"I Have a Cough": An Interactive Virtual Respiratory Case-Based Module

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Abstract

Introduction: The COVID-19 pandemic has radically disrupted traditional models of medical education, forcing rapid evolution in the delivery of clinical training. As a result, clinical educators must quickly transition away from in-person sessions and develop effective virtual learning opportunities instead. This virtual resource was designed to replace a clinical simulation session for the physical examination course for medical students in the preclinical years. Methods: We designed an online interactive module in three sections for preclinical (first- or second-year) medical students who had not yet learned the respiratory physical exam. The first section incorporated demonstration and practice of the components of the respiratory physical exam that could be effectively taught via videoconferencing software. Following this, students conducted a telemedicine encounter with a standardized patient and received patient-centered feedback evaluating their communication skills. The final segment involved a case discussion and clinical reasoning component. Results: These sessions were implemented for 122 first-year medical students. The module was well received by the students. A majority felt that it helped improve their telemedicine communication skills (93%), interpretation of physical exam findings (84%), development of differential diagnosis (95%), and correlation of clinical and basic science content (93%). Discussion: Our pilot educational session demonstrates that this virtual instruction method is an effective tool for teaching basic clinical skills during medical school. Virtual learning resources allow remote instruction to take place and can be a supplement when face-to-face clinical teaching is not possible.

Keywords
Virtual Clinical Teaching, Physical Exam, Telemedicine Competencies, Interpersonal and Communication Skills, Medical Knowledge, Patient Care, Professionalism, Clinical Teaching/Bedside Teaching, Online/Distance Learning, Standardized Patient, Virtual Learning

Educational Objectives
By the end of this activity, learners will be able to:

1. Describe the components of a thorax/lung exam and practice basic percussion and auscultation techniques.
2. Elicit a comprehensive history from a standardized patient during a telemedicine encounter and develop a differential diagnosis with supportive evidence from the history and physical examination.
3. Practice a telehealth encounter.
4. Recommend appropriate diagnostic testing for a patient with suspected pneumonia.
5. Demonstrate knowledge specific to community-acquired pneumonia and COVID-19.

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Introduction
Clinical skills education is deeply rooted in face-to-face history taking, hands-on physical examination, and collaborative clinical reasoning with faculty coaching and feedback. However, these traditional tenets of clinical skills training for medical students have been entirely upended by the COVID-19 pandemic, and educators have had to quickly adapt. As a result of the pandemic, many medical schools have suspended or curtailed in-person sessions, and virtual alternatives have become essential.

Clinical skills directors have been challenged to create virtual training interactions to ensure students are comfortable with and competent at history taking and physical examination skills.

Although medical student interaction with patients was suspended in March 2020 in accordance with AAMC guidelines, many clinical rotations continued to provide educational opportunities via virtual morning reports and telemedicine visits. Hoffman, Harding, Youm, and Wiechmann were even able to virtually bring students into the hospital rooms of COVID-19 patients, allowing the students to learn directly from
both patients personally experiencing the disease and the team members caring for them. Shih, Chan, Chen, and Lai adapted face-to-face demonstrations of techniques for preclinical students by a clinical tutor to Zoom-based small-group tutorials. Hannon, Lappe, Griffin, Roussel, and Colbert-Getz utilized videoconferencing software to convert in-person objective structured clinical examinations to remote ones, allowing for the continued assessment of students. Medical students have also challenged educators to use the current circumstances as a learning experience and expressed the desire that medical education should be continually adapted to meet their educational goals and prepare them for their eventual role as frontline workers. However, currently, there is a paucity of fully developed resources available for virtual clinical skills training.

We designed this online interactive case-based learning module to teach students how to evaluate a patient with respiratory concerns and perform some components of a respiratory exam. As the COVID-19 pandemic came to dominate the cultural conversation at all levels, we found it to be a remarkable diagnosis to center the module around. Additionally, as this virus is an entirely novel disease entity, diagnosis of the condition had not been previously taught in the clinical skills curriculum, making it an engaging, timely, and unique manner in which to train students in history taking and respiratory examination.

**Methods**

**Session Design**

Prior to the developing the module, faculty discussed the content that was imperative to include in the standardized patient (SP) presentation and case discussion. After identifying the most important pulmonary complaints commonly seen in the primary care setting, we focused on a patient presenting with cough and fever.

In particular, we incorporated the components of the respiratory physical exam that could be effectively taught and demonstrated via videoconferencing software. These real-time teaching sessions provided immediate feedback to students and served as supplementation to several other online teaching resources, such as physical exam video demonstrations and step-by-step written guides.

The SP portrayed the role of a patient presenting to a clinic with cough and fever who was anxious that the symptoms could be COVID-19. The ensuing physical exam presentation, differential diagnoses, and discussion centered around the clinical features of community-acquired pneumonia (CAP) and, in particular, COVID-19.

This session was designed to allow several interactions to take place between the following:

1. Faculty and students—during the demonstration of percussion and auscultation.
2. Students, SP, and faculty—during a telemedicine patient encounter with patient-centered feedback from the SP on students’ communication skills and “web-side” manner. Faculty also provided communication skills feedback.
3. Faculty and students—during the clinical reasoning and case discussion session.

At the conclusion of the session, students were encouraged to complete an optional four-question survey to measure their satisfaction with the demonstration of the respiratory physical exam, clinical reasoning exercises, and overall correlation with basic science content. The survey was administered through the school’s learning management platform (Moodle).

**Materials**

- Detailed facilitator guide (Appendix A): contains instructions for faculty preceptors.
- PowerPoint presentation (Appendix B): reveals case details and related questions sequentially as the case unfolds. Relevant teaching slides were included to illustrate important or difficult concepts.
- SP case (Madison Lopez) training material (Appendix C).
- Telemedicine encounter SP feedback checklist (Appendix D).
- Student worksheet (Appendix E).
- Postsession student survey (Appendix F).

**Facilitator Training**

All faculty facilitators attended a 90-minute training session held via videoconferencing software (Google Meet). During this training, the clinical skill course director familiarized facilitators with the learning objectives and case materials, demonstrated the relevant physical exam techniques, and coached instructors on guiding discussion among students. The director also reviewed session logistics, postencounter debriefing, and the importance of delivering meaningful feedback to students on their communication skills and empathy.

Additionally, as this videoconferencing platform was unfamiliar to many facilitators, the training session focused on features like screen sharing, muting nonparticipants, free-text typing, and answering student queries. Doing so preemptively addressed
many potential issues and ensured that sessions flowed smoothly with minimal technical difficulties. The training session improved the comfort level of facilitators and ensured that content delivery was standardized.

SP Training

**SP training for portrayal of Madison Lopez:** An SP trainer instructed SPs on the specific symptoms, concerns, and appropriate physical behaviors to portray for Madison Lopez, a patient presenting with respiratory concerns. SPs were also instructed to give patient-centered feedback using the feedback checklist (Appendix D). Feedback focused on students’ communication behavior and telemedicine web-side manner.

**SP training for the student session:** The SP training lasted 2 hours and was conducted via the same virtual platform used during the actual student sessions (Google Meet). The SPs were familiarized with session logistics, including using the videoconferencing software, specific times to log in, and when to provide feedback.

Presession Assignments for Students

We instructed students to review the physical exam of the lungs and thorax and accompanying videos from their required text.16,17 They were also required to develop three illness scripts for conditions that could cause a patient to present with fever and cough: CAP (including COVID-19), acute bronchitis, and upper respiratory infection.18

Session Delivery

**Personnel:** Each session was facilitated by clinical faculty who taught in the clinical skills course. Each group was assigned an SP who called in for the telemedicine encounter.

**Logistics:** Following the suspension of face-to-face teaching, these sessions were implemented for 122 first-year medical students during in their respiratory unit. Each session included six to eight students. Five clinical faculty ran 18 small-group sessions, each lasting 90 minutes. All sessions took place during the same week in April 2020. A postsession survey (Appendix F) was also given to participants.

Feedback to Students

Students received feedback both from SPs and from the clinical facilitator running their session. The SPs used a structured communication feedback tool (see Appendix D) to evaluate students directly following the telemedicine portion of the session. Clinical faculty also provided feedback to students on the clinical content of their interaction with the SP.

Results

A total of 122 first-year medical students participated in this session.

Student Satisfaction Survey

The voluntary survey was completed by 57 of 122 students (47%) who participated in the sessions. The majority of students felt that this session helped to improve their telemedicine communication skills (93%), interpretation of physical exam findings (84%), development of differential diagnosis (95%), and correlation of clinical and basic science content (93%). (See the Table for more details.)

Twenty-two of the 57 students who completed the survey wrote comments. Key themes identified were session format, student perception of learning, technology issues, and suggestions. These are listed below with representative quotes.

**Format of session:**

- “Small group setting is also great. I feel like I get a lot more out of these sessions compared to in-person ones that are larger.”
- “I really loved this! I feel like I learn so much more by having the physician watch the interview take place and then going through the physical exam findings and talking about the case as we go. It helps me get a better picture of everything and it is more cohesive.”
- “Good alternative to current dilemma.”

**Student perceptions of learning (i.e., history taking, physical exam, case discussion):**

| Statement | Strongly Disagree | Disagree | Neither Agree/Disagree | Agree | Strongly Agree |
|-----------|-------------------|----------|-----------------------|-------|----------------|
| The standardized patient interview and feedback helped with telemedicine communication skills. | 0 (0) | 0 (0) | 4 (7) | 26 (46) | 27 (47) |
| Demonstration of respiratory percussion and auscultation helped with interpretation of physical exam techniques. | 0 (0) | 3 (5) | 5 (8) | 24 (42) | 25 (44) |
| Case discussion helped me in developing a differential diagnosis. | 0 (0) | 2 (3) | 1 (2) | 14 (25) | 40 (70) |
| The session helped correlate clinical and basic science content. | 0 (0) | 0 (0) | 4 (7) | 19 (33) | 34 (60) |
“I thought it was helpful to incorporate telemedicine into our curriculum as it will likely be a part of our practice moving forward.”

“I like the idea of interviewing the patient in these group settings, with 1-2 students taking the lead. I have incorporated some questions into my own routine that I would not have otherwise asked by watching my peers ask those questions.”

“I think they are extremely helpful in ensuring we are taking a proper, thorough history as well as improving our medical reasoning.”

“I think this solidified my knowledge, in both the respiratory topics, but also the importance of being able to take a good history.”

“I thought that it was really helpful to go through certain aspects of the respiratory exam since we weren’t able to practice in person.”

Technology issues:

“There were some technological issues that made it difficult to hear at certain points in session.”

Suggestions:

“I think it would be great if we were allowed to have a willing and quiet family member, housemate or fellow classmate with us... and get real-time feedback from [clinical skills course] faculty.”

Discussion

This pilot educational session demonstrated that this method of virtual instruction is an effective educational tool for teaching basic clinical skills during medical school. However, we do not believe these sessions should replace dedicated curricular time for hands-on clinical teaching. We propose that creating virtual learning resources allows remote instruction to take place and can be a supplement to face-to-face clinical teaching in extraordinary situations.

Limitations

This module was developed at short notice following the abrupt cessation of in-person clinical skills teaching. Teaching of physical examination skills was certainly limited, but clinical faculty were still able to demonstrate selected techniques and discuss the pathophysiologic correlations of abnormal findings. The module also offered faculty an opportunity to coach small student groups and refine clinical reasoning. We believe that creating such resources allows remote instruction to take place within the current physical distancing needs and can be a supplement to face-to-face clinical teaching without suspension of that clinical teaching.

Using additional technology such as a digital stethoscope during teaching would augment demonstrations of the physical exam for these sessions. As this was only a single session, we did not assess student knowledge. We plan to repeat the session during the upcoming academic year and to create more robust assessment.

Lessons Learned

Session flow and faculty guide: To ensure that adequate time was afforded to each section, the faculty guide provided facilitators with detailed time-management guidelines, in addition to direction on session content. When screen sharing, clinical instructors were unable to see the faces and reactions of learners, making it difficult to maintain the same level of engagement as during an in-person session. For that reason, providing instructors with skills to facilitate meaningful participation was something we focused on during the faculty training session.

Faculty preparation: Faculty were reminded to include all participants in the conversations and discussions, ideally by assigning roles prior to the telemedicine SP encounter. This ensured the smooth flow of the interview, especially considering multiple students were working with the same SP. When data gathering was noted to be suboptimal, observing students were encouraged to participate at the end of the interview to obtain additional information. As the faculty instructors were in the unique position of being able to observe the interview without any distractions, they were also encouraged to record and provide feedback on the students’ communication skills independent of that provided by the SPs.

Conclusion

Numerous online modules for teaching various clinical skills like communication, physical examination, and clinical reasoning have been previously published and are available, but they tend to focus on each skill in isolation. MedEdPORTAL has several e-learning resources and telemedicine SP cases, but none involve multimodal teaching strategies. Our module integrates a telemedicine encounter, guided virtual practice of basic physical examination techniques, and delivery of relevant medical content and clinical reasoning with faculty educators who provide real-time coaching and feedback during each of these components.

Several medical schools and training programs have transitioned face-to-face clinical skills teaching and assessment to remote
Similar to Hannon and colleagues, this remote educational session delivery enabled us to observe core clinical skills like history taking, documentation, and clinical reasoning. The students also took a proactive role in their educational experience since there was an element of self-directed learning that preceded the interactive session.

This session was effective in bringing together small groups of classmates and giving them an opportunity to interact even when not physically together. Additionally, we anticipate that for students who had already learned this content, progression and enhancement of these skills may be quicker and easier when they return to the Clinical Skills Center for face-to-face instruction. This module can easily be implemented by clinical skills courses and utilized by other medical schools.

Appendices

A. Facilitator Guide.docx
B. PowerPoint for Facilitator.pptx
C. SP Case Development Tool.docx
D. Telemedicine Encounter SP Feedback Checklist.doc
E. Student Worksheet Postsession.docx
F. Student Survey Postsession.docx

All appendices are peer reviewed as integral parts of the Original Publication.

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Ethical Approval

The Oakland University Institutional Review Board approved this study.
