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# The Effects of the COVID-19 Pandemic on Resident Education and Wellness: A National Survey of Plastic Surgery Residents

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**Background:** The coronavirus disease of 2019 (COVID-19) pandemic has had a profound effect on surgical training programs, reflecting decreases in elective surgical cases and emergency restructuring of clinical teams. The effect of these measures on U.S. plastic surgery resident education and wellness has not been characterized.

**Methods:** An institutional review board–exempted anonymous survey was developed through expert panel discussion and pilot testing. All current U.S. plastic surgery trainees were invited to complete a cross-sectional 28-question survey in April of 2020. Respondents were queried regarding demographic information, educational experiences, and wellness during the COVID-19 pandemic.

**Results:** A total of 668 residents responded to the survey, corresponding to a 56.1 percent response rate. Sex, training program type, postgraduate year, and region were well represented within the sample. Nearly all trainees (97.1 percent) reported restructuring of their clinical teams. One-sixth of respondents were personally redeployed to assist with the care of COVID-19 patients. A considerable proportion of residents felt that the COVID-19 pandemic had a negative impact on their education (58.1 percent) and wellness (84.8 percent). Residents found virtual curriculum effective and meaningful, and viewed an average of 4.2 lectures weekly. Although most residents did not anticipate a change in career path, some reported negative consequences on job prospects or fellowship.

**Conclusions:** The COVID-19 pandemic had a considerable impact on U.S. plastic surgery education and wellness. Although reductions in case volume may be temporary, this may represent a loss of critical, supervised clinical experience. Some effects may be positive, such as the development of impactful virtual lectures that allow for cross-institutional curriculum. (*Plast. Reconstr. Surg.* 148: 462e, 2021.)

The coronavirus disease of 2019 (COVID-19) pandemic has had an unprecedented impact on all facets of health care allocation and administration worldwide.<sup>1</sup> Academic medical centers and residency programs are no exception, facing the added challenge of maintaining an educational environment despite

rapidly evolving clinical circumstances. As hospital systems prepared for increasing admission of COVID-19–positive patients, surgical specialties underwent anticipatory restructuring to mitigate risk of exposure and preservation of personal protective equipment.<sup>2–9</sup> These restructuring efforts, paired with the Centers for Disease Control and Prevention recommendations to limit in-person gatherings, have greatly affected surgical education for the foreseeable future.<sup>10</sup> Plastic surgery

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See the Appendix for a list of the Resident Council Wellness and Education Study Group members.

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residents have been and continue to be significantly affected by these measures in several ways.<sup>11</sup>

Resident physicians have been actively involved with all aspects of COVID-19 patient care when needed, and medical centers developed a number of systems to support these efforts.<sup>12,13</sup> Such redeployment of residents to other medical specialties is often necessary to ensure adequate care of all patients within a hospital or health care system, although these unanticipated clinical duties may have an impact on their surgical training and wellness. Plastic surgery residents are uniquely positioned for redeployment secondary to broad interdisciplinary training and availability with nonurgent case de-escalation.

Case volume and “hands-on” surgical education have been significantly reduced, reflecting Centers for Medicare and Medicaid Services and American Society of Plastic Surgeons recommendations to temporarily halt elective and nonurgent procedures and minimize nonessential personnel in the operating room.<sup>14,15</sup> These guidelines may have a greater impact on plastic surgery caseload, as many of these procedures can be delayed without significant mortality or morbidity.<sup>6,9</sup> Ultimately, the surgical team and/or institution decide the urgency of the particular surgical patient, introducing an unknown degree of practice variability.

Plastic surgery training programs have also been confronted with a significant change in the way didactic education is conducted.<sup>16,17</sup> Innovative and efficient responses to resident training have been marshaled by individual institutions and national organizations with the goal of sustaining educational opportunities. These largely focus on virtual learning by way of flipped classroom discussions, online conferences, and recorded dissections and procedures.<sup>18</sup> These teaching methodologies have the potential to become a mainstay of structured plastic surgery education going forward.

The COVID-19 pandemic has created sudden stressors across numerous domains in plastic surgery. To endure the ongoing COVID-19 pandemic and its aftermath, the plastic surgery community must pay special attention to the safety of not only our patients but also ourselves and our community.<sup>19</sup> Although focusing on wellness is always important, it has become even more crucial in these times.

In the context of a rapidly changing health care environment, there has been no investigation into the experiences of U.S. plastic surgery residents during the COVID-19 pandemic. Redeployment,

social distancing, reduced caseload, virtual education, and risk for COVID-19 transmission may all have a substantial effect on the wellness and learning of plastic surgery residents. Resident perspectives on clinical team restructuring, engagement in alternative learning strategies, and future career plans are of substantial value going forward. The goal of this study was to understand the determinants of plastic surgery resident educational experiences during the COVID-19 pandemic.

## METHODS

### Study Population

The University of Washington Institutional Review Board granted exempt status for this project before enrolling any subjects (STUDY00010119). All trainees in a plastic surgery program within the United States were eligible to participate in the survey. Participants were excluded if they were not currently enrolled in a plastic surgery residency program (e.g., fellows, observers, medical students), or declined to participate in the study. The total number of plastic surgery residents for the 2019 to 2020 academic year for integrated and independent programs was 1190 as reported by the Accreditation Council for Graduate Medical Education and served as the target population for this study.<sup>20</sup>

### Survey Instrument

A novel survey instrument was initially developed by an expert panel with experience in survey methodology, medical education, and wellness. The panel consisted of three plastic surgery residents (C.S.C., J.L., and S.D.M.) and two academic plastic surgeons (B.C.D. and J.E.J.) from four different institutions. Consensus agreement among the panel members resulted in the production of a draft instrument. Nine plastic surgery residents from six academic institutions in postgraduate years 1 through 9 (residents in both independent and integrated plastic surgery tracks) were selected to pilot the instrument, and their feedback was incorporated into the final survey. (See **Figure, Supplemental Digital Content 1**, which shows the pilot study feedback for design of final study instrument, <http://links.lww.com/PRS/E586>.) The expert panel approved the final survey instrument after incorporation of pilot study feedback. (See **Figure, Supplemental Digital Content 2**, which shows the final survey instrument distributed to U.S. residents, <http://links.lww.com/PRS/E587>.) Survey development followed the standards of adaptation toward the intended respondent population.<sup>21–23</sup>

The anonymous survey consisted of three sections: a cover page providing an overview and purpose of the study, questions related to plastic surgery resident education and wellness during the COVID-19 pandemic, and a demographic component. Demographic information included residency program location, postgraduate year, training program type (integrated versus independent), living situation, and sex (questions 25 through 28 in **Figure, Supplemental Digital Content 2**, <http://links.lww.com/PRS/E587>). The remainder of the questionnaire addressed the respondent's educational experiences, institutional responses, redeployment, and wellness during the COVID-19 pandemic (questions 1 through 24 in **Figure, Supplemental Digital Content 2**, <http://links.lww.com/PRS/E587>). Not all questions were applicable to every respondent; thus, branched logic arguments were used throughout the survey.

The final survey was circulated in electronic format every 2 days for a 9-day period in April of 2020. An institutional Web-based survey tool was used as the platform for electronic survey circulation.<sup>24</sup> The survey instrument was not linked to identifiable information, and all responses were anonymous.

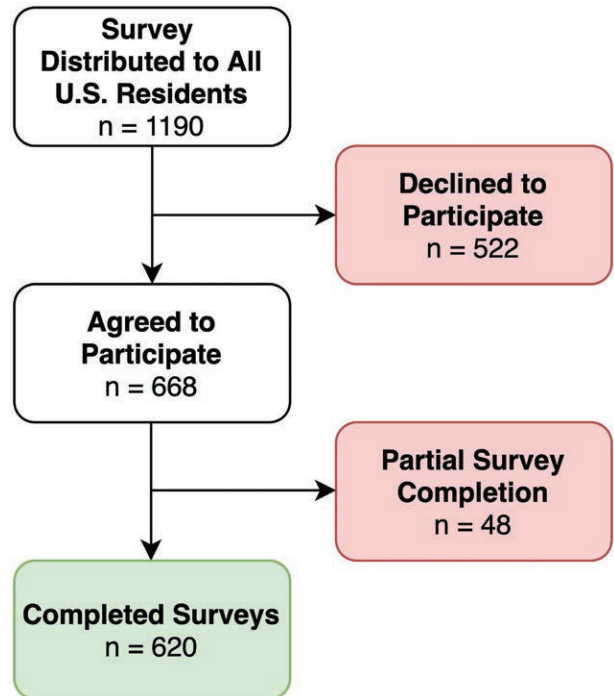
**Statistical Analysis**

All data were coded for appropriate analysis. Ten percent of the data were reentered to check for errors in data entry, with none found. Statistical analyses were performed using Microsoft Excel (Microsoft Corp., Redmond, Wash.). Significance was set at  $p < 0.05$ . All variables were categorical; therefore, all bivariate analysis consisted of chi-square tests, unless any cell in the contingency tables contained fewer than five, in which case Fisher's exact test was used.

**RESULTS**

A total of 668 plastic surgery residents responded to the survey request, corresponding to a 56.1 percent response rate. Of these respondents, 48 were only partially completed, thus a total of 620 surveys were included for final analysis (**Fig. 1**).

Male and female respondents constituted 57.6 percent and 42.1 percent of respondents, respectively, and two respondents identified as transgender (**Table 1**). Approximately 80 percent were in integrated track and 20 percent were in independent track training programs. Resident level was well represented in the sample. Geographic



**Fig. 1.** Survey respondents.

location was also evenly divided between Northeast (26.9 percent), Midwest (24.8 percent), South (24.5 percent), and West (23.7 percent) U.S. Census regions. A majority of respondents

**Table 1. Respondent Demographics**

	No. (%)
Sex	
Female	261 (42.1)
Male	357 (57.6)
Transgender	2 (0.3)
Nonbinary/other	0 (0)
Postgraduate year	
Integrated	513 (82.9)
Year 1	95 (15.3)
Year 2	89 (14.3)
Year 3	93 (15.0)
Year 4	75 (12.1)
Year 5	76 (12.3)
Year 6	74 (11.9)
Research/professional development	12 (1.9)
Independent	106 (17.1)
Year 1	37 (6.0)
Year 2	35 (5.6)
Year 3	34 (5.5)
Region	
Northeast	167 (26.9)
Midwest	154 (24.8)
South	152 (24.5)
West	147 (23.7)
Living situation	
Live alone	176 (28.4)
Live with an adult in the health care field	219 (35.3)
Live with an adult not in the health care field	203 (32.7)
Live with your child/children	123 (19.8)
Live with someone older than 65 yr	10 (1.6)

reported living with at least one other individual (71.6 percent). One-third of residents reported living with an adult who also works in the health care field. Approximately 20 percent of residents live with a child and 1.6 percent live with an adult older than 65 years.

Nearly all plastic surgery trainees (97.1 percent) reported restructuring of their residency program during the COVID-19 pandemic; however, only 14.4 percent were personally redeployed to assist in the care of COVID patients, either directly or indirectly (Table 2). Ten percent of redeployed residents worked on more than one service. The majority of redeployments were to COVID-specific intensive care units (56.4 percent), and the remainder were to non-COVID-19 intensive care units (15.8 percent), general surgery services (10.9 percent), emergency departments (7.9 percent), medicine services (5.9 percent), and non-M.D. roles (3.0 percent) (Fig. 2). Male residents were more frequently redeployed than their female counterparts, although the difference did not reach statistical significance (16.7 percent versus 11.1 percent;  $p = 0.06$ ). Similarly, integrated residents in their first 3 years of training were more likely to be redeployed as compared to integrated residents in their last 3 years or independent residents (18.8 percent versus 9.8 percent versus 13.2 percent, respectively;  $p = 0.03$ ).

A majority of residents felt that the COVID-19 pandemic had either a somewhat negative (47.9 percent) or a very negative (10.2 percent) impact on their education (Table 3). One-fifth of residents reported a somewhat positive impact.

**Table 2. Plastic Surgery Program Restructuring**

	No. (%)	<i>p</i>
Restructuring of residency	602 (97.1)	
Redeployment	89 (14.4)	
Area of redeployment*		
Emergency department	8 (7.9)	
Intensive care unit (non-COVID)	16 (15.8)	
COVID intensive care unit	57 (56.4)	
Medicine service	6 (5.9)	
General surgery	11 (10.9)	
Non-M.D. role†	3 (3.0)	
More than one area	10 (9.9)	
Sex and redeployment		0.06
Male	59 (16.5)	
Female	29 (11.1)	
Training level and redeployment		0.03‡
Integrated yr 1–3	18.8 (52)	
Integrated yr 4–6	22 (9.8)	
Independent	14 (13.2)	
Research/professional development	1 (8.3)	

\*Calculated based on 89 residents redeployed and 10 redeployed more than once.

†Non-M.D. roles included respiratory therapy, personal protective equipment team, and scribe.

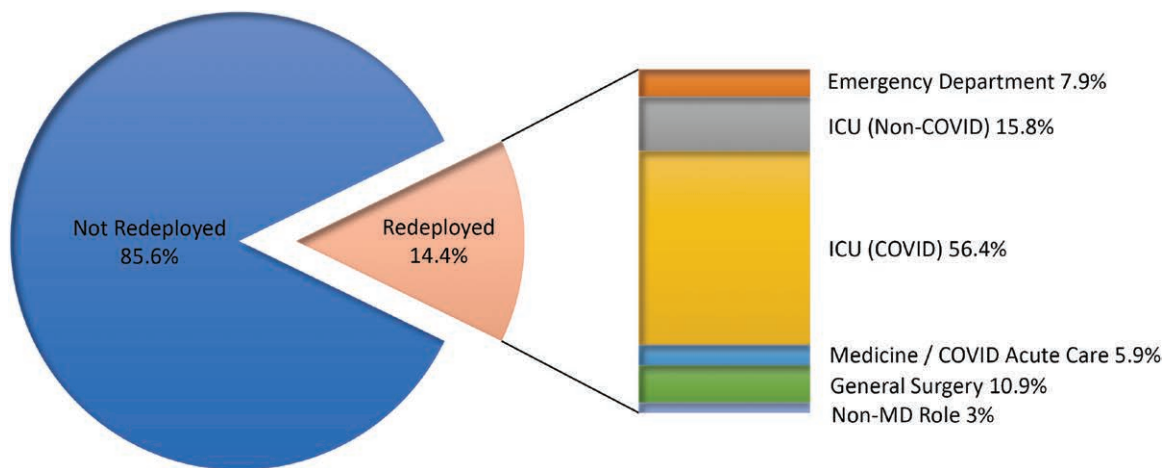
‡Statistically significant.

Eighteen percent of residents reported mandatory research by their program during the COVID-19 pandemic.

Ten percent reported a maximal negative impact on their operative experience, whereas 42.4 and 47.6 percent reported a moderate or minimal effect, respectively. Residents in their final year of training (integrated year 6 and independent year 3) reported a more significant impact on operative experience (Fig. 3). Overall, 7 percent of plastic surgery residents felt that they were not or will not be able to meet recommended case minimums secondary to COVID-related decreases in operative volume; however, this varied greatly by year and program type (Fig. 4). Approximately one-quarter of independent residents in their final year of training feared that they would not meet case minimums because of the postponement or cancellation of cases. Fewer than 10 percent of all other postgraduate years reported an inability to meet case minimums. Aesthetic cases (61.0 percent), followed by pediatric/craniofacial cases (31.7 percent), were the surgical categories where case numbers were most likely to be felt unmet.

Virtual education (e.g., online lectures, discussions) was the most favored learning modality, followed by reading, research, continuing work in the hospital, and lastly practicing surgical skills outside of the operating room (Table 4). The average number of virtual education sessions increased to an average of 4.2 per week during the COVID-19 pandemic compared to less than 1 per week before the emergence of COVID-19. Almost all residents reported having watched institutional and Society-sponsored lectures (Table 5). On average, residents found visiting professors lecture series, Society-sponsored lectures, Society-sponsored virtual education websites, and institutional lectures of the greatest educational value.

Seventy percent planned to pursue fellowship training before the COVID-19 pandemic. Fewer anticipated starting directly in a group private practice (13.2 percent), employed physician/hospital-based practice (6.0 percent), solo private practice (4.7 percent), or academic practice (3.1 percent). Most respondents reported no change in career path because of COVID-19 (85.5 percent), whereas a minority of residents reported an effect on their career path or plans (Table 6). Transition to a virtual job or fellowship interview and, more concerning, the loss or potential loss of a job were the two most reported career-related effects of COVID-19 [26 responses each (4.2 percent each)]. Rates of career changes were much higher in the final 2 years of training, with nearly 20 percent of



**Fig. 2.** Resident redeployment. The percentage of residents redeployed is shown within the pie chart, with the breakout bar graph illustrating the percentage of those redeployed to a given department. *ICU*, intensive care unit.

residents in their final year of training reporting actual or possible loss of their future job (Fig. 5). Six percent of residents now planned to pursue fellowship training as a result of the pandemic, and 3.9 percent planned to seek employment in a hospital-based practice. Overall, two-thirds of residents reported that job security was an extremely important determinant of career path.

Of the residents that were redeployed, 88.8 percent felt they had adequate institutional

support during this time. Of those that did not feel adequately supported, inadequate personal protective equipment (4.5 percent), psychosocial support (3.4 percent), and financial support (3.4 percent) were quoted. Most redeployed residents (84.8 percent) felt some impact on their wellness during this time. Psychological stress (37.1 percent), disruption of home life (28.8 percent), and strain to physical health (12.9 percent) were the most common. Nevertheless, 69.7 percent of those who were redeployed would welcome redeployment again (Table 7).

Although most residents felt their institutions offered psychosocial support, 7.6 percent felt there was minimal psychosocial support during the COVID-19 pandemic. Of note, 14.8 percent noted childcare support was offered and 6.3 percent noted additional financial support (i.e., hazard pay) was offered (Table 8). On bivariate analysis, only female residents ( $p = 0.06$ ) had a trend toward feeling less psychosocial support from their institutions (Fig. 6).

A significant portion of residents (82.6 percent) felt isolated from their colleagues during the COVID-19 pandemic. Video conferencing was the most common way residents maintained contact with their colleagues (92.7 percent). Eight percent of residents (47 respondents) said they were still having in-person contact with colleagues without appropriate social distancing (Table 9).

## DISCUSSION

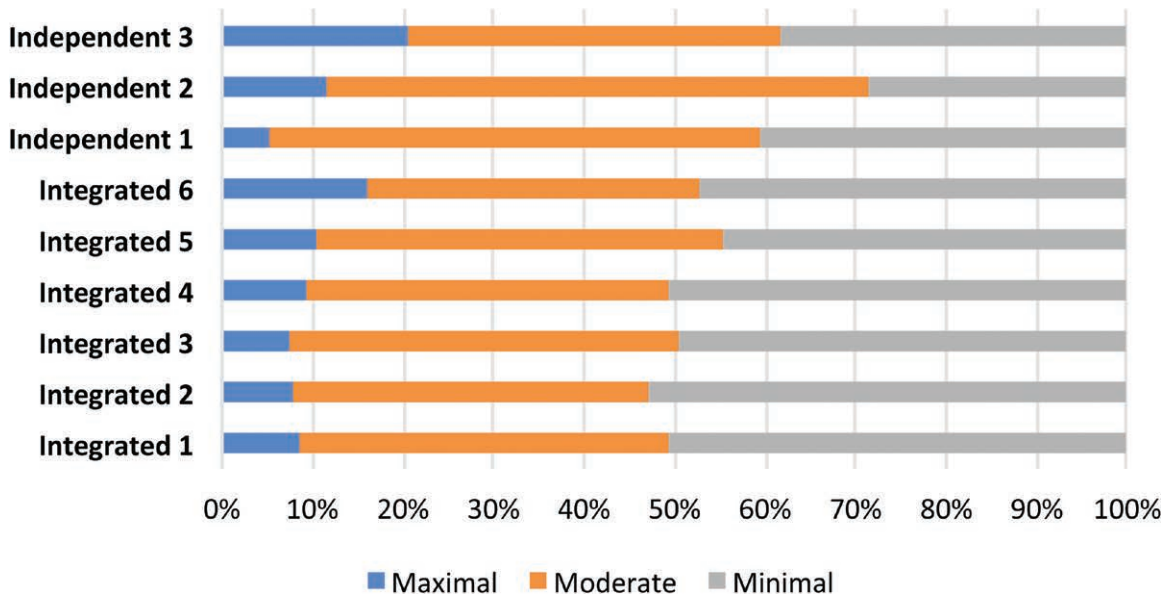
### Education

Surgical education is a core tenet of residency training and consists of several different facets of learning, both technical and nontechnical.<sup>25</sup> In

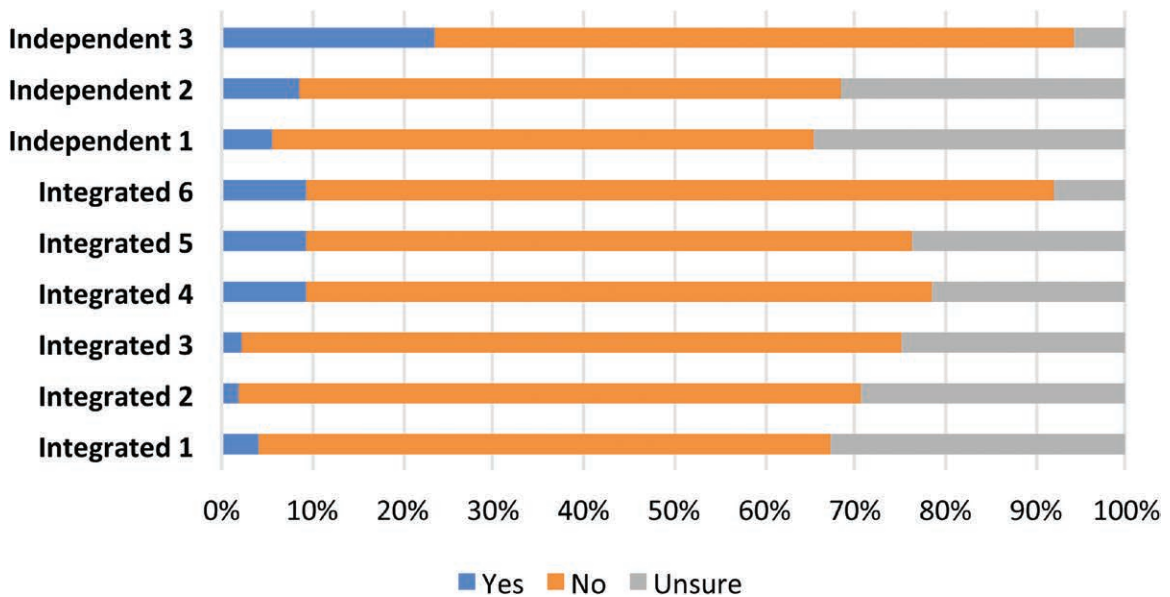
**Table 3. Plastic Surgery Educational Effects of COVID-19**

	No. (%)
Overall effect on education	
Very positive	22 (3.5)
Somewhat positive	138 (22.2)
No effect	100 (16.1)
Somewhat negative	297 (47.9)
Very negative	63 (10.2)
Mandated research during COVID-19 pandemic	
Yes	112 (18.1)
No	508 (81.9)
Overall effect on operative experience	
Maximally	62 (10.0)
Moderately	263 (42.4)
Minimally	295 (47.6)
Inability to achieve recommended case numbers	
Yes	41 (6.6)
No	426 (68.7)
Unsure	153 (24.7)
Specific areas where case numbers will be affected*	
Aesthetic	25 (61.0)
Extremity/hand	7 (17.1)
Breast reconstruction/microsurgery	6 (14.6)
Pediatrics/craniofacial	13 (31.7)
Burn	0 (0)
General surgery	2 (4.9)

\*Calculated from 41 respondents who said they would be unable to achieve case numbers. Not mutually exclusive.



**Fig. 3.** Perceived effect of COVID-19 on operative experience. Percentage of residents who noted maximal, moderate, or minimal effect on operative experience by postgraduate level.



**Fig. 4.** Inability to reach recommended operative case minimums. Percentage of residents who noted impacts on their ability to reach minimum recommended operative cases by postgraduate year.

**Table 4. Importance of Educational Mediums Used during COVID-19\***

Medium	Average Importance (SD)
Virtual education	1.8 (1.2)
Reading	2.5 (1.1)
Research	3.2 (1.2)
Continuing work in the hospital	3.3 (1.3)
Practicing surgical skills	4.2 (1.1)

\*Based on a 1 to 5 ranking scale, with 1 being the most important to education.

plastic surgery, this process is overseen by national organizations such as the Accreditation Council for Graduate Medical Education, the American Board of Plastic Surgery, and the American Council for Academic Plastic Surgeons.<sup>26</sup> When sweeping programmatic changes occur, such as the case during the COVID-19 pandemic, many aspects of resident education can be affected. This survey is the first to examine these effects on U.S. training programs.

**Table 5. Utility of Educational Mediums for Plastic Surgery Residents\***

Medium	Average Utility (SD)
Institution-sponsored lectures <sup>1</sup>	2.4 (0.6)
Society-sponsored lectures <sup>2</sup>	2.6 (0.6)
Visiting professor lecture series <sup>3</sup>	2.6 (0.6)
Society virtual education websites <sup>4</sup>	2.4 (0.7)
Industry-sponsored lectures <sup>5</sup>	1.9 (0.7)
Watching live anatomical dissections <sup>6</sup>	2.1 (0.8)
Watching real-time operations <sup>7</sup>	2.2 (0.8)

\*Ranked on 0 to 3, with 3 being extremely valuable. (1) 2.7% (17 respondents) not using this medium; (2) 5.3% (33 respondents) not using this medium; (3) 16.6% (103 respondents) not using this medium; (4) 14.0% (87 respondents) not using this medium; (5) 41.3% (256 respondents) not using this medium; (6) 70.3% (436 respondents) not using this medium; (7) 73.5% (456 respondents) not using this medium.

Our results demonstrate that academic medical centers and plastic surgery residency programs quickly responded to the limitations the COVID-19 pandemic inherently imposed on training and education. Expectedly, a large proportion of plastic surgery residents felt COVID-19 negatively impacted their education. Some residents were concerned about meeting recommended case minimums, and a considerable percentage in their final 2 years of training noted potential or actual loss of a prospective job. Such an effect would represent one of the most significant single events to affect the plastic surgery job market in recent decades.

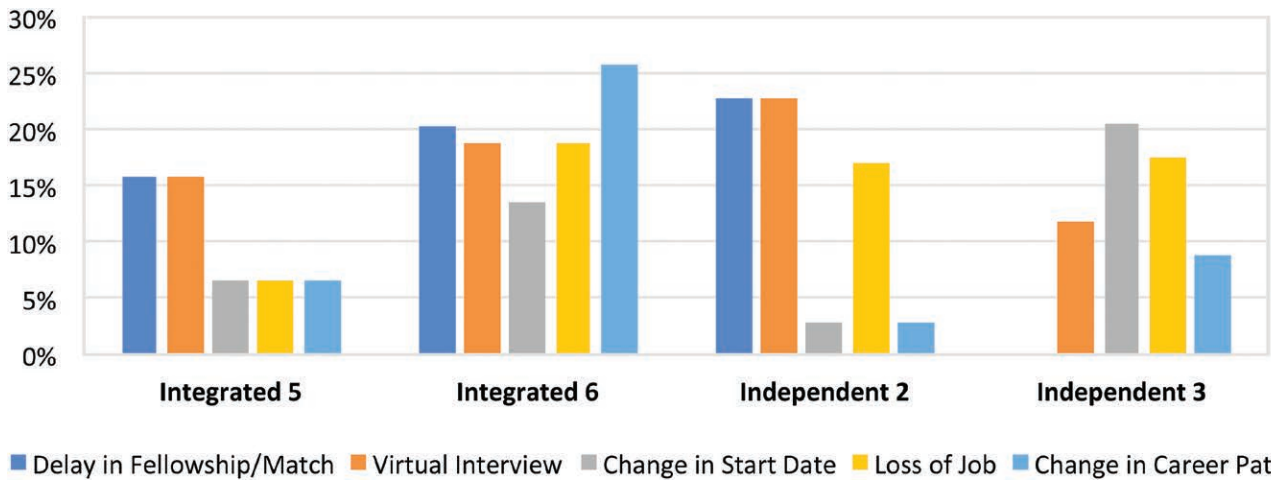
Although almost all plastic surgery residents reported restructuring of their training programs, several residents were redeployed to other services, specifically, COVID-19 intensive care units. Plastic surgery residents may be uniquely suited for redeployment. This may be partly attributable to a broad clinical exposure, with many plastic surgery residents having critical care experience as part of their general surgery training. Furthermore, many plastic surgery residents may have been available because of clinical team reorganization and reductions in elective case volume. The highest proportion came from junior-level integrated residents (postgraduate years 1 to 3; 19 percent), which may be a factor of their broad-based training during their early years of residency. Senior residents were likely more critical to their assigned plastic surgery service and less likely to be redeployed.

A majority of plastic surgery residents reported that changes secondary to COVID-19 precautions had a negative effect on their education. From cancellation of in-person conferences to reduction in elective operative experiences to loss of

**Table 6. Effects of COVID-19 on Career Path (All Years)**

	No. (%)
Anticipated career path before COVID-19	
Fellowship	434 (70.0)
Direct to academic practice	19 (3.1)
Direct to solo private practice	29 (4.7)
Direct to group private practice	82 (13.2)
Direct to employed physician/ hospital-based practice	37 (6.0)
Military	2 (0.3)
Not sure	17 (2.7)
Effect of COVID-19 on career path	
Delay in fellowship interview/match	24 (3.9)
Transition to virtual job/fellowship interviews	26 (4.2)
Change in anticipated job start date	18 (2.9)
Loss or potential loss of job	26 (4.2)
Change in career path	24 (3.9)
Unsure	5 (0.8)
No change	530 (85.5)
Anticipated career path change because of COVID-19	
Will not do fellowship	2 (0.3)
Will do fellowship	36 (5.8)
Going into academic practice	14 (2.3)
Going into private practice	16 (2.6)
Going into employed physician/ hospital-based practice	24 (3.9)
Consider alternate nonclinical career	2 (0.3)
Unsure	15 (2.4)
Will not change	530 (85.5)
Importance of job security in career path	
Extremely important	414 (66.8)
Somewhat important	180 (29.0)
Not important	26 (4.2)

patient interaction, plastic surgery residents were impacted in several different ways. More than half of plastic surgery residents noted a maximal or moderate effect on operative experience during the COVID-19 pandemic. Chief residents (i.e., integrated clinical year 6 and independent year 3) felt this impact to a greater degree than their more junior colleagues. Factors such as reduced resident cohorts paired with cancellation of senior-resident level clinical experiences (e.g., chief resident cosmetic clinic, community aesthetic cases, microvascular reconstructions) may be driving this sentiment. There may also be a greater perceived loss of surgical experience for those soon to be entering practice or fellowship training. More tangible is the fact that many residents—including one-quarter of independent residents in their final year of training—feared an inability to achieve the recommended Accreditation Council for Graduate Medical Education case numbers. Unfortunately, these findings suggest that the COVID-19 pandemic may have substantially impacted the training of chief residents. The implications may be even broader than the findings demonstrated in this study. For example, if graduating chief residents are less confident in



**Fig. 5.** Effect of COVID-19 on career path. Residents in their final 2 years of training and their noted career path changes.

their skill set in early practice, this may ultimately alter the caseload they undertake as “fully” trained plastic surgeons.

More residents noted that they now planned to pursue a fellowship or employment in a hospital-based practice as a result of COVID-19. These influences were undoubtedly multifactorial, but our results and analysis could not exclude the impact of operative experience on senior resident career decisions. More striking is that approximately 20 percent of those in their last 2 years of training noted potential or actual job loss. This may represent institution-wide hiring freezes in which contracts are withheld. With the significant financial stress faced by a large proportion of residents on completing residency (e.g., educational loans, family obligations), job instability further

compounds these stressors.<sup>27</sup> As the majority of plastic surgery residents note that job security is important to them, shifts in the career paths may be seen in the coming years as a result of the COVID-19 pandemic.

Although operative experiences have suffered, other new educational opportunities have become available and previous ones more readily adopted.<sup>28</sup> Plastic surgery residents noted that virtual education became their most important medium for plastic surgery learning. Society and institutionally sponsored grand rounds and visiting professors<sup>29</sup> allowed residents to learn from those outside their institutions. The number of virtual education sessions expanded to meet this need, with an increase from less than one to more than four per week, illustrating the swift adoption of this teaching modality. These results suggest that the success of transitioning to virtual

**Table 7. Resident Experiences with Redeployment\***

	No. (%)
Adequate institutional support	
Yes	79 (88.8)
No	4 (4.5)
Not sure	6 (6.7)
Reasons for inadequate institutional support†	
Inadequate PPE	4 (4.5)
Inadequate psychosocial support	3 (3.4)
Inadequate familial services	0 (0)
Inadequate financial support	3 (3.4)
Effect of redeployment on well-being†	
No hardship	20 (15.2)
Disruption of home life	38 (28.8)
Financial burden	5 (3.8)
Psychological stress	49 (37.1)
Strain to physical health	17 (12.9)
Negative impact on training	3 (2.3)
Volunteer for redeployment again?	
Yes	62 (69.7)
No	16 (18.0)
Unsure	11 (12.4)

\*Calculated from 89 residents that were redeployed.

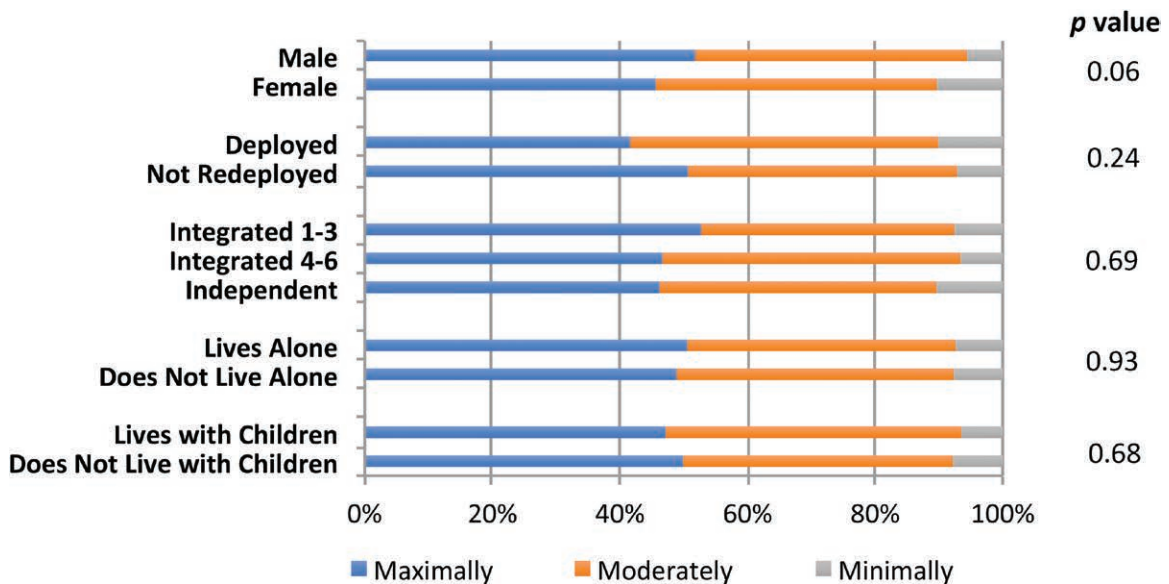
†Not mutually exclusive.

**Table 8. Psychosocial Support during the COVID-19 Pandemic**

	No. (%)
Institutional psychosocial support	
Maximal	306 (49.3)
Moderate	267 (43.1)
Minimal	47 (7.6)
What support was offered?*	
Financial support	36 (6.3)
Childcare support	85 (14.8)
Physical wellness	113 (19.7)
Psychosocial wellness	246 (42.9)
Reduced clinical responsibilities	498 (86.9)
Regular administration updates	25 (4.3)
Other†	7 (1.2)

\*Calculated from 573 respondents who noted their institution was maximally or moderately supportive of psychosocial well-being. Not mutually exclusive.

†Responses included virtual learning opportunities (n = 5), gift cards for food (n = 1), and paid parking (n = 1).



**Fig. 6.** Differences in perception of psychosocial support. Only female residents had a trend toward feeling less institutional psychosocial support.

education may offer a more accessible and equitable option for graduate medical education curricula. For instance, continued virtual learning and institutional collaborations, especially between smaller and larger programs, may be an innovative solution to provide equity in surgical education and further augment resident learning outside of the operating room.

**Wellness**

Wellness for those at the frontlines of the pandemic is often overlooked, especially in those that are already at high risk for burnout.<sup>30</sup> Residents, especially in surgical fields, experience increased rates of burnout and attrition at baseline.<sup>31,32</sup>

Our results revealed that many residents felt redeployment was a source of psychosocial

stress (37 percent) and disruption to their home life (38 percent). These findings are quite compelling given that, at baseline (e.g., before the pandemic), prior studies have revealed that residents are at high-risk for burnout and stress.<sup>30,33</sup> Approximately one-third of plastic surgery residents are believed to experience burnout during residency, and both stress and burnout are known to be important factors contributing to poor physician wellness.<sup>27,34,35</sup> Burnout has also been shown to negatively impact patient care and may lead to medical errors.<sup>36</sup>

Redeployment to emergency departments/intensive care units and clinical areas less familiar for plastic surgery trainees can be a source of stress. Anxiety over one’s own personal safety or loved ones, particularly with data emerging regarding airborne transmission, exposure risk from asymptomatic carriers, and conflicting advice regarding level of personal protective equipment, is well warranted. In addition, guilt and grieving associated with taking care of COVID-19 patients can be difficult for trainees that may have less experience with loss/death. Fortunately, our study also revealed that most redeployed residents believed that they had adequate institutional support (89 percent). In fact, if given the option, most redeployed residents (62 percent) revealed that they would redeploy again, likely revealing either the empathy and social mission of plastic surgery residents or the rigorous training of plastic surgery trainees. Furthermore, given that the respondents revealed a reduction in clinical responsibilities (87

**Table 9. Feelings of Isolation among Plastic Surgery Residents**

	No. (%)
How often do you feel isolated from colleagues?	
All the time	55 (8.9)
Most of the time	192 (31.0)
Sometimes	265 (42.7)
Rarely	69 (11.1)
Never	39 (6.3)
Mediums used to maintain contact with colleagues*	
In-person with appropriate social distancing	253 (40.8)
In-person without appropriate social distancing	47 (7.6)
Video conferencing	575 (92.7)
Telephone (calls or text)	494 (79.7)
E-mail/social media	283 (45.6)
Not staying in contact	2 (0.3)

\*Not mutually exclusive.

percent), the stress and anxiety of redeployment may be ameliorated by reduced working responsibilities and institutional support by means of wellness initiatives and childcare support. This survey importantly reveals that such institutional efforts promoting wellness must continue to assist trainees cope with the ongoing crisis.

However, it is important to note that the bivariate analysis revealed that female residents tended to endorse less psychosocial support from their institutions. Multiple studies have revealed that there is an implicit bias toward women in surgical specialties, including lower levels of promotion, decreased pay, and less representation at national society levels.<sup>37-41</sup> Further focus on resident wellness should try to mitigate any implicit bias, be it gender identity, race, or sexual orientation.

Our study also revealed that during the COVID-19 pandemic, plastic surgery residents experienced high levels of isolation. Isolation, especially in fields with constant human interaction, can negatively impact wellness and mental health. With decreased clinical responsibilities, residents may feel withdrawn from their colleagues, further worsening the psychosocial stress caused by the pandemic. However, embracing technology, especially in the form of video conferencing, was supported by residents to maintain contact with each other. With the increase in virtual conferences during the pandemic, the ability to maintain contact and interact on a regular basis is a significant benefit extending beyond education. As many institutions are exploring the utility of virtual education and cross-institutional collaboration, our ability to interact with colleagues throughout the United States will also be enhanced. Video conferencing may become an important portion of future educational and collaborative endeavors in addition to technological resources that are already established.<sup>28</sup>

### Limitations

As with any survey-based study, our survey was limited in several ways. First, this project was a cross-sectional study and the long-term changes and impacts on resident education and wellness were not explored. Nevertheless, this study gives us an initial, insightful understanding of plastic surgery resident adaptation to a changing educational environment. Second, this survey was constructed using multi-institutional expert panel input with pilot studying, but not reliability testing. However, this survey is strengthened by the substantial response rate (56.1 percent) from

plastic surgery residents across the country supporting the generalizability of these findings.

Survey responses are also limited in that they capture the disposition and attitudes of participants at a single point in time. As the crisis continues to evolve, education and well-being may change substantially. Further studies will be necessary to determine the true extent of this pandemic on plastic surgery training and careers.

## CONCLUSIONS

This cross-sectional, national survey of plastic surgery residents reveals that most residents felt the COVID-19 pandemic has had a deleterious impact on their plastic surgery education and their personal well-being. Although the operative experience of plastic surgery residents suffered, virtual education emerged as an educational adjunct that was well received by most plastic surgery residents and may very well persist after precautions are lifted.

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