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Providing APPE pharmacy students rural health assessment experience following wildfire event in western Montana

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Abstract

Background and purpose: We describe a novel, interprofessional, experiential training involving pharmacy students in response to a health emergency in rural Montana (MT).

Educational activity and setting: Fourth-year pharmacy students on clinical rotations were recruited to participate in screening events assessing effects of wildfire smoke in Seeley Lake, MT. Students were required to fulfill at least two hours of supplementary training in addition to education on human research guidelines. Students assisted with patient surveys (demographics,

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Author Statement

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Staff scientist instrumental in the organization of the events and worked closely with the students. She also performed data analyses and archiving of samples. She wrote a majority of the manuscript and assisted with revisions and resubmissions.

Sarah Ballou

Student in both Pharmacy and Public Health programs that help organize events and recruit participants. She wrote the initial draft of the manuscript and assisted with updates.

Mary Buford

Staff scientist that was instrumental in event organization, training of students, and patient assessments (spirometry). She assisted with manuscript preparation and revisions.

Ava Orr

Research student involved in organizing events, contacting participants, compiling and analyzing data. She assisted with manuscript preparation and some help with editing following reviewer comments.

Christopher Migliaccio

Primary investigator of the study and Clinical Pharmacist for the IPHARM program. Oversaw the training of students and student evaluations during and after the events. Worked closely with primary author in the preparation of the manuscript and was responsible for reviewer responses and resubmissions.

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health, and respiratory), physiological testing with biomedical researchers, blood pressure and medication counseling, and spirometry specialists.

Findings: At least 20 pharmacy students have participated in this project in addition to nursing (n = 8), public health (n = 1), and social work (n = 1) students. In initial and subsequent screenings, students worked alongside a team of biomedical researchers and faculty from the University of Montana. An initial cohort of 95 patients was recruited.

Summary: This unique experiential training opportunity has afforded pharmacy students access to rural community patient interaction and exposure to and performance of a variety of tests in response to an environmental health emergency. Furthermore, it enabled health professionals and researchers to assess individual and overall community health following an extreme wildfire smoke event, providing the groundwork for utilization of pharmacy students in healthcare responses to public health emergencies.

Keywords

Interprofessional; Wildfire; Health screening

Background and purpose

In awarding a doctor of pharmacy degree, educators hope to impart knowledge and professionalism that is commensurate with the student's career aspirations and employment climate. As such, schools of pharmacy have begun to include various certificate programs, interprofessional, and experiential opportunities.¹ The ImProving Health Among Rural Montanans (IPHARM) program in the Skaggs School of Pharmacy at the University of Montana was created in 2002 with the aim of providing advanced practice experiences (APPEs) for student pharmacists in rural settings.²

Montana (MT) is a predominantly rural state, covering the third largest geographical area in the contiguous United States, but having a population of just over one million. Sixty-five percent of this population lives outside of a metropolitan area greater than 50 000.³ Every county in Montana has been designated as a Health Professional Shortage area and/or Medically Underserved area.⁴ Rural communities often present with higher rates of the most prevalent chronic conditions, including cardiovascular and respiratory diseases.^{5,6} Lack of access to resources, counseling, and education for preventative care represents significant barriers for self-management of these diseases.^{7,8} Complicating the situation for rural community members is the challenge of health care responses following natural disasters and the identification of potential acute and long-term effects of these events.

For communities and individuals in the western United States, increasing intensity and frequency of wildfires and smoke exposure are of particular concern to health. In July 2017, residents of Seeley Lake, MT were exposed to 49 days of Environmental Protection Agency (EPA) designated PM_{2.5} (particles less than 2.5 microns in diameter) levels of "very unhealthy" or "hazardous," necessitating declaration of a public health emergency. In addition to a state of emergency being declared, the health department issued an official evacuation recommendation based on the smoke levels. PM_{2.5} have been associated with

adverse health effects and, in particular, with increased mortality from cardiovascular and respiratory causes.⁹ Additionally, wildfire smoke exposure has been linked with psychological distress, including anxiety and depression.^{10,11} In the past, studies on the health effects of wildfire smoke exposure have been retrospective analyses of visits to providers, emergency departments, and hospitals using International Classification of Disease codes for cardiovascular and respiratory designations.^{12–17}

The goal of this project was to provide a unique experiential educational opportunity to pharmacy students on a multidisciplinary team of health professionals (Table 1) to assess the health effects of an unprecedented wildfire smoke exposure in the rural town of Seeley Lake, MT. Additionally, students participated in yearly follow-up visits to assess the long-term impact of this exposure and provide health screenings in a control population for a community health comparison. The goals of the project, to train health professions students and recruit participants, were achieved and laid the groundwork for future endeavors of this nature. In addition, the retention of the cohort participants was also successful for the study and continued assessments of the exposed community. Students involved in the screenings obtained a unique educational experience and their work contributed to a National Institutes of Environmental Health Sciences-funded study that was recently published.¹⁸

Educational activity and setting

Fourth-year pharmacy students from the University of Montana were recruited to provide health screenings following a public health emergency in Seeley Lake, MT, with additional control comparison assessments in Thompson Falls and Malta, MT. Students were either enrolled in the IPHARM elective APPE or volunteered with the IPHARM program. At the time of each event, there were different students enrolled in the elective (rotations were four weeks) and the rest of the students were recruited via a program-wide email notification to all fourth-year students. The program has a successful history of training clinical health professions students in an ambulatory care setting. Due to the unpredictable nature of the wildfire event and exposure, the recruitment, training, and institutional review board (IRB) approval were on accelerated timetables (Table 2). The study protocol was approved by the IRB at the University of Montana and participants provided informed consent.

Pharmacy students were integrated into a team that included faculty and students from the schools of pharmacy, social work, community and public health, the department of integrative physiology and athletic training, the center for environmental health sciences, and a local physician (pulmonologist). For IRB compliance, all team members were required to complete HIPAA (Health Insurance Portability and Accountability Act) and human research qualification trainings prior to the event, conducted by pharmacy faculty and research staff. The students and researchers were instructed on the project protocol and procedures so that all testing was done precisely and consistently. In addition to their in-class training during the third year of didactics, students were trained over two days in the specific protocols outlined in the IRB, including human subjects protection. Clinical parameters were assessed at the initial Seeley Lake event, immediately subsequent to the wildfire smoke exposure. Explanation, guidance, and counseling were provided by student practitioners under the supervision of clinical faculty regarding test results, and participants were able to take their

screening results home. Students and faculty also administered two validated mental health screenings to assess the psychological impact of wildfire smoke exposure: the Abbreviated Profile of Mood States (POMS) and the Center for Epidemiological Studies Depression Scale (CESD-R). The POMS assesses current mental status or mood, while the CESD-R assesses depression status over a two-week period. Table 3 lists the various tests performed, the approximate time for training of the students, and the duties required/performed by the students at the screening event. All data entry and analyses were performed using Excel, version 16.16.7 (Microsoft).

Findings

Twenty pharmacy students have been trained, and they have participated in three years (2017–2019) of community health assessments of a rural area that experienced extreme and long-term exposure to wildfire smoke. Additionally, alongside the fourth-year pharmacy students, a mixture of students, staff, faculty, and health professionals from a variety of disciplines were represented in the interprofessional team (Table 1). The goals of including students in the community health assessment and biomedical research project were to provide unique experiential opportunities in a rural health setting, develop interprofessional relationships in a collaborative environment, support the aim of epidemiological and biomedical research in studies of wildfire smoke exposure, and deliver quality counseling to enrolled participants in the study. Metrics in this study were limited to numbers of student and faculty participators and enrollees and retention of the study cohort for biomedical and epidemiological research. The primary value of the experience was the opportunity to gain experiential knowledge in an emergency situation in a typical MT rural setting. To this end, an evaluation survey, previously developed by the program for interprofessional (IPE) events, was made available to all students online, and we received responses from 6 of the 20 that participated (n = 5 pharmacy, n = 1 nursing). All respondents felt they “were adequately trained” and they “had defined roles at the event.” The students also felt that the “event was well-organized” and the “supervision was helpful towards their clinical education.” In addition, all felt they “had a positive impact on participants’ health education.” With regards to the question of “how was the event useful to your professional education?” the following statements were submitted:

- “It was a setting that I likely won’t ever get to experience again. Anytime you can gain experience interacting with patients is useful.”
- “Provided real world experience and interactions with members of the community.”
- “I learned how to use a pulse wave blood pressure monitor and observed spirometry. I hope to one day gain specialized asthma/COPD (chronic obstructive pulmonary disease) training.”
- “Interprofessional team training.”

In addition to the online survey for the student participants, there was a team review after each event. This review consisted of faculty and students gathering and evaluating the event as well as the performance of the students with constructive feedback from the preceptors.

Students were able to discuss any pros and cons they felt during patient interactions and give feedback to the organizers.

The program required expediency and comprehensiveness in response to the county health department request's during the public health emergency declaration. The response included recruitment of students and assembling of an interdisciplinary team, training of the various students and staff, advertising health screenings in the impacted community, and development of the study plan including rapid IRB approval. Table 2 lists the chronological events included in the initial and subsequent events in the study. As can be seen, following the initial visit to the Seeley Lake community and an assessment of multiple health parameters, subsequent visits were performed in each of the next two years in Seeley Lake in addition to the enrollment of comparison cohorts in Thompson Falls (2018) and Malta (2019). Thompson Falls is a town of similar topography, population, and distance to healthcare services as the Seeley Lake community but experienced five-fold less wildland smoke inundation in 2017. Malta, located in eastern Montana, is also of comparable population size and healthcare access as Seeley Lake, but experienced negligible wildland smoke exposures historically.

Between the three communities in the study (Seeley Lake, Thompson Falls, and Malta), 176 participants were enrolled (Table 4). Most of participants in the health screenings were members of the Seeley Lake cohort. Of the 95 originally screened in Seeley Lake immediately subsequent to the fires in 2017, more than half (51.6%) returned to a health screening in one or both of the following years, with one-third (33.7%) attending and being assessed all three years. The average age for each of the cohorts was statistically similar, with a generally older population represented (average ages of the cohorts were 59 to 64 years).

Limitations and barriers

This was a unique educational opportunity that was not without significant barriers to success. The key aspect to overcome was time to implement a rapid health intercession. Due to the nature of the exposure event, there was limited time to develop a plan, achieve IRB approval, organize a diverse team, and coordinate with local officials. To this end, the initial meeting to develop a strategy and delegate appropriate responsibilities included faculty and staff with relevant expertise (biomedical research, public health, clinical practice/education), a local clinician, and a member of the city-county health department. The onus of the coordination was with the IPHARM director in the school of pharmacy, due to experience with similar health screening events. Obtaining rapid IRB approval was vital and a required component to move forward. Paramount to approval was the inclusion of only non-invasive testing and the exclusion of minors (< 18 years of age). In addition, the inclusion of a health department professional with a connection to the community was a major help to the study's success due to her ability to obtain local permissions and inform the community of the intention and time of the health assessments.

Discussion

The expanding responsibilities of pharmacists in healthcare, especially in rural settings, require increased clinical education for pharmacy students. The role of the pharmacist is particularly well-suited for rural communities due to the limited access to primary providers and emergency health. Pharmacists in rural community settings are often ranked with physicians as the most commonly consulted health professionals in rural Western Australia.¹⁹ Comparatively, Montana is the fourth largest state, but 47th in population, with just over a million residents. Over two-thirds of Montanans live rurally, implying barriers to health care regarding time and travel to larger cities.^{20,21} Montana has the oldest population average in the West, with several rural counties having twice the elderly (over 50) population as the national average. Combined with the likelihood of the need for more medical attention for this group and the long distances to a metropolitan hospital, meeting individual healthcare needs in these areas is challenging. Additionally, per capita, Montana's physician supply is lower than the national average.²² Further complicating healthcare in Montana is the increasing impact of wildland fires in the western United States with wildfire smoke being diffused into vulnerable (isolated) communities for extended periods of time.^{23–25} The opportunity to merge the traditional practice of IPHARM for individual health screenings with the assessment of the Seeley Lake population allowed for real-time analysis of health/lung function following extreme exposure to wildfire smoke as well as training for health profession students in a rural setting.

Wildfire smoke exposure has complex health impacts, and two of the key areas of concern are cardiovascular and respiratory health. PM_{2.5} is considered the respirable fraction of airborne particulates as it is able to descend deeply into the lungs and cause respiratory inflammation and damage. Based on hospital admission studies, increases in PM_{2.5} can be directly correlated to an increase in hospital admissions due to respiratory causes.^{16,26} The cardiovascular effects of PM_{2.5} have also been well-documented using morbidity and mortality outcomes.^{16,26,27} Administering health screenings in Seeley Lake, MT following this public health emergency allowed the team to address rural, immediate healthcare concerns. Pharmacy students administered tests, counseled individual patients on immediate health concerns, and were able to initiate chronic disease management. With particular consideration to the average age of the Seeley Lake cohort (63 years old), the IPHARM tests of lung function and cardiovascular effects were relevant in assessing the potential health consequences of the smoke exposure. Furthermore, follow-up visits allowed the pharmacists and students to provide a more comprehensive assessment and counseling to participants on the trend in individual and community-wide effects.

Previous studies by Cranor et al²⁸ and Nuffer et al²⁹ demonstrated the efficacy of clinical pharmacist interventions in unique settings including diabetes, asthma, and general medication management. The education and practice are bolstered by collaboration in interdisciplinary settings. The utilization of fourth-year pharmacy students in a response to a public health emergency provided not only interprofessional experience, but also was also vital to epidemiological and biomedical research aims in the assessment of community health following exposure to significant levels of wildfire smoke.

The use of a pharmacist-led interdisciplinary team to provide a timely response to a community natural disaster is a novel application of a mobile health care program and the APPEs in the University of Montana program. The ability to provide health screenings to a rural community impacted by wildfire smoke expanded the role of the University of Montana IPHARM clinic, provided students and faculty a unique educational setting for hands-on training and assessments of individuals and their community, and supported biomedical researcher studies of the long-term health evaluation of a rural community exposed to wildfire smoke. The collaboration that has developed within the interdisciplinary team has allowed for rural clinical assessments and for continued training and growth of student practitioners.

Summary

This type of interprofessional response to an environmental disaster is a novel application of pharmacy practice. The previous establishment of a unique mobile ambulatory care clinical practice program (IPHARM) was vital to this response in its applicability and promptness. While these health screenings will continue in the established cohorts, the experience and expertise established will benefit additional communities affected by wildfire smoke exposure in the future. This study has also provided challenging and vital educational experiences for students in a variety of disciplines, due to the interprofessional nature of the program.

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Table 1

Interprofessional health screening personnel.

Personnel	Discipline	n
Students	Pharmacy students	20
	Nursing students	8
	Public health students	1
	Social work students	1
	Undergraduate research students	1
Faculty/staff	Pharmacy faculty	4
	Biomedical research staff	4
	Social work faculty	1
	Physician	1
	Public health faculty	1
	Public health scientist	1

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Table 2

Timeline of study events.

Year	Date	Event
2017	24 July	Rice Ridge Fire results from lightning strike
	31 July	Rice Ridge Fire significantly expands
	31 August	MCCHD-DEQ contacted University of Montana
	5 September	Initial IPE group meeting
	5–19 September	Multiple “electronic” meetings; IRB development; advertising for recruitment
	19 September	IPE group recruitment and training
	20 September	Initial screening event
2018	12 July	Thompson Falls event
	18 August	Seeley revisit
	5 September	Seeley revisit
2019	5 June	Seeley revisit
	26 June	Seeley revisit
	1–2 October	Malta event

IPE = interprofessional education; IRB = institutional review board; MCCHD-DEQ = Missoula City-County Health Department - Department of Environmental Quality.

Table 3

Screening components and student training.

Component	Approximate training time	Duties at event
Spirometry	1 h	Pre-screen patients Assist specialist Obtain height and weight measurements
Blood pressure	Previous didactic, laboratory course	Perform blood pressure Counsel on results
Cardiovascular	0.5 h	Assist with 6-min walk Heart rate Blood pressure
HbA1c	Previous didactic, laboratory course	Fingerstick for CLIA-waived test Counsel on results
Cholesterol/lipid panel	Previous didactic, laboratory course	Fingerstick for CLIA-waived test Counsel on results
Buccal cell swab	0.5 h	Obtain, catalog and store samples
Plasma samples	0.5 h	Obtain blood from fingerstick (150–300 µl)
Surveys POMS CESD Demographics Medical history	0.5 h	Assist patients Answer questions Counsel as needed

µl = microliter; CESD = Center for Epidemiological Studies Depression Scale; CLIA = Clinical Laboratory Improvement Amendments; HbA1c = hemoglobin A1c; POMS = Abbreviated Profile of Mood States.

Table 4

Basic demographics of patient cohort.

Parameter	Seeley Lake	Thompson Falls	Malta
Participants	95	24	44
Average age	63	61	59
Sex			
Male	44	5	17
Female	51	19	27

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