Asthma Exacerbation Triggered by Wildfire: A Standardized Patient Case to Integrate Climate Change Into Medical Curricula

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Abstract

Introduction: Climate change presents unprecedented health threats. It is imperative that medical trainees understand the implications of climate change/planetary health on the physical and mental health and well-being of their patients. Medical professionals generally are not trained to consider climate change impacts in patient encounters. Hence, there is a need to train climate-aware providers who will be at the forefront of patient care in managing these current and emerging health impacts. Methods: We created a standardized patient (SP) case enhanced with details of risks and health impacts due to exposure to wildfire smoke. This session was deployed to 11 internal medicine clerkship students as part of a standard OSCE already included in our curriculum to evaluate core clinical and communication skills. Two cohorts, a group activity, and a one-on-one encounter were deployed and followed with a faculty debrief and learner assessments. Results: Students had increased awareness and knowledge of health impacts of climate change and potential actions for adaptation and mitigation. The improvements were statistically significant for the one-on-one cohort ($p = .006$). Postsimulation comments were favorable; students were more inclined to consider health impacts, risks, and vulnerabilities exacerbated by climate change. Discussion: Students had an increased recognition of climate change as a force impacting their patients' health which should be considered in patient care. This format allowed retention of well established curricular content, but also the inclusion of other crucial emerging issues that will impact public health locally and globally and foster the development of climate-aware health care providers.

Keywords

Climate Change, Asthma, Simulation, Standardized Patient, Objective Structured Clinical Exam, Climate Aware Providers, Adaptation and Mitigation, Pulmonary Medicine

Educational Objectives

By the end of this activity, students will be able to:

1. Demonstrate the importance of being a climate-aware provider.
2. Demonstrate increased knowledge of climate change and its health risks and impacts.
3. Determine relevant information from a patient's history and physical exam to recognize health impacts of climate change.
4. Develop awareness of the importance of environmental risks and ways to address and mitigate health impacts of climate change.

Introduction

Climate change presents unprecedented health threats that demand attention from the medical community. According to the World Health Organization, “Climate change is the greatest threat to global health in the 21st century.”¹ Heat waves and extreme environmental conditions result in population displacement, expanded infectious and vector borne illnesses, lost property, and interrupted access to resources contributing to physical and mental illnesses. Climate change also affects social determinants of health such as air and water quality and food security, with disproportionate impacts on vulnerable populations, including children, elderly, and those who are economically disadvantaged, thus increasing health disparities. Finkel writes,

There is a growing realization that as we prepare medical students to enter the profession, it is imperative that they graduate with an understanding of the implications of climate change/planetary health on the physical and mental health and well-being of their patients.²
Changes in the climate system are happening now. Hence, there is an urgency to train climate-aware providers who will be at the forefront of patient care in managing the health impacts of climate change.

While medical school curricula cover the diseases and symptoms that are linked to environmental threats, medical professionals generally are not trained to consider climate change impacts in patient encounters. This may be due to overloaded curricula or students already being taught about various disease states that are worsened by environmental factors. However, there is a need to focus on making the connection of human health to environmental challenges brought on by climate change. Several medical schools are incorporating climate change into their curricula. Examples include the University of California San Francisco (UCSF), which has an inquiry course exploring the link between climate change and health.3 Ilcahn School of Medicine at Mt. Sinai, New York has developed content on climate-related health problems which have been incorporated into several courses for first- and second-year medical students.4 According to the editor of MyGreenDoctor.org, Dr. Todd Sack, other schools have a climate change education process underway, though many very preliminarily as he explains, "Very few medical students or practicing physicians are receiving the information that they will need during their careers."5 This gap is also demonstrated in the findings of the International Federation of Medical Students' Associations. They found that only roughly 16% of their faculties had climate health integrated in the curricula.6 Additionally, a recent survey of institutional members of the Global Consortium on Climate and Health Education found that, Most respondents have encountered challenges in trying to institute climate-health curricula, and the two most cited issues are lack of available curricula (41%) and funding/time to support its development (34%), followed by competing institutional priorities/politics (31%).7

Our national professional organizations also support endeavors to include climate-related health education in curricula. In 2016, a position paper from the American College of Physicians included language that supported physicians and the broader health care community throughout the world to educate the public, their colleagues, and communities about health risks posed by climate change.8 The American Medical Association (AMA) adopted climate change educational policy in 2019 that pledged to promote education for medical students and physicians on health threats from climate change as well as supported a resolution to expand this training. Specifically, the AMA supports,

...[E]ducating the medical community on the potential adverse public health effects of global climate change and incorporating the health implications of climate change into the spectrum of medical education, including topics such as population displacement, heat waves and drought, flooding, infectious and vector-borne diseases, and potable water supplies.9

These domains provide a platform for a spectrum of offerings including individual courses and a longitudinal thread to stand-alone experiences. Additionally, the instructional strategies can range from demonstrating specific core competencies to a more general introduction to the climate crisis and its multiple public health impacts.

Despite these positive movements, there remains a lack of experiential opportunities for medical students to explore the link between health and climate change, in particular integration into simulation. A review of MedEdPORTAL resources did not reveal standardized patient (SP) cases that specifically addressed climate change and its connection to health impacts. We responded to the need for training on the health impacts of climate change in medical education through the use of our curriculum. However, we also recognized challenges to adding topics to existing curricula. Weiser, as cited in Earles, writes, "One of the biggest barriers is competing priorities and how to add content without taking away content."10 Recognizing schedule and resource constraints, we undertook a strategy to include this topic in existing curricular slots for simulated clinical scenarios.

Exercises using simulated clinical scenarios with SPs are well established strategies for teaching core clinical competencies and essential skills. These scenarios can be expanded to include relevant details that incorporate climate-related risks and vulnerabilities. With this in mind, starting in 2019 we deployed SP exercises for a target audience of third- and fourth-year medical students at the University of Illinois College of Medicine in Urbana. The exercises were created as low-stakes, formative teaching and assessment activities with the complexity tailored to the learners training level. The goal was to increase awareness, knowledge, and skills related to the connection between climate change and health, as well as strategies for mitigation and adaptation. The domains covered included communication, professionalism, and interpersonal skills, as well as history taking, physical exam, clinical reasoning, patient education, and documentation skills. Our strategy allowed the retention of well established curricular content, along with the inclusion of other crucial emerging issues that will impact public health locally and
globally and foster the development of climate-aware health care providers.

**Methods**

With an intent to add content without taking away content, we created an SP case enhanced with climate change material as part of an OSCE. This was done using an existing accepted format already included in the curriculum to evaluate core clinical and communication skills. Our target participants were learners rotating through their internal medicine (IM) clerkship. As IM faculty we were uniquely positioned to enrich the IM clerkship curriculum and chose to incorporate climate change-related content. It was also an ideal platform to review the evaluation and treatment of commonly encountered airway disease.

Prerequisites of learners included experience in history taking, physical exam, and core clinical medical knowledge expected of a third-year medical student. Facilitators were IM and family medicine faculty.

**Development of the SP Case**

The clinical case scenario (Appendix A) was developed by two IM faculty members: the director of the Clinical Simulation Center (CSC), and one of the IM clerkship directors (Japhia Ramkumar and Holly Rosencranz, respectively). Additional materials included a history checklist (Appendix B), physical examination checklist (Appendix C), exemplar note (Appendix D), and a faculty debrief guide (Appendix E). Considering the need for students to understand the pathophysiology and treatment of common clinical topics such as obstructive airway disease, we chose a case of asthma to incorporate our climate change content. In writing the case scenario and the SP training material, we enhanced the historical backstory with details of the patient’s risk due to exposure to wildfire smoke as well as the impacts on her lifestyle and overall mental and physical health. Our materials were reviewed by content experts in simulation and colleagues actively involved in the practice of adult medicine. Resources for the content creation included the 2018 Lancet Report, the 2018 Fourth National Climate Assessment, and Guidelines for the Diagnosis and Management of Asthma.

We trained two SPs to portray our patient, a 65-year-old retired female office worker from California, suffering from worsening asthma related to distant wildfires. SPs were given the training material in advance to review and trained per usual protocol of the CSC (Appendix F) by the director and author of the case, as well as the SP coordinator. Training took approximately 1 hour. It involved reviewing key points of the history and physical, answering questions, refining the script, and confirming that the SP was well versed with all aspects of the content as well as strategies to optimize the role portrayal. For example, we instructed the SPs to cue the students to the effects of the wildfires by wearing a dust mask (dangling around the neck) and emphasizing the poor air quality due to the smoke.

**Pilot**

Prior to the actual deployment of this case, a pilot test was conducted. We recruited three fourth-year medical students, two of whom were engaged in roles as teaching assistants in the simulation center and one who expressed interest in simulation. These students were made aware of the climate change context of the case. They ran through the simulated clinical encounter as per standard OSCE procedure. Two faculty members volunteered to observe the encounter and debrief the students using the faculty debrief guide (Appendix E). Both students and faculty thought the experience was valuable and it raised their awareness of the connection between climate change and its health impacts. Based on informal narrative feedback from the students, we decided to include some additional preparatory material for students going forward.

**Deploying the Case**

Third-year medical students at the midpoint of their IM rotation were regularly scheduled to participate in standard IM OSCEs in the CSC on our campus. Instructions, logistics, and preparatory materials were customarily communicated to them 2 weeks in advance through email. For our activity, they were alerted that one of the SP encounters would be connecting climate-related health risks to a common medical condition. They were sent preparatory materials with a link to a TED talk video. This provided a framework and background for students to consider health impacts of climate change as they approached the OSCE, as well as patient care during their clerkships and in the future. Faculty were provided with supplemental materials to review in a faculty debrief guide (Appendix E) prior to the encounter, with guidelines for asthma criteria as well as specific details related to climate adaptation and mitigation. The faculty were also instructed to guide the students to understand the psychosocial impacts of the patient’s condition in the context of the wildfire and other environmental challenges.

The CSC was equipped with rooms that could simulate an ambulatory or in-patient setting as well as a debriefing room. In this case, the setting for the encounter was an emergency department visit but could be easily adapted to be an outpatient clinic visit. Students brought their own stethoscopes, but had access to sphygmomanometers, ophthalmoscopes, otoscopes and other equipment required to perform an optimal physical
exam. The requirements for this encounter included: (1) hard copies of learner instructions (Appendices G and H), (2) clipboards with paper and pens, (3) SP seated in an exam gown wearing a dust mask which was dangling around her neck, (5) ruler, and (6) result card with physical exam findings (Appendix I). The physical exam findings included expiratory wheezes and decreased diaphragmatic excursion consistent with obstructive airway process, which, in this case, was related to an asthma exacerbation provoked by wildfire smoke. The encounter was deployed in two formats: group encounter and one-on-one encounter.

Cohort 1: Group Encounter Activity
Five medical students, one SP, and two IM faculty participated in the group encounter format. The medical students reported to the CSC debriefing room. They sat in a semicircle around the SP who was seated and dressed in an exam gown with a mask dangling around her neck. The students were given the learner instructions (Appendix G) and 2 minutes to read them. They took turns both interviewing the SP to obtain the history (20 min) and performing pertinent physical examinations (10 min). Students then took turns sharing their individual diagnoses and recommendations with the SP (10 min). The SP then provided feedback to the students regarding their communication skills (5 min). During the subsequent open group debriefing (30 min), faculty gave feedback and guidance on the history and physical examination using the checklists (Appendices B and C). Faculty also elaborated on topics related to the patient’s risks and vulnerabilities related to her asthma exacerbation and strategies for individual treatment. Additionally, approaches to mitigation and adaptation as well as recognition of social determinants of health that increase risks of adverse health impacts of climate change were discussed. These included the need to assess the patient’s mental health in the context of anxiety over the progression of her disease, isolation, dependence on others, and financial limitations, as well as strategies and resources for intervention. The faculty debrief guide (Appendix E) was used to facilitate these conversations. The total duration of this exercise was about 80 minutes.

Cohort 2: One-on-One Encounter Activity
Five medical students, one oral maxillofacial surgery resident, two SPs, one simulation coordinator, and two IM faculty participated in this one-on-one SP encounter format. Learners reported to the CSC at their predesignated times in batches of two at a time. There were three of these two-student batches, or flights, and each flight was 50 minutes in duration. The timing, instructions to the learners and SPs, and video recording of the encounters were overseen by the simulation coordinator. Each learner began the SP encounter at the door of the exam room where the learner instruction (Appendix H) was posted. They were given 15 minutes to obtain a history, perform a focused physical examination, and share their diagnosis and recommendations with the SP. The learners then synthesized clinical data in a structured note (10 min). Two faculty members were present and observed learners through video access in the debriefing room. On completion of the note, the students met with the SP again to receive verbal feedback regarding their communication skills (5 min). Each learner then met with faculty individually for a subsequent debriefing (20 min). Faculty gave feedback and guidance on the encounter on the history and physical examination using the checklists (Appendices B and C). The students’ notes were reviewed and compared to the exemplar note (Appendix D) which was used as a guide. Faculty also used this opportunity to make the connection between climate change and health impacts as well as strategies for mitigation and adaptation, similar to cohort 1. The faculty debrief guide (Appendix E) was used to facilitate these conversations. The total duration of this exercise was about 150 minutes.

Learner Assessment
In both cohorts, there were two parts to our learner assessment: (1) assessment of basic clinical and communication skills inherent in any OSCE format, and (2) assessment of the effectiveness of our educational strategy to increase medical students’ knowledge, skills, and awareness of health impacts of climate change.

Cohort 1 assessment 1: Upon completion of the encounter, faculty and the SP evaluated students in a group setting. Faculty engaged in discussions of key points for the communication, history taking, and physical exam skills. The checklists (Appendices B and C) were used to guide overall discussion. The SP provided additional feedback focused on the students’ communication skills.

Cohort 2 assessment 1: During the encounter, faculty evaluated the physical exam skills (Appendix C) and the SP evaluated the history taking (Appendix B) and communication skills using the revised University of Illinois at Chicago Communication and Interpersonal Skills Scale. At the completion of the encounter, the SP also provided additional verbal feedback to the learner focused on the student’s communication skills. In the subsequent debrief with the learner, faculty reviewed all checklists and the learner notes.

Cohort 1 and 2 assessment 2: Prior to the simulation, students completed a presurvey (Appendix J), which consisted of five
questions, and then after the simulation students completed the six-question postsurvey (Appendix K) which had the addition of an option for narrative comments. The first five questions on both surveys were identical and addressed a measure of students’ awareness, knowledge, and ability to educate others on the impact of climate change on patient health. Additionally, the postsurvey had a sixth question about the need for prior exposure to the content for better understanding and an option for narrative comments. The questions were scored with a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) and the raw data were tabulated for further statistical analysis. Students were advised that the surveys were anonymous, voluntary, and did not impact their standing in their training program. Both surveys were approved by our institutional review board.

Results
From July 2019 to October 2019, two cohorts of five learners and six learners, respectively, participated in the simulation. Ten completed surveys were returned. Paired sample statistics were calculated (Table 1) and the total pre- and postsurvey scores for each subject were compared using a paired sample t test (Table 2). The results for cohort 1 indicated no significant difference (p > .05) between the pretest (M = 18.2, SD = 3.83) and the posttest (M = 20.0, SD = 2.35), t (4) = 1.29, p = .266. The results for cohort 2 indicated a significant difference (p < .05) between the pretest (M = 18.4, SD = 1.34) and the posttest (M = 22.1, SD = 1.75), t (4) = 5.29, p = .006. Overall, the results indicated that the simulation encounters increased the participants’ recognition of the impacts of climate change on patient health and potential for them to consider proactive measures. There was no consensus in either cohort regarding the importance of the need for prior exposure (i.e., a lecture on this topic) to successfully participate in the exercise.

Postsimulation narrative comments included useful feedback on considering a more geographically local scenario and providing more introductory material related to climate change prior to the encounter. However, the majority of comments were favorable and fell into three overall categories:

1. Students recognized that the information they gathered from medical history helped them focus on exposures and risks and recognize the health impacts of climate change:
   - “I will be more conscious about the factors related to climate change that may contribute to a chief complaint. The session shed some light on additional questions to consider.”
   - “Considering health quality measures at home is a new concept which I look forward to incorporating in my future histories.”
   - “It made me think about factors like air conditioning and others that influenced what people with asthma have to think about and consider for management of health.”

2. Students demonstrated awareness of the importance of being climate-aware providers who could include patient education in their management plans:
   - “Good insight into environmental challenges [emergency departments] face in the west.”
   - “I will be more cognizant of not only a patient’s medical conditions but their environmental health impacts.”
   - “It made me think more outside the box. For example, if my patient has an exacerbation of the [shortness of breath], I will ask them about climate related exposures even if they don’t bring it up. I also hadn’t thought about the psych or emotional aspects of this topic, I will do so from now on.”
   - “I think it will help me be more prepared to speak about the climate issues with patients in the future. I will definitely be more comfortable now.”

3. Students expressed appreciation of the exercise:
   - “I really liked the simulation. The actors were good as was the storyline.”
   - “Opened my eyes to the issues. Showed me another level that I must approach patients and health.”

| Table 1. Paired Sample Statistics of Cohorts 1 and 2 |
|-----------------------------------|--------|--------|--------|-----------|--------|--------|-----------|---------|----------|
| Cohort 1 | Presurvey | Postsurvey | M | SD | Standard Error | M | SD | Standard Error |
|-----------|-----------|-------------|----|----|----------------|----|----|----------------|--------|
| 1          | 5         | 20          | 18.2 | 3.83 | 1.71          | 5 | 20.0 | 2.35 | 1.05 |
| 2          | 5         | 22.1        | 18.4 | 1.34 | 0.60          | 5 | 22.1 | 1.75 | 0.78 |

| Table 2. Paired Samples Tests of Cohorts 1 (N = 5) and 2 (N = 5) |
|-----------------------------------|--------|--------|--------|-----------|--------|--------|-----------|---------|----------|
| Cohort 1 | Presurvey | Postsurvey | M | SD | Standard Error | M | SD | Standard Error |
|-----------|-----------|-------------|----|----|----------------|----|----|----------------|--------|
| 1          | 5         | 20          | 18.2 | 3.83 | 1.71          | 5 | 20.0 | 2.35 | 1.05 |
| 2          | 5         | 22.1        | 18.4 | 1.34 | 0.60          | 5 | 22.1 | 1.75 | 0.78 |

*Significant at p < .05

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Discussion

While several medical schools’ curricula cover the diseases and symptoms that are linked to environmental threats, we found that medical professionals often are not trained to specifically consider climate change impacts in patient encounters. Our simulation activity gave students the opportunity to make the connection of the health risks of climate change to disease processes in the evaluation of a patient. In our case, the chief complaint of shortness of breath was due to an exacerbation of asthma provoked by an environmental risk of uncontrolled wildfires. Understanding the health impacts of climate change is of extreme importance to nurture climate-aware providers, but strategies for training are challenging due to scheduling restrictions and packed curricula. Therefore, we enhanced an existing, accepted simulation format used to evaluate core clinical and communication skills, by incorporating a backstory that included climate change related risks and vulnerabilities.

As health care providers committed to planetary and personal health, we recognized the need to develop case content that reflected the current and evolving risks of climate change. We found the process of developing this case content to be the most challenging task. It required investigation of the national and local climate impacts, and options for adaptation and mitigation at the individual and the community level. We also included up-to-date guidelines for classifying and treating asthma. Additionally, particular attention was given to relevant social determinants of health to create a realistic and compelling personal narrative in the SP’s backstory of the case scenario. We used our standard checklists with the addition of one question to determine if students asked about environmental risk factors in the history checklist (Appendix B). No changes were made in our existing communication and physical exam checklist (Appendix C). Additionally, there were no changes made in the protocols for training SPs or preparing faculty aside from developing the supplemental faculty debrief guide (Appendix E). Hence, minimal changes were required for our existing assessment tools or training protocols. While our preparatory materials focused on specific health impacts of climate change, faculty using this case can choose pre-experience materials that are relevant to their customized educational goals, in other words, mental health, social determinants of health, and health care infrastructure.

Regarding the implementation of our case and strategy, we found this to be an effective and realistic application of a simulation encounter that can be implemented in multiple learner settings. It can be adapted for different learner levels and using different formats within the constraints of resources. The diseases and environmental exposures portrayed can be unique to any geographic setting. This allows for increased awareness of climate related illnesses, nationally and globally. While our case reflected asthma exacerbation due to wildfires in California, other examples can include, but are not limited to, flooding or drought in the Midwest and hurricanes in coastal areas. All these environmental risks impact multiple aspects of health including cardiovascular, pulmonary, and mental well-being.

Our results indicated students had an increased recognition of climate change as a force impacting their patients’ health and to be considered in patient care. Additionally, students indicated that they found the simulation encounter format engaging and valuable. We concluded that we could educate our medical professionals and learners to be more aware and competent in health impacts of climate change through such realistic and temporal simulation encounters.

Limitations

As a satellite campus for the University of Illinois, our IM clerkship has a limited numbers of learners. Hence, our statistical study had a smaller number of participating subjects to power the results. Additionally, the result of our two cohorts did not have the same strength of outcomes. In cohort 1, the group interview revealed a trend, but no significant change in the subjects’ awareness of climate change impacts on health. However, the results of cohort 2 (i.e., the one-on-one encounter) demonstrated a statistically significant improvement in these parameters.

The process of developing this case content and its attendant resources required a time commitment to assure accuracy and authenticity. These efforts were valuable to create a portable and reproducible information resource for others to reuse and develop further. Time limitations impacted the depth and breadth of the faculty debrief and the ability to develop specifically tailored action plans to each disease state, but provided a potential focus for future encounters. Another conceivable limitation was the need for academic leadership buy-in regarding this topic. This was to assure its robustness, and that it was engaging and deployed at the appropriate level for different learners. Further study is being pursued.

Future Directions

Our experience has demonstrated that this strategy was easily adaptable and generalizable for any institution with its available resources. We propose that our strategy be incorporated in other clinical simulation curricula beyond IM and third-year clerkship venues. For example, a robust longitudinal climate curriculum could be developed and would allow students to learn how to practice medicine in the context of the current...
health impacts of climate change. Early in training, cases can be developed that guide students to elicit environmental risk factors from the social history. They can subsequently learn required elements of the physical exam and individual treatments in the context of climate-related health impacts. Regarding survey methods, we recognize the importance of assessing and addressing the psychosocial impacts of the climate crisis on patients’ health, and this could be elaborated further in assessing students’ knowledge. Survey questions can also be more granular to help measure specific domains of knowledge and skills gained. As for curricular innovation, as these students advance, specific tailored action plans can be the focus of the exercise. Equally, simulations can be developed that allow them to engage in making recommendations to community leaders and policy makers for mitigation and adaptation. Another educational innovation would be to have students be the authors of these cases based on their own personal and patient-related experiences. Hence there are multiple opportunities to use simulation to engage students and nurture interest in the future pursuit of individual, community, and population health.

Disclaimer
This case was written and deployed before the onset of the COVID-19 pandemic. The case may be adapted to include evaluation for exposure and/or infection with COVID-19, especially in an elderly patient with an underlying respiratory disease. Nonpharmacologic preventive strategies for COVID-19 should be included. Additionally, the most recent Global Initiative for Asthma guidelines, updated in 2020, should be followed for asthma management.16

Appendices

A. SP Case Development Tool.docx
B. History Checklist.docx
C. Physical Exam Checklist.docx
D. Exemplar Note.docx
E. Faculty Debrief Guide.docx
F. SP Manual.docx
G. Learner Instructions Cohort 1.docx
H. Learner Instructions Cohort 2.docx
I. Result Card with Physical Exam Findings.docx
J. Presimulation Survey.docx
K. Postsimulation Survey.docx

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

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The University of Illinois College of Medicine at Urbana Institutional Review Board approved this study.

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