Experiences of Residents and Fellows at Mayo Clinic After the Rapid Implementation of Telemedicine During the COVID-19 Pandemic

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ABSTRACT

OBJECTIVE: The COVID-19 pandemic led to many changes across medical organizations and graduate medical education programs nationwide including the rapid implementation of telemedicine as a modality for delivering health care. The purpose of this study was to investigate the telemedicine experiences of residents and fellows with their self-reported level of preparedness, impact on their education including precepting, skill development, and patient-physician relationships, and perceptions of telehealth platforms and curricula in the future.

METHODS: A total of 365 Mayo Clinic residents and fellows across three sites (Florida, Arizona, and Minnesota) were identified as trainees who conducted at least one telemedicine encounter from January 1, 2020 to June 30, 2020 and were sent an electronic survey by e-mail.

RESULTS: There was a total of 103 completed surveys across various specialties with 58.3% female respondents, 63.1% residents, 35.0% fellows and 77.7% of respondents who attended medical school in the United States. Most trainees reported having very little to no exposure to telemedicine in their medical careers before the pandemic. The majority were satisfied with their first telemedicine encounter and found precepting comparable to in-person visits. The trainees in this study had a favorable view with 98.1% believing telemedicine will play a more prevalent role in the future and most agreed this should be included in medical school and residency training.

CONCLUSION: Our survey found that after the implementation of telemedicine during the COVID-19 pandemic, the experiences of trainees at a multi-site academic center were overall positive. More research is needed on the perceptions of skill development (physical exam and history taking) during a telemedicine encounter and outlining an optimal telemedicine curriculum that can improve confidence in trainees.

KEYWORDS: telemedicine, medical education, trainees, residents/fellows, COVID-19 pandemic

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Introduction

At the end of 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes the coronavirus disease 2019 (COVID-19), became the third documented coronavirus in the past two decades to transfer from animals to humans causing a major pandemic.[1] Prior to March 2020, Medicare covered telemedicine (TM) services in a limited manner for specific situations (i.e., patients living in designated rural areas who must travel to medical facilities to receive telehealth services). In response to the COVID-19 pandemic, the Centers for Medicare & Medicaid Services (CMS) approved a new waiver to increase access to telehealth services.[2] In addition, many commercial insurance plans offered coverage for telemedicine visits. The goal was to minimize community spread of the virus by providing timely care to mildly symptomatic patients in their homes.[2] It was also essential to continue to provide routine care to patients, especially those with chronic medical conditions, without exposing them to public environments.[3]

Outside of global pandemics, telemedicine has been identified as a clinical tool that would be beneficial in primary care and specialty services. It can increase access to specialty care (particularly in rural areas), reduce disparities, create cost savings in healthcare, improve healthcare outcomes, reduce unnecessary in-person visits, and decrease wait times.[4,5]

Despite the clinical value of telemedicine, most residency programs have not directly integrated methods of electronic visits into training curriculums. In a 2019 study of family medicine residency programs, 46% of programs reported that their residents had never delivered primary care services using live interactive video.[5] A 2011 survey of psychiatry residency programs found that over half (54.3%) reported that their residents were not exposed to telepsychiatry.[5] The majority of dermatology

residency programs in a 2016 survey did not include telemedicine as part of their curriculum.[6]

The COVID-19 pandemic led to dramatic changes with the rapid implementation of the telemedicine services across many health systems and physician practices nationwide including residency programs. This provided a unique opportunity to study the experiences of residents and fellows in this evolving modality for delivering health care. A resident survey in Georgia compared experiences of telemedicine versus in-person visits for internal medicine and family medicine residents including time spent in the visits and burnout.[7] Another survey in New York assessed resident confidence with managing chronic diseases through telemedicine and future career choices involving telehealth.[8] The primary goal of our study was to assess the experience of residents and fellows (described herein as trainees) with the use of telemedicine services during the COVID-19 pandemic at Mayo Clinic. There are to date, no multi-campus trainee surveys that attempt to understand telemedicine exposure before the pandemic, training and preparedness during the pandemic, in addition to education experiences and future views of telemedicine.

Materials and Methods

The nature of this study was to create a survey for trainees to analyze their experiences with telemedicine implementation during the COVID-19 pandemic period. Mayo Clinic trainees who conducted a telemedicine encounter from January 1, 2020 to June 30, 2020 were identified across three Mayo Clinic sites (Florida, Arizona, Minnesota). A database was created by the Mayo Clinic Center for Digital Health with these criteria. Trainees who completed their training at the end of June 2020 and were no longer working at Mayo Clinic were excluded and the number of eligible participants totaled 365 and was the target sample size. The platform used for telemedicine visits at Mayo Clinic is Zoom videoconferencing. The project was reviewed by the Mayo Clinic Institutional Review Board (IRB) and was determined to be exempt due to minimal risk (IRB approved protocol number 20-008078). The project was also approved by the Mayo Clinic COVID-19 Research Task Force and the Education Research Committee (ERC). The e-mail recruitment script was reviewed and approved by the IRB and ERC; it outlines the project goals, that participation is voluntary, and that participants have the right to withdraw consent or discontinue participation at any time without penalty. Formal written consent was not required per the IRB and confirmed that the e-mail script contained all necessary project information for informed consent of participants; trainees who agreed to participate could click the hyperlink in the e-mail to be directed to the electronic survey.

The electronic survey was created using REDCap (Research Electronic Data Capture; Appendix 1).[9] The survey was pilot tested on 3 participants of the total 365 (1%) before being formally launched. Study data were also collected and managed using REDCap. The survey focused on the experience of trainees with telemedicine prior to COVID-19 (before January 2020) and during a specific timeframe of the COVID-19 pandemic (January to June 2020). This included questions about their first telemedicine encounter, precepting, and their views on advantages, disadvantages, and the future of telemedicine. The survey also obtained baseline demographic data from the trainees including age-range, gender, race/ethnicity, whether they attended medical school abroad or in the United States of America, and post-graduate year. All eligible trainees who completed a telemedicine visit during the studied timeframe (365 total) were sent a survey and therefore a power calculation was not needed retrospectively.[10] The surveys were sent by e-mail from April 2021 – May 2021 and closed for data input by June 2021. There were 103 completed surveys; although all questions were not mandatory to answer, the sample size of N = 103 was used as denominator for statistical analysis.

Statistical Analysis

Statistical analysis involved evaluation of all survey questions which were reported as frequency and percentages. Questions with ordinal answers which required comparison between two different subpopulations were done using Armitage trend tests.[11] Demographic information was compared between the two groups using Fisher's exact test. All tests were two-sided; a P value <.05 was considered statistically significant.

Results

A total of 365 Mayo Clinic trainees who had conducted a telemedicine encounter between January 1, 2020 and June 30, 2020 were identified. Prior to January 1, 2020 there were no telemedicine visits completed by trainees at Mayo Clinic. The survey was completed by 28.2% of the trainees via e-mail (103 of the 365 surveys sent). The specialty with the highest responding trainees at 22.3% (22) were from Internal Medicine, followed by Family Medicine at 13.6% (14), Neurology at 11.7% (12), Psychiatry and Psychology 10.7% (11), Gastroenterology and Hepatology 8.7% (9), Dermatology 4.9% (5), Endocrinology 2.9% (3), Neurology 2.9% (3), all other departments 22.3% (23). The patient telemedicine encounters varied; examples were a 53-year-old male seen for asthma follow-up by a Family Medicine resident, an 82-year-old male with history of chronic kidney disease seen for worsening renal labs by a Nephrology fellow, a 62-year-old female with toe cellulitis seen by an Internal Medicine resident, and a 35-year-old male seen for regular HIV follow-up by an Infectious Disease fellow.

Of the total respondents, 58.3% (60) were female, 77.7% (80) had attended medical school in the United States, 63.1% (65) were residents and 35.0% (36) were fellows. Participants ranged in years of training from PGY1 to PGY8, specifically: PGY-1 (18), PGY-2 (27), PGY-3 (16), PGY-4 (15), PGY-5

(10), PGY-6 (10), PGY-7 (3), PGY-8 (1) and three did not disclose. The number of individual trainee telemedicine visits ranged from 1 to 71 during the studied timeframe.

Experience prior to COVID-19 pandemic

Most trainees, 93.2% (96), reported having "none" or "very little" exposure to telemedicine during medical school regardless of whether they attended medical school in the United States or internationally. When asked about the amount of telemedicine used in their medical career prior to its implementation in the clinic during the COVID-19 pandemic, 59.2% (61) did not use telemedicine at all and 23.3% (24) used telemedicine very little (Figure 1). When surveyed regarding telemedicine training by their peers in other residency programs, 66.0% (68) did not believe that trainees in other residency programs were provided telemedicine training prior to the COVID-19 pandemic.

The first telemedicine encounter

In response to the pandemic, Mayo Clinic initiated TM visits for many providers including trainees. Results showed that 75.7% (78) of trainees reported receiving some degree of formal training prior to their first TM encounter. When assessing preparedness, 73.8% (76) of trainees were noted to be "somewhat" or "very prepared". The fellow and resident populations were examined with the Armitage trend, which showed consistency between the two sub-populations (80.6% of residents vs 70.8% of fellows, *P*-value .047). For the individuals who received initial training on telemedicine visits, 44.7% (46) found the training "somewhat helpful" and 27.2% (28) found it "very helpful". Most respondents were satisfied with their first telemedicine encounter with 40.8% (42) being "somewhat satisfied" and 35.9% (37) feeling "very satisfied" (Figure 2).

Precepting and telemedicine

Trainees were queried on how often preceptors joined the telemedicine visit while it was ongoing with 10.7% (11) noting that a preceptor always joined their TM encounter, 56.4% (57) noted a preceptor sometimes joined and 32.7% (33) reported

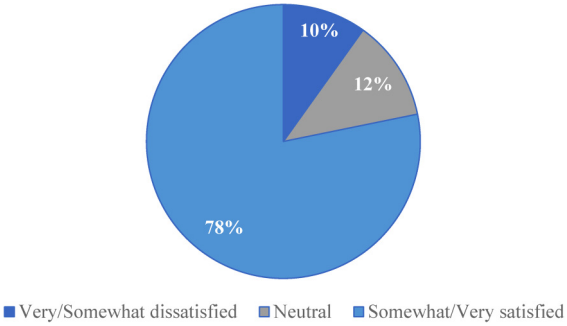

Figure 2. Pie graph outlining response percentages for how satisfied the trainees were with the workflow from start to finish with their first telemedicine encounter. This includes very dissatisfied 1% (1) and somewhat dissatisfied 8.8% (9) combined to total 9.9%, neutral 11.8% (12), and somewhat satisfied 41.2% (42) and very satisfied 36.3% (37) combined to total 77.5%; N = 101.

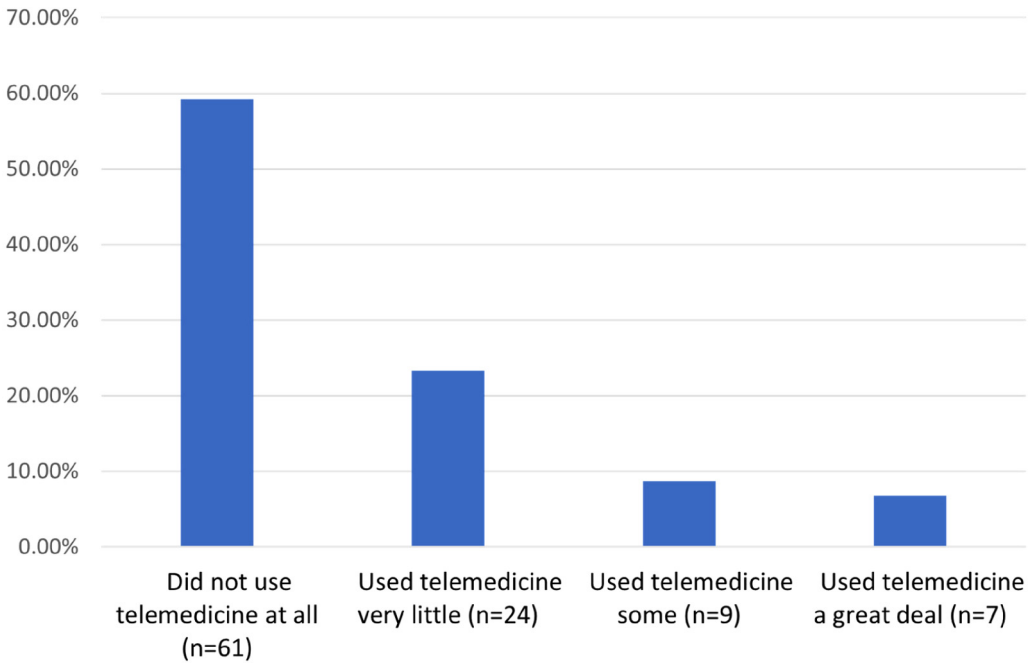

Figure 1. Survey results when trainees were asked "how much did you use telemedicine in your medical career, prior to its implementation in the clinic during the COVID 19 pandemic?" N = 101.

they never joined (Table 1). The majority of responding trainees agreed that preceptors were well prepared (59.2%, n = 61) and that the precepting experience for telemedicine visits was comparable to an in-person experience (47.6%, n = 49; Table 1).

Trainee learning experiences and telemedicine

The survey queried trainees on their thoughts about history taking and physical exams using telemedicine. There were 43.7% (45) of trainees who disagreed with the idea that TM visits limited their training with regards to performing a physical exam (Table 2). The majority of trainees (44.7%, n = 46) answered neutral to whether telemedicine helped improve their history taking skills. However, when examining PGY-1 versus other trainees (PGY-2 to PGY-8), most PGY-1 residents (9 of 18 PGY-1 respondents; 50.0%) reported that telemedicine encounters improved their history taking skills. This comparison between PGY-1 residents and the other resident/fellows had a *P*-value of .06. There was agreement when they were queried if TM training should be included at the residency level or at the medical school level.

Viewpoints on the future of telemedicine

Overall, the majority of trainees agreed that telemedicine will improve doctor-patient relationships (67%, n = 69), is a viable approach to providing care (96.1%, n = 99), and will play a more prevalent role in the future of medicine (98.1%, n = 101; Table 2). In addition, there was agreement that telemedicine should be included in residency (89.3%, n = 92) and medical school training (70.8%, n = 73). Refer to Table 2 for complete results.

Discussion

Utilization of telemedicine has been on the rise, however, the COVID-19 pandemic led to rapid implementation and adaptation of telehealth services across the country. This unique change led to residents and fellows being exposed to a new and evolving model of healthcare delivery.

The trainee survey respondents in this study represent a diverse group of residents and fellows across different specialties at Mayo Clinic and the majority shared a similar perception that they had very little to no exposure to telemedicine in medical school and in their medical careers before the pandemic. The Cleveland Clinic Internal Medicine Residency Programme developed an expedited telemedicine curriculum and surveyed residents before and after; pre-survey results showed 76.8% had no prior telemedicine experience and indicated limited comfort with the modality, which was similar to our findings.[12] A recent Association of American Medical Colleges (AAMC) survey of curriculums within medical schools revealed an increase of 20% of telemedicine coursework

Table 1. Views on precepting for telemedicine encounters. Values show percentages out of total 103 respondents, with (n) representing the absolute number of respondents in each category.

TRAINEES BELIEVED THAT…	STRONGLY DISAGREE/ DISAGREE	NEUTRAL	AGREE/ STRONGLY AGREE	DID NOT ANSWER
TM precepting was comparable to an in-person encounter	20.4% (21)	8.7% (9)	47.6% (49)	23.3% (24)
Preceptors were adequately prepared	15.5% (16)	13.6% (14)	59.2% (61)	11.7% (12)
TM encounter was enhanced when preceptor joined	10.7% (11)	23.3% (24)	36.9% (38)	29.1% (30)

Table 2. Trainee viewpoints on telemedicine. Values show percentages out of total 103 respondents, with (n) representing the absolute number of respondents in each category.

TRAINEES BELIEVED THAT…	STRONGLY DISAGREE/ DISAGREE	NEUTRAL	AGREE/ STRONGLY AGREE	DID NOT ANSWER
TM visits limited training in regards to performing a physical exam	43.7% (45)	12.6% (13)	36.9% (38)	6.8% (7)
TM visits improved history taking skills	24.3% (25)	44.7% (46)	29.1% (30)	1.9% (2)
TM visits improved current doctor-patient relationships	22.3% (23)	40.8% (42)	35.9% (37)	1.0% (1)
TM will enhance future doctor-patient relationships	7.8% (8)	25.2% (26)	67.0% (69)	0
TM is a viable approach to providing care	1.0% (1)	2.9% (3)	96.1% (99)	0
TM training should be included in medical school	12.6% (13)	14.6% (15)	70.8% (73)	1.9% (2)
TM training should be included in residency	1.9% (2)	8.7% (9)	89.3% (92)	0
TM will play a more prevalent role in the future	0	1.9% (2)	98.1% (101)	0

being offered in some capacity between the academic years of 2013/2014 to 2017/2018.[6] If this trend persists and medical schools continue to increase telemedicine exposure, this training will likely benefit future medical students. Another study assessing American College of Graduate Medical Education (ACGME) milestones in 2018 for resident training found that only 1 of 104 subspeciality programs mentioned the keyword "telehealth" which shows that there was an absence of core curricula which centered on telemedicine prior to the COVID-19 pandemic.[13] Different professional societies are now identifying this gap and responding accordingly. The AAMC has established its own telehealth competencies which can serve as a template for medical school or residency program curriculum development.[14] The Society of Teachers of Family Medicine (STFM) has shared learning objectives for a national telemedicine curriculum based on the AAMC competencies.[15]

Despite the rapid introduction of telehealth and lack of prior experience reported by the surveyed trainees at Mayo Clinic, most felt satisfied with their first telemedicine encounter. The Center for Digital Health at Mayo Clinic provided videos and clinical resource guides for telemedicine encounters that were available as early as March 2020. A study conducted by the Stanford-O'Connor family medicine residency program provided their residents with a 50-minute didactic lecture that included information on 5 domains of telemedicine including logistics of a telemedicine visit (appropriate visit types, technology set-up, etiquette, etc.), taking a history through telemedicine (and effective communication skills), conducting a virtual physical exam, documenting a telemedicine visit, and staffing with an attending virtually.[16] As a result of this educational material, they noted a statistically significant increase in resident confidence with performing a virtual physical exam, documenting a visit, and virtually staffing with an attending.[16] The telemedicine curriculum developed by Cleveland Clinic included an orientation presentation to standardize virtual visits, recordings of simulated encounters, education for residents and preceptors on how to document virtual encounters in addition to resources such as slide decks on the virtual platforms and communication tips.[12] Post-participation survey results indicated that this curriculum was perceived as effective at teaching telemedicine skills but recommended the format be more interactive.[12] These findings outline the need for appropriate learning resources to be available for trainees so they can feel prepared for telemedicine visits.

In regards to precepting, our study results indicated that trainees felt that telemedicine encounters were comparable to in-person visits and that the preceptors seemed adequately prepared to supervise a telemedicine visit. A family medicine residency program in California surveyed faculty preceptors and found they overall felt confident in their ability to provide feedback about residents' medical knowledge and clinical decision-making during telemedicine visits however they identified a need for a standardized learner evaluation tools for telemedicine visits and greater instruction on teaching telemedicine physical exam skills to residents.[17] This highlights the importance of understanding the views of not just the trainees but faculty involved in telemedicine supervision when creating a trainee telemedicine curriculum.

Our results indicated that the majority of trainees did not find their physical exam training to be limited due to telemedicine visits which is reassuring. In addition, the majority of trainees were neutral about telemedicine being an avenue to improve their history taking skills; these results may have been different if didactic lectures had been offered on these topics beforehand, as shown in the 5-domian telemedicine didactics studied by Stanford-O'Connor family medicine.[16] Another study provided education to residents on how to conduct and document a virtual visit and found improvements in confidence in obtaining a patient history virtually and conducting a physical examination in both video-based and telephone settings.[18]

Overall, the trainees in our study had a favorable view with implementation of telemedicine during the COVID-19 pandemic. The majority of trainees agreed that telemedicine will improve doctor-patient relationships, is a viable approach to providing care, and will play a more prevalent role in the future of medicine. Although current published residency surveys have their own unique questionnaire, most results show a positive response in the transition to use of telemedicine in the outpatient setting.[7,17]

Limitations of this study include that a survey was sent April to May 2021 to question trainees on their experiences from January to June 2020 which may result in recall bias. Survey questions can be open to interpretation and there was no objective way to quantify medical school and residency telemedicine training prior to the COVID-19 pandemic. Although Mayo Clinic did provide trainees with telemedicine resources, we were not able to measure when, if, or how much these resources were used. The trainee population surveyed was across three Mayo Clinic sites (Florida, Arizona, and Minnesota) which is an academic center and may not represent the general trainee population across the United States. The survey was pilot tested (on 1% of participants) but not formally validated which could limit consistency and dependability of the questions. Surveys have the potential for response bias where answers are based on the structure and language of the questions and not the true thoughts of the participant. The number of telemedicine visits for surveyed trainees varied (ranging from 1 to 71 visits); a larger sample size would better assess statistical significance of answers when looking at number of visits completed. The survey response rate for our study was 28.2%, which could be considered low or expected based on different studies examining expected response rates.[19,20] One study performed a comprehensive review of survey response rates within primary care literature

and reported it varied from 10.3% to 61%.[19] Other similar studies including the Cleveland project had a post-participation survey response rate of 29%.[12] Reasons behind the low response rate may include e-mail fatigue of trainees and the fact that e-mail was the only modality used for the survey. There are reports that when comparing electronic versus paper equivalent surveys in physicians, paper surveys had a higher response rate.[20] Low participation could further create selection bias with our sample and limiting representation of trainees across the country. On the contrary, studies have also shown that high response rates may offer little or no reduction of nonresponse bias.[21]

Conclusion

Telemedicine has become an essential part of patient care since the onset of the COVID-19 pandemic. Our study demonstrates that overall telemedicine was well received by residents and fellows with the majority of participants agreeing it is important for patient care and should be a component of medical education. Further research is needed to assess the effectiveness of training material currently being utilized and development of a formal telemedicine curriculum. Telemedicine will continue to play a large role in the future of healthcare and educating trainees on this medical platform is important for providing high-quality and compassionate medical care to our patients.

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Supplemental Material

Supplemental material for this article is available online.

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