






A Longitudinal Pediatric Residency Climate Justice Curriculum

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ABSTRACT

Background Graduate medical education programs must prepare physicians to adapt their care for patients whose health equity and outcomes are being threatened by climate change. This article presents the implementation of a longitudinal climate justice curriculum within a pediatrics residency program.

Objective To measure the self-reported changes in attitudes and intentions for change in behavior after implementation of a climate justice curriculum.

Methods A longitudinal, 4-part, climate justice and health equity (CJHE) curriculum was implemented from 2023 to 2024 into the broader advocacy training of a pediatrics residency program. Resident participants completed pre- and post-session surveys that assessed their attitudes toward climate change and health, as well as their intentions to engage in climate advocacy. Paired deidentified responses were analyzed via Wilcoxon signed-rank test.

Results Thus far, facilitators have conducted 4 introduction sessions, 4 narrative medicine sessions, and 3 health system sustainability sessions. Sixty-eight of 100 residents (68%) completed both pre- and post-session surveys. The curriculum was associated with increased self-reported understanding of how climate change impacts human health (CJHE 1: median of pairwise averages of pair-differences [MPA]=1.00, $P<.001$; CJHE 3-4: MPA=1.00, $P<.001$), increased agreement that health care providers can be effective climate advocates (CJHE 1: MPA=2.00, $P<.001$; CJHE 3-4: MPA=1.50, $P<.001$), and increased intention to discuss the health impacts of climate change in future patient encounters (CJHE 1: MPA=1.00, $P<.001$; CJHE 3-4: MPA=1.00, $P<.001$).

Conclusions This longitudinal CJHE curriculum demonstrated acceptability and increased participants' self-reported understanding of how climate change impacts human health and the ways in which physicians can act as advocates.

Introduction

Climate change is a significant threat to human health, demanding dynamic physician leaders at the nexus of climate, health, and justice.¹⁻⁴ The critical links between climate change and health have been integrated into the curricula of several US medical schools with the support of organizations like the American Medical Association and the American College of Physicians.⁵⁻¹¹ At the graduate medical education (GME) level, similar efforts are needed. Here, we highlight a longitudinal curriculum implemented within a pediatrics residency program that could be adapted across medical specialties.

We hypothesized that, after participation in curricular sessions, residents would report increased awareness of health threats related to climate change, increased agreement that patients' health is currently being impacted by climate change, increased agreement

that providers can be effective climate advocates, and increased intention to address the impacts of climate change with patients.

Methods

The Children's Hospital of Philadelphia (CHOP) Pediatrics Residency Program launched a longitudinal climate justice and health equity (CJHE) curriculum during the 2023-2024 academic year. The CJHE curriculum was integrated into the program's longitudinal advocacy curriculum, which is delivered during 2-week "Y" blocks that occur between inpatient clinical rotations.

The CJHE curriculum was designed and led by a team of residents, fellows, attendings, and faculty with special interests in climate change, curriculum design, health law, community engagement, and narrative medicine. The climate curriculum committee developed learning objectives (online supplementary data) to fit the overarching objectives of the program's advocacy curriculum through a combination of previously published frameworks,⁶ literature review,

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Editor's Note: The online supplementary data contains the learning objectives and curricular components of Climate Justice and Health Equity curriculum and the surveys used in the study.

and consensus expert opinion. Learning objectives were developed using the Bloom's Taxonomy framework and standardized across years to achieve a common understanding, given that trainees enter residency with variable exposure to climate and health content.^{7,12} Survey instruments (online supplementary data) were developed to measure success of learning objectives.

In line with previous interventions,¹³⁻¹⁵ a Theory of Planned Behavior framework was used in surveys to gauge attitudes and intentions associated with desired behavioral change. Residents completed novel pre- and post-session Likert-based surveys via the REDCap (RedCap Technologies LLC) platform.^{16,17} Paired deidentified survey responses were aggregated for analysis of change over the intervention via Wilcoxon signed-rank testing R software version 4.2.0 (R Foundation). This yielded medians of pairwise averages (MPA) of pair-differences (also known as pseudo-medians) as a measure of difference magnitude.

The longitudinal curriculum contains 4 sessions, each 60 to 90 minutes in length (online supplementary data). The postgraduate year (PGY) 1 "Introduction to Climate Justice Advocacy Workshop" (CJHE Session 1) examines the vulnerabilities of children to climate change, including local examples within Philadelphia. PGY-1 residents also attend an annual "Climate Change and Pediatric Health" noon conference (CJHE Session 2), which explores the links between climate change and children's health, teaches skills such as interpretation of heat and air quality indices, and provides approaches for discussing climate-related topics with patients and families.¹⁸ During PGY-2 and PGY-3, the focus shifts to skill building. In the "Climate Justice and Narrative Medicine Advocacy Workshop" (CJHE Session 3), participants read and discuss pertinent clinician-authored editorials and perspective pieces before drafting their own climate-related clinical narratives. In the "Health System Sustainability" session (CJHE Session 4), residents learn about contributions to climate change from the health care system and ways to mitigate these environmental

impacts, with institutional examples provided by the hospital's Sustainability Program Manager.

Participation in the sessions is a required part of the residency curriculum, but session attendees may opt out of survey participation without penalty.

The surveys and study protocols were reviewed by the CHOP Institutional Review Board and deemed exempt.

Results

At the time of this writing, facilitators had conducted 4 CJHE #1 sessions, 4 CJHE #3 sessions, and 3 CJHE #4 sessions. CJHE #2 is open to participation beyond residents, so survey data were not collected for this session. There were an estimated 100 participants across the CJHE #1, #3, and #4 sessions. Out of these, 68 completed both pre- and post-session surveys. There were 94 completed pre-session surveys and 78 completed post-session surveys. Additional attrition was secondary to mismatched survey identification data. Forty-two of 100 participants were first-year residents, and the remainder were second- and third-year residents. Sixty-six participants were between the ages of 25 and 29, and 31 were between the ages of 30 and 34 (TABLE 1).

Consistent with hypothesized changes in attitudes, participants reported increases in self-reported understanding of how climate change impacts human health (CJHE #1: MPA=1.00, $P<.001$; CJHE #3-4: MPA=1.00, $P<.001$), self-reported agreement that patients' health is currently being impacted by climate change (CJHE #1: MPA=1.00, $P=.003$; CJHE #3-4: MPA=1.00, $P<.001$), and self-reported agreement that providers can be effective climate advocates (CJHE #1: MPA=2.00, $P<.001$; CJHE #3-4: MPA=1.50, $P<.001$; TABLE 2). Consistent with hypothesized changes in behavioral intentions, participants also reported higher intent to discuss the health impacts of climate change in future patient encounters (CJHE #1: MPA=1.00, $P<.001$; CJHE #3-4: MPA=1.00, $P<.001$).

TABLE 1
Demographic Data for Survey Participants

CJHE Session	No. of Participants	Year of Training, n (%)	Age Range, n (%)	Gender Identity, n (%)
#1: "Introduction to Climate Justice Advocacy Workshop"	29	PGY-1	25-29 years: 22 (76)	Women: 22 (76)
			30-34 years: 5 (17)	Men: 4 (14)
			Unknown: 2 (7)	No response: 3 (10)
#3-4: "Climate Justice and Narrative Medicine Advocacy Workshop" and "Health System Sustainability"	39	PGY-2: 18 (46)	25-29 years: 23 (59)	Women: 26 (67)
		PGY-3: 21 (54)	30-34 years: 16 (41)	Men: 10 (26)
				No response: 3 (8)

Abbreviations: CJHE, climate justice and health equity; PGY, postgraduate year.

TABLE 2

Pre-/Post-Session Results for Attitudes and Intentions Related to Behavioral Change

CJHE Session	Survey Prompt	Mean Response (Standard Deviation)		Median Response (Interquartile Range)		Pseudo-median (Post-Pre)	P value
		Pre	Post	Pre	Post		
#1: "Introduction to Climate Justice Advocacy Workshop"	I understand how climate change impacts human health.	3.48 (0.83)	4.34 (0.48)	4 (1)	4 (1)	1.00	<.001
	Climate change is currently impacting the health of my patients.	4.31 (0.89)	4.79 (0.41)	5 (1)	5 (0)	1.00	.003
	I understand how climate change contributes to health inequities.	3.66 (0.86)	4.45 (0.51)	4 (1)	4 (1)	1.00	<.001
	I understand how health care providers can be climate advocates.	2.72 (0.80)	4.17 (0.60)	3 (1)	4 (1)	2.00	<.001
	Medical schools and residency programs should provide formal education on how climate change impacts health outcomes.	4.45 (0.51)	4.69 (0.47)	4 (1)	5 (1)	1.00 ^a	.01
	Medical schools and residency programs should provide formal education on how climate change contributes to health inequities.	4.45 (0.51)	4.69 (0.47)	4 (1)	5 (1)	1.00 ^a	.01
	In the next 3 months, I plan to talk to my patients and/or their families about the effects of climate change on health.	3.28 (0.80)	4.21 (0.82)	3 (1)	4 (1)	1.00	<.001
	In the next 3 months, I plan to consider sustainability in my day-to-day clinical practice.	3.89 (0.63)	4.54 (0.51)	4 (0)	5 (1)	1.00	<.001
	I can name 2 or more ways that a health care system could decrease its environmental impact.	3.34 (0.97)	4.24 (0.79)	4 (2)	4 (1)	1.50	<.001
#3-4: "Climate Justice and Narrative Medicine Advocacy Workshop" and "Health System Sustainability"	I understand how climate change impacts human health	3.92 (0.58)	4.38 (0.54)	4 (0)	4 (1)	1.00	<.001
	Climate change is currently impacting the health of my patients.	4.36 (0.58)	4.69 (0.52)	4 (1)	5 (1)	1.00	<.001
	I understand how climate change contributes to health inequities.	3.85 (0.78)	4.46 (0.51)	4 (1)	4 (1)	1.00	<.001
	I understand how health care providers can be climate advocates.	3.31 (0.73)	4.15 (0.71)	3 (1)	4 (1)	1.50	<.001
	Medical schools and residency programs should provide formal education on how climate change impacts health outcomes.	4.26 (0.72)	4.54 (0.55)	4 (1)	5 (1)	1.00	.003
	Medical schools and residency programs should provide formal education on how climate change contributes to health inequities.	4.26 (0.72)	4.54 (0.55)	4 (1)	5 (1)	1.00	.008
	In the next 3 months, I plan to talk to my patients and/or their families about the effects of climate change on health.	3.28 (0.76)	4.13 (0.73)	3 (1)	4 (1)	1.00	<.001
	In the next 3 months, I plan to consider sustainability in my day-to-day clinical practice.	3.64 (0.87)	4.31 (0.69)	4 (1)	4 (1)	1.00	<.001
	I can name 2 or more ways that a health care system could decrease its environmental impact.	3.41 (1.04)	4.46 (0.60)	4 (1)	5 (1)	1.50	<.001

^a R could not compute pseudo-median; midrange estimate used instead.

Note: Likert Scale 1 to 5: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

Residents agreed in both pre- and post-session surveys that medical schools and residency programs should provide education on climate change's health implications. Residents entered the curriculum with an average self-reported "neutral" understanding of "how climate change impacts human health," and residents demonstrated improved self-reported understanding on "how climate change contributes to health inequities" (CJHE #1: MPA=1.00, $P<.001$; CJHE #3-4: MPA=1.00, $P<.001$; TABLE 2).

Discussion

Implementation of the Climate Justice Health Equity Curriculum

Participants' self-reported agreement that "medical schools and residency programs should provide formal education on how climate change contributes to health inequities" suggests there is broad acceptability among pediatric trainees of our teaching related to climate change's health implications. Given this feedback and the topic's growing importance, the CJHE will continue to be presented and evaluated within the residency curriculum. As climate and health content expands at the undergraduate medical education level, the climate-related educational needs of future residents may shift. Therefore, the climate curriculum committee plans to continue involving trainees in future reviews of and modifications to the curricular elements. As future residents advance through the longitudinal curriculum, additional data will be collected and analyzed.

The CJHE curriculum highlights how didactic noon conferences and interactive workshop sessions can be utilized to deliver climate change-related content to residents. However, other modalities like simulations, journal clubs, grand rounds, and quality improvement projects could be utilized to implement this content into GME curricula. Encouragingly, the CJHE curriculum has already yielded trainee engagement outside the classroom: one resident published a session-inspired editorial about climate change and migrant health.¹⁹

Limitations

The CJHE curriculum was developed at a single large academic institution, with programmatic support for its integration into existing curricula. We recognize that there is variability in protected didactic time among residency programs, which could inhibit widespread implementation. Recruiting faculty facilitators with expertise related to climate change, health equity, advocacy, and narrative medicine may also prove challenging for some programs. Open-source resources offer opportunities for faculty

to learn about topics relevant to their areas of practice.

The survey instrument would benefit from statistical and iterative review to ensure that it accurately captures respondents' views. The results presented here are based on a small sample size of residents who participated in the first iterations of this curriculum; additional analyses will further contextualize our findings.

Adaptability Across Specialties

Considering the findings of our first data collection cycle, we propose that the CJHE curriculum could be adapted to meet the needs of other programs and specialties. For example, an internal medicine or family medicine curriculum could provide the foundational information linking climate change and health in CJHE #1 and #2 through scenarios more relevant to adult patients. In an adaptation of CJHE #3, internal medicine or family medicine residents could explore narrative reflection through relevant patient experiences, while CJHE #4 could reflect health care activities across associated inpatient or outpatient settings.

Conclusions

A longitudinal CJHE curriculum was implemented at a large pediatrics residency program. To date, it has been well-received by participants and effective in increasing residents' self-reported understanding of the topic.

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