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Virtual Rounding in Stroke Care and Neurology Education During the COVID-19 Pandemic - A Residency Program Survey

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Background and Purpose: During the coronavirus disease 2019 (COVID-19) pandemic, we instituted virtual inpatient stroke rounds and acute stroke evaluations via telemedicine in the emergency department. We sought to explore trainees' and experienced providers' views on stroke care and education. *Methods:* The implementation and the survey took place at a single academic comprehensive stroke center in northeast Ohio in the United States. "Virtual rounding" consisted of patient presentation and discussion in the morning in on-line virtual team format followed by in-person patient rounds in small groups. Acute stroke evaluations in the emergency department included direct in-person evaluation by neurology residents with supervision over telemedicine. The neurology residents, stroke fellows, stroke nurse practitioners, and stroke staff physicians were surveyed 2 months after implementation. Quantitative data was analyzed using descriptive statistical analysis, written responses in comment sections were analyzed using content analysis. *Results:* Thirty-two of 42 (73%) surveys were completed. Nine (45%) residents and 5 (42%) experienced providers responded that virtual rounds did not compromise learning and education on stroke service. Fifteen (75%) residents and all experienced providers agreed that virtual rounds protected caregivers from exposure to the virus. While more than a third of residents (37%) did not feel comfortable utilizing telemedicine in ED, the majority of experienced providers (89%) were at ease with it. A total of 58% of residents and 67% of experienced providers felt that they were spending less time at the bedside, and 42% of residents and 58% of experienced providers felt less connected to patients during the pandemic. *Conclusion:* Majority of neurology residents' experience was not positive utilizing telemedicine as compared to other staff providers. This is likely attributed to lack of prior exposure and unpreparedness. Incorporation of telemedicine curricula in medical school and residency training could prepare the next generation physicians to effectively use these technologies and meet the growing need for telehealth services for current and future pandemics.

Key Words: Virtual rounding—Telestroke—Resident education—COVID-19 pandemic

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Introduction

Healthcare systems have responded to the coronavirus disease 2019 (COVID-19) pandemic by adjusting practices and adopting new paradigms of care to protect caregivers from the exposure. There has been substantial increase in telehealth services by 154% during the first quarter of the year and rise of 2013% of outpatient televisits during the midyear 2020 since the COVID-19 outbreak.^{1,2} In parallel, there has been restructuring of residency programs across the United States to balance personal safety and patient care needs.^{3,4} One of the major changes included

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Received August 30, 2021; revision received October 2, 2021; accepted October 4, 2021.

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1052-3057/\$ - see front matter

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<https://doi.org/10.1016/j.jstrokecerebrovasdis.2021.106177>

integrating “protected code” for stroke evaluations and virtual platforms to discuss and deliver patient care.⁵ The effect of infectious disease outbreaks on trainees and educational programs were previously described during the 2003 SARS outbreak.^{6,7} A survey of neurology trainees in Italy reported the effects of COVID-19 pandemic on education, but specific effects of pandemic preparedness were not explored.⁸ We conducted a survey of trainees, staff physicians and advanced practice providers to understand the perception related to COVID-19 preparedness in education and patient care.

Methods

The study is a cross sectional survey at an academic medical center in the United States. Two major changes in stroke education and care were instituted at our comprehensive stroke center after the declaration of state emergency in Ohio on March 9, 2020. First, a virtual platform for rounding and teaching was introduced. Second, the stroke program instituted telemedicine in the emergency department (ED) with residents performing in-person patient evaluations under virtual supervision of a fellow or a staff member. In the study, the term residents and trainees are used interchangeably. Experienced providers included stroke physician, stroke fellow, advanced practice provider/stroke nurse practitioner. Besides stroke physicians, the stroke fellow who were neurology board certified during the implementation and the advanced practice provider at our hospital who are independent nurse practitioners working in the stroke service are considered as experienced providers in our study. Some of the questions pertaining to resident education are not relevant to advanced practice providers which were marked as not applicable during our analysis.

Virtual rounds: The stroke faculty, stroke fellow, stroke nurse practitioner and the neurology trainees meet virtually through a digital platform every day in the morning. Residents present the cases and the discussion is led by a stroke fellow and a staff physician. The team discusses management plans, while sharing screens to view electronic health records, diagnostic images, and medical literature. After the virtual rounds, the team is split into groups of 3 (stroke fellow, stroke staff physician, senior resident or resident taking care of the particular patient) for bedside rounds instead of the whole team rounding together. Later, the whole team reconvenes late in the afternoon on a virtual platform and discusses further change in plans and important physical and diagnostic imaging findings.

Telemedicine in the emergency department: For an acute stroke in the emergency department, daytime response includes ED physician, nurse, pharmacist, junior and senior neurology residents, stroke fellow or staff physician in person. During the COVID period, telemedicine equipment (InTouch Health, Xpress Cart) was deployed

to reduce personnel directly evaluating the patient. A stroke fellow or staff physician logged in via telemedicine and supervised the residents who were evaluating the patients in person.

Survey of neurology residents, stroke fellows, stroke advance providers, and stroke staff physicians was conducted as a part of the quality improvement initiative from May to June, 2020. The survey was sent through e-mail with a secure, password-protected link on Redcap (see Supplementary Appendix for questionnaire). The first portion of the survey evaluated the impact of virtual rounds on the learning and education, communication, perceived safety and organizational support. The second half of the survey explored the effects of the utilization of telemedicine in the ED on patient-provider communication, timely patient management, learning experience, trainee independence in decision making, and the future of stroke evaluations in the ED. Along with the specific questions on virtual rounds and ED telemedicine, two general questions assessed the pandemic's effect on patient-provider relationship. The survey responses were analyzed for research with the approval of the institutional review board.

Variables were classified on 4 categories: the responder characteristics (position, year of training, participation in virtual rounds, participation in virtual rounds on stroke service, the utilization of telemedicine in the ED), virtual rounds-related variables that determine clinical and educational impact (efficacy, learning and education, communication, safety and support), ED telemedicine variables (comfort, communication, delays, independence, decision-making, future of telemedicine in the ED), and the variables that reflect patient-provider relationships (time with patient, connection to patient). The descriptive statistics were generated from quantitative data. Additionally, participants were able to leave comments and suggestions regarding virtual rounds and ED telemedicine. Content analysis of open-ended survey sections was used to identify themes in the written data.

Results

A total 20 of 29 neurology residents (69%), 12 of 15 experienced providers (80%) who rotated in the stroke service during the pandemic responded to the survey. The experienced providers included 6 of 9 stroke faculty members (67%), all of 3 stroke fellows (100%), and all of the 3 stroke nurse practitioners (100%). Of the neurology resident responders, 25% were in their first post graduate year of training; 40 %, their second; 25%, their third; 10%, their fourth.

Effect of virtual rounds on learning and education

Nine (45%) residents and 5 (42%) experienced providers responded that virtual rounds did not compromise learning and education on stroke service. The quantitative

Table 1. *Learning and education.*

Question	Groups	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Virtual rounds compromised the quality of education on stroke service.	Resident	0	5(25%)	6(30%)	7(35%)	2(10%)
	Experienced providers	0	2(17%)	5(42%)	4(33%)	1(8%)
Virtual rounds negatively impacted bedside learning.	Resident	1(5%)	8(40%)	5(25%)	5(25%)	1(5%)
	Experienced providers	0	9(75%)	1(8%)	1(8%)	1(8%)
Virtual rounds positively impacted the quality of the attending- and fellow-led education.	Residents	0	4(20%)	13(65%)	3(15%)	0
	Experienced providers	0	3(25%)	7(58%)	2(17%)	0

findings were supported by qualitative data. Several participants emphasized that virtual rounds provided them with the ability to share the screen with residents and discuss imaging in more detail. Forty-five percent of residents and 75% of experienced providers responded that bedside teaching was felt to be negatively impacted by virtual rounding. While 20% of residents and 25% of experienced providers reported that virtual rounding improved the quality of attending- and fellow-led education, 15% of trainees and 17% of others disagreed (Table 1).

Virtual rounds impact on communication

Only 9 (45%) residents and 3 (25%) of experienced providers felt that virtual rounds affected their feelings of belonging and being included in the team (Table 2). Not rounding as a whole team did not lead to communication errors and delays according to quantitative and qualitative findings. Sixty percent of residents and 42% of experienced providers believed that virtual rounds did not affect communication within the stroke team.

Virtual rounds impact on safety and support

More than 75% of residents and 100% experienced providers felt that virtual rounds protected caregivers during COVID-19 pandemic. Eleven (55%) of residents, 10 (83%) experienced providers expressed that virtual platforms lessened the fear and anxiety of exposure to COVID-19 (Table 3)

Telemedicine in ED

The majority of stroke faculty and fellows (89%) agreed that they are comfortable with utilizing telemedicine (nurse practitioners are not part of the acute stroke

response in ED). Such a positive response was from only 2 residents, while more than a third of residents (37%) responded that they were not comfortable. Further, 3 (16%) residents felt that the use of telemedicine delayed stroke evaluations and limited trainee independence. This theme emerged as a result of content analysis as well. Following themes were identified: limited resident autonomy, the lack of guidance and training in telemedicine, and the additional responsibility to move and place a telestroke cart while “juggling between patient, families, fellow, pharmacist and paging out to appropriate teams”. Most of the participants were not in support of telemedicine as part of the routine stroke evaluations in ED and expressed their doubts regarding its utilization after the pandemic (Table 4).

Patient-provider relationships

Eleven residents (58%) and 8 experienced providers (67%) felt that they are spending less time at the bedside (Table 5). Only six (31%) residents disagreed with the statement. Further, a substantial portion of clinicians (42% of residents, 58% of others) felt less connected to the patients.

Discussion

The SARS-CoV-2 outbreak posed many challenges to academic institutions, training programs and clinical practices, which have to find innovative ways to balance trainee education, patient care and ensure safety of the healthcare providers.^{9,10} Our survey showed that our implementation of virtual rounding was acceptable to both trainees and other clinicians and most felt safer. But the implementation of telemedicine in ED was challenging mostly for residents.

Table 2. *Communication.*

Question	Groups	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Virtual rounds positively impact communication within the stroke team.	Resident	0	5(25%)	12(60%)	2(10%)	1(5%)
	Experienced providers	1(8%)	2(17%)	5(42%)	4(33%)	0
Virtual rounds limit my ability to express opinion, ask a question and get feedback	Resident	1(5%)	2(10%)	5(25%)	9(45%)	3(15%)
	Experienced providers	1(8%)	3(25%)	2(17%)	6(50%)	0
Not rounding as a whole team lead to communication errors and delays.	Resident	1(5%)	4(20%)	7(35%)	6(30%)	2(10%)
	Experienced providers	1(8%)	3(25%)	3(25%)	5(42%)	0
Virtual rounds did not affect my feelings of belonging and being included in the team	Residents	0	9(45%)	8(40%)	2(10%)	1(5%)
	Experienced providers	0	3(25%)	4(33%)	3(25%)	2(17%)

Table 3. *Safety and support during COVID-19 pandemic.*

Question	Groups	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Virtual rounds protect caregivers during COVID-19 pandemic.	Resident	6(30%)	9(45%)	4(20%)	1(5%)	0
	Experienced providers	7(58%)	5(42%)	0	0	0
Virtual rounds lessened the anxiety and or fear of exposure to COVID-19.	Resident	6(30%)	5(25%)	6(30%)	2(10%)	1(5%)
	Experienced providers	6(50%)	4(33%)	2(17%)	0	0
Virtual rounding is a good way to provide patient care during this COVID-19 pandemic.	Residents	2(10%)	12(60%)	5(25%)	1(5%)	0
	Experienced providers	3(25%)	5(42%)	3(25%)	1(8%)	0
Virtual rounds reflect the institutional commitment to keep me safe.	Residents	3(15%)	11(55%)	6(30%)	0	0
	Experienced providers	7(58%)	4(33%)	1(8%)	0	0

Trainee education

In a recent North American survey of neurosurgical residency, 65% had a favorable opinion on learning via remote platforms.¹¹ Forty-five percent of residents in our survey felt

that the virtual platform did not compromise the learning and education on the stroke service. However, in our survey, the same number of the residents (45%) and experienced providers (75%) felt that bedside learning was affected due to virtual rounding. One resident commented,

Table 4. Telemedicine in ED.

Question	Groups	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I feel comfortable utilizing telemedicine in the Main Campus ED.	Residents	2 (11%)	0	10 (53%)	5 (26%)	2 (11%)
	Fellows and faculty	4 (44.5%)	4 (44.5%)	0	0	1 (11%)
Telemedicine in the Main Campus ED delays my stroke evaluations.	Residents	1 (5%)	2 (11%)	13 (68%)	3 (16%)	0
	Fellows and faculty	1 (11%)	0	4 (45%)	3 (33%)	1 (11%)
Telemedicine in the Main Campus ED limits the independence of trainees in evaluating patients.	Residents	2 (11%)	1 (5%)	12 (63%)	4 (21%)	0
	Fellows and faculty	1 (11%)	2 (22%)	4 (45%)	1 (11%)	1 (11%)
Telemedicine in the Main Campus ED is helpful in making the correct decision in patient management.	Residents	0	4 (21%)	15 (79%)	0	0
	Fellows and faculty	3 (33%)	2 (22%)	4 (44%)	0	0
Telemedicine in the Main Campus ED should be a part of routine acute stroke evaluations in the future.	Residents	0	2 (11%)	12 (63%)	5 (26%)	0
	Fellows and faculty	1 (11%)	2 (22%)	4 (45%)	2 (22%)	0

The experienced provider responses were restricted to stroke fellows and faculty since nurse practitioners are not involved in acute stroke in ED.

Table 5. Patient provider relationship.

Question	Groups	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I am spending less time with patients at the bedside during COVID-19 pandemic.	Resident	5(26%)	6(32%)	2(11%)	5(26%)	1(5%)
	Experienced providers	0	8(67%)	3(25%)	0	0
I feel less connected to patients during COVID-19 pandemic.	Resident	1(5%)	7(37%)	5(26%)	5(26%)	1(5%)
	Experienced providers	1(8%)	6(50%)	3(25%)	1(8%)	1(8%)

“Junior /inexperienced resident physical exam cannot be well validated.” Some of our survey responses were in accordance with another survey of neurology residents in Italy, in which the majority felt the pandemic caused interruption to their scholarly, research, outpatient rotations, and overall had a negative educational impact.¹²

Our survey was done after implementation of two major changes which included virtual inpatient rounding and acute stroke evaluations via telemedicine in the

emergency department. The majority of residents and experienced providers felt virtual rounds implementation was a reasonable effort in balancing team safety, clinical care and education. Some of the faculty and supervising physicians felt inpatient virtual rounding was a good way to share images and review scientific papers during discussion of the patients. The majority of the residents felt it did not affect reviewing the patient imaging and in fact felt it was superior compared to traditional rounds.

Only a few residents felt the need of utilizing telemedicine at the emergency department. Some of the residents felt it takes out autonomy of the resident to evaluate the acute stroke patient at ED with one commenting, "telemedicine adds one more person looking over our shoulder". But overall, 42 % experienced providers agreed and 63% of residents were rather neutral in regards to telemedicine in the ED allowing effective communication between the stroke team and the patients/families. The negative feedback on implementation of telemedicine at ED from residents is probably due to lack of pre-training before implementation. The sudden exposure of interns and second year neurology residents in a hyper acute environment could be the reason for negative response regarding telemedicine implementation at the ED. Instead, the tele-supervision of residents in non-stroke coded situations initially and gradual exposure to the hyper acute situations would have been a reasonable approach.

COVID fear and anxiety

In a pediatric residency survey, 50% of the residents were afraid of contracting and spreading it to the patients and families.¹³ In our survey, the implementation of these changes lessened fear of exposure to COVID in 55% of residents, but 45% of them were neutral and or did not feel it was an effective measure to assure safety. In contrast, all experienced providers were either neutral or agreed. This may be due to neurology residents still being on the front-line interacting with patients in person. Hence, only 15% of residents strongly agreed that virtual rounds reflect the institutional commitment to keep them safe compared to experienced physicians (58%) who were now on the remote side of telemedicine. Fifteen percent of residents disagreed and 30% were neutral with the statement that virtual inpatient rounding and telemedicine at ED lessened their fear and anxiety of risk of exposure.

Patient physician relationship during COVID-19

Fifty-eight percent of residents and 67% supervising physicians stated that they were spending less time at the bedside interacting with the patient and the majority of participants agreed that they felt less connected not only with a patient but also with the team. One survey responder stated, "There is some human aspect to not rounding as a team and not seeing team members..." and "...there is also a human aspect to reducing patient contact". Another stated, "Currently patients appreciate our presence during COVID-19 pandemic, but we need to go back to being with the patients at some point."

Also, 37% of residents and 50% experienced providers felt they were less connected, but 40% of residents responded that it did not affect their feelings of belonging and being included in the team. One of the residents stated "I am less connected with virtual rounding, it is

effective because it needs to be, but only because of current times, I would not prefer it at all if the option was still traditional rounds".

The study is a survey of implementation of a particular response to COVID-19 pandemic in a single stroke program. The program's structure and educational culture during pre-pandemic and pandemic periods would have influenced the responses. The institutional structure and regular routine practice before the implementation of structural changes could have influenced the response which cannot be generalizable.

Our sample size is small, but the survey response rate was high enough to describe changes and highlight the differences between different groups of providers. We did not assess educational outcomes, but the stroke and neurology residency programs take trainee feedback as an important measure.

Recommendations and Conclusion

Based on our survey response, we implemented changes following the survey, to focus and improve resident learning and education. We restructured the stroke service, involving more residents during bedside rounding taking necessary precautions to prevent exposure. We continued morning discussions and imaging review of patients via virtual platforms, since the majority of residents and experienced providers favored them to be a useful and effective tool in information sharing and teaching. Telemedicine evaluations in ED were discontinued and stroke fellows or staff physicians returned to accompanying the residents in person to give immediate feedback, teaching and validate resident's exam. The decreased clinician interactions and feelings of connectedness with patients are concerns during the pandemic.

Overall, the majority of neurology residents' experience was not positive utilising telemedicine as compared to other providers. Stepwise approach of tele-supervision of trainees in non acute evaluations, followed by gradual exposure to hyper acute situations could be the better approach. Lack of exposure to telemedicine during the medical school and neurology residency training was a challenge for the academic institutions which have adopted virtual care during the COVID-19 pandemic. It may be essential to integrate telemedicine training into curricula of medical school and neurology residency to train the next generation physicians to effectively use these technologies and meet the growing need for telehealth services for current and future pandemics.

Study funding

None

Declaration of Competing Interest

The authors report no financial relationships or competing interests relevant to the study.

Acknowledgment: We thank the neurology residents, and members of the stroke program, and neurology residency program, for their assistance, in particular neurology chief resident Lindsay Ross, residency program director Maryann Mays, and stroke program director Andrew N. Russman.

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