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# Effect of COVID-19 on Surgical Training Across the United States: A National Survey of General Surgery Residents



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**INTRODUCTION:** COVID-19 emerged as a global pandemic in 2020 and has affected millions of lives. Surgical training has also been significantly affected by this pandemic, but the exact effect remains unknown. We sought to perform a national survey of general surgery residents in the United States to assess the effect of COVID-19 on surgical resident training, education, and burnout.

**METHODS:** An anonymous online survey was created and distributed to general surgery residents across the United States. The survey aimed to assess changes to surgical residents' clinical schedules, operative volume, and educational curricula as a result of the COVID-19 pandemic. Additionally, we sought to assess the impact of COVID-19 on resident burnout.

**RESULTS:** One thousand one hundred and two general surgery residents completed the survey. Residents reported a significant decline in the number of cases performed during the pandemic. Educational curricula were largely shifted toward online didactics. The majority of residents reported spending more time on educational didactics than before the pandemic. The majority of residents feared contracting COVID-19 or transmitting it to their family during the pandemic.

**CONCLUSIONS:** COVID-19 has had significant impact on surgical training and education. One positive consequence of the pandemic is increased educational didactics. Online didactics should continue to be a part of surgical education in the post-COVID-19 era. Steps need to be taken to ensure that graduating surgical residents are adequately prepared for fellowship and independent practice despite the significantly decreased case volumes

during this pandemic. Surgery training programs should focus on providing nontechnical clinical training and professional development during this time. (*J Surg Ed* 78:431–439. © 2020 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

**KEY WORDS:** Surgical Education, COVID 19, online didactics, surgical residents, residency survey

**COMPETENCIES:** Patient Care, Medical Knowledge, Practice-Based Learning and Improvement

## INTRODUCTION

The 2019 to 2020 coronavirus pandemic is an ongoing pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).<sup>1</sup> The outbreak was first identified in Wuhan, China, in December 2019.<sup>2</sup> The World Health Organization declared the outbreak a Public Health Emergency of International Concern on 30th January 2020, and a pandemic on the 11th of March 2020.<sup>3</sup> As of May 1, 2020, more than 3.3 million cases of COVID-19 have been reported in 187 countries and territories, resulting in more than 235,000 deaths.<sup>4</sup> COVID-19 has severely affected United States as well. On January 20, 2020, the first U.S. case of COVID-19 was reported in the state of Washington; and as of May 15, 2020, 1.11 million Americans have been affected with the virus resulting in 86,744 deaths.<sup>5,6</sup>

Not only has COVID-19 affected millions of lives, but it has also had a significant impact on the healthcare system and the practice of medicine and surgery. Surgical providers have been forced to reconsider almost every facet of their daily practice. To ensure adequate hospital resources and to maintain social distancing, elective surgeries have been cancelled and clinics have scaled back drastically. Inpatient care teams have downsized to limit

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provider exposure. At teaching hospitals, resident schedules have changed substantially to provide a workforce where needed while preventing unnecessary resident exposure. Resident educational curricula have moved toward completely online platforms to avoid large gatherings.<sup>7</sup>

Surgical trainees have been uniquely impacted by these changes. While solutions have been implemented to make up for missing in-person educational didactics and conferences, there are no substitutes in place to compensate for the significant reduction of hands-on surgical training during this period. Further the restrictions of visitors as well as the number of people permitted into patient rooms have impacted the training of patient and family communications. Infected residents have required long absences from the hospitals which has resulted in reassignments of remaining residents. To learn more about how the COVID-19 pandemic is affecting the training and education of surgical residents, we conducted a brief anonymous survey of general surgery residents across the United States.

## METHODS

An anonymous 23-question multiple choice survey was developed using Qualtrics, an online survey platform. All general surgery residency programs in the United States were invited to participate. The survey queried resident demographics, training program type and location, plans for fellowship training, operative and clinic duties before and during the COVID-19 pandemic, and effects of the pandemic on resident wellbeing and burnout.

Demographic and program information included clinical postgraduate year (PGY), training program state, and training program type (university or community). Changes to resident schedules, operating room protocols, duty hours, resident operative volume, number of clinic days before and during the pandemic and changes to educational curricula were assessed. Residents were asked if these changes will affect their graduation requirements and overall preparedness for their next career step. Finally, we assessed the effect of the pandemic on resident wellbeing and burnout.

## SURVEY DEVELOPMENT, AND DISTRIBUTION

The survey questions were developed after a comprehensive review of current literature and validated instruments. The questions were converted to an online format and beta tested to ensure brevity, clarity, relevance, and consistent interpretation. The survey was

then refined, incorporating feedback from the beta test of the survey. The survey was preceded by a statement explaining that the purpose of the survey was research, that data would be deidentified before analysis, and that program directors and chairs would not have access to the responses. There were no incentives or disincentives to participate. This study was deemed exempt by the University of Southern California Institutional Review Board.

A link to the survey was e-mailed to all 260 general surgery program directors (PDs) and program coordinators (PCs) and requested to be forwarded to the residents in their program. The emails of PDs and PCs were obtained from the Association of Program Directors in Surgery website ([www.apds.org](http://www.apds.org)). Reminder emails to encourage participation were distributed weekly for a period of 4 weeks. Responses were captured anonymously to maintain confidentiality. The survey is summarized in Appendix A1. Descriptive statistical analysis was performed to summarize the data.

## OUTCOMES MEASURED

The primary outcome was the change in volume of surgical cases performed by residents during the COVID-19 pandemic compared to prior.

Secondary outcomes were changes in educational curricula as a result of COVID-19, resident perceptions of the overall effects of the pandemic on their preparedness for their next career step, and the effects of COVID-19 on resident wellness and burnout.

## RESULTS

### Resident Information

One thousand one hundred and two general surgery residents completed the survey. The majority of respondents (18.7%) were from the state of New York followed by California (12.9%). Of the respondents, 20% were surgical interns, 38.1% were senior residents (PGY 4 and PGY 5) while mid-level residents (PGY 2 and 3) composed 41% of the respondents. The majority of residents belonged to a university-affiliated program (66%). Eighty-three percent of residents planned to pursue fellowship after residency. 70.4% of residents had cared for COVID-19 positive and suspected patients. [Table 1](#) highlights resident demographics and program structure.

### Surgical Training

In terms of daily rounding and floor duties, 77% of respondents reported that more duties were delegated to physician extenders such as nurse practitioners and

**TABLE 1.** Resident and Program Demographics

Q1. State of Training	
New York	18.70%
California	12.90%
Massachusetts	5.50%
Michigan	3.80%
Illinois	3.80%
Q2. Current year of clinical training	
PGY1	20%
PGY2	16%
PGY3	25.50%
PGY4	18.20%
PGY5	19%
Q3. Type of training institution	
University hospital	66.50%
Community with university affiliation	23.50%
Nonuniversity affiliated hospital	9.90%
Q4. Plan for fellowship after residency	
Yes	83.10%
Q5. Exposure to a COVID-19 positive patient	
Yes	53.40%
No	29%
Unsure	17.50%

physician assistants. Regarding changes to operating room protocol, 40.6% of the respondents reported that they were not allowed in the operating room for cases considered high-risk for COVID-19 transmission, and 12.5% of respondents reported interns and junior residents were not allowed in to the operating room at all. 26.6% of the respondents reported working more than 80 hours per week during the pandemic.

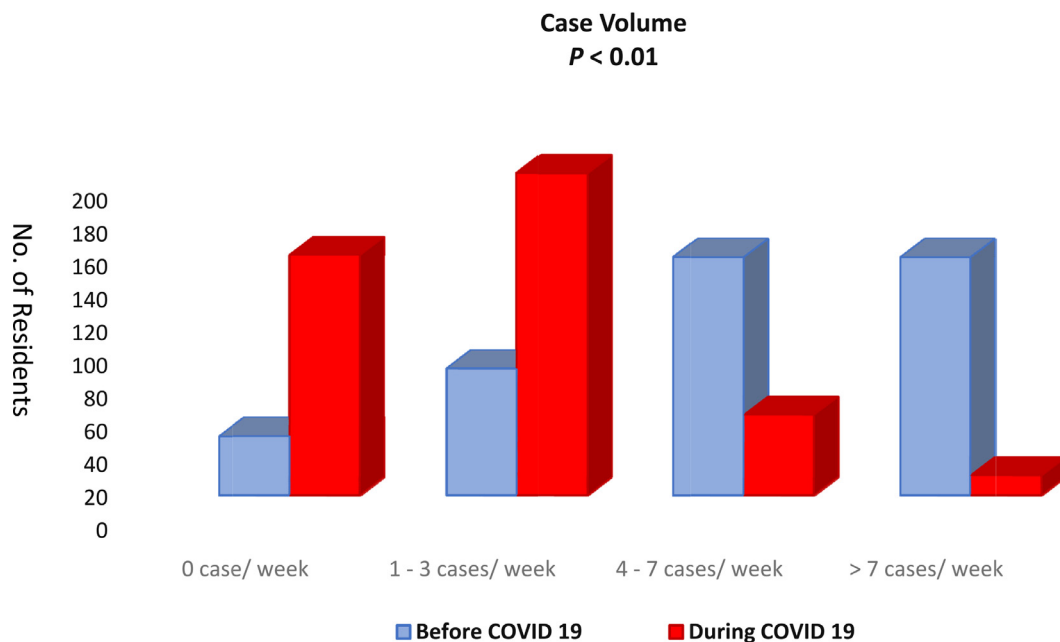
In terms of operative experience, we found a significant decline in the number of cases performed by residents per week. [Figure 1](#) highlights the change in resident operative experience during the pandemic. In terms of clinic experience, while the majority of surgical residents attended some clinic prior to the pandemic, the overwhelming majority (80.67%) of residents attended no clinic during the pandemic.

42.3% of general surgery respondents felt they would not meet the traditional Accredited Council for Graduate Medical Education (ACGME) case requirements for graduation with the current changes made to their program as a result of COVID-19. When asked if they would be comfortable graduating with less than the traditional required number of cases, responses varied by training year. Junior residents were less comfortable with this (34%-42%), compared to senior residents (58%-65%).

COVID-19 appeared to have a positive effect on educational didactics, as the majority of the respondents (41.3%) reported receiving more didactics during the pandemic than before. 80.6% of respondents reported a transition to a completely online platform for didactics. [Table 2](#) highlights the effect of COVID-19 on surgical education as reported by residents.

### Resident Work Hours and Burnout

The average days off for surgery residents in the pre-COVID-19 era is 4 days per month. During the pandemic, 65.1% of respondents reported having 5 or more days off per month. Despite more time off overall, 33.1%

**FIGURE 1.** Surgical case volume before and during the COVID-19 pandemic.

**TABLE 2.** Effects of COVID-19 on Surgical Training

Q6. Changes to resident schedules	
Residents completely removed from some services	29%
More responsibility given to NPs and PAs	77%
Smaller teams cover all the inhouse patients	12.70%
No change made	5.40%
Q7. Changes to operating room protocol	
No residents allowed	1.40%
No interns or junior residents allowed	12.30%
No residents allowed for high risk patients/case by case basis	40.60%
No changes made	31.60%
Q8. Changes in examining patients during rounds	
More frequently than before	10.10%
Less frequently than before	35.00%
My role did not change during rounds	55.00%
Q9. Days off per month during the pandemic	
<4/month	4.30%
5-7/month	23.50%
8-10/month	16.60%
Q10. Duty hour violations during the pandemic	
Yes	26.60%
Q11. Surgical cases performed per week prior to the pandemic	
0 case/week	7.20%
1-3 cases/week	16.50%
4-6 cases/week	34.30%
More than 7 case/week	37.10%
Q12. Surgical cases performed per week during the pandemic	
0 case/week	35.15%
1-3 cases/week	45.55%
4-6 cases/week	12%
More than 7 cases/week	2.50%
Q13. Outpatient clinics attended per week prior to the pandemic	
0 clinic/week	15.54%
1-4 clinic days/week	76.74%
Q14. Outpatient clinics attended per week during the pandemic	
0 clinic/week	80.67%
1-4 clinic days/week	13.72%
Q15. How likely do you feel you will NOT meet the traditional ACGME minimum case requirements for your training year with the current schedule and operative volume changes?	
Likely	42.20%
Not likely	47.61%
Q16. Are you comfortable graduating with less than the traditional number of required cases? (Yes)	
PGY 1	34%
PGY 2	39.60%
PGY 3	42%
PGY 4	58%
PGY 5	65%
Q17. Effect of the pandemic on the amount of educational didactics provided	
More than prior	41.30%
Less than prior	34.60%
Q18. Educational curriculum now completely online	
Yes	80.60%

**TABLE 3.** Effects of COVID-19 on Resident Well-being and Burnout

Q19. Do you feel more burnout now compared to before the pandemic? (Yes)	
PGY 1	38.80%
PGY 2	31.10%
PGY 3	34.90%
PGY 4	28.50%
PGY 5	28.50%
Q20. Compared to before, during the pandemic I spend more time on:	
Research	49.50%
Hobbies	44.20%
Reading/didactics	49.40%
Family/significant others	49.40%
Q21. During the pandemic I feel:	
Increased work-related stress	31.80%
Increased financial stress	13%
Increased stress about taking time off if I am sick	23.10%
Stress about potentially transmitting COVID-19 to family/friends	72.70%
Stress about contracting COVID-19	55.70%

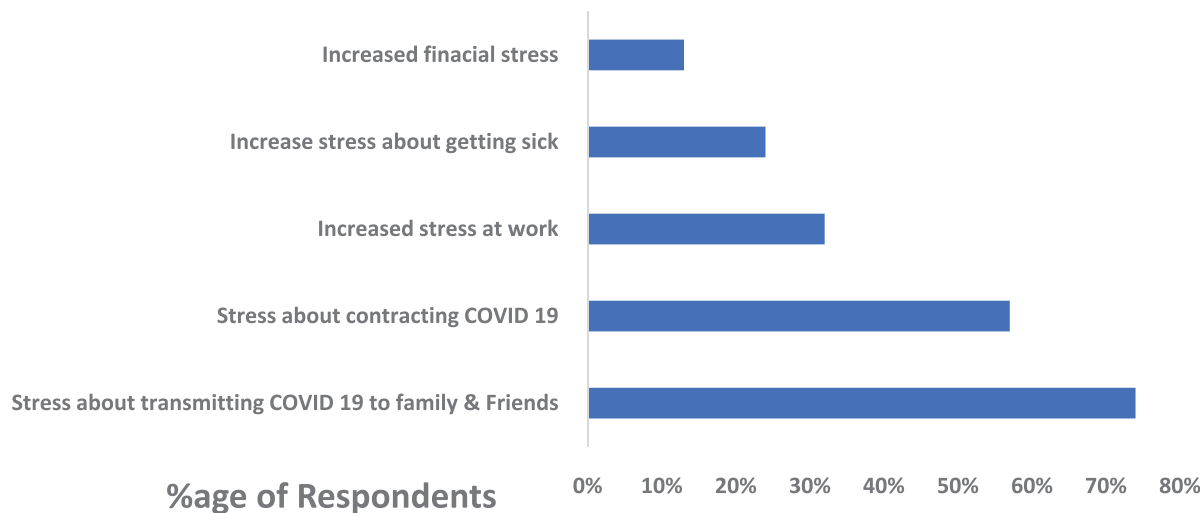
of respondents reported more burnout than usual during the COVID-19 pandemic. 72.7% reported concern about potential transmission of COVID-19 to family members and friends, while 55% reported concern about contracting COVID-19 themselves. [Table 3](#) highlights the effects of COVID-19 on resident wellbeing and burnout. [Figure 2](#) highlights specific resident stressors during the COVID-19 pandemic.

## DISCUSSION

We performed a survey to assess the effects of COVID-19 on surgical training, education, and burnout in surgical residents across the United States. By surveying trainees in all ACGME-accredited general surgical residency programs in the United States, we were able to comprehensively assess the overall effect of COVID-19 on surgical training. We saw a consistent decline in the number of surgical cases per week performed by residents during the pandemic compared to before, likely due to the elimination of elective cases nationwide. Other hospital policies to preserve personal protective equipment and decrease provider exposure, such as limiting residents in the operating room, has resulted in further reduction of surgical experience for residents. This is resulting in resident apprehension regarding their readiness for program completion and further studies are needed to determine what resident levels will be most impacted and what programmatic changes can be made to correct this deficit.

Another important finding of the study is that of resident wellness and burnout during the pandemic. The burn out rate was higher than the traditional rates





**FIGURE 2.** Effect of COVID 19 on resident well-being.

reported in literature.<sup>8-10</sup> Hewitt et al. in a national survey of general surgery residents reported a burnout rate of 22%.<sup>9</sup> In our study 65.1% of respondents reported having 5 or more days off per month during the pandemic, compared to 4 days per month before. The increased time off is likely a result of schedule changes that remove residents from services with low clinical volume due to the elimination of elective cases, in addition to the strategy of keeping a healthy reserve of residents at home in the case of a surge. Despite more time off overall, 33.1% of respondents reported more burnout than usual during the COVID-19 pandemic. This suggests burnout is not just associated with long duty hours. Stress about contracting the virus and bringing it home to friends and family appears to be an important contributor to burnout during the pandemic. We found that the PGY 1 class experienced more burnout than the other classes.<sup>9,10</sup> At this time, the immediate concerns pertaining to COVID-19 are on the forefront of research and planning. However, as time goes on, it can be anticipated that people will experience anxiety and depression. The data accumulated in this survey demonstrates that there are immediate emotional impacts and in order to manage these concerns and attempt to ameliorate future consequences, program should consider implementing aggressive and accessible wellness programs.

One positive consequence of the pandemic is that of increased resident educational didactics. The majority of the residents reported a shift to online didactics and an increase in overall didactic time during the COVID-19 pandemic. The use of technology allows residents to connect at any time of the day, from any location, with any expert present anywhere in the country. Several questions have been raised about the benefits of

telemedicine; we believe COVID 19 has highlighted the significance of telemedicine. From online didactics to virtual rounds to tele-clinic, the COVID-19 pandemic has brought telemedicine into a new light which will help us significantly in post COVID era.

We did not discuss the response rate of our survey. According to the Association of American Medical Colleges in 2018 there were 7378 residents in ACGME approved general surgery programs. So, if we were to use that number our response rate will be 14.6% (1102/7378). This however is subject to debate as the number of total residents as mentioned by Association of American Medical Colleges does include residents who are in active research year and also the other major factor being the survey was not equally distributed to all the residents in the United States. Hence, the true response rate of this study would be hard to gauge.

Our study has several limitations typical of survey-based studies. First, we had a low response rate. The survey was emailed to all program directors and coordinators in the United States. It was at their discretion if it was sent to the residents or not. Though the total response rate may be low, we had a higher response rates from states with higher incidence of Coronavirus such as New York and California. Also, because of lower response, only descriptive analysis was used. Another limitation was that participation was voluntary, meaning it is possible that people who had strong opinions regarding surgical education and COVID 19 are more likely to complete the survey, resulting in selection bias.

Surgical education aims to provide resident physicians with a foundation of surgical knowledge, clinical judgment, and technical competency. In the course of their training, residents are confronted with increasing

clinical complexity and take on graded responsibility.<sup>11</sup> Even before the current global pandemic, surgical education has needed to respond to dynamic changes in knowledge of surgical disease, new technologies, new treatments, and new procedures. Simultaneously, the public demand for greater accountability, resident oversight, and patient safety has pushed programs to re-examine their training practices.<sup>10</sup> Experience suggests that the usual slow-paced response to changing training models will prove ineffective in the face of a rapidly escalating global crisis that is forcing many trainees to stay home, and a greater number to shift their attention from the management of surgical patients to preparing to manage critically ill medical patients.<sup>12-14</sup>

While there may be no way to replace direct hands-on training in the operating room during this pandemic,

## APPENDIX 1. COVID-19 AND SURGICAL TRAINING, EDUCATION, AND BURNOUT

What is your residency year?

- PGY1-2
- PGY3-4
- PGY5

Which of the following best describes your training institution?

- University hospital
- Community hospital with university affiliation
- Nonuniversity affiliated hospital

In which state is your training program?

Do you plan to pursue a fellowship?

- Yes
- No
- Unsure

Have you personally cared for a COVID-19 positive patient at your hospital, involving face-to-face interaction?

- Yes
- No
- Unsure (tests were pending or not performed)

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

programs can support trainees' clinical development in other ways, taking advantage of the fact that many residents and faculty have more time off now than ever before. Programs should provide increased support for trainees' clinical development in nontechnical skills, such as providing opportunities and courses related to teamwork development, crisis management, leadership, and residents as educators.<sup>15-17</sup> Professional development can also be supported in the realms of research and academic productivity, career planning, and financial literacy. Residents approaching graduation can continue to prioritize completing case logs, preparing for board examinations, and career transitions (e.g., credentialing/licensing paperwork).<sup>18-20</sup>

- A smaller team of in-house residents covers more patients
- More work is delegated to advanced practice providers (i.e. nurse practitioners, physician assistants)
- No changes have been made to my program
- Other \_\_\_\_\_

What operating room changes, if any, have your hospital(s) made to limit the number of people in the operating room during a case? (select all that apply)

- No residents are allowed in the operating room
- Interns and/or junior residents are not allowed in the operating room
- Residents are allowed into the operating room on a case-by-case basis (i.e. not allowed in high-risk cases)
- No changes have been made at my hospital(s)
- Other \_\_\_\_\_

How many surgical cases on average per week were you performing prior to the COVID-19 pandemic?

- 0 cases/week
- 1-3 cases/week
- 4-6 cases/week
- More than 7 cases/week

How many surgical cases on average per week are you performing during the COVID-19 pandemic?

- 0 cases/week
- 1-3 cases/week
- 4-6 cases/week
- More than 7 cases/week

How many clinic days on average per week were you attending prior to the COVID-19 pandemic?

- 0 clinic days/week
- 1-3 clinic days/week
- More than 4 clinic days/week

How many clinic days (not including telemedicine visits) on average per week are you attending during the COVID-19 pandemic?

- 0 clinic days/week
- 1-3 clinic days/week
- More than 4 clinic days/week

Compared to before, during the COVID-19 pandemic, how has your role examining patients on rounds changed?

- I examine patients less frequently on rounds now
- I examine patients more frequently on rounds now
- My role examining patients on rounds has not changed

How many days off per month on average do you have during the COVID-19 pandemic?

- Less than 4 days off per month
- 4 days off per month
- 5-7 days off per month
- 8-10 days off per month
- More than 10 days off per month

Have you violated the 80-hour per week duty requirement during the COVID-19 pandemic?

- Yes
- No
- Unsure

If the COVID-19 pandemic persists until June, how likely do you feel you will not meet the traditional ACGME case minimum requirements for your training year or program (not including the new accommodated requirements)?

- Very likely
- Likely
- Somewhat likely
- Not likely
- Unsure

Q16 Would you feel comfortable graduating with less cases than the traditional number required by the ACGME, even if you met new accommodated requirements?

- Yes
- No

How concerned are you that the changes in your surgical training during the COVID-19 pandemic will make you less prepared in your next career step (fellowship or as a new attending)?

- Very concerned
- Concerned
- Somewhat concerned
- Not concerned

What effect, if any, has the COVID-19 pandemic had on the amount of educational didactics provided by your program (including lectures, conferences, etc.)?

- More didactics than before the pandemic
- Less didactics than before the pandemic
- No change in didactics
- Unsure

Has your educational curriculum been moved to a completely online format?

- Yes
- No
- Unsure

What changes, if any, have been made to your educational curriculum during the COVID-19 pandemic? (select all that apply)

- Some didactics have been moved online, but others remain in-person
- In-person didactics now fulfill social distancing requirements (i.e. smaller groups, distancing between group members, etc.)
- No changes have been made to my educational curriculum
- Other \_\_\_\_\_

Compared to before, during the COVID-19 pandemic I feel:

- Less burned out
- More burned out
- No differently in terms of burnout

Compared to before, during the COVID-19 pandemic I spend (select all that apply):

- More time with family/significant others/friends
- More time on hobbies
- More time on educational activities (i.e. reading, didactics, etc.)



- More time on research activities
- More time on: \_\_\_\_\_
- None of the above

Compared to before, during the COVID-19 pandemic I have felt (select all that apply):

- Increased stress at work (i.e. longer patient lists, sicker patients, greater responsibility, etc.)
- Increased stress about missing work if I am sick
- Increased financial stress
- Stress about contracting COVID-19
- Stress about potentially transmitting COVID-19 to others in my family, community, etc.
- Other: \_\_\_\_\_
- None of the above

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