

Pharmacy Interns' Perception of Climate Change and Its Impact on Health

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Abstract

Background: The effects of climate change are major threats to health and well-being. While the profession of pharmacy can make a difference through patient care activities, sustainability, and advocacy, literature detailing U.S. pharmacist and student pharmacist views on this topic is scant. **Objectives:** To assess Ohio pharmacy interns' knowledge and beliefs regarding climate change and human health as well as its relevance to pharmacy practice and education, and to compare and contrast their perceptions with those of Ohio pharmacists previously surveyed. **Methods:** An anonymous 31-item electronic survey was emailed to a random sample of 500 pharmacy interns registered in Ohio with questions regarding climate change and health, climate change policy, potential roles for pharmacists and pharmacy interns, pharmacy education, and demographics. Data were analyzed using descriptive and nonparametric statistics, and responses collected from this study were compared with those from the Ohio pharmacist study conducted the previous year. **Results:** Ninety-two interns completed the survey. The majority of respondents thought climate change is happening (87%), will harm human health in their community (68%), and is relevant to pharmacists or pharmacy practice (62%). Compared to registered pharmacists, pharmacy interns more often acknowledged these statements and more often identified roles in climate action. Sixty-two percent somewhat or strongly agreed that there should be more education about climate change and health in the pharmacy curriculum. **Conclusion:** The majority of Ohio pharmacy interns participating in this survey recognized the impact of climate change on health, believed they have roles in mitigating its effects, and wanted to learn more about it. As these are the first data assessing U.S. pharmacy interns' perceptions of this topic, additional studies should be performed in other parts of the country. Increased education among student pharmacists may help propel the pharmacy profession to take the lead in climate action and sustainability.

Keywords: Climate Change; Perception; Students; Pharmacy; Education

Introduction

Climate change is the long-term alteration of the Earth's temperature and weather patterns.¹ Human activity has been the principal cause of climate change since the 19th century,¹ with many sectors in the United States (U.S.), including healthcare, contributing to its acceleration.²⁻⁴ Climate change is an imminent threat to humanity, as the World Health Organization has declared climate change the single biggest health threat.⁵

The health effects of climate change are broad and potentially severe, threatening physical and mental health.^{2,5,6} In the U.S., health and well-being have been impaired by increased frequency and severity of extreme events (e.g., heat, droughts, floods, wildfires), increased spread of infectious and vector-borne diseases, declines in air and water quality, and deterioration of food and water security.^{2,6,7} In 2023, the U.S. experienced an extraordinary number of climate-driven events, including locally-acquired cases of malaria in Arkansas, Florida, Maryland, and Texas; unprecedented high precipitation in California and Vermont; and historic wildfires in Hawaii.^{2,7}

Additionally, over 100 million people in the northern U.S. were exposed to significant and widespread smoke pollution from wildfires in Canada.^{2,7} While climate change impacts health across the world, certain populations such as communities of color and those with low wealth bear a disproportionate burden, worsening existing inequities.^{2,6} Increased air pollution, extreme rainfall, algal blooms, and vector-borne disease (notably Lyme disease and West Nile virus) have impacted the North American Midwest, including Ohio.⁸⁻¹¹

The pharmacy profession can take the lead in addressing the impacts of climate on human health through health education, clinical interventions, mitigation efforts, and advocacy.^{4,12-19} However, literature detailing pharmacist and student pharmacist views on this topic is scant. Aside from one study among student pharmacists in Australia regarding environmental sustainability,²⁰ to our knowledge no published studies have explored pharmacy interns' perceptions of climate change and health. Furthermore, only one study conducted among pharmacists registered in Ohio in October 2022 investigated U.S. pharmacists' awareness of the impact of climate change on health and their opinions regarding pharmacists' responsibilities in climate action.²¹ Therefore, we decided to distribute a similar survey to a sample of pharmacy interns registered in Ohio to assess their knowledge and beliefs regarding climate change and human health as well as its relevance to pharmacy practice and education, and to compare and contrast their perceptions with those of Ohio pharmacists previously surveyed.

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Methods

From a list of all pharmacy interns registered in Ohio as of June 2023,²² a random sample of 500 individuals were selected using the RAND function in Microsoft Excel 2022 (Redmond, WA). The anonymous survey was emailed in July 2023 (Qualtrics XM, Provo, UT) and remained open for nine weeks. It was adapted from the instrument used with Ohio pharmacists²¹ and contained three questions about general threats to the U.S., 12 questions regarding climate change and health, one question about U.S. climate change policy, seven questions on potential roles for pharmacists and pharmacy interns, two questions about pharmacy education, and six demographic questions. Similar to the Ohio pharmacists' survey,²¹ the cover letter did not disclose the survey topic and the first three questions assessed potential threats to the U.S. from the global economy and global disease outbreaks as well as global climate change to minimize response bias. As an incentive, participants who finished the survey were given the opportunity to designate one of three charitable organizations (American Pharmacists Association Foundation, American Red Cross, or Humane Society) to receive a small donation. The conclusion screen contained links to resources regarding climate change and health.^{11,23} The Ohio Northern University Institutional Review Board deemed the study exempt.

Data were analyzed using Microsoft Excel 16 and IBM SPSS 29 (Armonk, NY). Percentage of responses to each question was calculated; because no questions were mandatory, percentages were calculated from the total number of respondents who answered each question. As previous reports have shown that demographic characteristics such as gender (i.e., male/female) or geography (i.e., rural/urban) may influence opinions regarding climate change or action among U.S. residents,^{24,25} Chi-square and Fisher's exact test were used to examine potential differences in responses to selected questions for these variables. To allow for comparisons with the pharmacists' responses,²¹ respondents were categorized into generational cohorts based on their age at survey completion.²⁶ Binomial tests were used to compare the proportion of responses from selected questions from this study with those from the Ohio pharmacist study.²¹ Alpha was set *a priori* at 0.05. Missing data were excluded from analyses.

Results

The survey was successfully emailed to 497 pharmacy interns registered in Ohio; three emails were undeliverable. Ninety-two interns (19%) completed the survey (Table 1), of which 11 were graduate interns. Respondents were affiliated with each of the seven schools of pharmacy in Ohio, and three attended an out-of-state institution.

Respondents' views regarding climate change and health are shown in Table 2. Several differences are apparent when comparing responses from Ohio pharmacy interns to Ohio pharmacists.²¹ Interns more often indicated global climate

change (56%) as a major threat to the U.S. than the condition of the global economy (51%) or global disease outbreaks (44%), unlike the registered pharmacists who did not perceive global climate change to be a major threat as often ($p < .001$). Female interns more often believed that climate change is happening compared to male interns ($p = 0.035$), but no difference was observed among those practicing in a rural setting compared to an urban setting ($p = 0.381$). The majority of intern respondents recognized that racial and ethnic minoritized populations (66%) and lower-income individuals (77%) are more likely to be negatively affected by climate change. Most intern respondents thought climate change adversely affects sufficient food supplies (81%), safe drinking water (80%), and secure shelter (75%). Forty-two percent of intern respondents predicted that the increased frequency of catastrophic weather events would have the greatest impact on human health, followed by 29% identifying temperature change and 16% identifying changes in precipitation patterns.

Sixty-two percent of interns thought climate change is moderately or greatly relevant to pharmacists or pharmacy practice, with 20% thinking it was "only a little" relevant and 14% thinking it was "not at all" relevant. Female interns more often believed that climate change was relevant to the profession than male interns ($p = 0.006$). No difference was found among interns practicing in rural areas as compared to urban areas ($p = 0.290$).

Figure 1 shows Ohio pharmacy interns' perceptions of potential roles in climate action. Just over half of respondents agreed/strongly agreed that pharmacists and pharmacy students have a responsibility to bring the health effects of climate change to the public's attention, should advocate for stronger climate change policy and action, and can have an impact on mitigating climate change and increasing sustainability in the health care system. More female interns than male interns identified these potential roles for pharmacists ($p = 0.022$, $p = 0.055$, $p = 0.022$, respectively) and for pharmacy students ($p = 0.022$, $p = 0.008$, $p = 0.008$, respectively). Overall, a significantly greater number of the surveyed pharmacy interns thought that pharmacists could have an impact in each of these areas compared to the surveyed pharmacists²¹ ($p < .001$). Seventy-eight percent of pharmacy interns agreed/strongly agreed that there needs to be stronger climate change policy and action in the U.S., compared with 54% of registered pharmacists²¹ ($p < .001$). This was agreed upon more often by female interns in comparison with male interns ($p = 0.016$).

When asked whether their college teaches them about climate change in the pharmacy curriculum, 61% of interns indicated "not at all", 25% indicated "only a little", 5% indicated a "moderate amount"/"great deal", and 9% indicated they did not know. The majority of intern respondents (62%) somewhat/strongly agreed that there should be more

education about the impacts of climate change on health in the pharmacy curriculum.

Discussion

In general, most Ohio pharmacy interns who responded to the survey realized the impact of climate on the health of patients in their community and agreed there are roles and responsibilities for pharmacists and student pharmacists in climate action. Compared to registered pharmacists²¹ pharmacy interns more often acknowledged this on nearly every question in the survey. While definitive reasons driving these differences are not known, there are a few possible explanations. One is the age difference between participants in the two studies. All participating interns were Millennials or Generation Z; according to the Pew Research Center, both generations are more highly engaged with the issue of climate change through social media or volunteerism than older generations.²⁷

Another explanation may be the timing of survey distribution. The intern study happened to coincide with significant air pollution in Ohio from Canadian wildfires.²⁸ While data on the influence of weather experiences on climate attitudes are mixed, firsthand exposure and media attention may increase the salience and lessen the psychological distance of climate change, making the issue more noticeable and “feel closer to home”.^{29,30} Witnessing the effects of the wildfires on visibility and air quality may have resulted in more interns identifying global climate change as a major threat to the U.S. and a threat to health in their local communities as compared to the pharmacists who took the survey before this event. Furthermore, although some impacts of climate change on health already documented in Ohio are related to vector-borne diseases, extreme weather, and air pollution,⁸⁻¹¹ only illness due to reduced air quality was recognized by more than half of the interns as presently affecting residents of the state.

While significant differences in responses were not found between those working in rural or urban areas, female interns more frequently answered affirmatively to the questions. This finding is consistent with gender differences seen in the Ohio pharmacist study²¹ and previous studies where American women more often expressed concern about climate change than men, which may result from socialization and social roles associated with gender.²⁴ However, previous studies have also shown that while women tend to have more accurate risk perceptions regarding the potential harm of climate change to human and animal health, they more often express uncertainty about their knowledge and are less likely to know certain facts about climate change as compared to men.³¹ Therefore, there is a need among all genders for more education about climate change in order to improve knowledge (especially for women) and understanding of its effects (especially for men).³¹

One potential venue for student pharmacists to receive information about climate change and its impact on health is through their curricula. However, the majority of respondents to this survey indicated that they had not yet learned about this topic in their pharmacy-related classes. Although proposed strategies and published examples of incorporating topics of climate change or environmental sustainability in health professions courses currently exist³²⁻⁴³ pharmacy programs need to imbed this material more consistently.

The American Association of Colleges of Pharmacy (AAPC) House of Delegates recently endorsed a policy on curriculum that “supports the integration of curricular components related to social forces and environmental factors and their impact on the environment, health, and health equity within Doctor of Pharmacy and graduate education programs to support the development of knowledge necessary to understand the role pharmacists, pharmaceutical scientists, and other health care professionals must play in reducing the negative impact of global climate change and environmental degradation.”⁴⁴ This policy was put forward by the Argus Commission, a committee comprising the past five AAPC Presidents. Their 2021-2022 Report recommended establishing a framework, educational resources, and faculty development on climate change and health for pharmacy and interprofessional education curricula and called for pharmacy organizations to advocate for programs and policies that mitigate climate change.⁴⁵ Their 2022-2023 follow-up Report guided pharmacy programs on how to intentionally incorporate topics related to the effects of climate change on health and inequities into curricula in order to “enhance the awareness of graduating students of the potential impact of climate change on health both now and in the future.”⁴⁶ Additionally, increasing clinical prevention and population health education in pharmacy schools is an objective of the Healthy People 2030 initiative,⁴⁷ and the Association for Prevention Teaching and Research’s Clinical Prevention and Population Health Curriculum Framework advises to include the impact of the environment on population health as a key topic to meet this objective.³⁶

Limitations to the study include that results may not be representative of all pharmacy interns in Ohio; in addition, responses may not represent those of pharmacy interns practicing in other regions. Actual curricular content was not assessed, but rather student perceptions or recollections of content were collected. As half of the respondents had not completed the didactic curricula, they do not have full knowledge of all topics discussed in their pharmacy courses.

Notwithstanding these limitations, this study is important as it is the first to characterize U.S. pharmacy interns’ awareness and beliefs regarding climate change and health. Future studies should be performed to examine the views of pharmacy interns throughout the U.S. and in other countries. Moreover, although the Plenary Health Report Card initiative has sought to evaluate

the curricula and practices of health professions programs, analysis of pharmacy schools has been minimal to date.⁴⁸ Therefore, more research is needed to systematically capture the current state of pharmacy education and action on this topic, identify areas for improvement, and disseminate best practices.

Conclusion

The profession of pharmacy has roles and responsibilities related to climate change and health. Ohio pharmacy interns participating in this study recognized that climate change is happening, is a major threat to the U.S., and harms human health significantly more often than surveyed Ohio pharmacists. Ohio pharmacy interns were also more likely to recognize the impact pharmacists can have on climate action compared to surveyed Ohio pharmacists and indicated wanting to learn more about climate change and health. As these are the first data assessing U.S. pharmacy interns' perceptions of this topic, this survey can be replicated to examine the views of pharmacy interns throughout the U.S. and in other countries. The AACP Argus Commission and House of Delegates have called for greater inclusion of these topics in pharmacy curricula to address the gap in education about climate and health. Increased education among student pharmacists may help propel the pharmacy profession to take the lead in climate action and sustainability.

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Conflicts of interest: None

Disclaimer: The statements, opinions, and data contained in all publications are those of the authors.

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Table 1. Demographic characteristics of Ohio pharmacy interns (summer 2023) and pharmacists²¹ (fall 2022) responding to each survey

	Pharmacy Interns (n=92)	Pharmacists (n=70)
<i>Gender</i>		
Female	57 (67%)	41 (67%)
Male	28 (33%)	19 (32%)
Non-binary/third gender	0	0
Prefer not to say	0	1 (1%)
Missing	7	9
<i>Generational Cohort</i>		
Generation Z (19-26 y)	76 (90%)	0
Millennials (27-42 y)	8 (10%)	22 (36%)
Generation X (43-58 y)	0	26 (43%)
Baby Boomers (59-77 y)	0	13 (21%)
Missing	8	9
<i>Practice Setting</i>		
Community pharmacy	47 (51%)	25 (36%)
Hospital/health system	34 (37%)	28 (40%)
Industry	2 (2%)	1 (1%)
Other (e.g., telehealth, nuclear)	9 (10%)	16 (23%)
<i>Practice Setting Community Type</i>		
Urban	34 (37%)	26 (37%)
Suburban	42 (46%)	34 (49%)
Rural	15 (17%)	10 (14%)
Missing	1	0
<i>Year of Graduation</i>		
2023	11 (12%)	non-applicable
Expected 2024	35 (38%)	
Expected 2025	22 (24%)	
Expected 2026	20 (22%)	
Expected 2027 or later	4 (4%)	

Table 2. Perceptions regarding climate change and health among Ohio pharmacy interns (summer 2023) and pharmacists²¹ (fall 2022)

	Pharmacy Interns (n=92)	Pharmacists (n=70)	p-value
<i>Global climate change is a major threat to the U.S.</i>	56%	39%	<0.001
<i>Climate change is happening</i>	87%	78%	0.040
<i>Climate change will harm human health worldwide a moderate amount or a great deal</i>	82%	73%	0.039
<i>Climate change will harm human health in my community a moderate amount or a great deal</i>	68%	45%	<0.001
<i>Climate change has already adversely affected physical or mental health in Ohio due to increased storms/flooding</i>	45%	29%	<0.001
<i>Climate change has already adversely affected health in Ohio due to vector-borne infectious diseases</i>	43%	42%	0.465
<i>Climate change has already adversely affected health in Ohio due to reduced outdoor air quality</i>	71%	46%	<0.001
<i>Climate change is greatly or moderately relevant to pharmacists or pharmacy practice</i>	62%	55%	0.108
<i>Climate change is not at all relevant to pharmacists or pharmacy practice</i>	14%	23%	0.024

Figure 1. Ohio pharmacy interns' perceptions on potential roles in climate action (n=92)

