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COVID-19 Pandemic and the Lived Experience of Surgical Residents, Fellows, and Early-Career Surgeons in the American College of Surgeons

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- BACKGROUND:** To better understand how the COVID-19 pandemic has affected surgical trainees' and early-career surgeons' professional and personal experiences, a survey of the membership of the American College of Surgeons (ACS) Resident and Associate Society (RAS) and Young Fellows Association (YFA) was performed.
- STUDY DESIGN:** An anonymous online survey was disseminated to members of RAS and YFA. Descriptive analyses were performed and factors associated with depression and burnout were examined with univariate and multivariable stepwise logistic regression.
- RESULTS:** Of the RAS/YFA membership of 21,385, there were 1,160 respondents. The majority of respondents (96%) reported the COVID-19 pandemic having a negative impact on their clinical experience, with 84% of residents reporting a > 50% reduction in operative volume and inability to meet minimum case requirements. Respondents also reported negative impacts on personal wellness. Nearly one-third reported inadequate access to personal protective equipment, and depression and burnout were pervasive ($\geq 21\%$ of respondents reported yes to every screening symptom). On multivariable analysis, female sex (odds ratio [OR] 1.54 for depression, OR 1.47 for burnout) and lack of wellness resources (OR 1.55 for depression, OR 1.44 for burnout) predicted depression and burnout. Access to adequate personal protective equipment was protective against burnout (OR 0.52).
- CONCLUSIONS:** These data demonstrate a significant impact of the COVID-19 pandemic on the lives of residents and early-career surgeons. Actionable items from these data include mitigation of burnout and depression through increasing personal protective equipment access and provision of wellness programs, with a particular focus on high-risk groups. (*J Am Coll Surg* 2021;232:119–137. © 2020 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)
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Members of the RAS-ACS COVID-19 Task Force who co-authored this article are listed in the [Appendix](#).

Drs Coleman and Abdelsattar contributed equally to this work.

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Surgical residents, fellows, and early-career surgeons face unique challenges during the severe acute respiratory syndrome coronavirus 2, or COVID-19, global pandemic. In the face of rapid disease spread and resource disparities, healthcare systems have been forced to adapt and, in turn, the downstream effects have resulted in restructuring of surgical training, reduction of nonemergency surgical cases, and reassignment of trainees to different clinical rotations. These actions interrupted the standard educational curricula, reduced the number of surgical cases, and limited trainees' ability to meet mandatory

Abbreviations and Acronyms

ACS	= American College of Surgeons
FACS	= Fellow of the American College of Surgeons
OR	= odds ratio
PPE	= personal protective equipment
RAS	= Resident and Associate Society
YFA	= Young Fellow Association

graduation requirements established by ACGME and other certifying licensing agencies.¹⁻³ To overcome the loss of clinical and operative opportunities, many surgical training programs implemented technology-based solutions, such as virtual didactics. These novel adaptations have assisted in the continued education of residents and fellows while maintaining social distancing.^{4,5}

Collectively, the stressors of the work environment amidst the COVID-19 pandemic are potential threats to surgeons' own well-being. Ethical decision-making about interactions with and treatment of COVID-19 patients has led to increased anxiety and burnout among physician trainees.⁶ Many healthcare providers also fear contracting COVID-19 themselves and, more frequently, passing the disease to their loved ones.^{6,7} Exacerbating these stressors is the lack of adequate personal protective equipment (PPE), which not only drastically limits trainees' learning opportunities but can aggravate feelings of burnout.^{2,7} Despite the ongoing, unprecedented epidemic and these stressors, surgical residents and fellows are still expected to achieve predetermined clinical and educational milestones.

Ultimately, the new pandemic environment has great potential to affect young surgeons' clinical, educational, and personal experiences. However, there has not been a detailed national assessment of how the COVID-19 pandemic has affected residents' and early-career surgeons' experiences. Previous surveys have not targeted the American College of Surgeons' (ACS) membership and have been limited to a focus on educational effects.⁸ Therefore, the ACS Resident and Associate Society (RAS) created a COVID-19 Resident Task Force to document and analyze the effects of the pandemic on the lived experiences of its membership and to highlight potential opportunities to inform evidence-based responses and planning around pandemics and national crises of similar magnitude.

METHODS

The RAS is a subset of the ACS that provides surgical trainees an avenue for participation in ACS affairs, fosters leadership skills in academic surgery, and provides

opportunities for the opinions and concerns of young surgeons and trainees to be heard by ACS leadership. Within RAS, there are resident members (actively in surgical residency or fellowship) and associate members (who are surgeons within 6 years of practice, however, are not yet a Fellow of the American College of Surgeons [FACS]). The Young Fellow Association (YFA) consists of FACS surgeons who are younger than 45 years ("early-career surgeons") and provides them with representation in the greater ACS organization. In response to the COVID-19 pandemic, ACS RAS formed a COVID-19 Resident Task Force in May 2020 to analyze the effects of the pandemic on RAS and YFA membership. This task force was composed of 10 RAS members and 2 YFA members who led composition and dissemination of a survey, as described below, with a specific focus on the following cohorts: residents and fellows and early-career surgeons. The resident cohort was composed entirely of RAS member. The early-career surgeons cohort was composed of associate members in RAS (surgeons who have completed an accredited surgical residency program and have entered surgical practice but are not yet FACS) and members of the YFA. By creating these 2 cohorts, we aimed to identify the experience of surgical trainees vs the experience of young, fully trained surgeons.

To quantitatively assess the lived experience of these cohorts, an anonymous, online survey consisting of 43 questions (for the resident cohort) or 29 questions (for the early-career surgeons cohort) was created and disseminated to the RAS and YFA listservs using SurveyMonkey software. Questions focused on clinical, educational, financial, and personal experiences, and how they might have changed as a result of the COVID-19 pandemic (eDocument 1). A 5-point Likert scale was used to quantify the effect of the pandemic on these experiences. Residents' and early-career surgeons' degree of depression and burnout was assessed using the Patient Health Questionnaire-9, which screens for depression using 9 questions,⁹ and the modified, abbreviated Maslach Burnout Inventory-Human Service Survey for Medical Personnel, which examines emotional exhaustion and depersonalization using 3 questions.¹⁰⁻¹²

An invitation was sent to participate in the study by filling out the anonymous online survey via a SurveyMonkey link during the month of July 2020. During a period of 2 weeks, an initial survey was sent out and then 2 reminders were sent to those who had not responded initially. Recipients were notified that completing the survey was considered their consent and that identities could not be linked to the individual respondents, their programs, or their place of employment. The study design was submitted to the American Institutes for Research's

IRB and received exempt status. The resulting survey data were aggregated on a secure spreadsheet for ACS administrative use only.

Descriptive analyses were performed of the entire respondent cohort, followed by a stratified analysis by resident or early-career surgeons status. After this, a comparison was made between resident and early-career surgeon responses to assess variations in impact of the pandemic by level of training of the respondent. Lastly, depression and burnout were assessed by standardized questions as mentioned, and factors associated with high number of depression or burnout symptoms were determined. Descriptive statistics were reported with percentages. Univariate analysis was performed with chi-square and Fisher exact tests. To better determine factors predictive of depression and burnout, a multivariable stepwise logistic regression was performed, in addition to univariate analysis, after controlling for covariates identified on the univariate ($p < 0.20$). Statistical analyses were performed using R software (R Foundation for Statistical Computing). All tests were 2-tailed, with significance established at $p < 0.05$.

RESULTS

Overall, of the membership of 21,385 (13,232 RAS members, 8,153 YFA members), there were 1,160 respondents (40% [$n = 465$] residents and 60% [$n = 695$] early-career surgeons), for a combined response rate of 5.4%. Most of the respondents were between the ages of 31 and 40 years (66%); men and women were represented equally (53% men, 47% women); and the majority (60%) identified as Caucasian, followed by 19% Asian, 10% Hispanic/Latino, and 3% African American. Of the 1,160 respondents, 17% were from the Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin), 22% from the Northeast (Connecticut, Maine, New Hampshire, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont), 24% from the South (Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Oklahoma, North Carolina, South Carolina, Tennessee, Texas, Virginia, Washington, DC, and West Virginia), and 16% were from the West (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming); 21% responded "other" (outside of the US) to the question of region, with the majority (91%) being international, 6% were from Canada, 2% were overseas on military duty, and 1% were unemployed. A majority of respondents (64%) were married, 31% were single, and 5% were divorced. Fewer than 1% identified as

LGBTQ+ (lesbian, gay, bisexual, transgender, and queer [or questioning]) and others ($n = 6$). Approximately one-half (49%) had children.

Residents: effect of COVID-19 pandemic on clinical experience

Overall, of the 10,991 RAS resident members, there were 465 respondents (Table 1), for a response rate of 4.2%. In describing their hospital status of COVID-19 admissions, responses were mixed, with 41% reporting that numbers are still increasing ("uptick" in curve) and 40% reporting that numbers are decreasing. When asked about the status of elective operations at the peak of the first wave of the COVID-19 pandemic, the majority (84%) reported a reduction of at least 50% in nonemergency case volume, and another 19% reported a decrease in emergency case volume (Table 2; complete survey responses in eTables 1 to 4).

A variety of schedule changes were reported by residents (Table 2), with most (70%) reporting being grouped into staggered shifts and several also reporting being completely removed from services (31%), having vacations being rescinded (33%), and being deployed to nonsurgical services to fill medical system needs (35%). Lastly, resident participation in outpatient clinic during the COVID-19 pandemic has been impacted, with more reporting no residents allowed in clinic (27%) or limited number of residents in clinic (chief and senior residents only) (20%). Only 24% report resident participation in virtual/telemedicine clinic.

Overall, the majority of residents reported COVID-19 pandemic response having a negative response of their clinical experience (Table 2). Seventy-four percent of respondents reported a negative or extremely negative impact on their clinic experience. The impact appeared to be greatest, however, on operative volume. Ninety-six percent reported a negative or extremely negative impact on elective operative experience, and nearly one-fourth of residents (24%) reported that the COVID-19 pandemic negatively impacted their ability to meet ACGME minimum case requirements.

Residents: effect of COVID-19 pandemic on educational experience

Responses to impact of the COVID-19 pandemic on resident education were widely mixed among respondents (Table 2). The majority of respondents (61%) reported a negative or extremely negative impact on their didactic educational programming; however, interestingly, 21% reported a positive or extremely positive impact on their didactic experience. When asked to what degree a resident's institution has used innovative education and

Table 1. Demographic Characteristics of Resident (Resident and Associate Society) Survey Respondents

Characteristic	Survey response (n = 465)	
	n	%
Age		
20 to 25 y	3	0.6
26 to 30 y	170	37
31 to 35 y	241	52
36 to 40 y	46	10
40 to 45 y	5	1
Sex, m	216	47
Race		
African American	16	4
Asian	71	16
Caucasian	300	67
Hispanic/Latino	41	9
Other	20	4
LGBTQ+ sexual orientation	29	6
Marital status		
Divorced	7	2
Married	219	48
Single	232	51
Have children	110	24
Region		
Midwest	96	21
Northeast	152	33
South	99	21
Western	72	15
Other	46	10
Institutional affiliation		
Military	9	2
Non-university affiliated	75	16
University affiliated	377	81
Other, please specify	3	0.6
Program size		
Fewer than 3 graduating chief residents	71	15
More than 8 graduating chief residents	52	11
4 to 5 graduating chief residents	160	34
6 to 8 graduating chief residents	181	39
Trauma center level		
Level I	337	72
Level II	55	12
Level III	21	4
Not accredited as a trauma center	52	11
Program specialty		
Acute care, trauma, and burn	8	2
Bariatric or minimally invasive surgery	5	1
Breast surgery	2	0.4

(Continued)

Table 1. Continued

Characteristic	Survey response (n = 465)	
	n	%
Cardiothoracic surgery	6	1
Colorectal surgery	6	1
Critical care	6	1
Endocrine surgery	1	0.2
General surgery	388	84
Neurologic surgery	1	0.2
Orthopaedic surgery	3	0.6
Other, please specify	4	1
Otolaryngology	3	0.6
Pediatric surgery	8	2
Plastic and reconstructive surgery	7	2
Surgical oncology or hepatobiliary	6	1
Transplantation surgery	1	0.2
Urology	2	0.4
Vascular surgery	6	1

Data are not shown for "prefer not to answer" or "other" responses and is included in percent calculations.

LGBTQ+, lesbian, gay, bisexual, transgender, and queer (or questioning) and others.

training solutions during COVID-19, the majority answered "somewhat" (55%) or "to a great extent" (18%). When asked about specific educational programming that was adapted (eg suspended, transitioned to virtual format, and recorded for viewing later), the majority reported adaptations to morbidity and mortality conference, grand rounds, visiting professorships, tumor board, research conferences, and simulation training and center accessibility.

When asked to what extent the COVID-19 pandemic has impacted expected progression of operative autonomy, the majority of residents reported either "to a great extent" (17%) or "moderately" (42%). Sixty percent of residents reported no change on feedback on clinical performance/assessment, and 37% reporting a negative or extremely negative impact.

Residents: effect of COVID-19 pandemic on personal experience and risk perception

Nearly one-half of residents (47%) reported the COVID-19 pandemic having an extremely negative or negative effect on their physical health (Table 2). Similarly, more than one-half of residents (53%) reported COVID-19 pandemic having an extremely negative or negative effect on their sense of physical safety. Lastly, 70% of residents reported a negative or extremely negative impact on mental health.

Table 2. Resident (Resident and Associate Society) Responses to Survey Questions about Effects of COVID-19 Pandemic on Clinical, Educational, and Personal Experience

Experience	Survey response (n = 465)	
	n	%
Clinical		
Reduction in elective operations as a result of COVID-19 pandemic		
1% to 25%	21	4
26% to 50%	31	7
51% to 75%	96	18
76% to 100%	304	65
Do not know	11	2
No change	12	3
Reduction in emergent operations as a result of COVID-19 pandemic		
1% to 25%	111	24
26% to 50%	92	20
51% to 75%	61	13
76% to 100%	17	4
Do not know	39	8
No change	145	31
Modification in schedule response to the COVID-19 pandemic		
Residents have been completely removed from service	143	31
Residents have been grouped into staggered shifts	325	70
More work is designated to APP	36	8
Less work is designated to APP	69	15
Vacations have been rescinded	152	33
Residents have been deployed to nonsurgical services	163	35
Changes were made but the schedule has returned to normal	333	72
No changes have been made	21	4
Modification in case coverage in response to COVID-19 pandemic		
No residents allowed in OR	5	1
More cases are designated to APP	4	1
No residents are allowed in the OR if a patient is known COVID-19-positive	37	8
Residents are allowed in the OR on a case-by-base basis	86	18
Residents are limited in number in the OR	199	43
Changes were made but the schedule has returned to normal	244	52
No changes have been made	112	24
Modification in clinical coverage in response to COVID-19 pandemic		
No residents are allowed in clinic	127	27

(Continued)

Table 2. Continued

Experience	Survey response (n = 465)	
	n	%
Clinic appointments are designated to APP		
	21	4
Residents are limited in number in clinic		
	92	20
Residents are seeing patients via telemedicine appointments		
	113	24
Changes were made but the schedule has returned to normal		
	221	48
No changes have been made		
	76	16
Impact of COVID-19 pandemic on didactic educational programs		
Extreme negative impact		
	55	12
Extreme positive impact		
	12	3
Negative impact		
	213	50
No impact		
	69	15
Positive impact		
	98	21
Impact of COVID-19 pandemic on elective operative experience		
Extreme negative impact		
	247	53
Negative impact		
	199	43
No impact		
	17	4
Positive impact		
	1	0.2
Impact of COVID-19 pandemic on emergent operative experience		
Extreme negative impact		
	31	7
Extreme positive impact		
	3	0.6
Negative impact		
	194	42
No impact		
	224	48
Positive impact		
	11	2
Impact of COVID-19 pandemic on clinic experience		
Extreme negative impact		
	80	17
Extreme positive impact		
	3	0.6
Negative impact		
	263	57
No impact		
	96	21
Positive impact		
	22	5
Impact of COVID-19 pandemic on physical health		
Extreme negative impact		
	44	10
Extreme positive impact		
	6	1
Negative impact		
	174	37
No impact		
	189	41
Positive impact		
	52	11
Impact of COVID-19 pandemic on physical safety		
Extreme negative impact		
	48	10
Extreme positive impact		
	3	0.6
Negative impact		
	199	43
No impact		
	202	43
Positive impact		
	12	3

(Continued)

Table 2. Continued

Experience	Survey response (n = 465)	
	n	%
Impact of COVID-19 pandemic on emotional health		
Extreme negative impact	86	18
Extreme positive impact	6	1
Negative impact	239	52
No impact	111	24
Positive impact	22	5
Have you taken care of a COVID-19-positive patient?		
I am not sure	22	5
No	64	14
Yes	379	82
Have you performed an operation or an invasive procedure on a COVID-19-positive patient		
I am not sure	24	5
No	136	29
Yes	305	66
Educational		
Educational programs that have been adapted/modified during COVID-19 pandemic		
Morbidity and mortality conference	388	83
ABSITE preparation	163	35
Grand rounds	373	80
Visiting professors	291	63
Tumor board	262	56
Research conferences	288	62
Simulation training/center accessibility	256	55
Teaching rounds	219	47
Meetings with mentors	157	34
Interview for fellowship and/or jobs	252	54
Training linked to telehealth platforms	80	17
Impact of COVID-19 pandemic operative volume on ability to meet minimum case requirement		
Greatly impacted	110	24
Not impacted	163	35
Slightly impacted	189	41
Impact of COVID-19 on expected progression of operative autonomy		
Do not know	53	12
Moderately	195	42
Not at all	136	29
To a great extent	78	17
Personal		

(Continued)

Table 2. Continued

Experience	Survey response (n = 465)	
	n	%
Biggest concern during COVID-19 pandemic		
Clinical competency	37	8
Education	23	5
Ethical considerations	23	5
Fear of contracting COVID-19	64	14
Spread of infection to family	172	37
Surgical case load	131	28
Have witnessed or been subject to harsh treatment as a result of changes during COVID-19 pandemic	51	11
Program has instituted formal mechanisms to support resident wellness and promote resiliency	240	52
Used wellness or resiliency programs offered by the American College of Surgeons or other professional societies during the COVID-19 pandemic	60	13
Perceived to have adequate personal protective equipment access	300	65
Have experienced new or an increase in the following symptoms:		
Depressed mood	142	30
Anxiety	250	54
Change in sleep habits	174	37
Change in appetite	101	22
Lost interest	144	31
Change in weight	182	39
Change in ability to sustain attention	165	36
Emotional exhaustion	257	55
Depersonalization	180	39
Decrease in sense of personal achievement	209	45

Data are not shown for "prefer not to answer" or "other" responses and is included in percent calculations.

ABSITE, American Board of Surgery in-Service Training Examination; APP, advanced practice provider; OR, operating room.

A majority of residents (82%) reported taking care of a known COVID-19-positive patient, and 66% reported performing an interventional procedure and/or operation on a known COVID-19-positive patient. Residents were asked to cite their biggest concern during the COVID-19 pandemic from the following: education, clinical competency, surgical case volume, ethical considerations, fear of contracting COVID-19, or spread of infection to family. The top 2 cited concerns were spread of infection to family (37%) and surgical case load (28%). When asked

whether programs have made arrangements to reduce risk to residents' families, nearly one-half (46%) reported their programs had not, and 32% reported alternative housing or living arrangements.

When asked to what degree a resident's institution has demonstrated sensitivity to specific concerns of residents, 51% reported "somewhat" and 41% reported "to a great extent." Seventy-nine percent of respondents reported that their program provided COVID-19 testing for employees. However, 34% of residents reported not having adequate access to PPE during the COVID-19 pandemic. A small fraction of respondents (8%) reported that programs asked residents to provide their own PPE.

Residents were asked whether they thought that the type of care and risk of exposure they were being asked to take on was commensurate with their level of training. The majority (80%) reported "yes." When asked whether they thought that the surgical attending and/or clinical educators were taking on the same level of risk as residents, 44% reported that they thought that their attendings were taking on a decreased level of risk, 40% reported the same level of risk, and only 14% reported an increased level of risk. When asked whether residents thought that their program has treated residents equally compared with attending surgeons during the pandemic, 38% reported unequal treatment, and the majority (57%) reported equal treatment. The vast majority of residents (80%) reported their hospital system had not provided residents with any bonus or "hazard pay."

Residents were then screened for new or increased symptoms of depression. The results demonstrate a majority of residents had new or increased depression symptoms, with 31% reporting depressed mood, 54% reporting anxiety, 37% reporting change in sleep habits, 22% reporting change in appetite, 31% reporting decreased interest or happiness in activities, 39% reporting weight changes, and 35% reporting difficulty in maintaining attention. Residents were also screened for new or increased symptoms of burnout. Similar to depression, the endorsement of burnout feelings was notable. More than one-half (55%) of residents reported emotional exhaustion, 39% reported depersonalization, and 45% reported decrease in sense of personal accomplishment. Approximately one-half (52%) of residents reported that their program instituted formal mechanisms to support resident wellness and resiliency during the COVID-19 pandemic. Only 13% reported using wellness or resiliency resources offered by the ACS or other professional societies during the pandemic.

Early-career surgeons: effect of COVID-19 pandemic on clinical experience

Overall, of the 16,257 early-career surgeons (8,104 RAS associate members and 8,153 YFA members), there were 695 respondents (316 RAS associate members, 379 YFA members) (Table 3), for a response rate of 4.2%. In terms of the status of COVID-19 admissions, one-half reported admissions are still increasing (50%) and 30% reported decreasing (Table 4; complete survey responses in eTables 1 to 4). When asked about the status of elective operations at their peak of the COVID-19 pandemic, the majority reported a reduction of 76% to 100% (38%) in elective case volume or 51% to 75% reduction (19%), with few reporting a decrease in emergent case volume (Table 4). In regard to scheduling changes as a result of the COVID-19 pandemic, the most common reported changes were vacations being rescinded (29%) and administrative staff or clinical staff being furloughed (29% and 28% respectively). In addition, only 5% reported physicians being fired.

Early-career surgeons: effect of COVID-19 pandemic on personal experience and risk perception

The majority of respondents (68%) reported taking care of patients with known COVID-19 infection and approximately one-half (52%) reported performing operations and/or an invasive procedure on patients with known COVID-19 infection. Early-career surgeons were asked to cite their biggest concern during the COVID-19 pandemic from the same list as residents (Table 5). The top 2 concerns cited were spread of infection to family (40%) and surgical case load/practice concerns (18%). More than one-half (56%) of respondents reported a decrease in compensation during the pandemic, with the majority reporting either a 0% to 10% (35%) or 10% to 20% (27%) decrease in annual income this coming year compared with the previous year. Only 11% of respondents reported receiving hazard pay. A majority of respondents (86%) reported that COVID-19 added or increased personal stressors due to decreased availability of school, childcare, or other activities.

When asked whether a respondent's institution or department had instituted any formal mechanisms to support faculty wellness and promote resiliency during the COVID-19 pandemic, only about one-half (53%) reported "yes," and even fewer reported using those wellness resources (18%). Only 34% reported being aware of ACS wellness resources, and even fewer (15%) reported using those resources. The majority of respondents (78%) reported feeling as though they did not have adequate PPE access. Nearly one-quarter of respondents

Table 3. Demographic Characteristics of American College of Surgeons Early-Career Surgeons

Characteristic	Survey response (n = 695)	
	n	%
Age		
26 to 30 y	10	2
31 to 35 y	168	24
36 to 40 y	306	45
40 to 45 y	202	29
Sex, m	396	57
Race		
African American	14	2
Asian	146	22
Caucasian	383	57
Hispanic/Latino	75	11
Other	59	9
LGBTQ+ sexual orientation	18	3
Marital status		
Divorced	27	4
Married	524	77
Single	132	19
Have children	456	67
Region		
Midwest	106	15
Northeast	98	14
South	176	25
Western	113	16
Other	200	29
Institution affiliation		
Military	39	6
Non-university affiliated	251	36
University affiliated	379	55
Other, please specify	25	4
Practice specialty		
Acute care, trauma, and burn	116	17
Bariatric or minimally invasive surgery	33	5
Cardiothoracic surgery	22	3
Colorectal surgery	62	9
Critical care	5	1
Endocrine surgery	7	1
General surgery	207	30
Neurologic surgery	10	2
Ophthalmology	2	0.3
Orthopaedic surgery	11	2
Other, please specify	34	5
Otolaryngology	25	4
Pediatric surgery	28	4
Plastic and reconstructive surgery	21	3
Surgical oncology or hepatobiliary	50	7

(Continued)

Table 3. Continued

Characteristic	Survey response (n = 695)	
	n	%
Transplantation surgery	12	2
Urology	12	2
Vascular surgery	36	5

Data are not shown for "prefer not to answer" or "other" responses and is included in percent calculations.

LGBTQ+, lesbian, gay, bisexual, transgender, and queer (or questioning) and others.

(21%) reported that their institution asked providers to supply their own PPE. The majority (77%) reported that COVID-19 testing was being provided by their institution.

Early-career surgeons were then screened for new or increased symptoms of depression. Much like the response from residents, there were a remarkable number of respondents who reported new or increased depressive symptoms, with 31% reporting depressed mood, 61% reporting anxiety, 42% reporting change in sleeping habits, 21% reporting change in appetite, 36% reporting lack of interest in previously enjoyed activities, 44% reporting change in weight, and 34% reporting a decrease in attention maintenance. Similarly, the majority reported new or increased burnout symptoms, with 56% reporting emotional exhaustion, 30% reporting depersonalization, and 45% reporting decrease in sense of personal accomplishment.

Comparison of residents and early-career surgeons

A comparison of demographics and shared question responses was performed between residents and early-career surgeons (eTables 1 to 4). Early-career surgeons were more likely to report an "uptick" in COVID-19 numbers at their institution vs residents (50% vs 41%; $p = 0.003$). However, early-career surgeons reported less of a decrease in elective case volume. Residents, compared with early-career surgeons, were more likely to report taking care of known COVID-19-positive patients (82% vs 68%; $p < 0.001$) and performing operations or interventional procedures with known COVID-19-positive patients (66% vs 52%; $p < 0.001$). In this context, more residents reporting receiving hazard pay than early-career surgeons (19% vs 11% fellows, $p < 0.001$).

There were differences in the concerns expressed as the most pressing during the COVID-19 pandemic. Although both residents' and early-career surgeons' most cited concern was spread of infection to family, this was reported with a slightly higher percent by early-career surgeons (40% vs 37%; $p < 0.001$). Although both residents and early-career surgeons reported a high rate of new or increased depression and burnout symptoms, residents

Table 4. American College of Surgeons Early-Career Surgeons' Responses to Survey Questions on Effects of COVID-19 Pandemic on Clinical and Personal Experience

Experience	Survey response (n = 695)	
	n	%
Clinical		
Reduction in elective operations as a result of COVID-19 pandemic		
1% to 25%	106	15
26% to 50%	120	17
51% to 75%	161	23
76% to 100%	266	38
Do not know	6	1
No change	35	5
Reduction in emergent operations as a result of COVID-19 pandemic		
1% to 25%	192	28
26% to 50%	124	18
51% to 75%	62	9
76% to 100%	10	2
Do not know	34	5
No change	271	39
Modification in schedule response to the COVID-19 pandemic		
Administrative staff have been fired	54	8
Administrative staff have been furloughed	200	29
Clinical staff (nurse/PCT/MA) have been fired	47	7
Clinical staff (nurse/PCT/MA) have been furloughed	195	28
APP staff have been fired	16	2
APP staff have been furloughed	83	12
Physicians have been fired	33	5
Physicians have been furloughed	72	10
More work is designated to APP	75	11
Less work is designated to APP	52	8
Vacations have been rescinded	203	29
Physicians have been reassigned to nonsurgical services	181	26
No changes have been made	89	13
Changes were made but the schedule has returned to normal	280	40
Have you taken care of a COVID-19-positive patient?		
I am not sure	45	6
No	180	26
Yes	468	68

(Continued)

Table 4. Continued

Experience	Survey response (n = 695)	
	n	%
Have you performed an operation or an invasive procedure on a COVID-19-positive patient?		
I am not sure	43	6
No	292	42
Yes	357	52
Personal		
Biggest concern during COVID-19 pandemic		
Administrative issues	25	4
Ethical considerations	30	4
Fear of contracting COVID-19	100	14
Household issues relating to children or other dependent	54	8
Lost compensation	46	7
Spread of infection to family	279	40
Surgical case load/practice concern	126	18
Decrease in compensation due to COVID-19 pandemic	390	56
COVID-19 has added or increased personal stressor due to decreased availability of school, childcare, other activity	469	86
Program has instituted formal mechanisms to support resident wellness and promote resiliency	368	53
Aware of wellness programs from ACS and other professional societies	234	34
Perceived to have adequate PPE access	479	70
Program has provided COVID-19 testing	528	77
Have experienced new or an increase in the following symptoms:		
Depressed mood	212	31
Anxiety	424	61
Change in sleep habits	287	42
Change in appetite	145	21
Lost interest	246	36
Change in weight	302	44
Change in ability to sustain attention	231	34
Emotional exhaustion	385	56
Depersonalization	204	30
Decrease in sense of personal achievement	307	45

Data are not shown for "prefer not to answer" or "other" responses and is included in percent calculations.

ACS, American College of Surgeons; APP, advanced practice provider; MA, medical assistant; PCT, patient care technician; PPE, personal protective equipment.

were more likely to report depersonalization (39% vs 30%; $p = 0.002$).

Wellness outcomes

To better understand factors associated with high numbers of depression (4 or more positive answers to depression symptoms) and burnout (2 or more positive answer to burnout symptoms) symptoms, a comparison of demographic and COVID-19-specific responses was performed (Table 5). Those who reported high levels of depression were more likely to be women (53% vs 44%; $p < 0.007$) and less likely to report wellness resources at their institution (46% vs 56%; $p = 0.001$). Those who reported a high number of depression symptoms were less likely to report access to adequate PPE (62% vs 72%; $p = 0.001$) and more likely to report their institution requesting that they provide their own PPE (22% vs 13%; $p < 0.0001$). When examining burnout, similar associations were observed (Table 5). Respondents with a high number of burnout symptoms were more likely to be women (53% vs 42%; $p = 0.002$), more likely to report a 76% to 100% reduction in elective case volume (52% vs 46%; $p = 0.03$), and more likely to have reported taking care of (78% vs 70%; $p = 0.007$), and/or operating on known COVID-19-positive patients (62% vs 54%; $p = 0.008$). In addition, respondents who reported a high number of burnout symptoms were less likely to report wellness resources at their program (46% vs 58%; $p < 0.001$), less likely to report adequate access to PPE (59% vs 75%; $p < 0.0001$), and more likely to report their institution requesting that they provide their own PPE (19% vs 13%; $p < 0.001$).

After identifying these associations, a multivariable stepwise logistic regression was performed. The following were found to increase the odds of depression: female sex (adjusted odds ratio [OR] 1.54; 95% CI, 1.18 to 2.00), lack of wellness resources (adjusted OR 1.55; 95% CI, 1.20 to 2.02), being asked to provide one's own PPE (adjusted OR, 1.71; 95% CI, 1.21 to 2.43), > 25% reduction in emergent case volume (adjusted OR 1.52; 95% CI, 1.05 to 2.20), and university affiliation (adjusted OR 1.37; 95% CI, 1.04 to 1.81). The following were found to increase the odds of burnout: female sex (adjusted OR 1.47; 95% CI, 1.15 to 1.89), lack of wellness resources (adjusted OR 1.44; 95% CI, 1.12 to 1.85), and caring for known COVID-19-positive patients (adjusted OR 1.62; 95% CI, 1.21 to 2.17). In contrast, having adequate PPE was protective against burnout (adjusted OR 0.52; 95% CI, 0.39 to 0.68).

DISCUSSION

In this survey of more than 1,100 respondents from the ACS RAS and YFA membership, we found that the COVID-19 pandemic has negatively impacted surgical trainees' and early-career surgeons' clinical and personal experiences. Residents reported a negative impact on their clinical experience, with substantial changes in rotation scheduling and decreased ability to meet minimum case requirements. However, the effect on the educational experience is more mixed, with some reporting an increase in innovative didactics but a reduction in operative autonomy and in-person learning opportunities. Residents also reported a negative impact on personal experience, with nearly one-half reporting decreased physical wellness and sense of physical safety and more than two-thirds reporting decreased emotional wellness. Although residents reported institutional measures aimed to increase safety and address resident concerns, nearly 1 in 3 respondents reported inadequate PPE access and a considerable number reported increased depressive and burnout symptoms. Similarly, associate members (fellows and early-career surgeons) reported a negative effect on clinical and personal experience, with decreased support staff and compensation. They reported increased personal stressors and practice concerns, with decreased awareness of and use of wellness resources. More than three-quarters of early-career surgeons reported inadequate PPE access, and a large number reported increased depression and burnout symptoms. Compared with early-career surgeons, residents were more likely to report taking care of known COVID-19-positive patients and were more likely to report depersonalization symptoms. Lastly, those who reported high depression and burnout symptoms were more likely to be women, less likely to report availability of wellness resources, more likely to report taking care of known COVID-19-positive patients, and less likely to report access to adequate PPE.

In this survey of residents and early-career surgeons in the ACS, respondents generally thought that the COVID-19 pandemic had negative effects on their clinical experience. These results have been echoed in other studies of trainees from surgical trainees in programs based in the US¹³⁻¹⁵ and outside of the US,¹⁶⁻¹⁹ citing concerns about severe reductions in training exposure,¹⁶⁻¹⁹ including decreased operative volume,¹³ and anxiety about a potential required extension of training due to inability to meet operative requirements for graduation.^{14,15,17} In addition, not only has a reduction in formalized educational programming for trainees been reported, but on some surveys, residents have reported decreased satisfaction with virtual education programming.²⁰ Our survey

Table 5. Factors Associated with High Depression Score (4 or More Symptoms) and High Burnout Scores (2 or More Symptoms)

Depression and burnout, associated factor	Low symptoms		High symptoms		p Value
	n	%	n	%	
Depression*					
Membership type					0.34
Resident member	315	41	150	38	
Early-career surgeon	451	59	244	62	
Age					0.12
20 to 25 y	0	0	3	1	
26 to 30 y	124	16	56	14	
31 to 35 y	276	36	133	34	
36 to 40 y	226	30	126	32	
40 to 45 y	137	18	70	18	
Sex, m	429	56	183	47	0.007
Race					0.06
African American	23	3	7	2	
Asian	140	19	77	20	
Caucasian	465	63	218	57	
Hispanic/Latino	64	9	52	14	
Other	51	7	28	7	
LGBTQ+ sexual orientation	28	4	19	5	0.38
Marital status					0.06
Divorced	17	2	17	4	
Married	504	67	239	62	
Single	234	31	130	34	
Have children	389	52	177	46	0.07
Have you taken care of a COVID-19-positive patient?					0.29
I am not sure	47	6	20	5	
No	170	22	74	19	
Yes	549	72	298	76	
Have you operated or performed an interventional procedure on a COVID-19-positive patient?					0.14
I am not sure	42	6	25	6	
No	298	39	130	33	
Yes	424	56	238	61	
Biggest concern during COVID-19 pandemic					0.03
Clinical competency	22	3	15	4	
Education	11	1	12	3	
Ethical considerations	33	4	20	5	
Other, please specify	27	4	20	5	
Spread of infection to family	298	39	153	39	
Surgical case load	191	25	66	17	
Administrative issues	14	2	11	3	
Fear of contracting COVID-19	99	13	65	16	
Household issues relating to children or other dependents	39	5	15	4	
Program has instituted formal mechanisms to support resident wellness and promote resiliency	427	56	181	46	0.001
Used wellness programs from ACS and other professional societies	53	10	60	22	< 0.001

(Continued)

Table 5. Continued

Depression and burnout, associated factor	Low symptoms		High symptoms		p Value
	n	%	n	%	
Perceived to have adequate PPE access	538	72	241	62	0.001
Program has asked you to provide your own PPE					< 0.001
Do not want to answer	3	0.4	5	1	
No	594	79	265	68	
No, however, external PPE was independently acquired by residents and approved by the program director	47	6	26	7	
No, however, external PPE was requested by residents and acquired by the program director	11	2	11	3	
Yes	97	13	84	22	
Burnout [†]					
ACS membership type					0.18
Resident member	256	38	209	42	
Early-career surgeon	411	62	284	58	
Age					0.08
20 to 25 y	0	0	3	1	
26 to 30 y	93	14	87	18	
31 to 35 y	248	38	161	33	
36 to 40 y	199	30	153	31	
40 to 45 y	121	18	86	18	
Sex, m	382	57	230	47	0.002
Race					0.05
African American	22	3	8	2	
Asian	135	21	82	17	
Caucasian	393	61	290	61	
Hispanic/Latino	56	9	60	13	
Other	43	7	36	8	
LGBTQ+ sexual orientation	26	4	21	4	0.88
Marital status					0.24
Divorced	23	4	11	2	
Married	434	66	309	64	
Single	199	30	165	34	
Have children	332	51	234	48	0.38
Reduction in elective surgery as a result of COVID-19 pandemic					0.04
1% to 25%	88	13	39	8	
26% to 50%	92	14	59	12	
51% to 75%	139	21	108	22	
76% to 100%	312	47	258	52	
Do not know	12	2	5	1	
No change	24	4	23	5	
Have you taken care of a COVID-19-positive patient?					0.007
I am not sure	45	7	22	4	
No	157	24	87	18	
Yes	464	70	383	78	

(Continued)

Table 5. Continued

Depression and burnout, associated factor	Low symptoms		High symptoms		p Value
	n	%	n	%	
Have you operated or performed an interventional procedure on a COVID-19-positive patient?					0.008
I am not sure	39	6	28	6	
No	271	41	157	32	
Yes	356	54	306	62	
Biggest concern during COVID-19 pandemic					0.06
Clinical competency	22	3	15	3	
Education	9	1	14	3	
Ethical considerations	27	4	26	5	
Spread of infection to family	258	39	193	39	
Surgical case load	171	26	86	18	
Administrative issues	13	2	12	2	
Fear of contracting COVID-19	86	13	78	16	
Household issues relating to children or other dependents	32	5	22	4	
Lost compensation	24	4	22	4	
Other, please specify	24	4	23	5	
Program has instituted formal mechanisms to support resident wellness and promote resiliency	383	58	225	46	< 0.001
Used wellness programs from ACS and other professional societies	58	12	55	16	0.15
Perceived to have adequate PPE access	493	75	286	59	< 0.001
Program has asked you to provide your own PPE					< 0.001
Do not want to answer	5	1	3	1	
No	525	80	334	69	
No, however, external PPE was independently acquired by residents and approved by the program director	31	5	42	9	
No, however, external PPE was requested by residents and acquired by the program director	9	2	13	3	
Yes	87	13	94	19	

*Low symptoms (n = 766), high symptoms (n = 394).

†Low symptoms (n = 667), high symptoms (n = 493).

ACS, American College of Surgeons; LGBTQ+, lesbian, gay, bisexual, transgender, and queer (or questioning) and others; PPE, personal protective equipment.

results found a mixed response from residents asked about their educational experience, with nearly two-thirds of respondents reporting a negative or extremely negative impact on their didactic educational program and 21% reporting a positive or extremely positive impact on their didactic experience. This latter positive report is likely reflecting quality educational didactic programming created to compensate for loss in real-time clinical education. Unfortunately, the survey was not designed to capture what specifically was found to improve or worsen the educational programming and deserves follow-up investigation. Other surveys of trainees have reported that there is interest in continuing the newly adopted virtual didactic sessions beyond mandated social distancing precautions, as they are an effective method to provide

education.²¹ Many institutions have supplemented their formalized curricula with COVID-19 literature reviews, teleconferencing didactics targeting areas of weakness on earlier in-service examinations, telemedicine involvement, hospital-based and home-based simulation models, modified CME modules, and “virtual” boot camps,^{1,5,22-29} which have increased resident satisfaction with education. These supplemental didactics serve as exemplars for incorporating novel adjuncts to the traditional educational development.

Deleterious effects on education and clinical work were not the only negative effects of COVID-19 identified by survey respondents, with the majority also reporting negative effects on the personal experience, sense of wellness, and risk perception. A substantial number of residents

and early-career surgeons reported taking care of known COVID-19-positive patients, which has been shown to be independently associated with higher levels of anxiety, fear, depression, and work exhaustion.^{7,30} The damaging effect is amplified when combined with concern about PPE availability, which was reported in 35% of our respondents, and is a concern echoed by other healthcare providers who have reported similar shortages and the re-using of PPE.³¹ Residents and early-career surgeons also reported fear of contracting the virus, a concern not without legitimacy, given reports describing up to a 25% COVID-19-positivity rate in surgical consultants³² and the high rate of potential exposure with residents and early-career surgeons continuing to serve on the frontlines of COVID-19 patient care.^{16,33} However, the prime concern for both early-career surgeons and residents was transmission of infection to family. This concern has been reported similarly, seeming to take a priority over trainees' and early-career surgeons' concern for their own infection risk.^{13,16,34} Unfortunately, despite prevalence of the concern for transmission to family, many respondents reported no programming to enhance protection of family, highlighting a potential area for future policy-makers as this pandemic continues.

There are distinct challenges faced by residents compared with early-career surgeons. Although residents are more concerned about decline in surgical case volume and the challenge of meeting minimum case requirements, early-career surgeons are more worried about practice changes, decreased compensation, and future job prospects. This difference has been echoed among other early-career surgeons with reports of rescinded promotions and job offers,³⁵ and surgical trainees completing fellowship in search of jobs.^{36,37} This observed difference between training levels reflects the need for training institutions' response to the pandemic to be catered to level of training and professional development.

The results of this survey identified a high rate of new or increased depression and burnout symptoms in residents and early-career surgeons during the COVID-19 pandemic. Those who reported high depression and burnout symptoms were less likely to report availability of wellness resources, more likely to report taking care of known COVID-19-positive patients, and less likely to report access to adequate PPE. This is not the first study to highlight declining mental health in healthcare providers during the COVID-19 pandemic and, in particular, trainees compared with attending- or senior-level surgeons.³⁸⁻⁴³ Similar to our findings, a cross-sectional survey of 131 Italian general practitioners demonstrated an association between taking care of COVID-19-positive patients and a lack of PPE with

higher depressive symptoms. Amerio and colleagues⁴⁴ found in their survey of 2,707 healthcare professionals from 60 countries that adequate PPE was protective against burnout (risk ratio 0.88; 95% CI, 0.79 to 0.97). These results illustrate how prioritizing PPE access for healthcare workers could not only improve physical wellness, but is also protective to emotional and mental wellness. Our results also indicated that those who reported high depression and burnout symptoms were more likely to be women, a result that has also been reported in other studies.^{39,40,45-47} Additional reports have also corroborated a disproportionate negative impact of the pandemic on female surgeons' academic professional life (in addition to personal life aspects), which were not specifically measured in our survey.⁴⁸⁻⁵⁰ However, these data collectively underscore the need for directed programming and additional research to better understand the risk female sex poses to higher rates of burnout, depression, and other associated disparities during such times.

Although many health institutions' main focus is protecting the physical safety and well-being of their workers, less emphasis is placed on supporting the emotional well-being of workers, which is a cause for concern, as highlighted by our results and others. The working conditions during the peak COVID-19 pandemic and the heightened stress, resource limitations, uncertainty of physical safety, and considerable patient morbidity and mortality, have been compared with battlefield conditions. This environment enmeshes providers in uncertainty and anxiety that ultimately predisposes them to stress exposure syndromes, including post-traumatic stress disorder and burnout, as well as a predisposition to medical errors and suboptimal patient care.⁵¹⁻⁵³ Although our results identify increased PPE availability as a potential target to improve mental well-being in providers, there is also a need for formalized mental health promotion programs. Our results showed that those who report less availability and/or use of wellness programs at their institution were more likely to demonstrate high depressive symptoms and burnout. This result is echoed in a survey of 375 neurosurgeons taking care of COVID-19-positive patients; Sharif and colleagues⁵⁴ found that the likelihood of depression was higher among providers who did not receive guidance about self-protection from their institution. These results underscore the importance of wellness programming at institutions for providers. Wellness options can include peer programming, formalized counseling, mindfulness and meditation programs, and grassroots wellness initiatives, with existing models of these from across the country serving as exemplars for more widespread adoption.⁵⁵⁻⁵⁷

The limitations of this study include a small sample size relative to the number of trainees and early-career surgeons in the US, with a response rate of 5.4%. In addition, this survey was sent and responses collected in a finite period (2 weeks in July), which we now recognize might be early in the pandemic and might not fully capture the current situations of trainees and early-career surgeons as institutions slowly adapt beyond the initial peak of the pandemic. There might be sampling bias in that those who are more likely to respond to the survey might have stronger opinions, either positive or negative, about their educational, clinical, and personal experience, potentially limiting generalizability. For example, junior residents and residents from Independent Academic Medical Centers appear to be underrepresented in the response group. However, to the best of our knowledge, this study has the largest sample size of trainees and early-career surgeons compared with existing survey data mentioned that has been published around the COVID-19 pandemic. Finally, although institution-specific data were asked about the prevalence and trend of COVID-19 cases, this was not controlled for in answers and it is possible that the heterogeneity of COVID-19 pandemic status in various programs biased responses across the pool of surgeons.

CONCLUSIONS

This survey highlights the extent of the negative impact of the COVID-19 pandemic on surgical trainees' and early-career surgeons' clinical, educational, and personal experience. These data also underscore the enormous impact of the stress of the COVID-19 pandemic on surgeons' physical, emotional, and mental well-being. Importantly, the impact of the pandemic is ongoing, with nearly one-half of respondents reporting that there is still an increase in COVID-19 cases at their hospitals. As medical professionals, our obligations extend beyond provision of care to our patients, but also to care for our colleagues and trainees. Improvements to the educational, clinical, and personal experiences of our surgeons and trainees are essential to sustaining the workforce in a pandemic without a clear end point. These improvements must be dynamic with short- and long-term interventions and monitoring, and also be adaptive to the feedback from resident and early-career surgeon input. These data reveal actionable items to facilitate evidence-based guidelines and responses during this major health crisis, including increasing PPE access, increased wellness resources and encouraging their use, and targeting high-risk demographic groups. Adapting future pandemic responses to the needs of surgical trainees and early-career surgeons

and improving their educational, clinical, and personal experiences is essential to sustain the workforce through this pandemic and beyond.

APPENDIX

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REFERENCES

1. Edwards JA, Breitman I, Kovatch I, et al. Lessons learned at a COVID-19 designated hospital. *Am J Surg* 2020 Aug 4 [Epub ahead of print].

2. Dedeilia A, Sotiropoulos MG, Hanrahan JG, et al. Medical and surgical education challenges and innovations in the COVID-19 era: a systematic review. *In Vivo* 2020;34 [Suppl]:1603–1611.
3. Al-Jabir A, Kerwan A, Nicola M, et al. Impact of the coronavirus (COVID-19) pandemic on surgical practice—part 1. *Int J Surg* 2020;79:168–179.
4. Okland TS, Pepper JP, Valdez TA. How do we teach surgical residents in the COVID-19 era? *J Surg Educ* 2020;77:1005–1007.
5. Chick RC, Clifton GT, Peace KM, et al. Using Technology to maintain the education of residents during the COVID-19 pandemic. *J Surg Educ* 2020;77:729–732.
6. Kannampallil TG, Goss CW, Evanoff BA, et al. Exposure to COVID-19 patients increases physician trainee stress and burnout. *PLoS One* 2020;15:e0237301.
7. Evanoff BA, Strickland JR, Dale AM, et al. Work-related and personal factors associated with mental well-being during COVID-19 response: a survey of health care and other workers. *J Med Internet Res* 2020;22:e21366.
8. Aziz H, James T, Remulla D, et al. Effect of COVID-19 on surgical training across the United States: a national survey of general surgery residents. *J Surg Educ* 2020 Jul 30 [Epub ahead of print].
9. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16:606–613.
10. McManus IC, Winder BC, Gordon D. The causal links between stress and burnout in a longitudinal study of UK doctors. *Lancet* 2002;359:2089–2090.
11. Riley MR, Mohr DC, Waddimba AC. The reliability and validity of three-item screening measures for burnout: evidence from group-employed health care practitioners in upstate New York. *Stress Health* 2018;34:187–193.
12. Hu YY, Ellis RJ, Hewitt DB, et al. Discrimination, abuse, harassment, and burnout in surgical residency training. *N Engl J Med* 2019;381:1741–1752.
13. Collins C, Mahuron K, Bongiovanni T, et al. Stress and the surgical resident in the COVID-19 pandemic. *J Surg Educ* 2020 Jul 25 [Epub ahead of print].
14. Fero KE, Weinberger JM, Lerman S, Bergman J. Perceived impact of urologic surgery training program modifications due to COVID-19 in the United States. *Urology* 2020;143:62–67.
15. Huntley RE, Ludwig DC, Dillon JK. Early effects of COVID-19 on oral and maxillofacial surgery residency training—results from a national survey. *J Oral Maxillofac Surg* 2020;78:1257–1267.
16. Balhareth A, AlDuhileb MA, Aldulajjan FA, Aldossary MY. Impact of COVID-19 pandemic on residency and fellowship training programs in Saudi Arabia: a nationwide cross-sectional study. *Ann Med Surg* 2020;57:127–132.
17. Caruana EJ, Patel A, Kendall S, Rathinam S. Impact of coronavirus 2019 (COVID-19) on training and well-being in subspecialty surgery: a national survey of cardiothoracic trainees in the United Kingdom. *J Thorac Cardiovasc Surg* 2020;160:980–987.
18. Amparore D, Claps F, Cacciamani GE, et al. Impact of the COVID-19 pandemic on urology residency training in Italy. *Ital J Urol Nephrol* 2020;72:505–509.
19. Osama M, Zaheer F, Saeed H, et al. 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. *Int J Surg* 2020;79:252–256.
20. Chang DG, Park JB, Baek GH, et al. The impact of COVID-19 pandemic on orthopaedic resident education: a nationwide survey study in South Korea. *Int Orthop* 2020;1–8.
21. Figueroa F, Figueroa D, Calvo-Mena R, et al. Orthopedic surgery residents' perception of online education in their programs during the COVID-19 pandemic: should it be maintained after the crisis? *Acta Orthop* 2020:1–4.
22. Adesoye T, Davis CH, Del Calvo H, et al. Optimization of surgical resident safety and education during the COVID-19 pandemic—lessons learned. *J Surg Educ* 2020 Jul 1 [Epub ahead of print].
23. Bhashyam AR, Dyer GSM. "Virtual" boot camp: orthopaedic intern education in the time of COVID-19 and beyond. *J Am Acad Orthop Surg* 2020;28:e735–e743.
24. Gawad N, Towaij C, Stuleanu T, et al. Prioritizing resident and patient safety while maintaining educational value: emergency restructuring of a Canadian surgical residency program during COVID-19. *Can J Surg* 2020;63:E302–E305.
25. Juprasert JM, Gray KD, Moore MD, et al. Restructuring of a general surgery residency program in an epicenter of the coronavirus disease 2019 pandemic: lessons from New York City. *JAMA Surgery* 2020 Jul 7 [Epub ahead of print].
26. Kanneganti A, Sia CH, Ashokka B, Ooi SBS. Continuing medical education during a pandemic: an academic institution's experience. *Postgrad Med J* 2020;96:384–386.
27. McKechnie T, Levin M, Zhou K, et al. Virtual surgical training during COVID-19: operating room simulation platforms accessible from home. *Ann Surg* 2020;272:e153–e154.
28. Prsic A, Boyajian MK, Snapp WK, et al. A 3-dimensional-printed hand model for home-based acquisition of fracture fixation skills without fluoroscopy. *J Surg Educ* 2020 Jun [Epub ahead of print].
29. Rasouli JJ, Shin JH, Than KD, et al. Virtual spine: a novel, international teleconferencing program developed to increase the accessibility of spine education during the COVID-19 pandemic. *World Neurosurg* 2020;140:e367–e372.
30. Lu W, Wang H, Lin Y, Li L. Psychological status of medical workforce during the COVID-19 pandemic: a cross-sectional study. *Psychiatry Res* 2020;288:112936.
31. Latz CA, Boitano LT, Png CYM, et al. Early vascular surgery response to the COVID-19 pandemic: results of a nationwide survey. *J Vasc Surg* 2020 May 23 [Epub ahead of print].
32. Álvarez Gallego M, Gortázar de Las Casas S, Pascual Migueláñez I, et al. SARS-CoV-2 pandemic on the activity and professionals of a general surgery and digestive surgery service in a tertiary hospital. *Cir Esp* 2020;98:320–327.
33. An TW, Henry JK, Igboechi O, et al. How Are orthopaedic surgery residencies responding to the COVID-19 pandemic? An assessment of resident experiences in cities of major virus outbreak. *J Am Acad Orthop Surg* 2020;28:e679–e685.
34. He K, Stolarski A, Whang E, Kristo G. Addressing general surgery residents' concerns in the early phase of the COVID-19 pandemic. *J Surg Educ* 2020;77:735–738.
35. Culp BM, Frisch NB. COVID-19 impact on young arthroplasty surgeons. *J Arthroplasty* 2020;35:S42–S44.
36. Guo T, Kiong KL, Yao C, et al. Impact of the COVID-19 pandemic on otolaryngology trainee education. *Head Neck* 2020 Jul 15 [Epub ahead of print].
37. Pelargos PE, Chakraborty A, Zhao YD, et al. An evaluation of neurosurgical resident education and sentiment during the

- coronavirus disease 2019 pandemic: a North American Survey. *World Neurosurg* 2020;140:e381–e386.
38. Bradley M, Chahar P. Burnout of healthcare providers during COVID-19. *Cleve Clin J Med* 2020 Jul 9 [Epub ahead of print].
 39. Civantos AM, Byrnes Y, Chang C, et al. Mental health among otolaryngology resident and attending physicians during the COVID-19 pandemic: national study. *Head Neck* 2020;42:1597–1609.
 40. Di Tella M, Romeo A, Benfante A, Castelli L. Mental health of healthcare workers during the COVID-19 pandemic in Italy. *J Eval Clin Pract* 2020 Jul 25 [Epub ahead of print].
 41. Hu D, Kong Y, Li W, et al. Frontline nurses' burnout, anxiety, depression, and fear statuses and their associated factors during the COVID-19 outbreak in Wuhan, China: a large-scale cross-sectional study. *EClinicalMedicine* 2020;24:100424.
 42. Luceño-Moreno L, Talavera-Velasco B, García-Albuérne Y, Martín-García J. Symptoms of posttraumatic stress, anxiety, depression, levels of resilience and burnout in Spanish health personnel during the COVID-19 pandemic. *Int J Environm Res Public Health* 2020;17[15].
 43. Vafaei H, Roozmeh S, Hessami K, et al. Obstetrics healthcare providers' mental health and quality of life during COVID-19 pandemic: multicenter study from eight cities in Iran. *Psychol Res Behav Manage* 2020;13:563–571.
 44. Amerio A, Bianchi D, Santi F, et al. Covid-19 pandemic impact on mental health: a web-based cross-sectional survey on a sample of Italian general practitioners. *Acta Biomed* 2020;91:83–88.
 45. Naser AY, Dahmash EZ, Al-Rousan R, et al. Mental health status of the general population, healthcare professionals, and university students during 2019 coronavirus disease outbreak in Jordan: a cross-sectional study. *Brain Behav* 2020;10:e01730.
 46. Yildirim TT, Atas O, Asafov A, et al. Psychological status of healthcare workers during the Covid-19 pandemic. *J Coll Physicians Surg Pak* 2020;30:26–31.
 47. Zhu Z, Xu S, Wang H, et al. COVID-19 in Wuhan: sociodemographic characteristics and hospital support measures associated with the immediate psychological impact on healthcare workers. *EClinicalMedicine* 2020;24:100443.
 48. Kibbe MR. Consequences of the COVID-19 pandemic on manuscript submissions by women. *JAMA Surg* 2020 Aug 4 [Epub ahead of print].
 49. Pinho-Gomes AC, Peters S, Thompson K, et al. Where are the women? Gender inequalities in COVID-19 research authorship. *BMJ Global Health* 2020;5:e002922.
 50. Gabster BP, van Daalen K, Dhatt R, Barry M. Challenges for the female academic during the COVID-19 pandemic. *Lancet* 2020;395[10242]:1968–1970.
 51. Ballesio A, Lombardo C, Lucidi F, Violani C. Caring for the carers: advice for dealing with sleep problems of hospital staff during the COVID-19 outbreak. *J Sleep Res* 2020 Jun 8 [Epub ahead of print].
 52. Barello S, Palamenghi L, Graffigna G. Burnout and somatic symptoms among frontline healthcare professionals at the peak of the Italian COVID-19 pandemic. *Psychiatry Res* 2020;290:113129.
 53. Preti E, Di Mattei V, Perego G, et al. The psychological impact of epidemic and pandemic outbreaks on healthcare workers: rapid review of the evidence. *Curr Psychiatry Rep* 2020;22:43.
 54. Sharif S, Amin F, Hafiz M, et al. COVID 19-depression and neurosurgeons. *World Neurosurg* 2020;140:e401–e410.
 55. Albott CS, Wozniak JR, McGlinch BP, et al. Battle buddies: rapid deployment of a psychological resilience intervention for health care workers during the COVID-19 pandemic. *Anesth Analg* 2020;131:43–54.
 56. Lie JJ, Huynh C, Scott TM, Karimuddin AA. Optimizing resident wellness during a pandemic: University of British Columbia's General surgery program's COVID-19 experience. *J J Surg Educ* 2020 Jul 19 [Epub ahead of print].
 57. Behan C. The benefits of meditation and mindfulness practices during times of crisis such as COVID-19. *Ir J Psychol Med* 2020 May 14 [Epub ahead of print].

Invited Commentary

COVID-19 Pandemic and the Need for Disaster Planning in Surgical Education



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The COVID-19 pandemic disrupted nearly every aspect of life in the US and beyond. The findings of the article by Coleman and colleagues¹ provide important and timely insights on the impact of the COVID-19 pandemic on clinical experience and the well-being of surgical trainees and young surgeons in practice. The results were similar for residents and young surgeons, showing substantial decreased clinical experience affecting resident education and practicing surgeon compensation, variable access to personal protective equipment (PPE), and the resulting emotional problems and burnout.

We will focus our comments on the resident survey findings. Predictably, the impact was particularly severe for trainees in procedure-based residencies and fellowships as community hospitals and academic health centers cancelled nonemergency operations to make room for patients infected with COVID-19 and preserve PPE. As with all surveys, a major weakness might be the introduction of bias, as those who were most severely impacted would be more likely to participate. Was this simply a few disgruntled residents responding to their plight? Absolutely not. Of those surveyed, there were 465 respondents for a response rate of 9%. They were relatively equally distributed throughout the US. In addition, the results are validated by being nearly identical to the findings of a survey of surgical educators by A Special

eDocument 1

American College of Surgeons Survey

Dear Young Surgeon:

We invite you to participate in a brief online survey on your clinical, educational, and personal experience during the COVID-19 pandemic.

The goal of this survey is to describe the experiences of young surgeons during the COVID-19 pandemic (specifically focusing on your clinical, educational, and personal experience) and to assist in informing future pandemic planning by highlighting the collective experiences of young surgeons.

Your participation is voluntary, and your responses will not be linked to your identity in any way, and this survey is completely anonymous. By participating in this survey, you consent to your anonymized data being used for analysis, presentation to the American College of Surgeons (ACS) leadership, and/or publication.

American College of Surgeon status:

- Resident member of ACS—Direct to resident questions
- Associate Fellow member of ACS (out of training but not yet a Fellow of the American College of Surgeons [FACS])—Direct to Associate and YFA questions
- Young Fellow member of ACS (carry the FACS credentials, and are 45 years or younger)—Direct to Associate and YFA questions
- Fellow of ACS older than 45 years—Direct to disqualification message
- Affiliate member of ACS—Direct to disqualification message

RESIDENT QUESTIONS

Section 1: program information and demographics

1. What is your age?
 - 20 to 25 years
 - 26 to 30 years
 - 31 to 35 years
 - 36 to 40 years
 - 40+ years
 - Do not want to specify
2. What is your sex?
 - Male
 - Female
 - Other
 - Do not want to specify
3. What is your ethnicity?
 - Caucasian
 - African American
 - Hispanic/Latino
 - Asian
 - Other
 - Prefer not to answer
4. What is your sexual orientation?
 - Heterosexual
 - LGBTQ+ (lesbian, gay, bisexual, transgender, and queer (or questioning) and others)
 - Prefer not to answer
5. What is your marital status?
 - Married
 - Single
 - Divorced
 - Widowed
 - Prefer not to answer
6. Do you have children?
 - Yes
 - No
 - Prefer not to answer
7. In which region is your residency located?
 - Northeast: Connecticut, Main, New Hampshire, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
 - South: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Oklahoma, North Carolina, South Carolina, Tennessee, Texas, Virginia, Washington DC, West Virginia
 - Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin
 - Western: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming
 - Other: please specify
8. How would you best describe your primary institution?
 - University affiliated
 - Non-university affiliated
 - Military
 - Other, please specify
9. What is the size of your residency program?
 - Fewer than 3 graduating chief residents
 - 4 to 5 graduating chief residents
 - 6 to 8 graduating chief residents
 - More than 8 graduating chief residents
10. Which of the below best describes your primary institution?
 - Level I trauma center
 - Level II trauma center
 - Level III trauma center
 - Not accredited as a trauma center
11. What is your current clinical PGY level?
 - PGY1
 - PGY2

- PGY3
 - PGY4
 - PGY5
 - Currently not a clinical PGY, please specify (eg research resident, fellow)
12. What training program are you in?
- Acute care, trauma, and burn
 - General surgery
 - Bariatric or minimally invasive surgery
 - Cardiothoracic surgery
 - Colorectal surgery
 - Critical care
 - Endocrine surgery
 - Neurological surgery
 - Ophthalmology
 - Orthopaedic surgery
 - Otolaryngology
 - Palliative care
 - Pediatric surgery
 - Plastic and reconstructive surgery
 - Surgical oncology or hepato-pancreatico-biliary
 - Transplantation surgery
 - Urology
 - Vascular surgery
 - Other, please specify
- Section 2: effects of covid-19 on clinical experience**
13. What would you estimate is the status of COVID-19 admissions at your hospital currently?
- Numbers are still increasing (“uptick” of the curve)
 - Numbers are starting to level (“flattened” part of curve)
 - Numbers are decreasing
 - Do not know
- Comments
14. At the peak of the COVID-19 curve in your area, please indicate any reduction in elective surgery as a result of COVID-19 pandemic, at the institutional level.
- No change
 - 1% to 25%
 - 26% to 50%
 - 51% to 75%
 - 76% to 100%
 - Do not know
- Comments
15. At the peak of the COVID-19 curve in your area, please indicate any reduction in emergency operations as a result of COVID-19 pandemic, at the institutional level.
- No change
 - 1% to 25%
 - 26% to 50%
 - 51% to 75%
 - 76% to 100%
 - Do not know
- Comments
16. What scheduling changes, if any, has your program made in response to the COVID-19 pandemic (select all that apply)
- Residents have been completely removed from some services
 - Residents have been grouped into staggered shifts
 - More work is designated to advanced practice providers (APPs) (physician assistants [PAs], nurse practitioners [NPs])
 - Less work is designated to APPs (PAs, NPs)
 - Vacations have been rescinded
 - Residents have been re-deployed to nonsurgical services
 - No changes have been made
 - Changes were made but the schedule has now returned to “normal”
- Comments
17. What modifications in case coverage have taken in place, if any, during the COVID-19 pandemic? (select all that apply)
- No residents are allowed in the operating room
 - More cases are designated to APPs (PA, NPs)
 - No residents are allowed in the operating room if a patient is known COVID-19 positive
 - Residents are allowed in the operating room on a case-by-case basis
 - Residents are limited in number in the operating room (eg chief residents only, senior residents only)
 - Changes were made but the schedule has now returned to “normal”
 - No changes have been made
 - Do not know
18. What modifications in clinic coverage have taken in place, if any, during the COVID-19 pandemic? (select all that apply)
- No residents are allowed in clinic
 - Clinic appointments are designated to APPs (PA, NPs)
 - Residents are limited in number in clinic (eg chief residents only, senior residents only)
 - Residents are seeing patients via telemedicine appointments
 - Changes were made but the schedule has now returned to “normal”
 - No changes have been made
 - Do not know

19. What has been the impact of the COVID-19 pandemic on your experience in the following areas: Matrix/rating scale:

Extreme negative impact	Negative impact	No impact	Positive impact	Extreme positive impact
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- Didactic educational programs
- Elective operative experience
- Emergency operative experience
- Clinic experience
- Outside rotations
- Feedback on clinical performance/assessment
- Physical health
- Physical safety
- Emotional health

20. To what degree has your institution taken the following adaptive steps in response to COVID-19 Matrix/rating scale:

Not at all	Somewhat	To a great extent	N/A
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- Demonstrating sensitivity to specific concerns of residents
- Enhancing safety measures in addition to routine use of personal protective equipment (PPE) (eg social distancing)
- Deploying surgical trainee to nonsurgical services
- Instituting innovative education and training solutions

21. During the pandemic, have you taken care of patients who tested positive for COVID-19?

- Yes
- No
- I am not sure

Comments

22. During the pandemic, have you been involved with interventional procedures (eg operation, bedside procedure) on patients who tested positive for COVID-19?

- Yes
- No
- I am not sure

Comments

23. If a patient is deemed high-risk for COVID-19 infection but the test results are still pending, how does the surgical team round/take care of the patient?

- Most senior-level resident sees and examined patient
- Only faculty see and examine the patient

- Full team rounds on patient as usual
- Patient is not examined until test result is back
- Other, please explain

Section 3: effect of COVID-19 on educational experience

24. What, if any, adaptations did your program(s) make to education programs for surgical trainees? (eg suspended, virtual, in-person, in-person with virtual option, recorded session [eg podcast, webinar], not applicable) (select all that apply)

- Morbidity and mortality
- American Board of Surgery In-Service Training Examination preparation
- Grand rounds
- Visiting professors
- Tumor board
- Research conferences
- Simulation training/center accessibility
- Teaching rounds
- Meetings with mentors
- Interviews for fellowship and/or jobs
- Training linked to telehealth platforms
- Please include any additional educational programs that were adapted and/or elaborate ways the above program(s) were adapted

25. How has the operative volume during COVID-19 affected you meeting minimum case requirements?

- Not impacted
- Slightly impacted
- Greatly impacted

26. To what extent did COVID-19 impact expected progression of your operative autonomy?

- Not at all
- Moderately
- To a great extent
- Do not know

27. Which of the following describes your institution's approach to evaluations during the COVID-19 pandemic? Check all that apply.

- Business as usual
- End-of-rotation evaluations have been suspended during the pandemic
- End-of-rotation evaluations have been modified to include pandemic-specific concerns
- The number of evaluations has been reduced
- Other, please elaborate

28. How do you believe formative (clinical performance) feedback has been impacted?

- Decreased significantly
- Stayed the same

- Increased significantly If feedback to learners has been modified in any way in response to COVID-19 pandemic, please describe here

Section 4: effects of COVID-19 on personal experience and risk perception

29. What has been your biggest concern during the COVID-19 pandemic? Please choose 1:
- Education
 - Clinical competency
 - Surgical case load
 - Ethical considerations
 - Fear of contracting COVID-19
 - Spread of infection to family
 - Other, please specify
30. As a result of changes during the COVID-19 pandemic, have you witnessed or been subject to harsh (eg what you believe to be unfair, unprofessional) treatment by attending physicians at your hospital? Please describe.
- Yes
 - No
 - Do not want to respond
- Comments
31. Has your program instituted any formal mechanisms to support resident wellness and promote resiliency during the COVID-19 pandemic?
- Yes
 - No
- Comments
32. Have you used any wellness or resiliency resources offered by the ACS or other professional societies during the COVID-19 pandemic?
- Yes
 - No
- Comments
33. Has your hospital system provided any residents with bonuses or “hazard pay”? If so, please describe amount.
- Yes
 - No
 - Do not want to respond
- Comments
34. Do you feel you have had adequate access to PPE during the COVID-19 pandemic and treating COVID-19 patients?
- Yes
 - No
35. Has your program asked you to provide your own PPE, whether medical grade or homemade?
- Yes
 - No
- No, however external PPE was independently acquired by residents and approved by the program director
 - No, however, external PPE was requested by residents and acquired by the program director
 - Do not want to answer
- Comments
36. Has your program provided COVID-19 testing of employees? If so, in what circumstances?
- Yes
 - No
 - Do not want to answer
- Comments (feel free to elaborate, as we recognize policies can be fluid based on local status on “COVID-19 curve”)
37. Do you feel like the type of care and risk of exposure you are being asked to take on is commensurate with your level of training, experience, and/or COVID-19-specific preparation by your program?
- Yes
 - No
 - Do not want to respond
- Comments
38. Do you feel attending surgeons and/or clinical educators are taking on the same level of risk compared with residents?
- Yes, same level
 - No, increased level
 - No, decreased level
 - Do not want to respond
- Comments
39. Do you think your program has treated the residents equally compared with attending surgeons during this pandemic?
- Yes, equally
 - No, unequally
 - Do not want to respond
- Comments
40. Please respond if you have experienced new or an increase in the following symptoms of depression (yes/no)
- Depression
 - Anxiety
 - Sleep problems
 - Change in appetite
 - Lack of interest or happiness in things you previously enjoyed
 - Weight loss or gain
 - Difficulty with attention
41. Please respond if you have experienced new or an increase in the following symptoms of burnout (yes/no)
- Emotional exhaustion (feelings of being emotionally overextended and exhausted by one’s work)

- Depersonalization (feeling an impersonal response towards patients)
 - Personal accomplishment (diminished feelings of competence and successful achievement in one's work)
42. Did your program leadership inquire whether any resident believes they are at high risk due to a pre-existing medical condition? If so, what was done to decrease risk of infection?
- Yes
 - No
 - Do not want to respond
- Comments
43. Has your program done anything to reduce the risk of the families of residents? Choose all that apply:
- Provided alternative housing or living arrangements
 - Provided professional cleaning and sterilization services of homes and living spaces
 - Provided cleaning supplies for homes
 - My program has not done anything
- Comments
- Other
 - Prefer not to answer
6. Do you have children?
- Yes
 - No
 - Prefer not to answer
7. In which region is your practice located?
- Northeast: Connecticut, Main, New Hampshire, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
 - South: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Oklahoma, North Carolina, South Carolina, Tennessee, Texas, Virginia, Washington DC, West Virginia
 - Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin
 - Western: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming
 - Other: please specify
8. How would you best describe your primary institution?
- University affiliated
 - Non-university affiliated
 - Military
 - Other, please specify
9. What type of practice are you in?
- Acute care, trauma, and burn
 - General surgery
 - Bariatric or minimally invasive surgery
 - Cardiothoracic surgery
 - Colorectal surgery
 - Critical care
 - Endocrine surgery
 - Neurological surgery
 - Ophthalmology
 - Orthopaedic surgery
 - Otolaryngology
 - Palliative care
 - Pediatric surgery
 - Plastic and reconstructive surgery
 - Surgical oncology or hepato-pancreatico-biliary
 - Transplant surgery
 - Urology
 - Vascular surgery
 - Other, please specify

ASSOCIATE FELLOW AND YOUNG FELLOWS ASSOCIATION QUESTIONS

Section 1: program information and demographics

1. What is your age?
- 26 to 30 y
 - 31 to 35 y
 - 36 to 40 y
 - 40 to 45 y
 - Do not want to specify
2. What is your sex?
- Male
 - Female
 - Other
 - Do not want to specify
3. What is your sexual orientation?
- Heterosexual
 - LGBTQ+
 - Prefer not to answer
4. What is your marital status?
- Married
 - Single
 - Divorced
 - Widowed
 - Prefer not to answer
5. What is your ethnicity?
- Caucasian
 - African American
 - Hispanic/Latino
 - Asian
- ### Section 2: effects of COVID-19 on clinical experience
10. What would you estimate is the status of COVID-19 admissions at your hospital currently?

- Numbers are still increasing (“uptick” of the curve)
 - Numbers are starting to level (“flattened” part of curve)
 - Numbers are decreasing
 - Do not know
- Comments
11. Compared with normal volumes, at its most significant, please indicate any reduction in elective operations as a result of COVID-19 pandemic, at the institutional level.
- No change
 - 1% to 25% reduction
 - 26% to 50% reduction
 - 51% to 75% reduction
 - 76% to 100% reduction
 - Do not know
- Comments
12. Compared with normal volumes, at its most significant, please indicate any reduction in emergency operations as a result of COVID-19 pandemic, at the institutional level.
- No change
 - 1% to 25% reduction
 - 26% to 50% reduction
 - 51% to 75% reduction
 - 76% to 100% reduction
 - Do not know
- Comments
13. What scheduling changes, if any, have your program made in response to the COVID-19 pandemic (select all that apply)
- Administrative staff have been fired
 - Administrative staff have been furloughed
 - Clinical staff (nurses/patient care technicians [PCTs]/medical assistants [MAs]) have been fired
 - Clinical staff (nurses/PCTs/MAs) have been furloughed
 - APP staff have been fired
 - APP Staff Have been furloughed
 - Physicians have been fired
 - Physicians have been furloughed
 - More work is designated to APPs (physician’s assistants [PAs], nurse practitioners [NPs])
 - Less work is designated to APPs (PA, NPs)
 - Vacations have been rescinded
 - Physicians have been re-assigned to nonsurgical services
 - No changes have been made
 - Changes were made but the schedule has now returned to “normal”
- Comments
14. During the pandemic, have you taken care of patients who tested positive for COVID-19?
- Yes
 - No
 - I am not sure
- Comments
15. During the pandemic, have you been involved with interventional procedures (eg surgery, bedside procedure) on patients who tested positive for COVID-19?
- Yes
 - No
 - I am not sure
- Comments
- Section 3: effects of COVID-19 on personal experience and risk perception**
16. What has been your biggest concern during the COVID-19 pandemic? Please choose 1:
- Surgical case load/practice concerns
 - Administrative issues
 - Lost compensation
 - Ethical considerations
 - Fear of contracting COVID-19
 - Spread of infection to family
 - Household issues relating to children or other dependents Other, please specify
17. Have you or will you see a decrease in compensation due to COVID-19?
- Yes
 - No
18. If yes, what percentage of annual income are you anticipating losing on a yearly basis compared with previous year.
- 0% to 10%
 - 10% to 20%
 - 20% to 30%
 - 30% to 40%
 - 40% to 50%
 - > 50%
19. If yes, has COVID-19 added or increased the level or amount of personal stressors due to decreased availability of school, childcare, other activities?
- Yes
 - No
- Comments
20. Has your hospital system provided any bonuses or “hazard pay”? If so, please describe amount.
- Yes
 - No

- Do not want to respond
 - Comment
21. Has your institution or department instituted any formal mechanism to support faculty wellness and promote resiliency during the COVID-19 pandemic?
- Yes
 - No
 - Comments
22. If yes to above, have you used those mechanisms?
- Yes
 - No
23. Are you aware of any wellness or resiliency mechanisms available to you from ACS or other organizations or professional societies during the COVID-19 pandemic?
- Yes
 - No
 - Comments
24. If yes to above, have you used those mechanisms?
- Yes
 - No
25. Do you feel you have had adequate access to PPE during the COVID-19 pandemic and treating COVID-19 patients?
- Yes
 - No
26. Has your institution asked you to provide your own PPE, whether medical grade or homemade?
- Yes
 - No
- Do not want to answer
 - Comments
27. Has your institution provided COVID-19 testing of employees? If so, in what circumstances?
- Yes
 - No
 - Do not want to answer
 - Comments (feel free to elaborate, as we recognize policies can be fluid based on local status on "COVID-19 curve")
28. Please respond if you have experienced new or an increase in the following symptoms of depression (yes/no)
- Depression
 - Anxiety
 - Sleep problems
 - Change in appetite
 - Lack of interest or happiness in things you previously enjoyed
 - Weight loss or gain
 - Difficulty with attention
29. Please respond if you have experienced new or an increase in the following symptoms of burnout (yes/no)
- Emotional exhaustion (feelings of being emotionally overextended and exhausted by one's work)
 - Depersonalization (feeling an impersonal response towards patients)
 - Personal accomplishment (diminished feelings of competence and successful achievement in one's work)

eTable 1. Residents’ (American College of Surgeons Residents and Associate Society Members) Responses to Survey Questions on Effects of COVID-19 Pandemic on Clinical, Educational, and Personal Experience

Experience	Survey response	
	n	%
Clinical		
Status of COVID-19 admissions at hospital currently		
Do not know	23	5
Numbers are decreasing	188	40
Numbers are starting to level (“flattened” part of curve)	64	14
Numbers are still increasing (“uptick” of the curve)	190	41
Reduction in elective operations as a result of COVID-19 pandemic		
1% to 25%	21	4
26% to 50%	31	7
51% to 75%	96	18
76% to 100%	304	65
Do not know	11	2
No change	12	3
Reduction in emergent operations as a result of COVID-19 pandemic		
1% to 25%	111	24
26% to 50%	92	20
51% to 75%	61	13
76% to 100%	17	4
Do not know	39	8
No change	145	31
Modification in schedule response to the COVID-19 pandemic		
Residents have been completely removed from services	143	31
Residents have been grouped into staggered shifts	325	70
More work is designated to APPs	36	8
Less work is designated to APPs	69	15
Vacations have been rescinded	152	33
Residents have been deployed to nonsurgical services	163	35
Changes were made but the schedule has returned to normal	333	72
No changes have been made	21	4
Modification in case coverage in response to COVID-19 pandemic		
No residents are allowed in OR	5	1
More cases are designated to APPs	4	1
No residents are allowed in the OR if a patient is known COVID-19- positive	37	8
Residents are allowed in the OR on a case-by-case basis	86	18

(Continued)

eTable 1. Continued

Experience	Survey response	
	n	%
Residents are limited in number in the OR	199	43
Changes were made but the schedule has returned to normal	244	52
No changes have been made	112	24
Modification in clinic coverage in response to COVID-19 pandemic		
No residents are allowed in clinic	127	27
Clinic appointments are designated to APPs	21	4
Residents are limited in number in clinic	92	20
Residents are seeing patients via telemedicine appointments	113	24
Changes were made but the schedule has returned to normal	221	48
No changes have been made	76	16
Impact of COVID-19 pandemic on didactic educational programs		
Extreme negative impact	55	12
Extreme positive impact	12	3
Negative impact	213	50
No impact	69	15
Positive impact	98	21
Impact of COVID-19 pandemic on elective operative experience		
Extreme negative impact	247	53
Negative impact	199	43
No impact	17	4
Positive impact	1	0.2
Impact of COVID-19 pandemic on emergent operative experience		
Extreme negative impact	31	7
Extreme positive impact	3	0.6
Negative impact	194	42
No impact	224	48
Positive impact	11	2
Impact of COVID-19 pandemic on clinic experience		
Extreme negative impact	80	17
Extreme positive impact	3	0.6
Negative impact	263	57
No impact	96	21
Positive impact	22	5
Impact of COVID-19 pandemic on outside rotations		
Extreme negative impact	150	32
Negative impact	156	34
No impact	154	33
Positive impact	5	1

(Continued)

eTable 1. Continued

Experience	Survey response	
	n	%
Impact of COVID-19 pandemic on feedback on clinical performance/assessment		
Extreme negative impact	39	9
Extreme positive impact	1	0.2
Negative impact	135	29
No impact	280	60
Positive impact	8	2
Impact of COVID-19 pandemic on physical health		
Extreme negative impact	44	10
Extreme positive impact	6	1
Negative impact	174	37
No impact	189	41
Positive impact	52	11
Impact of COVID-19 pandemic on physical safety		
Extreme negative impact	48	10
Extreme positive impact	3	0.6
Negative impact	199	43
No impact	202	43
Positive impact	12	3
Impact of COVID-19 pandemic on emotional health		
Extreme negative impact	86	18
Extreme positive impact	6	1
Negative impact	239	52
No impact	111	24
Positive impact	22	5
To what degree your institution has demonstrated sensitivity to specific concerns of residents		
Not at all	35	8
Somewhat	238	51
To a great extent	189	41
To what degree your institution has enhanced safety measures in addition to routine use of PPE		
Not at all	23	5
Somewhat	167	36
To a great extent	275	59
To what degree your institution has deployed surgical trainees to non-surgical services		
Not at all	214	46
Somewhat	130	28
To a great extent	82	18

(Continued)

eTable 1. Continued

Experience	Survey response	
	n	%
To what degree your institution instituted innovative education and training solutions		
Not at all	51	11
Somewhat	255	55
To a great extent	154	33
Have you taken care of a COVID-19-positive patient?		
I am not sure	22	5
No	64	14
Yes	379	82
Have you performed an operation or an invasive procedure on a COVID-19-positive patient?		
I am not sure	24	5
No	136	29
Yes	305	66
If a patient is deemed high risk for COVID-19 but test results are pending, how does the surgical team round/take care of patient?		
Full team rounds on patient as usual	65	14
Most senior level resident sees and examines patient	290	62
Only faculty see and examine the patient	57	12
Patient is not examined until test result is secured	15	3
Educational		
Educational programs which have been adapted/modified during COVID-19 pandemic		
Morbidity and mortality conference	388	83
ABSITE preparation	163	35
Grand rounds	373	80
Visiting professors	291	63
Tumor board	262	56
Research conferences	288	62
Simulation training/center accessibility	256	55
Teaching rounds	219	47
Meetings with mentors	157	34
Interview for fellowship and/or jobs	252	54
Training linked to telehealth platforms	80	17
Impact of COVID-19 pandemic operative volume on ability to meet minimum case requirement		

(Continued)

eTable 1. Continued

Experience	Survey response	
	n	%
Greatly impacted	110	24
Not impacted	163	35
Slightly impacted	189	41
Impact of COVID-19 on expected progression of operative autonomy		
Do not know	53	12
Moderately	195	42
Not at all	136	29
To a great extent	78	17
Institutional approach to evaluations during COVID-19 pandemic		
Business as usual	303	65
End-of-rotation evaluations have been suspended	36	8
End-of-rotation evaluations have been modified to include pandemic-specific concerns	47	10
Number of evaluations has been reduced	84	18
Impact of COVID-19 on formative feedback		
Decreased significantly	173	38
Increased significantly	9	2
Stayed the same	274	60
Personal		
Biggest concern during COVID-19 pandemic		
Clinical competency	37	8
Education	23	5
Ethical considerations	23	5
Fear of contracting COVID-19	64	14
Spread of infection to family	172	37
Surgical case load	131	28
Have you witnessed or been subject to harsh treatment as a result of changes during COVID-19 pandemic	51	11
Program has instituted formal mechanisms to support resident wellness and promote resiliency	240	52
Used wellness or resiliency programs offered by the ACS or other professional societies during the COVID-19 pandemic	60	13
Received bonuses or "hazard pay"	89	19
Perceived to have adequate PPE access	300	65

(Continued)

eTable 1. Continued

Experience	Survey response	
	n	%
Program has asked you to provide your own PPE		
No	320	70
No, however, external PPE was independently acquired by residents and approved by the program director	73	16
No, however, external PPE was requested by residents and acquired by the program director	22	5
Yes	38	8
Program has provided COVID-19 testing	364	79
Believe type of care and risk of exposure is commensurate with your level of training	364	79
Believe attending surgeons and/or clinical educators are taking on same level of risk		
No, decreased level	206	44
No, increased level	65	14
Yes, same level	186	40
Believe program has treated residents equally as compared with attendings during the pandemic		
Do not want to respond	21	4
No, unequally	178	38
Yes, equally	264	57
Program asked if high risk due to pre-existing condition	214	46
Program instituted the following to reduce risk of families:	26	6
Provided alternative housing or living arrangements	149	32
Provided professional cleaning and sterilization services of homes and living spaces	5	1
Provided cleaning supplies for homes	2	0.4
Program has not done anything	288	62
Have experienced new or an increase in the following symptoms:		
Depressed mood	142	30
Anxiety	250	54
Change in sleep habits	174	37
Change in appetite	101	22
Lost interest	144	31

(Continued)

eTable 1. Continued

Experience	Survey response	
	n	%
Change in weight	182	39
Change in ability to sustain attention	165	36
Emotional exhaustion	257	55
Depersonalization	180	39
Decrease in sense of personal achievement	209	45

Data are not shown for "prefer not to answer" or "other" responses and is included in percent calculations
 ABSITE, American Board of Surgery in-Training Examination; ACS, American College of Surgeons; APP, advanced practice provider; OR, operating room; PPE, personal protective equipment.

eTable 2. Early-Career Surgeons' Responses to Survey Questions on Effects of COVID-19 Pandemic on Clinical and Personal Experience

Experience	Survey response	
	n	%
Clinical		
Status of COVID-19 admissions at hospital currently		
Do not know	28	4
Numbers are decreasing	212	30
Numbers are starting to level ("flattened" part of curve)	106	15
Numbers are still increasing ("uptick" of the curve)	348	50
Reduction in elective operations as a result of COVID-19 pandemic		
15% to 25%	106	15
26% to 50%	120	17
51% to 75%	161	23
76% to 100%	266	38
Do not know	6	1
No change	35	5
Reduction in emergent operations as a result of COVID-19 pandemic		
1% to 25%	192	28
26% to 50%	124	18
51% to 75%	62	9
76% to 100%	10	2
Do not know	34	5
No change	271	39
Modification in schedule response to the COVID-19 pandemic		
Administrative staff have been fired	54	8
Administrative staff have been furloughed	200	29
Clinical staff (nurses/PCT/MAs) have been fired	47	7
Clinical staff (nurses/PCT/MAs) have been furloughed	195	28
APP staff have been fired	16	2
APP staff have been furloughed	83	12
Physicians have been fired	33	5
Physicians have been furloughed	72	10
More work is designated to APPs	75	11
Less work is designated to APPs	52	8
Vacations have been rescinded	203	29
Physicians have been reassigned to nonsurgical services	181	26
No changes have been made	89	13
Changes were made but the schedule has returned to normal	280	40

(Continued)

eTable 2. Continued

Experience	Survey response	
	n	%
Have you taken care of a COVID-19-positive patient?		
I am not sure	45	6
No	180	26
Yes	468	68
Have you performed an operation or an invasive procedure on a COVID-19-positive patient?		
I am not sure	43	6
No	292	42
Yes	357	52
Personal		
Biggest concern during COVID-19 pandemic		
Administrative issues	25	4
Ethical considerations	30	4
Fear of contracting COVID-19	100	14
Household issues relating to children or other dependents	54	8
Lost compensation	46	7
Spread of infection to family	279	40
Surgical case load/practice concerns	126	18
Decrease in compensation due to COVID-19 pandemic	390	56
Percent of annual income anticipated to lose this year as compared with previous year		
> 50%	20	4
0% to 10%	170	36
10% to 20%	127	27
20% to 30%	89	19
30% to 40%	40	8
40% to 50%	32	7
COVID-19 has added or increased personal stressors due to decreased availability of school, childcare, other activity	469	86
Received bonuses or "hazard pay"	75	11
Program has instituted formal mechanism to support resident wellness and promote resiliency	368	53
Has used program's wellness resources	80	18
Aware of wellness programs from ACS and other professional societies	234	34
Used wellness or resiliency programs offered by the ACS or other professional societies during the COVID-19 pandemic	53	15

(Continued)

eTable 2. Continued

Experience	Survey response	
	n	%
Perceived to have adequate PPE access	479	70
Program has asked you to provide your own PPE	143	21
Program has provided COVID-19 testing	528	77
Have experienced new or an increase in the following symptoms:		
Depressed mood	212	31
Anxiety	424	61
Change in sleep habits	287	42
Change in appetite	145	21
Lost interest	246	36
Change in weight	302	44
Change in ability to sustain attention	231	34
Emotional exhaustion	385	56
Depersonalization	204	30
Decrease in sense of personal achievement	307	45

Data are not shown for "prefer not to answer" or "other" responses and is included in percent calculations.

ACS, American College of Surgeons; APP, advanced practice provider; MA, medical assistant; PCT, patient care technician; PPE, personal protective equipment.

eTable 3. Comparison of Survey Responses Between American College of Surgeons Residents and Early-Career Surgeons

Demographic	Resident (n = 465)		Associate member (n = 695)		p Value
	n	%	n	%	
Age					< 0.001
20 to 25 y	3	0.6	0	0	
26 to 30 y	170	37	10	2	
31 to 35 y	241	52	168	24	
36 to 40 y	46	10	306	45	
40 to 45 y	5	1	202	29	
Sex, m	216	47	396	57	0.001
Race					0.001
African American	16	4	14	2	
Asian	71	16	146	22	
Caucasian	300	67	383	57	
Hispanic/Latino	41	9	75	11	
Other	20	4	59	9	
LGBTQ+ sexual orientation	29	6	18	3	0.004
Marital status					< 0.001
Divorced	7	2	27	4	
Married	219	48	524	77	
Single	232	51	132	19	
Have children	110	24	456	67	< 0.001
Region of hospital					< 0.001
Midwest	96	21	106	15	
Northeast	152	33	98	14	
South	99	21	176	25	
Western	72	15	113	16	
Other	46	10	200	29	
Institution affiliation					< 0.001
Military	9	2	39	6	
Non-university affiliated	75	16	251	36	
Other, please specify	3	1	25	4	
University affiliated	377	81	379	55	
Status of COVID-19 admissions at hospital currently					0.003
Do not know	23	5	28	4	
Numbers are decreasing	188	40	212	30	
Numbers are starting to level (“flattened” part of curve)	64	14	106	15	
Numbers are still increasing (“uptick” of the curve)	190	41	348	50	
Reduction in elective operation as a result of COVID-19 pandemic					< 0.001
1% to 25%	21	4	106	15	
26% to 50%	31	7	120	17	
51% to 75%	86	18	161	23	
76% to 100%	304	65	266	38	
Do not know	11	2	6	1	
No change	12	3	35	5	
Reduction in emergent operations as a result of COVID-19 pandemic					< 0.001
1% to 25%	111	24	192	28	
26% to 50%	92	20	124	18	

(Continued)

eTable 3. Continued

Demographic	Resident (n = 465)		Associate member (n = 695)		p Value
	n	%	n	%	
51% to 75%	61	13	62	9	
76% to 100%	17	4	10	1	
Do not know	39	8	34	5	
No change	145	31	271	39	
Have you taken care of a COVID-19-positive patient?					< 0.001
I am not sure	22	5	45	6	
No	64	14	180	26	
Yes	379	81	468	68	
Have you operated or performed an interventional procedure on a COVID-19-positive patient?					< 0.001
I am not sure	24	5	43	6	
No	136	29	292	42	
Yes	305	66	357	52	
Biggest concern during COVID-19 pandemic					< 0.001
Clinical competency	37	8	0	0	
Education	23	5	0	0	
Ethical considerations	23	5	30	4	
Other, please specify	13	3	34	5	
Spread of infection to family	172	37	279	40	
Surgical case load	131	28	126	18	
Administrative issues	0	0	24	4	
Fear of contracting COVID-19	64	14	100	14	
Household issues relating to children or other dependents	0	0	54	8	
Received bonuses or "hazard pay"	89	19	75	11	< 0.001
Program has instituted formal mechanism to support resident wellness and promote resiliency	240	52	368	53	0.70
Aware of wellness programs from ACS and other professional societies	60	13	53	15	0.51
Perceived to have adequate PPE access	300	66	479	70	0.11
Program has asked you to provide your own PPE					< 0.001
Do not want to answer	3	1	5	1	
No	320	70	539	78	
No, however, external PPE was independently acquired by residents and approved by the program director	73	16	0	0	
No, however, external PPE was requested by residents and acquired by the program director	22	5	0	0	
Yes	38	8	143	21	
Program has provided COVID-19 testing					0.009
Do not want to respond	4	1	0	0	
No	93	20	154	22	
Yes	364	79	528	77	
Do not want to answer	0	0	7	1	
Have experienced new or an increase in the following symptoms:					
Depressed mood	142	30	212	31	0.90
Anxiety	250	54	424	61	0.01
Change in sleep habits	174	37	287	42	0.15
Change in appetite	101	22	145	21	0.92

(Continued)

eTable 3. Continued

Demographic	Resident (n = 465)		Associate member (n = 695)		p Value
	n	%	n	%	
Lost interest	144	31	246	36	0.12
Change in weight	182	39	302	44	0.10
Change in ability to sustain attention	165	36	231	34	0.62
Emotional exhaustion	257	55	385	56	0.96
Depersonalization	180	39	204	30	0.002
Decrease in sense of personal achievement	209	45	307	45	0.94
High depression score	150	32	244	35	0.35
High burnout score	209	45	284	41	0.19

Data are not shown for "prefer not to answer" or "other" responses and are included in percent calculations.

ACS, American College of Surgeons; LGBTQ+, lesbian, gay, bisexual, transgender, and queer (or questioning) and others; PPE, personal protective equipment.

eTable 4. Factors Associated with High Depression Score (4 or More Symptoms) and High Burnout Score (2 or More Symptoms)

Depression and burnout, associated factor	Low symptoms		High symptoms		p Value
	n	%	n	%	
Depression*					
Membership type					0.34
Resident	315	41	150	38	
Early-career surgeon	451	59	244	62	
Age					0.12
20 to 25 y	0	0	3	1	
26 to 30 y	124	16	56	14	
31 to 35 y	276	36	133	34	
36 to 40 y	226	30	126	32	
40 to 45 y	137	18	70	18	
Sex, m	429	56	183	47	0.007
Race					0.06
African American	23	3	7	2	
Asian	140	19	77	20	
Caucasian	465	63	218	57	
Hispanic/Latino	64	9	52	14	
Other	51	7	28	7	
LGBTQ+ sexual orientation	28	4	19	5	0.38
Marital status					0.06
Divorced	17	2	17	4	
Married	504	67	239	62	
Single	234	31	130	34	
Have children	389	52	177	46	0.07
Region of hospital					0.37
Midwest	139	18	63	16	
Northeast	168	22	82	21	
South	182	24	89	23	
Western	125	16	60	15	
Other	152	20	98	25	
Institutional affiliation					0.46
Military	35	5	13	3	
Non-university affiliated	222	29	104	26	
University affiliated	489	64	267	68	
Other, please specify	20	3	8	2	
Status of COVID-19 admissions at hospital currently					0.20
Do not know	35	5	16	4	
Numbers are decreasing	277	36	123	31	
Numbers are starting to level ("flattened" part of curve)	115	15	55	14	
Numbers are still increasing ("uptick" of the curve)	338	44	200	51	
Reduction in elective operations as a result of COVID-19 pandemic					0.24
1% to 25%	94	12	33	8	
26% to 50%	104	14	47	12	
51% to 75%	155	20	92	23	
76% to 100%	371	48	199	51	
Do not know	13	2	4	1	
No change	29	4	18	5	

(Continued)

eTable 4. Continued

Depression and burnout, associated factor	Low symptoms		High symptoms		p Value
	n	%	n	%	
Reduction in emergent operations as a result of COVID-19 pandemic					0.07
1% to 25%	208	27	95	24	
26% to 50%	140	18	76	19	
51% to 75%	69	9	54	14	
76% to 100%	18	2	9	2	
Do not know	56	7	17	4	
No change	273	36	143	36	
Have you taken care of a COVID-19-positive patient?					0.29
I am not sure	47	6	20	5	
No	170	22	74	19	
Yes	549	72	298	76	
Have you operated or performed an interventional procedure on a COVID-19-positive patient?					0.14
I am not sure	42	6	25	6	
No	298	39	130	33	
Yes	424	56	238	61	
Biggest concern during COVID-19 pandemic					0.03
Clinical competency	22	3	15	4	
Education	11	1	12	3	
Ethical considerations	33	4	20	5	
Other, please specify	27	4	20	5	
Spread of infection to family	298	39	153	39	
Surgical case load	191	25	66	17	
Administrative issues	14	2	11	3	
Fear of contracting COVID-19	99	13	65	16	
Household issues relating to children or other dependents	39	5	15	4	
Lost compensation	30	4	16	4	
Received bonuses or "hazard pay"	114	15	50	13	0.38
Program has instituted formal mechanism to support resident wellness and promote resiliency	427	56	181	46	0.001
Used wellness programs from ACS and other professional societies	53	10	60	22	< 0.001
Perceived to have adequate PPE access	538	72	241	62	0.001
Program has asked you to provide your own PPE					< 0.001
Do not want to answer	3	0.4	5	1	
No	594	79	265	68	
No, however, external PPE was independently acquired by residents and approved by the program director	47	6	26	7	
No, however, external PPE was requested by residents and acquired by the program director	11	2	11	3	
Yes	97	13	84	22	
Program has provided COVID-19 testing					0.51
Do not want to respond	3	0.4	1	0.3	
No	153	20	94	24	
Yes	596	79	296	75	
Do not want to answer	5	1	2	1	

(Continued)

eTable 4. Continued

Depression and burnout, associated factor	Low symptoms		High symptoms		p Value
	n	%	n	%	
Burnout ^f					
Membership type					0.18
Resident	256	38	209	42	
Early-career surgeon	411	62	284	58	
Age					0.08
20 to 25 y	0	0	3	1	
26 to 30 y	93	14	87	18	
31 to 35 y	248	38	161	33	
36 to 40 y	199	30	153	31	
40 to 45 y	121	18	86	18	
Sex, m	382	57	230	47	0.002
Race					0.05
African American	22	3	8	2	
Asian	135	21	82	17	
Caucasian	393	61	290	61	
Hispanic/Latino	56	9	60	13	
Other	43	7	36	8	
LGBTQ+ sexual orientation	26	4	21	4	0.88
Marital status					0.24
Divorced	23	4	11	2	
Married	434	66	309	64	
Single	199	30	165	34	
Have children	332	51	234	48	0.38
Region of hospital					0.06
Midwest	121	18	81	16	
Northeast	128	19	122	25	
South	166	25	105	21	
Western	98	15	87	18	
Other	153	23	97	20	
Institutional affiliation					0.18
Military	31	5	17	4	
Non-university affiliated	189	28	137	28	
University affiliated	426	64	330	67	
Other, please specify	21	3	7	1	
Status of COVID-19 admissions at hospital currently					0.47
Do not know	26	4	25	5	
Numbers are decreasing	238	36	162	33	
Numbers are starting to level (“flattened” part of curve)	102	15	68	14	
Numbers are still increasing (“uptick” of the curve)	301	45	237	48	
Reduction in elective operations as a result of COVID-19 pandemic					0.04
1% to 25%	88	13	39	8	
26% to 50%	92	14	59	12	
51% to 75%	139	21	108	22	
76% to 100%	312	47	258	52	
Do not know	12	2	5	1	
No change	24	4	23	5	

(Continued)

eTable 4. Continued

Depression and burnout, associated factor	Low symptoms		High symptoms		p Value
	n	%	n	%	
Reduction in emergent operations as a result of COVID-19 pandemic					0.20
1% to 25%	179	27	124	25	
26% to 50%	111	17	105	21	
51% to 75%	64	10	59	12	
76% to 100%	15	2	12	2	
Do not know	42	6	31	6	
No change	254	38	162	33	
Have you taken care of a COVID-19-positive patient?					0.007
I am not sure	45	7	22	4	
No	157	24	87	18	
Yes	464	70	383	78	
Have you operated or performed an interventional procedure on a COVID-19-positive patient?					0.008
I am not sure	39	6	28	6	
No	271	41	157	32	
Yes	356	54	306	62	
Biggest concern during COVID-19 pandemic					0.06
Clinical competency	22	3	15	3	
Education	9	1	14	3	
Ethical considerations	27	4	26	5	
Spread of infection to family	258	39	193	39	
Surgical case load	171	26	86	18	
Administrative issues	13	2	12	2	
Fear of contracting COVID-19	86	13	78	16	
Household issues relating to children or other dependents	32	5	22	4	
Lost compensation	24	4	22	4	
Other, please specify	24	4	23	5	
Received bonuses or "hazard pay"					0.31
Do not want to respond	16	2	7	1	
No	554	84	407	83	
Yes	88	13	76	16	
Program has instituted formal mechanisms to support resident wellness and promote resiliency	383	58	225	46	< 0.001
Used wellness programs from ACS and other professional societies	58	12	55	16	0.15
Perceived to have adequate PPE access	493	75	286	59	< 0.001
Program has asked you to provide your own PPE					< 0.001
Do not want to answer	5	1	3	1	
No	525	80	334	69	
No, however, external PPE was independently acquired by residents and approved by the program director	31	5	42	9	
No, however, external PPE was requested by residents and acquired by the program director	9	2	13	3	
Yes	87	13	94	19	

(Continued)

eTable 4. Continued

Depression and burnout, associated factor	Low symptoms		High symptoms		p Value
	n	%	n	%	
Program has provided COVID-19 testing					0.52
Do not want to respond	3	1	1	0.2	
No	134	20	113	23	
Yes	518	79	374	76	

Data are not shown for "prefer not to answer" or "other" responses and is included in percent calculations.

*Depression: low symptoms (n = 766), high symptoms (n = 394).

†Burnout: low symptoms (n = 667), high symptoms (n = 493).

ACS, American College of Surgeons; LGBTQ+, lesbian, gay, bisexual, transgender, and queer (or questioning) and others; PPE, personal protective equipment.