A Workshop Combining Simulation and Self-Directed Learning to Teach Medical Students About Pneumonia

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Abstract

Introduction: Self-directed learning as a form of active learning is student centered rather than the faculty-centered model employed in traditional lectures or large-group teaching. In order to highlight the content taught during a microbiology course we developed a 2-hour workshop to help teach second-year medical students about pneumonia. Methods: One week prior to session, the class is divided into groups of 30 and then further divided into groups of five, each of which is assigned one of six cases to review. The student then attend the session and perform a high-fidelity simulation matching the case they were assigned. After a debrief with a faculty facilitator each group is asked to diagnose their patient and present it to the other 25 learners. Results: The workshop has received positive evaluations from our students and has been reported to achieve the learning objectives. Most second-year medical students (97.1%, n = 171) reported that the self-directed learning component and simulation complemented each other and enhanced the learning experience. Discussion: Most students view working as a team as a positive experience and favor a student-facilitated session. Because of the success of this workshop, we have modified others to follow a similar format.

Keywords
Simulation, Pneumonia, Self-Directed Learning

Educational Objectives
By the end of this workshop, learners will be able to:
1. Review the evaluation and management of a patient presenting to the emergency department with shortness of breath, cough, and fever.
2. Perform a focused history and physical examination.
3. Work as a team to promote a collaborative learning experience.
4. Reinforce their understanding and knowledge of this clinical condition.
5. Enhance their ability to apply basic science knowledge to clinical medicine.

Introduction
In 2013, we developed a workshop as part of our microbiology block to help teach second-year medical students about pneumonia. We designed this workshop to incorporate both a simulation and an active (self-directed) learning experience. The simulation component is just one facet of the exercise and serves to augment the learning experience. In addition to helping bridge the basic science/clinical gap, the integration of simulation into this workshop serves to add a direct patient care component and puts a face on a specific clinical condition. In our experience, introducing simulation is beneficial for the students even in the preclinical curriculum.1,2

Self-directed learning as a form of active learning is student centered rather than the faculty-centered model employed in traditional lectures or large-group teaching. Freeman and colleagues offered a consensus definition of active learning: "Active learning engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work."3 This statement very concisely defines the paradigm
shift in medical education as self-directed learning engages the students in the learning process, shifts the level of responsibility for learning towards the student, and allows faculty to serve in the role of facilitator rather than lecturer. As a teaching modality, self-directed learning has been shown to have a positive effect on learning outcomes in health professions education.\(^4\)

As defined by the Liaison Committee on Medical Education, self-directed learning involves students' self-assessment of learning needs; independent identification, analysis, and synthesis of relevant information; and appraisal of the credibility of information sources.\(^5\) Based on our experience with this and similar workshops we have developed, these sessions should help to promote critical thinking.\(^1,2\)

**Methods**

Our workshop is held during our microbiology block in the second year of medical school. It is helpful to schedule the workshop to coincide with the basic science course work reviewing pneumonia and respiratory pathogens. We identified six clinical conditions that are incorporated into the workshop to further highlight this material and build on the students' medical knowledge. These six clinical conditions are presented to the students as unknown cases.

- Case 1A: community-acquired pneumonia.
- Case 1B: *Pneumocystis jiroveci* pneumonia.
- Case 1C: tuberculosis.
- Case 2B: *Legionella* pneumonia.
- Case 2C: aspiration pneumonia.

Instructions (Appendix A) are distributed to the students 1 week before the workshop. This document includes the guidelines and expectations for the students along with the six clinical cases and accompanying radiographs. This workshop is 2 hours in length and is completed over three afternoon sessions to accommodate our class size. We schedule two sessions each afternoon (1:00 pm-3:00 pm & 3:00 pm-5:00 pm) for a total of six sessions. For each session, approximately 30 students are assigned to attend. Prior to the workshop, each group of 30 students (preassigned learning community) is subdivided into six groups of approximately five students each (Groups 1A, 1B, 1C, 2A, 2B, and 2C), which correspond to the above six clinical conditions. Each student group is assigned one case (e.g., Group 1A is assigned to Case 1A).

As part of the workshop, we also introduce the students to the evaluation and management of a patient presenting to the emergency department with shortness of breath, cough, and fever. This is accomplished with the simulation component of the workshop. As a teaching modality, high-fidelity simulation has been shown to lead to effective learning. Simulation allows for nearly simultaneous feedback to the learner using a variety of debriefing techniques and can easily be adapted to learners at multiple levels.\(^5\) Simulation can be easily incorporated into the undergraduate medical education curriculum.\(^6-8\)

Opportunities for experiential learning are another advantage of simulation whereby the students develop knowledge and skills from their experiences outside of the traditional classroom or clinic experiences.

After the students groups report to their session, half of the students (three groups of five students each) are brought into our simulation center. We have the capability (simulation center and faculty resources) to run three simulation cases simultaneously; this helps to keep group sizes small.

We developed a simulated case of community-acquired pneumonia using a high-fidelity simulator. Each student group encounters the same simulation case (Appendix B. Simulation Case 1 & Appendix C. Case 1 Chest Radiograph). Each simulation case is run by a clinical faculty member who can role-play the patient and nurse and is also able to provide a short debrief after the encounter. In the instructions for the workshop, students are provided with a triage note for the patient that includes the name, age, chief complaint, medical history, medications, and allergies for the simulation case. In the simulation experience, the students perform a focused history and physical examination and are encouraged to think about the differential diagnosis, diagnostic workup, and treatment plan for the case. In the absence of a high-fidelity
simulator, institutions with alternative resources may choose to employ role-playing by a faculty member or standardized patient or substitute audio recordings of adventitious breath sounds.

Each simulation room is set up in an identical fashion as an emergency department treatment room. The patient is connected to a cardiac monitor, which can display the cardiac rhythm, oxygen saturation, and blood pressure. In each exam room, oxygen delivery devices such as a nasal cannula, nonrebreather face mask, and bag valve mask should be available. Our simulation center uses both SimMan and SimMan Essential.

To run the three simultaneous simulation cases, we need three preceptors. Each simulation preceptor should be familiar with the case and have a basic understanding of the operation of the simulation software. In addition to role-playing the patient, the preceptor can also role-play the nurse as needed.

The student groups are assessed by direct observation. The exercise is designed to provide the student groups with brief formative feedback as opposed to summative assessment at the conclusion of this component of the workshop. Although the simulation case does have critical actions, we do not employ a checklist.

After each simulation case is completed, the preceptor can debrief the students. During this brief discussion, the group performance along with the decision points and critical actions for the case can be reviewed. The depth of the debriefing will be limited because of the time constraints of this component of the workshop. To add some additional consistency to the workshop, the faculty can review the critical actions for this case after the student presentation of Case 1A (community-acquired pneumonia).

As part of the self-directed learning component of the workshop, the students are advised to work as a team to diagnose their assigned unknown case. This exercise is different than a traditional team-based learning approach; however, this experience does provide students with an opportunity to accomplish similar goals such as developing problem-solving skills and teamwork, as well as improving communication and leadership skills.9

The students are told to think about what is wrong with their patient and, for the purposes of the exercise, should try to identify the causative agent (if possible) or the most likely causative agent. Although we developed our cases to provide enough information to support the diagnosis, additional data are necessary to identify the causative agent or the most likely causative agent. To accomplish this, we allow the student groups to request additional clinical or laboratory data to assist them in making their case diagnosis. Each group is allowed to e-mail the faculty for additional data only one time leading up to the workshop. We do this to limit the e-mails to a manageable number (36 total groups). We are then able to guarantee a response within 24 hours. In our experience, we are able to respond to most e-mails the same day.

The students are also told that certain data will be provided only if normally be available in relative real time to patient care (e.g., if a test result would normally take 2 days to be available, the results will not be provided). Thus, we encourage the students to be specific in regard to what they ask for. When contacting the faculty, the students are told to identify their group, session, and date of the workshop so we can keep track.

Since the workshop is part of the microbiology block, we want to emphasize identifying the causative agent or likely causative agent. Because of this, we provide results of sputum gram stain, etc., when asked for. It is, however, important to review with the students during the discussion that the yield for gram stains of the sputum is poor and that routine clinical practice typically requires empiric antibiotic administration prior to identifying an underlying pathogen. See Appendix D (Commonly Requested Test Results) for the results of commonly requested tests, including sputum stains. All of the stains are originals and are not copyrighted images.

It is impossible to predict the information that a particular group will ask for. Some groups request common laboratory tests (CBC, ABG, BMP, etc.), whereas others ask for culture results from sputum or blood and a host of other microbiologic assays/stain results or more invasive procedure results.
(broncoalveolar lavage, lung biopsy) that would not be available in relative real time or would not be performed in the care of the patient. In addition to the sputum stains, the results of most tests are nonspecific other than a positive rapid HIV test for the P. jiroveci case and a positive urine Ag test for Legionella for the Legionella pneumonia case. Because of this unpredictability, it is very important to be consistent in the responses provided to the groups. Students will also ask for history or physical exam information (travel history, occupational exposure, presence of a heart murmur, etc.) that cannot be easily predicted or accounted for in every case history. The responses to all of these questions are typically negative or noncontributory.

The culmination of the self-directed learning component for the groups is to work together to prepare and then present a 6- to 8-minute PowerPoint presentation on the day of the workshop to the entire group of 30 or more students attending the session. Detailed instructions regarding the presentation format are included in the student instructions (Appendix A). These include case review, supportive data, diagnosis/causative agent, treatment, teaching points, etc. For these presentations, the faculty (basic science and clinical faculty) serve as expert consultants and help to reinforce key aspects of the case after each presentation or may pose questions to the students to further promote critical thinking and dispel any misconceptions. Examples of two group presentations are included in Appendices E and F. To further assist the faculty in preparing for this workshop, a number of resources have been identified that will provide an in-depth review of all six pneumonia cases.10-15

Results

In 2013, all 180 second-year students completed the exercise, with 172 (95.6%) returning the postworkshop evaluation. All students reported that the exercise achieved the stated learning objectives. Most (97.1%, n = 171) reported that the self-directed learning component and simulation complemented each other and enhanced the learning experience and (95.9%, n = 172) that both the self-directed learning component and the simulation were valuable. Independently, each component of the workshop was highly rated by the students. The self-directed learning component was reported to be valuable (96.5%, n = 172), and the simulation component of the exercise was also reported to be highly valuable (95.9%, n = 172). Many (90.1%, n = 172) noted that working as a team helped them to better understand the material. Prior to the workshop, almost all of the students (98.8%, n = 172) reported meeting to discuss their unknown case. Most reported that the other group presentations were educational and valuable (91.5%, n = 172). The majority of students (77.9%, n = 172) reported that they enjoyed the shift away from a faculty-facilitated session to a student-facilitated session. All 36 groups contacted us for additional information prior to the session, and all groups correctly identified the likely causative agent of their assigned unknown clinical case. Lastly, all groups developed high-quality presentations, shared responsibility for presenting the information, and dressed professionally for the exercise.

Discussion

Overall, we view this workshop as a success. At our institution, this was our first attempt to combine simulation and a self-directed learning experience. Our format was effective and provided an opportunity for the students to work together as a group, solve an unknown case, apply critical thinking skills, and teach their classmates through the group presentations. Because of the encouraging reviews, we have since modified existing workshops and created new ones to incorporate a similar format, each receiving very positive reviews.

For our workshop, faculty availability is one key to success as we need three clinical faculty to run the simulation cases. For the presentations, we need a basic science and one or more clinical faculty members to be available and be familiar with the cases and clinical conditions.

The ability of the student groups to contact faculty for additional information was an interesting twist to this workshop. We found that all groups requested some information to assist them with diagnosing their case.
Some student groups did request data that would not be immediately available or would be considered impracticable; this is likely attributable to a lack of clinical experience and of an understanding of the workup and evaluation of these conditions.

It is absolutely necessary to be responsive to the student e-mails for this aspect of the workshop to be effective. Although we provide the students with instructions 1 week before the workshop, we tend to get a bulk of the group e-mails 1-2 days before the workshop. This creates the need for time-sensitive responses to allow the students the opportunity to incorporate the new data into their thought process. In the 2 years since we have introduced this workshop, every group has e-mailed the faculty requesting additional information.

It is important to provide students with the workshop material about 1 week ahead of time. This allows ample time for the students to meet outside of class to review their assigned case. The instructions also need to be clear and concise. Participating faculty will also need to be familiar with student expectations along with the clinical aspects of the cases to allow for meaningful discussion after each student group presentation.

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References


