptoms, such as a cough and fever, may be mild, some individuals develop acute respiratory distress syndrome, pneumonia, septic shock and multi-system organ failure requiring intensive care. SARS-CoV-2 is spread between humans by respiratory droplets and is more infectious than seasonal influenza, with the basic reproductive number varying between 1.4 and 6.5. This has led to more than 240 million confirmed cases to date, worldwide.

The first cluster of 27 cases was identified in Wuhan, China, on Dec. 31, 2019, and the first Canadian case was identified in Toronto on Jan. 23, 2020. COVID-19 was declared a global pandemic on Mar. 11, 2020, and in response, the Canadian government implemented border restrictions and many provinces declared a state of emergency. While all provinces had documented cases of COVID-19, the degree to which COVID-19 affected their health care systems varied, resulting in many provincial lockdowns with differing degrees of restrictions. Non-essential services, including elective surgeries, were paused in an effort to conserve personal protective equipment in the event of an exponential surge in cases. Similarly, attempts were made to increase available health care workers, including residents, should hospitals become overwhelmed with patients with COVID-19.

The necessary redistribution of resources to meet a predicted surge affected residency training in many different ways. Residents were recalled to central health care institutions to increase the number of workers in the event of a surge. For surgical residency training programs, this often translated to residents being recalled from an elective operative rotation to service intensive care units (ICUs) or emergency departments (EDs). Furthermore, many institutions cancelled elective surgeries to conserve resources and hospital beds, leading to an unprecedented decrease in the volume of available procedures for trainees to participate in. The increased predicted service needs also had to be balanced with maintaining trainee wellness, so many clinical services and rotations had to be remodelled to limit the spread of SARS-CoV-2 among trainees.

The province-to-province variability of public health measures and regulations made the adaptations of general surgery training programs highly contextual to the local situation. As a result, the adaptations made to training were not uniform. The purpose of this study was to assess and catalogue the changes made to general surgery training programs across Canada, allowing for an understanding of both positive and negative effects of the COVID-19 pandemic on education.

**Methods**

A 27-question qualitative survey (Appendix 1, available at canjsurg.ca/) was created to evaluate the following domains: baseline residency program demographics, structural changes to the learning environment, clinical exposure for general surgery residents, changes to organized educational sessions, and wellness of general surgery residents.

The survey was sent to all 17 general surgery residency program directors in Canada 3 weeks from the initial general declaration of provincial states of emergency in response to the COVID-19 pandemic in Canada. Responses were collected from April 12 to May 13, 2020. Results were then compiled and analyzed according to the previously mentioned domains. Categorical data are represented as proportions where appropriate, supplemented by narrative responses.

**Results**

Most (15/17 [88.2%]) Canadian general surgery residency program directors responded to the survey (Table 1). Thirteen (86.7%) of those programs recalled residents from their scheduled rotations. Several (11/14 [78.6%]) programs perceived a decrease in the volume of general surgery emergencies since the beginning of the COVID-19 pandemic; 3 (21.4%) programs perceived no change.

**Educational environment**

Recalled residents from 7 of 12 (58.3%) programs were redistributed, primarily to cover 1 or more core rotations, including acute care surgery (ACS), trauma and intensive care. Four programs ensured that residents were redistributed for those core services, but also had residents on surgical subspecialty rotations, including hepatopancreaticobiliary, colorectal and pediatric surgery.

**Table 1. Canadian general surgery programs that responded or did not respond to the survey assessing changes to surgical education for general surgery residents in response to the COVID-19 pandemic**

| Programs that responded | Programs without a response |
|------------------------|-----------------------------|
| University of British Columbia | Northern Ontario School of Medicine |
| University of Calgary | Université de Montréal |
| University of Alberta | |
| University of Saskatchewan | |
| University of Manitoba | |
| Western University | |
| McMaster University | |
| University of Toronto | |
| Queen’s University | |
| University of Ottawa | |
| McGill University | |
| Université de Sherbrooke | |
| Université Laval | |
| Dalhousie University | |
| Memorial University of Newfoundland | |
Most programs restructured their ACS models in some way, with 11 of 12 (91.7%) programs increasing the overall number of residents on ACS. In terms of changes made to their ACS models, the approach varied, with some programs changing the number of ACS teams or changing the number of junior or senior residents per team. One program disbanded the ACS system, and the resident serving as head of the general surgery service collaborated on a daily basis with staff and the internal medicine service to allocate residents based on need.

Furthermore, most programs created a dedicated “reserve” pool of residents to replace trainees who became infected with SARS-CoV-2. Among programs without a dedicated reserve pool of residents, 2 programs had research residents or residents on leave who were designated as back-up should the need arise.

Clinical environment

In 12 of 14 (85.7%) programs, all general surgery residents assigned to a clinical service were not necessarily working every day. Based on the survey responses, most programs attempted to limit resident presence in the hospital wherever necessary. This included a rotating system for residents on service where they would work for 1–2 weeks, followed by a week off. Attempts were also made to maintain specific junior–senior pairs for call to limit contact. Some programs had residents round only on their team’s patients, but only the on-call team was expected to stay in-house after rounding, whereas other programs only had the on-call team working on any given day. Elective cases that involved residents were often oncology cases (e.g., breast, colorectal cancers), where senior residents may be assigned to assist, or residents could sign up if their schedule permitted.

Clinical exposure

New consults who tested positive for SARS-CoV-2 were triaged by either the senior resident or staff physician at 12 of 13 (92.3%) programs for emergency consults and 13 of 14 (92.8%) programs for new inpatient consults (Figure 1). They were similarly first seen by the senior resident or staff physician in most programs. This was in contrast to new consults who tested negative for SARS-CoV-2 or those who had no symptoms and had not been tested (COVID status unknown), where the junior resident was exclusively first call in most programs (9/13 [69.2%] emergency consults and inpatient consults) and was first to see these patients (7/14 [50%] emergency consults, 10/14 [71.4%] inpatient consults) (Figure 2).

This was consistent with rounds on postoperative patients who were SARS-CoV-2-positive, who were seen by either staff or the senior resident in 10 of 13 (76.9%) programs, and those who tested negative or whose COVID status was unknown, who were seen by either a junior or senior resident at 8 of 14 (57.1%) programs or either the junior or senior resident or staff physician at 5 of 14 (35.7%) programs (Figure 3).

Residents were not scheduled for Telehealth or virtual clinics at 12 of 15 (80%) programs. However, 1 of those programs continues to hold in-person clinics, though it is unclear if residents were involved.

Fig. 1. Roles for first call or seeing new consults who tested positive for SARS-CoV-2.

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Procedural exposure
In terms of operating, there was a national focus on maintaining only 1 learner per case. Eleven of 14 (78.6%) programs had 1 learner scrubbed, and the remaining 3 (21.4%) programs had a maximum of 2 learners scrubbed. This included junior- (e.g., laparoscopic appendectomy) and senior-level operations (e.g., colectomy). Given the shift in clinical exposure, which saw junior residents less involved in cases or suspected cases of COVID-19, and given that operations were mostly limited to a single learner, procedural exposure was perceived to have decreased for junior trainees.

Fourteen of 15 (93.3%) programs continued to formally evaluate residents for their clinical rotations during the COVID-19 pandemic.

Fig. 2. Roles for first call or seeing new consults who tested negative for SARS-CoV-2 or those who had no symptoms and had not been tested (COVID status unknown).

Fig. 3. Roles for rounding on surgical inpatients.
Fourteen of 15 (93.3%) programs continued to hold academic teaching sessions, with all programs delivering them virtually. All programs also had some form of additional virtual teaching rounds held at varying frequencies (Figure 4).

**Wellness**

During the COVID-19 pandemic, 8 of 15 (53.3%) programs were meeting with residents on an as-needed basis. Seven of 15 (46.7%) programs regularly met with residents as a group, which occurred weekly for 4 (57.1%) programs and biweekly for 2 (28.6%) programs.

Vacations were temporarily suspended for 5 of 15 (33.3%) programs.

**Discussion**

The COVID-19 pandemic created an unprecedented crisis for health care in Canada. This extended to the clinical and academic milieu of general surgery residency programs across the country. Our survey identified that during this pandemic, all general surgery residency programs across the country prioritized resident wellness. While provision of clinical services was necessary, many programs made structural changes to limit potential resident exposure to SARS-CoV-2, primarily having senior residents or staff triage and see new general surgery consults who were confirmed or suspected to have SARS-CoV-2 infection and limiting involvement in all surgical procedures to only 1 resident. Further, some programs restructured their acute care surgery service in response to the pandemic, presumably to minimize resident exposure to SARS-CoV-2. While limiting resident exposure may have been in part be due to conservation of resources such as personal protective equipment or to an overall decrease in clinical volume, as perceived by program directors in the survey, it may also have reflected a concern about residents contracting SARS-CoV-2 and potentially spreading the virus among trainees. This concern is reflected by the creation of “reserve” pools, which was a near-universal response in programs across the country. These reserve pools were residents who were isolated from clinical activities for days to weeks, to ensure that if other residents contracted SARS-CoV-2 or needed to self-isolate, clinical services in areas of critical need could continue. Furthermore, by creating teams of residents who rotated on and off clinical activities, exposure to SARS-CoV-2 was mitigated.

However, prioritizing resident wellness by limiting clinical exposure has led to decreased clinical and procedural exposure, which is a crucial aspect in training for a technical specialty. Though the exact deficit has not been quantified, the perceived decrease in general surgery emergencies, public health cessation of elective cases, limiting the number of residents involved in each operation, and recalling residents from nonessential rotations to serve core services, such as ICU or internal

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**Fig. 4.** Frequency of virtual teaching sessions in a given week.
Les défis en termes de timing et maximisation des atterrissages

Un curriculum unifié devra être évalué, et chal-

lenges d'interaction entre participants et lec-

teurs, ainsi que les questions concernant le

patient et sa demande. Cet format, en retour, peut promou-

ver les cours didactiques au lieu d'un enseignement interac-

tif. Bien que la livraison de l'éducation virtuelle

parait être un nouveau modeste avec de nombreuses

opportunités au-delà de ceux des cours didactiques tradi-

tifs, une évaluation des résultats de la même façon

que pour l'enseignement virtuel doit être effectuée pour dé
tercer si des résultats similaires peuvent être obtenus

given les différences entre les programmes.

Finalement, peut-être que l'apprentissage virtuel

sera étendu pour inclure l'assistance aux patients

par les résidents grâce au télé-

guérison — un secteur sous-utilisé lors de la première vague

du pandémie — pour aider à compléter et augmenter l'ex-

posé clinique. Bien que la présence virtuelle de l'appren-

tissage puisse être limitée en raison de certaines pathologies

générales de chirurgie, elle peut continuer à fournir certaines

consultations cliniques. Les activités de réseautage et de

lancement de l'éducation virtuelle devront être mitiées

par des conférences virtuelles, mais l'effet de

l'enseignement virtuel didactique par rapport à un enseignement

tactile reste à déterminer à long terme. Une limite

du temps d'apprentissage peut être compensée

par des simulations.

La santé des conséquences de la réduction

de l'exposition clinique sur l'enseignement des résidents sont inconnus, spécia-

lement lorsqu'on sait que la pandémie n'est pas encore terminée. À

tel point, il est nécessaire de procéder à l'investigation de

les pertes encourues durant la pandémie. En outre, le

nombre de cas peut ne pas nécessairement traduire des

déficits quantifiables en compétence. Des études futures

devraient comparer la compétence et la confiance des résidents

à réaliser des interventions chirurgicales après avoir obtenu

ces résultats. Elles pourraient éclairer les effets ultimes sur la compétence techni-

e.

Par ailleurs, peut-être que les résidents peuvent

orienter les rotations dans des cohortes, plutôt que d'avoir une réserve dédiée,

pour garantir une distribution égale des opportunités d'enseignement.

Cette situation peut nécessiter une attention significative,

car les programmes de résidence en chirurgie générale au Canada

ont récemment adopté le modèle de compétence par design

en 2020-21 académique.

Dans le cadre des séances d'enseignement organisé,

les programmes étaient capables de maintenir les sessions de résident

et d'ajouter des cours de résident dans des formes variées

à des fréquences changantes. Du fait des restrictions COVID-

19, ces sessions étaient uniformément transmises

virtuellement, démontrant un nouveau modèle de
didactique. L'enseignement virtuel permet de

évaluer la compétence en virtual education pour

les programmes de résidence en chirurgie générale,

notre enquête montre que c'est une alternative viable à l'apprentissage in-

personnel. Les bénéfices de l'éducation virtuelle

y compris une augmentation des fréquences, donnant l'accès

facile quel que soit le lieu. Cho et collègues confir-
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