Telehealth for the internal medicine resident: A 3-year longitudinal curriculum

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Abstract

Aims: Across the United States of America, patients are increasingly receiving healthcare using innovative telehealth technologies. As healthcare continues to shift away from traditional office-based visits, providers face new challenges. Telehealth champions are needed to adapt technologies to meet the needs of patients, providers and communities, especially within the realm of primary care specialties. Given these challenges, this intervention aimed to incorporate telemedicine into internal medicine resident training across multiple training years to prepare them for practice in the current and changing healthcare system.

Methods: Education and telehealth leaders at the Medical University of South Carolina identified key topics relevant to telehealth and the provision of general internal medicine services. With this as a framework, we developed a 3-year longitudinal telehealth curriculum for internal medicine resident physicians, consisting of an introduction to telemedicine equipment in the first year, didactic learning through in-person education and online modules in the second year and experiential learning through remote monitoring of chronic disease in the third year. Participants included approximately 100 internal medicine residents per year (2016–2019). Self-perceived knowledge, comfort and ability to provide telehealth services was assessed via a survey completed before and after participation in the curriculum.

Results: Resident physicians' self-reported knowledge of telehealth history, access to care, contributions of telehealth applications and quality of care and communication each improved after completion of the online curriculum. There were also significant improvements in resident comfort and perceived ability to provide telehealth services after participation in the curriculum, as assessed via a survey. Overall, 41% of residents felt their ability to utilize telehealth as part of their current or future practice was greater than average after completion of the online modules compared to only 2% at baseline ($p<0.01$). Results also show residents accurately identify barriers to telehealth adoption at the healthcare system level, including the lack of clinical time to implement services (67% post- vs 47% pre-curriculum, $p = 0.02$), unfamiliarity with concepts (65% post- vs 21% pre-curriculum, $p<-0.01$) and concerns about consistent provider reimbursement (74% post- vs 39% pre-curriculum, $p < 0.01$).

Conclusion: Telemedicine and remote patient monitoring are an increasingly prevalent form of healthcare delivery. Internal medicine residents must be adept in caring for patients utilizing this technology. This curriculum was effective in improving resident comfort and self-efficacy in providing care through telehealth and provided residents with hands-on opportunities through supervised inclusion in remote patient-monitoring services. This curriculum model could be employed and evaluated within other internal medicine residency programmes to determine the feasibility at institutions with and without advanced telehealth centres.

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Introduction

Telehealth champions are needed to leverage technologies to meet the needs of patients, providers and communities. Nearly half (46%) of healthcare consumers in 2016 reported using three or more 'digital health tools'

such as telemedicine and wearables, up from 19% the year before.[1] Many physicians are interested in providing telemedicine: 57% of primary care doctors are willing to utilize video services for patient consults.[2] Additionally, there is growing evidence of the benefits of telehealth on patient care. These include improved health outcomes, quality of care and patient satisfaction.[3–7] It has been posited that providers who embrace telehealth will develop deeper and more trusting relationships with their patients.[8]

Given these benefits, telemedicine is a promising tool to address disparities and improve health outcomes for diverse patient populations. This is pertinent to residency programmes that are challenged to teach and address healthcare disparities and cultural competency tailored to their local populations.[9] Creating opportunities for trainees and faculties to learn about the integration of telehealth into clinical practice will help current and future generations of physicians develop services that improve the effectiveness and efficiency of healthcare services. As telehealth modalities evolve, so too must residency training in internal medicine (IM).

By incorporating telemedicine into resident training, graduate medical education can ensure new generations of physicians are empowered to utilize telehealth to face the challenges of their clinical practice. The American Medical Association has recommended formalized training in telemedicine for residents and medical students,[10] but the Accreditation Council for Graduate Medical Education (ACGME) has not yet developed formal guidelines. There is a rapidly expanding body of literature to support telemedicine training in residency programmes that rely heavily on medical images, such as dermatology and ophthalmology.[11–13] In 2015, 47% of dermatology residency programmes reported incorporating teledermatology into the training curriculum.[11] Model curricula in telepsychiatry and teleneurology have also been published.[14–16] In 2014, the American Telemedicine Association set forth practice guidelines for different areas of telehealth, including 'Practice Guidelines for Live, On Demand, Primary and Urgent Care'.[17] Despite this, there is a dearth of information on telemedicine education for residents in primary care specialties.[18] This is a critical issue as there are more than 25,000 residents currently training in IM.[19] There are myriad opportunities for telehealth applications that are directly pertinent to IM residents' future practice: tele-intensive care units for future cardiologists or intensivists, tele-stroke for future hospitalists, teleconsultation for future subspecialists and remote patient monitoring (RPM) for future providers. Although the Veterans Affairs system, the setting for a significant amount of IM training, has been innovative in expanding telehealth initiatives for patient care, education and formal training for residents has not been a major component.[20]

Objective

To meet the needs of current trainees, we developed a longitudinal telehealth curriculum to be completed over a 3-year IM residency programme. The instructional objectives of this curriculum, utilizing Bloom's taxonomy as a framework, are to:

1. Relate how the history of telehealth has contributed to the current application of this technology in healthcare.
2. Describe the various types of telehealth modalities and potential clinical implications.
3. Examine how telehealth increases cost efficiency, reduces transportation expenses, improves patient access to specialists and mental health providers and improves the quality of care and communication among providers.
4. Demonstrate the use of three telehealth tools in clinical, research and educational settings.

The objective of evaluating this curriculum is to determine the residents' self-identified knowledge gains associated with the interventions, confidence with utilizing telehealth as part of their future practice and ability to apply telehealth principles to improve care delivery and coordination systems. In addition, residency faculty members are interested in documenting best practices to support new generations of providers who will be more likely to utilize telehealth technologies across the span of their careers regardless of practice setting.

Methods

Population studied

The Medical University of South Carolina (MUSC) IM residency programme is a medium-sized university-affiliated programme with approximately 100 residents per year (postgraduate years (PGY) 1–5): primarily categorical residents with a minority combined medicine-paediatrics and medicine-psychiatry residents. Clinical, research and educational initiatives in telemedicine are being rapidly developed in this state, and the Health Resources and Services Administration (HRSA) recently designated MUSC one of only two national Telehealth Centers of Excellence.

The Telehealth Curriculum was introduced in 2016 for PGY2 and PGY3 residents. In 2017, it was expanded to include all PGY1, PGY2, PGY3 and PGY4+ categorical and combined residents with data obtained for participants from 2016–2019.

Programme design

To train IM residents for future practice including provision of telehealth services, formalized education is needed. In 2016, IM faculty leaders and telehealth experts designed the content and structure of an online curriculum, focusing on key educational topics to prepare residents for practice across a variety of care settings. This included didactics on the history of telemedicine, health policy and advantages and disadvantages of telehealth. The curriculum outline and objectives are publicly available (http://muschealth.org/telehealth-resident-syllabus). In 2017, the curriculum was expanded to include hands-on exposure to modern equipment and resources plus clinical care delivery processes via RPM. According to a 2016 Agency for Healthcare Research and Quality brief, the best available evidence for telehealth is in RPM and communication and counselling for chronic conditions.[3] We chose to utilize an RPM programme supporting uncontrolled diabetic patients in our resident continuity clinic as our primary experiential training.

The full 3-year curriculum was rolled out over a 2-year period. During the inaugural year, a majority of 2016–2017 PGY2 and PGY3 residents completed the online didactic modules. Residents were asked to complete a pre-test assessment prior to didactic module completion and all residents who had completed the modules were asked to complete the post-test and self-assessment evaluation. In 2017–2018, the curriculum was expanded to include all 3 years of residency and learning modalities as described below and in Figure 1.

The first year of the longitudinal curriculum introduces residents to telemedicine faculty, available equipment and current processes for telehealth delivery. This is achieved through a 1-hour overview of telehealth and a tour of our institution's Center for Telehealth.

Didactic learning in the second year consists of five mandatory web-based online modules, accessible throughout the year. Topics include: History and Changing Models of Care; Access and Population Health; Technology: Infrastructure and Applications, Legislation and Regulation; and Team-Based Care and Community Partnerships. Participation is assessed through written responses in discussion forums, tied into the module platform (Moodle™) and evaluated by course faculty. Participant responses are evaluated as 'below expectations', 'meets expectations', or 'exceeds expectations' resulting in a pass or fail grade for the modules.

Experiential learning, through oversight and management of RPM, occurs at the PGY3+ level. Categorical residents are assigned to RPM for 1 half-day per week during at least one month-long ambulatory block of their third year. The residents' role within RPM is to review patient-obtained glucose and blood pressure readings. Based on the values and trends of these data, residents recommend medication titration and/or lifestyle modification to improve chronic disease control. Outpatient general IM faculty members oversee this care. At the conclusion of the inaugural year of the experiential curriculum, over 100 patients were enrolled in the RPM programme. All curricular components are completed during ambulatory blocks with protected time and without
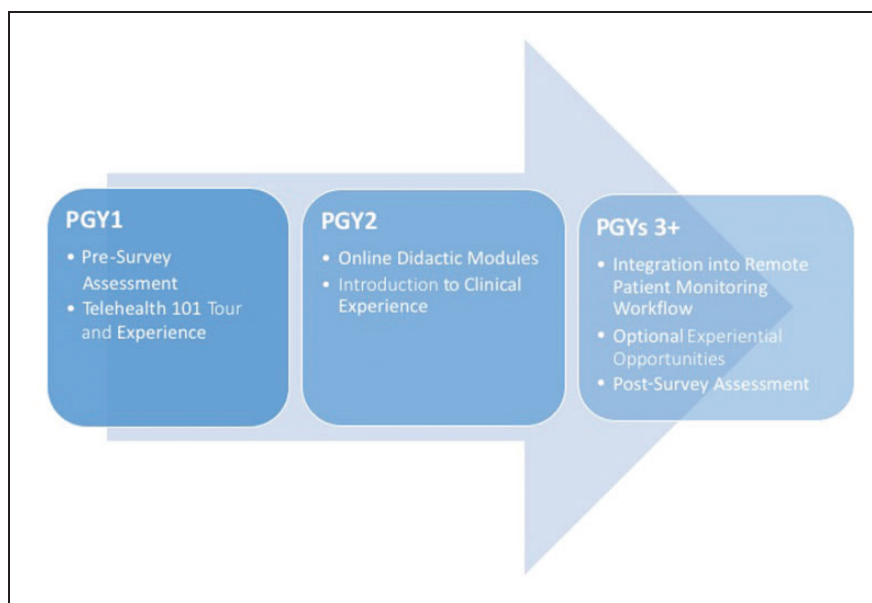

Figure 1. Curriculum integration across internal medicine programme years.

disruption of other training activities. From a faculty standpoint, one outpatient attending had 10% protected time for the RPM programme, including resident education, oversight of the experiential component and faculty development. The RPM programme itself has grant support as part of a quality improvement initiative. A small amount of protected time, especially during the initial curriculum design phase, allowed programme support for the faculty overseeing necessary medical, education and administrative functions. Ongoing activities are supported through current RPM and graduate medical education service provision.

Programme evaluation

The longitudinal curriculum is evaluated by an online survey tool comprised of multiple-choice questions with responses on a Likert-based scale, administered prior to and following completion of didactic modules. In 2016–2017, PGY2 and PGY3 residents completed the pre-test assessment followed by assigned didactic modules and a post-test assessment. In 2017–2018, PGY1 and PGY2 residents completed the pre-test assessment, with PGY2 residents completing the post-test assessment. PGY1 residents will complete the post-test after their PGY2 year. In this way, all residents were asked to complete a pre-test assessment prior to didactic module completion and all residents who had completed the modules were asked to complete the post-test survey. Some post-survey attrition was experienced due to scheduling conflicts that limited dedicated time for the completion of the intervention. Hereafter, all interns will take the pre-test prior to the first course activity and all residents will receive the post-test assessment after didactic module completion.

An assessment of perceived importance or relevance of telehealth, knowledge of telehealth services, comfort in providing telehealth services and perceived barriers to using telehealth in the future was conducted via a survey at baseline and after completion of the online curriculum. The survey was derived from a validated undergraduate medical/graduate health professions tool utilized with interprofessional telehealth team courses over the past five years and from a needs-assessment conducted with IM programme attendings in preparation for the development of curriculum. Perceived importance was rated using a Dreyfus scale as 'essential to my future practice', 'nice to know, but not an immediate priority' and 'not a comfort or future priority'. Respondents rated knowledge as 'non-existent', 'limited', 'average for someone in the health professions field', 'knowing more than the average person in the health professions field', or 'I'm an expert'. Comfort was classified as 'not at all',

'maybe', 'I could do an average job of this for someone in the healthcare profession', 'not a problem' or 'I could write a book'. For purposes of analysis, 'knowing more than the average person in the health professions field', 'I'm an expert', 'not a problem' and 'I could write a book' were grouped to represent greater than average.

Common barriers to telehealth adoption were assessed via a survey to gauge the current practice environment, with the option to select all that apply. The frequency of each positive response was analysed. Finally, competence in remote care delivery was assessed via direct faculty supervision of remote patient interactions based on established guidelines.[14] This project was deemed quality improvement and therefore not subject to Institutional Review Board review or approval.

Results

In the first two years, 64 IM residents completed the online curriculum and an aggregated longitudinal analysis was conducted of the cohorts. Pre-test survey response rate was 85% (47/54) in 2016–2017 and 84% (42/50) in 2017–2018. The post-test response rate was 87% (45/52) in 2016–2017 and 76% (13/17) in 2017–2018. Prior to completion of the online curriculum, 21% of the 89 residents taking the pre-test felt that learning more about telehealth was 'essential' to future practice (Table 1). After completion of the online curriculum, this increased to 38% among the 58 residents taking the post-test ($p < 0.03$). There were improvements in resident self-reported knowledge of telehealth history, access to care, contributions of telehealth applications and quality of care and communication after completion of the online curriculum. Overall, 41% of residents felt their ability to utilize telehealth as part of their current or future practice was greater than average after completion of the online modules compared to only 2% at baseline ($p < 0.01$).

After completing the curriculum, fewer residents identified unfamiliarity with telemedicine concepts as a barrier to telehealth practice (21% vs 65%, $p < 0.001$) whereas a greater percentage of residents identified concerns regarding reimbursement and time to implement telehealth services (74% vs 39%, $p < 0.001$; 67% vs 47%, $p = 0.0169$, respectively; Table 2). By the end of the inaugural year of experiential training in 2018, 74% of graduating PGY3+ residents had participated in the experiential components of the curriculum. In subsequent years, all graduates will participate in all three years of the curriculum, including RPM and RPM-specific knowledge evaluation.

Table 1. Respondents indicating above-average knowledge, comfort and interest level at baseline and after completion of online curriculum.[a]

	Pre-test % (n=89)	Post-test % (n=58)	p value
Ability to utilize telehealth in future practice	2% (2)	41% (24)	<0.001
Knowledge of the history of telehealth	0% (0)	48% (28)	<0.001
Comfort determining how telehealth improves patient access	6% (5)	41% (24)	<0.001
Ability to explain how telehealth applications have contributed to healthcare	1% (1)	47% (27)	<0.001
Comfort determining how telehealth improves quality of care and communication	4% (4)	40% (23)	<0.001
Telehealth is essential to future practice	21% (19)	38% (22)	0.0284

Chi-squared analysis.

[a]Positive responses include those that indicate greater-than-average knowledge, comfort, or interest. Average levels of these indicators were treated as a negative response.

Table 2. Respondents who identify specific barriers to telehealth.

	Pre-test (n=89)	Post-test (n=58)	p value
Unfamiliar with concepts	65% (58)	21% (12)	<0.001
Not helpful for patients	7% (6)	3% (2)	0.4800
Concerns about privacy	17% (15)	21% (12)	0.5572
Concerns about reimbursement	39% (35)	74% (43)	<0.001
Lack of time to implement services	47% (42)	67% (39)	0.0169
Lack of time to provide services	49% (44)	53% (31)	0.6345

Chi-squared analysis.

Discussion

As part of IM ambulatory training, the ACGME mandates that residents have responsibility for chronic disease management, coordination of care for patients across healthcare settings and participation in the management of patients between outpatient visits.[21] Telemedicine, and particularly RPM, provides an opportunity to fulfil each of these goals. Further, the ACGME has encouraged programme innovation to address these issues and prepare residents for future practice.[22] Our curriculum satisfies this call and demonstrates improved resident comfort and knowledge regarding delivery of telemedicine services. Curriculum refinement is ongoing to meet these evolving mandates and clinical opportunities and should help to advance the documented lack of prioritization for eHealth (or telehealth) in medical education curricula.[23]

Survey analysis demonstrates that participation in the online modules increased self-reported knowledge of and interest in telehealth, yet resulted in increasing concerns regarding time and reimbursement. There is room for improvement in post-test knowledge, comfort level and interest, thus we continue to update and improve our curriculum according to identified needs. Similar concerns about reimbursement were also seen by family practice residents and faculty in a pilot study looking at telehealth in primary care outpatient training.[24] This highlights a need to educate and inform providers and trainees on the current political climate regarding telemedicine. Laws governing telehealth vary by state and there continue to be advances in parity laws and reimbursement for individual services through Medicare, Medicaid and private insurers. This constantly changing climate necessitates ongoing faculty development and learning as a way of preparing for a future in which telehealth heavily influences and supports professional practice.[25] Accordingly, telehealth experts (clinical, educational, administrative and technological) have been fundamental in the design of our curricular content due to rapid advances in this care delivery system in the setting of limited internal faculty expertise.

There are several limitations to our study. This curriculum is still in its first years of implementation and many opportunities for improvement exist. The surveys were administered anonymously, preventing ability to match pre- and post-test responses at the individual level given the current data-capture system. This prevented analysis of individual, longitudinal growth due to the inability to match responses while maintaining complete anonymity. Our current post-test data reflect only the online curriculum as in the first years, all attempts were made to engage all residents in the curriculum and evaluation processes, but due to scheduling conflicts, a small number were not included. In future years, we will be able to assess the baseline data in the PGY1 residents and again prior to residency

graduation for an evaluation of the entire longitudinal curriculum. This curriculum model could be employed and evaluated within other IM residency programmes to determine the feasibility at institutions with and without advanced telehealth centres. Other programmes may find it helpful to utilize similar curriculum strategies already underway or otherwise supported at their home institution while enlisting the expertise and commitment of faculty who can model clinical telehealth delivery.

Conclusions

As the curriculum becomes more robust, there are increasing opportunities for hands-on practice including expanding RPM to include second-year residents as well as the provision of video consultations and asynchronous electronic visits (text-based clinical triage, diagnosis and treatment). Residents now are able to select shadowing and experiential sessions in a combination of ambulatory, urgent or intensive care services. Protected time for participation in telehealth education (and evaluation) is critical and must account for other clinical and non-clinical obligations that may limit participation among trainees. Future analysis will need to include measures of resident satisfaction, patient satisfaction, impact of the curriculum on resident decision to pursue primary care versus subspecialty or fellowship tracks, and health-quality outcomes.

Future work should also address the need for faculty development as graduating residents may have more experience and training in telehealth than their faculty advisors. As telehealth education expands to include medical students, faculty comfort and experience with telehealth will be even more important.[26,27] Our College of Medicine is offering faculty training to help address such gaps in training through professional development 'crash courses'. By spanning the curriculum across three years of training, utilizing various education delivery tools and engaging faculty in specific areas of expertise, we are able to provide a more rigorous and comprehensive curriculum. This also allows implementation of a robust curriculum even in settings where faculty may have only limited experience in telehealth.

Our work demonstrates opportunities in telehealth to formalize IM resident involvement in effective systems of care in structured and novel ways. By empowering residents to frame how telehealth applications can be used to support their current and future patients, they can become telehealth champions who help advance the provision of telehealth services to address the specific clinical needs of the populations they serve.

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