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Author: Jonas Christopher E. DO; Durning Steven J. MD, PhD; Zebrowski Catherine PhD, MPH; Cimino Francesca MD

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An Interdisciplinary, Multi-Institution Telehealth Course for Third-Year Medical Students

Christopher E. Jonas, DO, Steven J. Durning, MD, PhD, Catherine Zebrowski, PhD, MPH, and Francesca Cimino, MD

C.E. Jonas is associate professor of family medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland.

S.J. Durning is professor of medicine and pathology, and director, Graduate Programs in Health Professions Education, Uniformed Services University of the Health Sciences, Bethesda, Maryland.

C. Zebrowski is senior analyst for telehealth and metrics and analysis, Connected Health, Defense Health Agency, Silver Spring, Maryland.

F. Cimino is assistant professor of family medicine, Department of Family Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland.

Correspondence should be addressed to Christopher Jonas, Uniformed Services University for the Health Sciences, 4301 Jones Bridge Road, Rm A1038A, Bethesda, Maryland 20814; telephone: 301-295-3630; email: christopher.jonas@usuhs.edu.

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Disclaimer: The views expressed herein are those of the authors alone and not necessarily those of the Uniformed Services University of the Health Sciences, Department of the Air Force, Department of the Navy, Connected Health, Defense Health Agency, Department of Defense or any other Federal agencies.

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Abstract

Problem

The American Medical Association has called for telehealth to become a core competency of medical students. Studies indicate a principal reason physicians do not practice telehealth is lack of training, yet patient interest in and satisfaction with telehealth is high. No comprehensive U.S. undergraduate medical education curriculum teaching telehealth principles has been published.

Approach

In February 2018, the Uniformed Services University of the Health Sciences (USU) provided an innovative telehealth training experience for third-year medical students. USU led an interinstitutional, interprofessional learner-centered course including six segments: (1) multiple choice pre-test; (2) asynchronous lectures covering telehealth history, applications, ethics, safety, military uses, etiquette, and patient considerations; (3) in-person interactive telehealth instruction including patient selection, current uses, risk management (4) faculty-supervised mock-patient telehealth encounters; (5) hands-on diagnosis and advanced surgical procedures using telehealth equipment; and (6) multiple choice post-test.

Outcomes

This course was piloted with 149 third-year medical students. Students' improvement in telehealth knowledge was demonstrated through (1) 10.1% average improvement between pre- and post-test scores; (2) completion of competency-based checklists; and (3) post-course preceptor and student feedback. Faculty feedback indicated technology use was novel and effective based upon student input. Faculty noted that students enjoyed engaging via videoconference, and of participating medical students, 119 (80%) indicated future plans to practice telehealth; several requested to be part of future telehealth courses.

Next Steps

Telehealth will be integrated into clinical rotations in collaboration with other institutions. As the telehealth curriculum is taught at other institutions, lessons learned will inform enhancements at USU.

Problem

The Health Resources and Services Administration defines telehealth as

> the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health and health administration. Technologies include video conferencing, the internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications.[1]

Telehealth can be synchronous (live/interactive) or asynchronous (delayed time between provider input and patient receipt, such as a radiological image sent to a remote provider). Telehealth can be delivered by a solo provider, or a telepresenter can augment a patient's visit with, for example, a physician assistant, nurse, or technician, who performs an initial examination and facilitates communication between the patient and the telepresenter. Telehealth has been available in various forms since the 1920s but modern telehealth began roughly 20 years ago around the turn of the 21st century. Recent increased interest in telehealth reflects technical refinements (including widespread availability of smartphones); surveys indicating high patient and provider satisfaction; cost and time savings for patients; and studies suggesting that telehealth care yields equal or better health outcomes for selected conditions compared to in-person care.[2] The Department of Health and Human Services estimated in 2016 that more than 60% of all health care institutions and 40%-50% percent of all U.S. hospitals use some form of telehealth.[3] Venture capital funding in digital health reached $4.3 billion in 2015.[4,5] Telehealth is widely used in the Department of Veterans Affairs, where over 2 million telehealth encounters were conducted in 2017.[6] Telehealth is poised to expand significantly in the Military Health System, which was a pioneer of telehealth use in austere environments such as combat

zones. The 2017 National Defense Authorization Act (NDAA) directs, in part, that the full range of telehealth services be made available in the direct care and purchased care components in the Military Health System.[6]

One of the biggest barriers to telehealth adoption is lack of physician training. A 2017 survey of 4,980 family physicians revealed that, despite their stated interest, only 15% of respondents reported utilizing telehealth; 55% cited "lack of training on how to use telehealth" (OR, 1.61; 95% CI, 1.18 –2.18) as their reason for not utilizing telehealth.[7] The American Medical Association (AMA) has called for telehealth to become a core competency of medical students. The AMA has urged the U.S. House of Representatives to embrace telehealth broadly to ameliorate provider shortages, increase access to health care, and lower costs of reaching patients in remote settings.[8]

A literature search reveals telehealth courses teaching communication skills to medical students.[9] However, no comprehensive curriculum for a telehealth course has been published in the United States. Based upon the needs, observations, and favorable outcomes of telehealth outlined above the F. Edward Hébert School of Medicine at the Uniformed Services University of the Health Sciences (USU) designed, administered, and evaluated an Introduction to Telehealth course in February 2018.

Approach

Between February 2017 and February 2018, our nine-hour course was developed in close partnership with telehealth educational design and curriculum development experts at the Connected Health branch of the Defense Health Agency. February 2018, the program was delivered in collaboration with interprofessional representatives from five government institutions and a civilian university in Maryland and Virginia, including: USU, Connected

Health at the Defense Health Agency, Walter Reed National Military Medical Center, Fort Belvoir Community Hospital, the Daniel K. Inouye Graduate School of Nursing, and Old Dominion University. Faculty included seven family medicine physicians, one critical care physician, one doctor of optometry, three psychologists, four doctor nurse practitioners (DNPs), one registered nurse and eight information technology support staff. Evaluation was completed one week after course completion.

This required course specifically requested by the USU dean's office was piloted in February 2018 with 149 third-year medical students who had just completed core clinical clerkships. The telehealth course filled space in the curriculum previously occupied by an elective course. Course objectives were to: (1) utilize commercial off-the-shelf and military-specific technologies to teach telehealth; (2) expose students to current military telehealth equipment and applications; (3) practice faculty-supervised mock telehealth encounters via videoconference; (4) leverage technology to teach and prepare medical students to independently deliver telehealth; and (5) respond to calls by the AMA and the NDAA to improve provider comfort and proficiency with telehealth.

This learner-centered course directly engaged students, taught explicit skillsets, encouraged reflection on learning, and prompted learners to pursue control and collaboration in their learning during mock encounters. Training consisted of six segments consistent with Kern's approach to curricular development[10]: (1) A 21-question, required multiple-choice pre-test delivered one week prior to the course; (2) Four hours of asynchronous, interactive, graphics-rich lectures covering telehealth history, applications, ethics, safety, military uses, etiquette, and patient considerations; (3) Three hours of in-person interactive telehealth instruction, including ethics, patient selection, current uses, risk management, and telehealth etiquette (4) Two standardized,

faculty-supervised 30-minute mock patient encounters by way of videoconference; and (5) Hands-on operational experience where students practiced diagnosing common maladies and practicing advanced surgical procedures via telehealth using military telehealth equipment; and (6) A 21-question, required multiple-choice post-test and course evaluation completed within one week post course. Pre- and post-test questions (see Supplemental Digital Appendix 1, available at http://links.lww.com/ACADMED/A652) were identical, blueprinted to course goals and curriculum, and relevant to mock encounters, lectures, and classroom interactions. Checklists were utilized to assess for success in mock encounters and completion of course objectives. (Appendix 1). The Uniformed Services University Institutional Review Board/Human Research Protections Office reviewed the course and determined it does not constitute research and does not require IRB review.

To avoid monotony, we used three different approaches to education throughout the course: asynchronous instruction, classroom interaction, and mock patient encounters.

Asynchronous instruction

An interprofessional panel of telehealth experts selected and created asynchronous materials deemed essential for conducting a telehealth encounter. Prior to the course day, students were advised to view 4 hours of online materials presented in written and PowerPoint formats covering important topics, including history and rationale for telehealth, telehealth etiquette, mental health aspects, patient selection, applications, advantages, disadvantages, patient perceptions, physician beliefs, current military and civilian care, applicable legislation, NDAA, Government Accountability Office, doctor-patient relationships, human factors, ethics, safety, and use of lighting. This self-paced material was designed to impart basic knowledge of telehealth for students prior to entering the classroom in hopes of optimizing engagement and

preparation for mock encounters. Students were informed they would be expected to recall and use this information during mock telehealth encounters and post-testing, however student participation in the asynchronous portion was not monitored.

Classroom interaction

The lecture portion of the course was taught using traditional large-classroom instruction with audience participation. Information covered in these sessions focused on ethics and risk management, proper etiquette, lighting, camera angles, clothing selection, telepresentation skills and technical skills needed for successful video-based encounters. Case vignettes, examples of good and bad telehealth encounters, physician attitudes, experiences, current facilities providing telehealth, and operational and clinical pitfalls were also discussed. At various points students were asked to respond to online polling questions using their mobile devices as well as traditional verbal question-and-answer sessions. Many questions probed student attitudes about, experiences with, and plans to practice telehealth. A dedicated section on military telehealth was taught by critical care professionals who currently provide telehealth globally in support of deployed providers and service-members. Students were given faculty-supervised dedicated time during the course and elective time to practice advanced diagnostic and surgical treatments using military telehealth ear, nose, throat, surgical, and trauma equipment on mannequins.

Mock patient encounters

Students were assigned to small groups of 4, and faculty provided instructions on how to conduct a history and physical via videoconference (Table 1). Other students who role-played patients were provided written scripts for one of two cases (see Supplemental Digital Appendixes 2 and 3, available at http://links.lww.com/ACADMED/A652). The first case was a common varicella skin rash, while the second was a complicated patient with diabetes and potential medication-

induced mania. Cases were selected reflecting two common uses of telehealth in the Military Health System: tele-dermatology and tele-behavioral health; neither posed significant physical exam requirements. Both cases were overseen by faculty members who facilitated the student-to-student encounters and who had attended a 60-minute training session prior to the course. Checklists that had been created by an interdisciplinary panel of telehealth experts as unique products believed to be essential to conducting a proper telehealth encounter were used to assess proficiency. These checklists were utilized both by fellow medical student observers and by faculty in rating all 149 (100%) students who led mock patient encounters. After each case, faculty and students provided "patient" feedback emphasizing precourse principles and lecture materials, and verified on checklists (Appendix 1). Technology failures were minimal.

Outcomes

Students increased their overall telehealth knowledge, which was demonstrated in several ways: (1) a 10.1% average improvement between pre- and post-test scores (mean pre-test score: 13.76, [SD 1.95]; mean post-test score: 15.89 [SD 2.67]); (2) successful completion of all checklist tasks; and (3) post-course preceptor and student feedback. Faculty and students felt that, in contrast to a traditional lecture-based format, the mixed-methods course design and simulated telehealth encounters were novel and engaging. Faculty and students expressed enjoyment with telehealth mock encounters and cases, and checklists were effective in focusing these exercises, highlighting specific points, and standardizing educational experiences. Students and faculty suggested increasing practice with military diagnostic and procedural equipment in future courses.

Among participating students, 80% (119) indicated plans to provide telehealth in the future. Several requested to be part of future courses or electives about telehealth. The hands-on practice using advanced operational equipment, such as augmented reality headsets, was very popular and effective. Having the full support and direction from the USU dean's office was unique and crucial in terms of selecting the most appropriate space, substance, and execution of this course. There were no drawbacks from having that support and direction.

Every study has limitations; this one is no exception. Our observations are based on the first teaching of the course to a single class of medical students who attend a medical school with a unique, national service mission. The 10.1% increase in knowledge between pre- and post-test responses is relatively modest for the time invested, but checklist assessments of students' performance documented acquisition and application of skills. Space and time considerations did not allow for as much student participation in telehealth delivery as students wanted. Nevertheless, interest and acceptance were high. Because we found no other published curricula to introduce medical students to telehealth, we could not compare of our approach to others. Publication of other curricula and subsequent comparison will be crucial to assess true effectiveness of telehealth education. We welcome collaboration with interested institutions.

Next Steps

The short course we developed is designed to serve as a baseline introduction to telehealth for USU medical students. Future plans include telehealth integration in field training exercises, core clerkships, and clinical electives. Nationally, core principles and methods from this course may be adopted by other medical schools to teach their students.

Future iterations should focus on student participation in supervised mock encounters via videoconference and maximizing use of telehealth technologies, including diagnostic and procedural equipment. We found this methodology was more popular than other means of instruction, so we will expand it in future courses. We may also add telehealth practice with standardized patients in our Simulation Center. Additionally, assessing student interest in telehealth prior to and after the course, expanding pre and post testing, and monitoring participation in asynchronous instruction should prove useful.

Incorporating standardized patients and monitoring student participation will be key enhancements. In the first iteration of this course, students served as mock patients and monitored their own participation in asynchronous instruction because of space and time considerations. A next step would be the potential testing with standardized patients in a 1:1:1 (patient:telepresenter:student) training model with faculty oversight. The ultimate test will be to assess patient experiences between those trained in this method and those either trained in another method or not at all. With that comparison, a more ideal telehealth educational platform can be created and implemented. Our goal is to share our own lessons learned and collaborate with other institutions in improving telehealth education and ultimately patient care nationally.

This course represents a potential first step in teaching medical students comprehensive telehealth in the United States. Although elements of our curriculum included military-specific content, the vast majority of instruction focused on basic principles of telehealth delivery in synchronous and asynchronous applications. It could be worthwhile to remove military-specific portions of this course and pilot the remaining portions in any U.S. medical school to assess interest, impact, and estimate generalizability.

Because today's medical students have grown up using computers, video games, and smart phones, we feel it is essential to emphasize differences between medical and personal uses of communication technologies. The former requires training in appropriate principles and standards for health care delivery, including patient privacy and information security. It is important to note that throughout the course, students reported they are already using personal communications technology in health care capacities and settings without formal training. This finding underscores the importance of foundational training in appropriate use of telehealth to every student at an early point in training. Otherwise, there is a significant risk of serious missteps in patient care or medical ethics.

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Table 1

Instructions for Mock Video-Based Patient Encounters in a Required Third-Year Telehealth Course, Uniformed Services University of the Health Sciences, February 2018[a]

Topic	Information
Learning objective	After the in-class simulation, the student should be able to demonstrate basic competency in conducting a simulated TH encounter
Location	MDL rooms. There will be signs outside of each room providing directions. Once inside, sit down and take a seat at your designated location.
Simulation explanation/instructions	• Each seat in an MDL room will be labeled with a number (1-8). That number determines your role for both simulations. You will find the role assignment charts on each scenario description (Note: You will not have the same role for each scenario). • There will be a preceptor in the room to observe and facilitate the TH encounters. • Videoconference will be already set-up in all of the MDL rooms. You will not need to log-on or establish a connection. In the event of a failed connection or technology malfunction, a student-provided smartphone video connection, such may be used. For each scenario the preceptor will coordinate with the students to ensure that one of the doctors and the patient have the ability to connect in this way in case it is needed. • Take a moment to briefly review the scenarios. • There will be two doctors, four observers, a patient and a telepresenter for each scenario. Role descriptions can be found below. • Observers will use the Telehealth Visit Checklist, which can be found on the last page of this packet. • Each simulation will run approximately 20 minutes with a 10 minute debrief. After the debriefing, the preceptor will instruct you to begin the second scenario. The provider side for the first scenario will be the patient side in the second, and vice versa.
Role descriptions	• *Patient*: Assume the role of the individual described in the case; interact with the doctor through Adobe Connect; answer the doctors' questions. • *Telepresenter*: Present the patient to the doctor; facilitate the set-up of alternate video connection on the side of the patient in the event that Adobe Connect fails; assist the patient with lighting, sound, etc. • *Doctor*: Work with partner to perform a team consult; interact with the patient through the video connection

Topic	Information
	• *Observer*: Use the TH Visit Checklist to evaluate the doctor to which you are assigned.

Abbreviations: TH indicates telehealth; MDL, Multi-Disciplinary Laboratory.

[a]These instructions were provided at the beginning of the course and then again just prior to conducting a mock telehealth patient encounter.

Appendix 1

Checklist for Students and Faculty Observing Third-Year Medical Students Completing a Videoconference-Based Telehealth History and Physical During a Required Telehealth Pilot Course, Uniformed Services University for the Health Sciences, 2018

Please circle one: Scenario 1 OR Scenario 2			
Please circle one: **INSTRUCTOR observing Team Consult (Including Telepresenter)** **STUDENT 3 observing Doctor A STUDENT 4 observing Doctor B** **STUDENT 5 observing Doctor A STUDENT 6 observing Doctor B**			
No.	**Checklist Item**	**"✓" = Yes "—" = No "N/A" = N/A**	**Comments**
	Provider-End Room Set Up		
1	Ensures provider-end environmental security and privacy.		
2	Ensures computer is on, Adobe Connect is working and camera is at the correct level.		
	Patient Engagement		
3	Determines that provider and patient can see and hear each other adequately.		
4	Discusses environmental privacy with patient and recommends remedial actions (if necessary).		
5	Discusses with patient what to do in the event of technical difficulty.		
6	Obtains number to contact patient in case of disconnect.		
7	Conducts physical exam via telehealth as indicated by case presentation.		
	Provider Telehealth Behaviors		
8	Looks directly at camera, approximately every 30 seconds, to simulate eye contact with patient.		
9	Positions self wholly within camera frame. *(Body not cut off on top, left or right.)*		
10	Gestures within camera frame.		
11	Balances attention appropriately between patient and documentation.		
12	Speaks naturally (does not raise voice).		
13	Avoids extraneous noise near mic (tapping, shuffling papers).		
14	Avoids carrying on side conversations unless microphone is muted.		
15	Maintains professional demeanor throughout.		
	Telepresenter Telehealth Behaviors		
16	Provides relevant pre-session behavioral observations/information to providers (if indicated – otherwise, mark "NA").		
17	Adjusts image and lighting as requested by providers (if indicated – otherwise, mark "NA").		