

Single-centre study surveying neurology trainees' and faculty's perceptions of the impact of the COVID-19 pandemic on residents' medical education

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ABSTRACT

Objective To assess perceptions of our neurology residents and faculty regarding training experience and medical education during the early COVID-19 pandemic.

Methods We distributed two online, voluntary and anonymous surveys to trainees and teaching faculty of our Neurology Department at Henry Ford Hospital. Surveys inquired about trainees' stress, well-being, clinical experience and satisfaction with medical education and available support resources during the first wave of the COVID-19 pandemic in Michigan (mid-March to June 2020).

Results A total of 17/31 trainees and 25/42 faculty responded to the surveys. Eight (47%) trainees reported high stress levels. Nine (57%) were redeployed to cover COVID-19 units. Compared with non-redeployed trainees, redeployed residents reported augmented medical knowledge (89% vs 38%, $p=0.05$). There was no difference in the two groups regarding overall satisfaction with residency experience, stress levels and didactics attendance. Twenty-one (84%) faculty felt that the redeployment interfered with trainees education but was appropriate, while 10 (59%) trainees described a positive experience overall. Both trainees and faculty believed the pandemic positively impacted trainees' experience by increasing maturity level, teamwork, empathy, and medical knowledge, while both agreed that increased stress and anxiety levels were negative outcomes of the pandemic. Twelve (70%) trainees and 13 (52%) faculty were interested in pursuing more virtual didactics in the future.

Conclusion Our findings provide an objective assessment of residents' experience during the COVID-19 pandemic and can guide teaching programmes in their medical education response in the face of future global crises.

INTRODUCTION

The COVID-19 pandemic has changed health-care systems across the USA and the world. In addition to the increased need for material and human resources, the pandemic presented practical and logistical challenges that disrupted medical education and training.^{1 2} These challenges mandated a quick and effective response to transform traditional educational methods

while introducing novel methods for teaching and learning.³ The state of Michigan, and particularly the Detroit metropolitan area, rose as one of the 'hot spots' in the country with a steep surge in the number of cases beginning in early March 2020. Henry Ford Health System (HFHS) adopted a quick plan in response to the severity of the situation and the increased number of patients afflicted with COVID-19. Across all departments, this response included modifications to residency and fellowship programme routine workflow and didactics in order to comply with social distancing measures and limit the exposure of trainees to confirmed or suspected cases. Previously, we described the organised response of our HFHS Department of Neurology response to the pandemic which included putting a moratorium on all 'non-essential' rotations, redeploying residents to provide care for patients in overwhelmed COVID-19 units, implementing teleneurology outpatient visits, and shifting to online learning modules and lectures.⁴ In this study, we conducted two anonymous surveys: one distributed to our neurology trainees (residents and fellows) and one given to our neurology faculty, to assess and compare their perceptions of trainees' medical education, clinical experience and well-being during the pandemic. To our knowledge, this is the first study to objectively report both neurology trainee and teaching faculty perspectives on the challenges faced in education and work conditions during the early COVID-19 response.

METHODS

We conducted two anonymous, voluntary and confidential online surveys using SurveyMonkey from 1 June 2020 to 1 July 2020, intended to inquire about the period stretching from mid-March 2020 to June

2020, which corresponds to the first wave of the pandemic in Michigan. The trainees and faculty survey forms and the consent for participation can be found in online supplemental tables 1 and 2, respectively. One survey was sent to neurology residents and fellows of all postgraduate year (PGY) levels. Another survey was sent to all teaching faculty within the Department of Neurology at HFHS. The study protocol was reviewed and approved by the Institutional Review Board of HFHS. Our goal was to assess the trainees' perception of their well-being, stress level and the effects of changes brought to their education on clinical and didactics grounds during the pandemic. We queried the faculty with similar questions to survey their opinions on trainees' well-being and the quality of the medical education they received during COVID-19. We also compared level of stress, lecture attendance, and overall satisfaction with the experiences in redeployed vs non-redeployed residents. Participants were electronically consented to take part in the study prior to answering the questions.

Surveys

Trainee survey

In order to protect respondent anonymity, the only demographic question that was asked to trainees was their level of training. The answers to each question were pooled in order to prevent tracing back answers to the individual respondent. The survey was made of 33 questions, spanning 5 categories: demographics (PGY level), well-being, experience with redeployment to COVID-19 units, medical/didactics education and perceived performance. Query formats were a combination of single-answer multiple choice questions (MCQs), multiple-answer MCQs and open-ended questions.

Faculty survey

This survey was made of 22 questions, the format of which was a combination of single-answer MCQs (satisfaction level, yes/no), multiple-answer MCQs and open-ended questions. The categories of questions were faculty demographics (number of years in practice, subspecialties, types of interaction with trainees such as inpatient, outpatient, research, didactics and mentoring), perception of trainees' well-being and satisfaction with trainees' education. Similar to the trainee survey, responses were pooled for each question, limiting the cross-referencing with demographic answers. Questions for both surveys are included in Exhibit X.

Statistical analysis

Statistics describing survey responses included sample sizes, percentages and the corresponding 95% CIs. Fisher's exact tests were done for comparisons of redeployed and non-deployed residents experiences. The impact of the pandemic on medical training from trainees and faculty responses were compared using Fisher's exact tests.

RESULTS

Demographics

In March 2020 to July 2020, the HFHS Neurology Department had 31 trainees (24 residents, and 7 fellows across 3 subspecialties) and 42 teaching faculty. A total of 17/31 (54.8%) of Neurology Department trainees completed the survey. Trainee surveys were sent to all postgraduate year (PGY) residents and fellows (table 1). Survey participation was rather evenly distributed across PGY levels. A total of 25/42 (60%) supervising neurology faculty completed the faculty survey. Faculty respondents spanned all neurological subspecialties available at HFHS. Of the participating faculty, all but one worked full time. Regarding faculty practice experience, four (16%) of the faculty had 1–3 years of practice, nine (36%) had 4–10 years, nine (36%) had 11–20 years and three (12%) had more than 20 years of experience. All but 1 faculty member routinely interacted with trainees, with 20 (80%) interacting through didactics, 17 (68%) through mentorship, 17 (68%) in the outpatient setting, 14 (56%) in the inpatient setting and 13 (52%) through research (table 1).

Trainee survey

The personal stress level during the COVID-19 outbreak was high for 8 (47%) of the residents, moderate for 8 (47%), and low for 1 (6%); whereas family stress level was extremely high for 4 (24%), high for 8 (47%), and moderate for 5 (29%) of the trainees. All residents were aware of how to access emotional support resources, with 14 (82%) of them being at least satisfied with the resources made available to them. None of the residents reported violating their clinical work hours. Three residents were confirmed or suspected to have contracted COVID-19. Of these residents, two were satisfied with the amount of time-off they received and one had a neutral response (table 2 and online supplemental table 3).

Regarding work allocation, nine (53%) of the residents were redeployed to a COVID-19 unit and all of them were satisfied/very satisfied with the supervision on COVID-19 units, the personal protective equipment (PPE) provided, the overall effort to decrease exposure, and the nursing staff support. All found their time on COVID-19 units at least moderately fulfilling.

When asked if they agreed that the amount of work was overwhelming during the pandemic, two (12%) residents agreed with the statement, seven (41%) were neutral, five (29%) disagreed and three (18%) strongly disagreed. All but one resident were at least satisfied with their overall performance during the COVID-19 outbreak. While 10 (59%) residents responded that their overall experience was positive during the outbreak, 4 (24%) had a neutral experience and 3 (18%) had a negative experience.

When asked about the positive ways that the pandemic had contributed to their training experience, 11 (65%) answered solidarity/teamwork, 11 (65%) indicated expanded medical knowledge/skills, 9 (53%) indicated increased maturity and 9 (53%) answered enhanced

Table 1 Characteristics of surveyed trainees and faculty

Trainees (N=17)		
Level of training	PGY1	3 (18%)
	PGY2	4 (24%)
	PGY3	4 (24%)
	PGY4	3 (18%)
	PGY5	1 (6%)
	PGY6	2 (12%)
Are you a graduating resident/fellow?	Yes	5 (29%)
	No	12 (71%)
Were you redeployed to a COVID-19 unit?	Yes	9 (53%)
	No	8 (4%)
Did you test positive for COVID-19 or were you suspected to have COVID-19?	Yes	3 (18%)
	No	14 (82%)
Faculty (N=25)		
Years of practice	1–3 years	4 (16%)
	4–10 years	9 (36%)
	11–20 years	9 (36%)
	>20 years	3 (12%)
Subspecialty	Epilepsy	3 (12%)
	General neurology	1 (4%)
	Headache and facial pain	1 (4%)
	Movement disorders	1 (4%)
	Multiple sclerosis/autoimmune	2 (8%)
	Neuro-oncology	2 (8%)
	Neurocritical care	1 (4%)
	Neurocritical care/vascular	1 (4%)
	Neurointerventional	1 (4%)
	Neuromuscular	7 (28%)
	Neuromuscular/MS	1 (4%)
	Vascular neurology	4 (16%)
Full time?	Yes	24 (96%)
	No	1 (4%)
Do you routinely interact with residents?	Yes	24 (96%)
	No	1 (4%)
In what capacity do you routinely interact with residents?	Mentorship	17 (68%)
	Direct supervision in outpatient	17 (68%)
	Direct supervision in inpatient	14 (56%)
	Didactics	20 (80%)
	Research	13 (52%)

MS, multiple sclerosis; PGY, postgraduate year.

empathy. When asked about the negative impact the pandemic had on their experience, 14 (82%) responded increased stress, 8 (47%) fear/anxiety and 5 (29%) reduced productivity (table 2 and online supplemental table 3).

Responses of redeployed versus non-redeployed trainees

Residents who were redeployed to COVID-19 units and those who were not were compared for their responses to their personal stress level, family stress level, lecture attendance, overall satisfaction with the experience, and

Table 2 Trainees survey results. (complete responses to all questions can be found in the online supplemental table 3)

Question	Response	(N=17)
What was your stress level during the COVID-19 outbreak?	High	8 (47%)
	Moderate	8 (47%)
	Low	1 (6%)
What was your family's stress level during the COVID-19 outbreak?	Extremely high	4 (24%)
	High	8 (47%)
	Moderate	5 (29%)
Were you aware of how to access emotional support resources?	Yes	17 (100%)
How satisfied were you with the resources for emotional support made available to you?	Neither satisfied nor dissatisfied	3 (18%)
	Satisfied	9 (53%)
	Very satisfied	5 (29%)
How satisfied were you with the supervision you received on COVID-19 units?*	Satisfied	4 (44%)
	Very satisfied	5 (56%)
How satisfied were you with the availability and quality of disinfectants and PPE (gowns, masks, gloves, eye shields, etc) on COVID-19 units?*	Neither satisfied nor dissatisfied	1 (11%)
	Satisfied	6 (67%)
	Very satisfied	2 (22%)
How satisfied were you with the efforts made by the supervising faculty to decrease your exposure while on COVID-19 units?*	Satisfied	3 (33%)
	Very satisfied	6 (67%)
How satisfied were you with the level of support provided by the nursing staff on COVID-19 units?*	Satisfied	5 (56%)
	Very satisfied	4 (44%)
Did you find your time during COVID-19 redeployment to be fulfilling?*	A great deal	2 (22%)
	A lot	4 (44%)
	Moderately	3 (33%)
Did you violate clinical work hours during the pandemic?	No	17 (100%)
Whether deployed to a COVID-19 unit or not, do you agree with the statement 'the amount of work was overwhelming during the pandemic'?	Agree	2 (12%)
	Neither agree nor disagree	7 (41%)
	Disagree	5 (29%)
	Strongly disagree	3 (18%)
During COVID-19 pandemic, how often were you able to attend didactics virtually?	Close to 25%	1 (6%)
	Close to 50%	2 (12%)
	Close to 75%	10 (59%)
	Close to 75%	4 (24%)
How satisfied were you with the convenience of attending lectures virtually?	Dissatisfied	2 (12%)
	Neither satisfied nor dissatisfied	1 (6%)
	Satisfied	10 (59%)
	Very satisfied	4 (24%)
Were you provided with on-line resources (AAN resources, PowerPoints, electronic modules) to use during the pandemic?	Yes	16 (94%)
	No	1 (6%)
In a typical week during the pandemic, whether at work or outside of work, how often would you access the aforementioned on-line resources provided?	1–2 days	5 (29%)
	3–4 days	8 (47%)
	5–6 days	3 (18%)
	Never	1 (6%)

Continued

Table 2 Continued

Question	Response	(N=17)
How satisfied are you overall with your performance as a resident/fellow during the pandemic?	Neither satisfied nor dissatisfied	1 (6%)
	Satisfied	12 (71%)
	Very satisfied	4 (24%)
Describe how the pandemic has affected your overall experience as a resident.	It was a negative experience—a stressful and compromising one	3 (18%)
	It was a neutral experience—I am indifferent	4 (24%)
	It was a positive experience—a fulfilling and inspiring one	10 (59%)

*Among residents/fellows redeployed to COVID-19 units.
AAN, American Academy of Neurology; PPE, personal protective equipment.

ways the COVID-19 outbreak affected their experiences. Residents who were redeployed reported a positive effect on expanded medical knowledge/skills relative to non-redeployed residents (89% vs 38%, $p=0.05$). Although not statistically significant, redeployed residents were also less likely to report decreased self-confidence as a negative impact of the pandemic compared with non-redeployed residents (0% vs 38%, $p=0.082$). There was no significant difference in the two groups regarding overall satisfaction with residency experience, personal or family stress levels, and ability to attend didactics (table 3).

Faculty survey

During the COVID-19 outbreak, 22 (88%) surveyed faculty members had significant interactions with residents, with 10 (40%) interacting through didactics, 8 (32%) through mentorship, 14 (56%) in the outpatient setting, 13 (52%) in the inpatient setting and 12 (48%) through research (table 4).

While nine (36%) faculty members witnessed emotional distress in residents, two of them were directly approached by trainees for emotional support (table 4). Regarding medical education, 13 (52%) of the faculty were satisfied/very satisfied with the didactics given to trainees during the COVID-19 outbreak, 9 (36%) were neutral, and 3 (12%) were dissatisfied/very dissatisfied. When asked their opinion about the impact that the pandemic had on residents' education, 9 responses (36%) were positive, 8 (32%) were neutral, and 8 (32%) were negative. When asked about whether redeployment had interfered significantly with resident education, 4 (16%) of the faculty answered not at all, 11 (44%) said a little, 7 (28%) said moderately and 3 (12%) said a lot. When asked about the positive ways the pandemic had contributed to residents' experiences, 21 (84%) of the faculty said solidarity/teamwork, 19 (76%) enhanced empathy, 16 (64%) increased maturity and 12 (48%) expanded medical knowledge/skills (table 5). When asked about the negative ways the

pandemic had contributed to residents' experiences, 18 (72%) responded increased stress, 18 (72%) fear/anxiety and 11 (44%) feeling overwhelmed. Responses for these and other questions can be found in tables 4 and 5.

Trainee and faculty responses

Both residents and faculty were asked about the positive and negative ways the pandemic contributed to the residents' experience. For the positive ways, residents had higher rates for expanded medical knowledge/skills (65% vs 48%) and greater clinical competence (41% vs 32%), while faculty responded with higher rates for solidarity teamwork (84% vs 65%), increased maturity level (64% vs 53%), heightened assertiveness (32% vs 12%) and enhanced empathy (76% vs 53%). However, none of these differences were statistically significant between the two groups. For the negative ways, residents responded with higher rates for increased stress (82% vs 72%) and decreased self-confidence (18% vs 8%), while faculty had higher rates for fear/anxiety (72% vs 47%), feeling overwhelmed (44% vs 24%), and decreased sleep (16% vs 0%). Again, none of these differences reached statistical significance (table 5).

DISCUSSION

To adapt to the rapidly changing landscape brought by the early COVID-19 pandemic, health systems had to reorganise their operations at all levels, such as clinical care in outpatient and inpatient settings, visitation limitations, screening of patients, visitors and employees, procurement and rationing of PPE, and deferment and cancellation of elective procedures and surgeries. Teaching programmes all over the country were also impacted and had to undergo temporary restructuring to limit potential exposure of trainees to a virus of which little was known and to funnel manpower to those areas of hospitals in dire need of medical personnel.⁵ We have previously

Table 3 Comparing redeployed and non-redeployed trainees' responses

Question	Response	Non- redeployed (N=8)	Redeployed (N=9)	P value
What was your stress level during the COVID-19 outbreak?	High	4 (50%)	4 (44%)	>0.99
	Moderate	4 (50%)	4 (44%)	
	Low	0 (0%)	1 (11%)	
What was your family's stress level during the COVID-19 outbreak?	Extremely high	3 (38%)	1 (11%)	0.574
	High	3 (38%)	5 (56%)	
	Moderate	2 (25%)	3 (33%)	
Do you agree with the statement "the amount of work was overwhelming during the pandemic"?	Agree	2 (25%)	0 (0%)	0.444
	Neither agree nor disagree	5 (63%)	2 (22%)	
	Disagree	2 (25%)	3 (33%)	
	Strongly disagree	1 (13%)	2 (22%)	
How satisfied are you overall with your performance as a resident/fellow during the pandemic?	Dissatisfied	0 (0%)	0 (0%)	0.772
	Neither satisfied nor dissatisfied	1 (13%)	0 (0%)	
	Satisfied	5 (63%)	7 (78%)	
	Very satisfied	2 (25%)	2 (22%)	
During COVID-19 pandemic, how often were you able to attend didactics virtually?	Close to 25%	1 (13%)	0 (0%)	0.302
	Close to 50%	1 (13%)	1 (11%)	
	Close to 75%	3 (38%)	7 (78%)	
	Always	3 (38%)	1 (11%)	
In what positive ways has the pandemic contributed to your experience?	Increased maturity level	5 (63%)	4 (44%)	0.637
	Solidarity teamwork	6 (75%)	5 (56%)	0.620
	Greater clinical competence	2 (25%)	5 (56%)	0.335
	Expanded medical knowledge skill	3 (38%)	8 (89%)	0.050
	Heightened assertiveness	2 (25%)	0 (0%)	0.206
	Enhanced empathy	4 (50%)	5 (56%)	>0.99
	Increased productivity	2 (25%)	0 (0%)	0.206
	None	1 (13%)	0 (0%)	0.471
In what negative ways has the pandemic contributed to your experience?	Increased stress level	7 (78%)	7 (88%)	>0.99
	Fatigue	3 (33%)	1 (13%)	0.576
	Fear anxiety	4 (44%)	4 (50%)	>0.99
	Decreased self confidence	0 (0%)	3 (38%)	0.082
	Feeling overwhelmed	2 (22%)	2 (25%)	>0.99
	Hopelessness	0 (0%)	2 (25%)	0.206
	Decreased productivity	3 (33%)	2 (25%)	>0.99
Do you feel it has been the leadership's priority to decrease exposure for neurology trainees whenever possible during the COVID-19 outbreak?	A top priority, but not the most important	2 (25%)	6 (67%)	0.153
	The most important priority	6 (75%)	3 (33%)	

Continued

Table 3 Continued

Question	Response	Non- redeployed (N=8)	Redeployed (N=9)	P value
How would you rate the support provided by the leadership during the pandemic?	Exceeded expectations	4 (50%)	6 (67%)	0.637
	Met expectations	4 (50%)	3 (33%)	
How satisfied were you with the resources for emotional support made available to you?	Dissatisfied	0 (0%)	0 (0%)	0.128
	Neither satisfied nor dissatisfied	3 (38%)	0 (0%)	
	Satisfied	4 (50%)	5 (56%)	
	Very satisfied	1 (13%)	4 (44%)	

described our experience and challenges as a Neurology Department at the beginning of the pandemic.⁴ In this study, we surveyed our own neurology trainees and teaching faculty using two anonymous and voluntary web-based questionnaires to assess their viewpoints on the impacts the pandemic had on our trainees' well-being, performance, education and clinical experience. To our knowledge, this is the first study to analyse and compare perceptions through surveying both neurology faculty and trainees at a teaching institution serving an area hit hard by the early COVID-19 pandemic.

In 2020, during the first wave of the pandemic, the Neurology Department at HFHS was composed of 42 teaching faculty, 24 adult neurology residents with 6 residents in each PGY level and 7 fellows. Most of our inpatient services, with the exception of the neurointensive care unit, were converted to isolation units to accommodate a rising number of patients with COVID-19 while hospitalisations for neurological diagnoses experienced a sharp decline, as reported by ourselves and others.⁴⁵ Eighteen of the 24 neurology residents and 3 of the 7 fellows were redeployed to cover COVID-19 services. The residency programme director and chief residents together determined which residents were to be redeployed based on the residents' rotation schedules. Priority was to redeploy second- and third-year neurology residents who were on elective rotations, keeping in mind programme and graduation requirements. General and specialty neurology clinics were closed for in-person encounters and converted to telehealth visits. All educational activities migrated to virtual platforms in observance of the strict social distancing policies enforced by the hospital's administration.

The majority of trainees reported high personal and family stress levels, whether redeployed to COVID-19 units or not. The stress was mainly imputed to fears of exposing family members but also concerns with training being disrupted and graduation being delayed should the redeployment last longer than a couple of months. Importantly, the majority of residents thought that their training experience during the pandemic was a fulfilling one (59%) and, surprisingly, although not statistically significant, more redeployed trainees reported a positive

experience than those who were not redeployed (67% vs 50%). This observation likely stems from the fact that a larger number of them felt that their medical knowledge and skill set were significantly expanded as a result of caring for patients with COVID-19 and a sense of making a significant contribution in the treatment and improvement of these patients. Despite the uncertainty and increased stress levels, both trainees and faculty took ownership of education and wellness by sharing ideas on how to creatively respond to the current crisis. This included knowledge sharing, launching research projects, and conducting daily virtual meetings with department leadership for updates and available resources that helped foster transparency and address resident concerns. The department put an emphasis on mental health and wellness in particular, with a variety of resources made available. Faculty also prioritised resident safety by incorporating innovative ways to reduce trainee exposure. For example COVID-19 patients in COVID-19 units were virtually pre-rounded, and faculty went in alone to examine the patients to reduce potential trainee viral exposure. Similarly, on consultation services, the majority of the team remained outside of the room while only faculty examined the patients.

Faculty's outlook on the impact of the pandemic on residents' medical education was, however, more divided. While the trainees' perception was a predominantly positive one, our surveys indicate that faculty were evenly divided between positive, neutral, and negative impressions. Approximately 40% of surveyed faculty thought that the pandemic had at least moderately interfered with resident education, although none of them believed that the redeployment had been inappropriate. The concern by many faculty who thought that the impact had been a negative one is in line with the reduced exposure of trainees to neurodiagnostic rotations such as electromyography, electroencephalography and transcranial doppler ultrasound, as nearly all non-urgent outpatient procedures were halted for several months. Finally, migration to virtual learning was positively received, as 70% of trainees and 52% of faculty who answered the surveys were interested in pursuing more virtual avenues for didactics

Table 4 Faculty survey results

Question	Response	(N=25)
Have you significantly interacted with residents during the pandemic?	Yes	22 (88%)
	No	3 (12%)
In what capacity have you interacted with residents during the pandemic?	Mentorship	8 (32%)
	Direct supervision in outpatient	14 (56%)
	Direct supervision in inpatient	13 (52%)
	Didactics	10 (40%)
	Research	12 (48%)
Have you witnessed emotional distress in residents?	Yes	9 (36%)
	No	16 (64%)
Have residents reached out to you for emotional/mental support related to the pandemic?	Yes	2 (8%)
	No	23 (92%)
How prepared did you feel in providing the residents emotional support?	I did not provide emotional support	4 (16%)
	Not prepared at all	0 (0%)
	Somewhat unprepared	1 (4%)
	Somewhat prepared	12 (48%)
	Very prepared	8 (32%)
How satisfied are you with the didactics the residents have received during the pandemic?	Very dissatisfied	1 (4%)
	Dissatisfied	2 (8%)
	Neither satisfied nor dissatisfied	9 (36%)
	Satisfied	7 (28%)
	Very satisfied	6 (24%)
How satisfied are you with your personal contribution to resident education and mentorship during the pandemic?	I did not contribute	1 (4%)
	Very dissatisfied	2 (8%)
	Dissatisfied	1 (4%)
	Neither satisfied nor dissatisfied	6 (24%)
	Satisfied	8 (32%)
	Very satisfied	7 (28%)
Did you participate in giving virtual lectures to residents during the pandemic?	Yes	13 (52%)
	No	12 (48%)
How satisfied are you with the audio/visual quality of the virtual lectures you gave during the pandemic?	Very dissatisfied	0 (0%)
	Dissatisfied	2 (15%)
	Neither satisfied nor dissatisfied	1 (8%)
	Satisfied	7 (54%)
	Very satisfied	3 (23%)
How interested would you be to continue giving certain teaching opportunities virtually after the pandemic resolves?	Not at all interested- it is useless	0 (0%)
	Not so interested- it has limited use	4 (16%)
	Somewhat interested	8 (32%)
	Very interested- it is helpful but not essential	5 (20%)
	Extremely interested- it is essential	8 (32%)
In your opinion, what kind of impact has the pandemic had on resident's education?	Negative	8 (32%)
	Neutral	8 (32%)
	Positive	9 (36%)

Continued

Table 4 Continued

Question	Response	(N=25)
Do you think that neurology residents redeployment to COVID-19 units was appropriate?	Strongly disagree	0 (0%)
	Disagree	0 (0%)
	Neither agree nor disagree	4 (16%)
	Agree	14 (56%)
	Strongly agree	7 (28%)
How satisfied are you with the communication related to redeployment strategies you have received from administration and programme directors?	Very dissatisfied	0 (0%)
	Dissatisfied	0 (0%)
	Neither satisfied nor dissatisfied	9 (36%)
	Satisfied	8 (32%)
	Very satisfied	8 (32%)
Do you think that redeployment has interfered significantly with resident education?	Not at all	4 (16%)
	A little	11 (44%)
	Moderately	7 (28%)
	A lot	3 (12%)
	A great deal	0 (0%)

in the future. This may potentially become important as virtual online platforms have experienced a sharp increase in utilisation during the pandemic and can now provide trainees on off-site rotations the ability to attend lectures remotely, even as normalcy returns.

The impact of the COVID-19 pandemic on postgraduate medical education has been published in several papers,^{6 7} a few of which have used surveys. For instance, surveys of surgical residents reported

reduction in clinical exposure with the cancellation of elective surgeries and limited operative time.^{8–10} Similar to our findings, one study found that residents reported higher levels of stress that were attributed to uncertainty, decrease in clinical exposure, and concern for visa situations.¹¹ Our study was innovative in that it was designed to take into consideration both trainee and teaching faculty viewpoints on various aspects of postgraduate neurological medical education during

Table 5 Comparing residents and faculty's responses

Question	Response	Trainees (N=17)	Faculty (N=25)	P value
In what positive ways has the pandemic contributed to residents' experience?	Increased maturity level	9 (53%)	16 (64%)	0.534
	Solidarity/teamwork	11 (65%)	21 (84%)	0.268
	Greater clinical competence	7 (41%)	8 (32%)	0.744
	Expanded medical knowledge	11 (65%)	12 (48%)	0.353
	Heightened assertiveness	2 (12%)	8 (32%)	0.162
	Enhanced empathy	9 (53%)	19 (76%)	0.184
	Increased productivity	2 (12%)	4 (16%)	>0.99
	None	1 (6%)	2 (8%)	>0.99
In what negative ways has the pandemic contributed to residents' experience?	Increased stress	14 (82%)	18 (72%)	0.490
	Increased fatigue	4 (24%)	7 (28%)	>0.99
	Fear/anxiety	8 (47%)	18 (72%)	0.121
	Decreased self confidence	3 (18%)	2 (8%)	0.379
	Feeling overwhelmed	4 (24%)	11 (44%)	0.207
	Hopelessness	2 (12%)	3 (12%)	>0.99
	Decreased productivity	5 (29%)	6 (24%)	0.733
	Decreased sleep	0 (0%)	4 (16%)	0.134
None	0 (0%)	3 (12%)	0.260	

the pandemic, while comparing survey answers from redeployed and non-redeployed trainees.

Despite these strengths, our study bears a few limitations. First, our findings are limited by the average participation rates among trainees (53%) and faculty (60%). That being said, the large size of the Neurology Department at HFHS, one of the largest medical groups in the country, yielded a satisfactory sample size, which allowed us to make valuable observations. Second, the single-centre experience limits generalisability of the findings to other teaching institutions, and more information could have been gathered from surveying other neurological teaching programmes in the area. While this is certainly a limitation, we believe that our experience can be representative of similarly diverse urban academic centres which, like Detroit, were significantly impacted by high infectivity and mortality rates during the early days of the pandemic. Third, some survey questions could have been asked differently so that more direct comparisons could have been made between trainee and faculty responses. Lastly, inclusion of a pre-pandemic comparator for faculty/resident perspectives of residency training may have yielded valuable information and could have augmented some of our observations. To that effect, a post-pandemic follow-up study may be extremely informative to gauge the significance of the impact the pandemic has had on medical education.

Our study uniquely surveyed neurology faculty and trainees and their perceptions of residents' well-being and the quality of medical education received during the first wave of the COVID-19 pandemic in the US amidst redeployment and virtual learning initiatives. While the pandemic is still raging around the world and many institutions have adapted to this new and unprecedented reality, our findings can guide teaching programmes tailor their own responses in times of future pandemics and crises.

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asked participants whether they agree to participate in the online surveys. We only included answers from participant who answered with yes.

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REFERENCES

- Murphy B. Residency in a pandemic: How COVID-19 is affecting trainees. *American Medical Association*, 2020. Available: <https://www.ama-assn.org/residents-students/residency/residency-pandemic-how-covid-19-affecting-trainees> [Accessed 30 Mar 2021].
- Tomlinson SB, Hendricks BK, Cohen-Gadol AA. Editorial. innovations in neurosurgical education during the COVID-19 pandemic: is it time to reexamine our neurosurgical training models? *J Neurosurg* 2020;14–15.
- 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;77:729–32.
- Ramadan AR, Alsrouji OK, Cerghet M, *et al*. Tales of a department: how the COVID-19 pandemic transformed Detroit's Henry Ford Hospital. Department of Neurology—part I: the surge. *BMJ Neurol Open* 2020;2:e000070–6.
- Waldman G, Mayeux R, Claassen J, *et al*. Preparing a neurology department for SARS-CoV-2 (COVID-19): early experiences at Columbia university Irving medical center and the new York Presbyterian hospital in New York City. *Neurology* 2020;94:886–91.
- Sanghavi PB, Au Yeung K, Sosa CE, *et al*. Effect of the coronavirus disease 2019 (COVID-19) pandemic on pediatric resident well-being. *J Med Educ Curric Dev* 2020;7:2382120520947062
- Cravero AL, Kim NJ, Feld LD, *et al*. Impact of exposure to patients with COVID-19 on residents and fellows: an international survey of 1420 trainees. *Postgrad Med J* 2021;97:postgradmedj-2020-138789–2010.
- Wise CE, Bereiknyei Merrell S, Sasnal M, *et al*. COVID-19 impact on surgical resident education and coping. *J Surg Res* 2021;264:534–43.
- Bambakidis NC, Tomei KL. Editorial. impact of COVID-19 on neurosurgery resident training and education. *J Neurosurg* 2020;5:10–11.
- Rosen GH, Murray KS, Greene KL, *et al*. Effect of COVID-19 on urology residency training: a nationwide survey of program directors by the Society of academic Urologists. *J Urol* 2020;204:1039–45.
- Rana T, Hackett C, Quezada T, *et al*. Medicine and surgery residents' perspectives on the impact of COVID-19 on graduate medical education. *Med Educ Online* 2020;25:1818439.