2024-2025 Planetary Health Report Card Advocacy Implementation at the University of Minnesota

Leyla Taghizadeh[1]; Gabriela Christensen[1]; Jameleddine Benhamida[1]; Peyton Nelson[1]; Aarohi Shah[1]
[1] University of Minnesota Medical School

Background

The Planetary Health Report Card (PHRC), a global initiative started by medical students at University of California San Francisco School of Medicine in 2019, is designed to help medical schools introduce climate justice into their curriculum, research, communities, and campuses[1].

PLANETARY HEALTH REPORT CARD

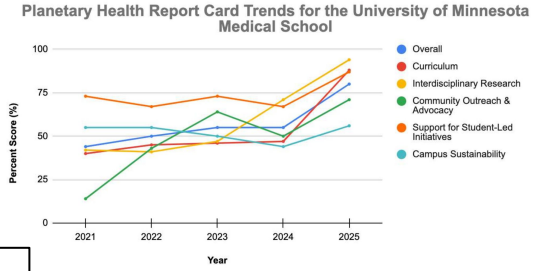
Methods

- Discrete metrics, developed by global experts based on literature reviews[1], constitute the score
- Data were collected through review of institutional resources, faculty correspondence, and internal documents
- Validation and benchmarking by PHRC national team
- After the UMMS PHRC generation, evidence-based recommendations for the medical school were created

Results

UMMS '24-25 Report Card

Section	Weight	Raw Score	Letter Grade
Planetary Health Curriculum	30%	87.5%	A
Interdisciplinary Research	17.5%	94.12%	A
Community Outreach and Advocacy	17.5%	71.43%	B
Support for Student-led Planetary Health Initiatives	17.5%	86.67%	A
Campus Sustainability	17.5%	56.25%	C+
Institutional Grade	**100%**	**80.23%**	**A-**



Strong curriculum improvement
- 43.06% in 2024 → 87.5% in 2025
- PHRC advocacy within the medical school and implementation of the SERVE curriculum[2]

Discussion

PHRC 2024-2025 Recommendations

Campus Sustainability	Community Outreach
Source local and sustainable food	Implement community facing programs
Designate staff for hospital/medical school sustainability	Update educational materials for health impact with community perspectives
Update information on Office of Sustainability website	Provide opportunities for medical student involvement

Accomplished
- Presented 2024-2025 PHRC at MMCGME Quality Forum
- Restarted interdisciplinary Health Students for a Healthy Climate student group
- HSHC leading 2025-2026 PHRC interdisciplinary collaboration at UMN between 4 programs
- Initiated PHRC in the dental school
- HSHC monthly newsletter - provide sustainability research opportunities for students
- Engaged with and amplified the work of Health Professionals for a Healthy Climate

In Progress
- Climate Resilience Teach-In Interdisciplinary PHRC presentation
- Interdisciplinary hike and trash pick up along Mississippi River
- Climate story workshop - advocacy through storytelling
- COP30 Webinar: overview and action items
- 2026 Ride for Their Lives

HSHC

Ride for Their Lives[3] Interest Form

References

1. Planetary Health Report Card. https://phreportcard.org/
2. UMMS SERVE Curriculum. https://med.umn.edu/sites/med.umn.edu/files/2023-05/curriculum%20graphic%2020apr.pdf
3. Ride for Their Lives. https://rideforttheirlives.net/about

Acknowledgments

Thank you to the University of Minnesota, the global Planetary Health Report Card organization, and our PHRC faculty mentor, Dr. Kate Shafto, for their contributions, insight, and expertise during the completion and revision process. We would also like to thank Dr. Jo Bjorgaard and Dr. Angelica Walton for their support as our Health Students for a Healthy Climate faculty advisors.

Investigating the Effects of Race, Gender, and Ethnicity on the Accuracy of Clinical Diagnoses made by Artificial Intelligence Models

Megi Maci[1], Grace Dekoker[1], Amy Wozniak[1], Monica R. Edwards[1,4], Theresa Nguyen[1,2], Lena R. Wiley[1,3]

[1]Loyola University Chicago, Stritch School of Medicine, [2]Loyola University Chicago, Center for Community and Global Health, [3]Loyola University Medical Center, Department of Obstetrics and Gynecology, [4]Loyola University Medical Center, Department of Internal Medicine

Abstract

Background: AI is becoming more pervasive in healthcare, particularly for its use in assisting with clinical decision support and diagnostic accuracy. However, before employing it in clinical practice, it's imperative to assess the effects of demographics – such as race, gender, and ethnicity – on the clinical accuracy of large language models (LLMs): Claude, Chat GPT-4omni (4o), and Google Gemini 3.
Objective: The objective of this study is to investigate how demographic factors affect the accuracy of clinical diagnoses made by Artificial Intelligence (AI).
Methods: Two mock clinical vignettes were created (with chief complaints of chest pain and changes in bowel habits, and diagnoses of acute coronary syndrome and colorectal cancer, respectively). Each vignette had a total of 13 cohorts with variations in race, gender, and ethnicity. These cohorts were inserted into a randomized generator that dictated the order in which they would be run on each LLM. Each cohort was run a total of 43 times to be able to conclude statistical differences compared to a null hypothesis of 90%.
Results: All 13 cohorts, which portrayed various combination of race (white, black, Asian), gender (male, female), and ethnicity (Hispanic, non-Hispanic) for two mock clinical vignettes, showed that Chat GPT-4o, Claude, and Gemini 3 Pro put the correct diagnosis as its top differential 100% of the time.
Conclusion: The results showed that variations in demographics – race, gender, and ethnicity – do not impact the clinical accuracy of Claude, Chat GPT-4o, and Gemini. As AI continues to gain more prominence and use in medicine, AI clinical decision support (AI-CDS) holds promise in supplementing, rather than substituting, clinical decision-making for healthcare trainees.

Introduction and Background

In 1955, the Dartmouth Conference led to a research proposal for the creation of Artificial Intelligence (AI). Since then, AI has been revolutionizing the world through its powerful and efficient use of deep and machine learning technology.

There are two distinct methods by which AI functions: (1) the top-down (symbolic) approach that uses symbolic descriptions to replicate intelligence and (2) bottom-up (connectionist) approach that mimics the brain's structure via the creation of artificial neural networks.

Deep learning gives rise to neural networks that then gives rise to machine learning. Similar to how the human brain is made up of networks of neurons that communicate and carry out many functions, AI has been similarly created to harness the power of these neural networks to give rise to machine learning, which uses algorithms and data to make predictions. AI's ability to mimic human intelligence is what makes it unique and advanced.

As advancements in AI continued, the question of how to train them remained, leading to experimentation with different learning styles: supervised, unsupervised, and self-supervised learning, among others. This led to the development of the supervised learning era (2012-2017) and the self-supervised learning era (2017-present). Supervised learning refers to training a model from annotated (i.e. labelled) data, which then provides an algorithm that can be used to classify other unlabeled data. In other words, it is a way for AI to learn information that is already known (from labelled data) and apply that knowledge to make accurate predictions on new, unseen (i.e. unlabeled) data. Self-supervised learning, on the other hand, involves training an AI model on unannotated (i.e. unlabeled) data.

An example of self-supervised learning is Large Language Models (LLMs), like ChatGPT (OpenAI, San Francisco, CA, USA). These are AI-powered, natural language models that can generate written texts in response to written input from the user. As a result, AI has proven that it can mimic many human functions: reading, writing, seeing, hearing, understanding, speaking, smelling, touching, understanding emotions, playing games and sports, engaging in debates with other humans, creating art, poetry, and music, and reading humans' minds through interpretation of brain signals to create speech – a revolutionary feat for those with speech impairments (Marr, 2019).

As AI began gaining traction, medicine began experimenting on the implementation of AI in healthcare. Supervised learning led to breakthroughs in diagnostic medical imaging, particularly in the fields of radiology, ophthalmology, dermatology, endocrinology, and pathology. In 2016, scientists developed and validated an algorithm based on deep machine learning to detect diabetic retinopathy. As a result, Retina AI was created, providing onsite, point-of-care, diabetic eye screening. In dermatology, chatbots and smartphone apps have been developed to help accurately diagnose various skin conditions, including skin cancer. In 2017, IBM's AI model, Watson, identified altered RNA-binding proteins in the neurodegenerative disease, amyotrophic lateral sclerosis (ALS). As AI showed promising use in healthcare, the focus shifted towards assessing its clinical accuracy. Drs. Kanjee, Crow, and Rodman (2023) showed that Chat GPT-4 "provided the correct diagnosis in its differential in 64% of challenging cases and as its top diagnosis in 39%," and that Chat GPT-4 is clinically superior to its earlier counterpart, Chat GPT-3. In radiology and endocrinology, for example, the focus has not only been on the clinical accuracy of the diagnosis, but also on sensitivity to subtleties. Chat GPT-4 has been used to diagnose malignant thyroid nodules without the use of invasive surgery and to identify subtle findings on radiology exams. Briefly, GPT-4 has been used to identify rare diseases, consulted to ensure that diagnostic possibilities have not been overlooked, and more efficiently and effectively scan patients' medical records to parse key diagnostic data for differential diagnoses. Additionally, Chat GPT-4 outperformed medical students in clinical reasoning. Chat GPT-4 (now referred to as Dr. GPT) is now being used to assist healthcare providers in clinical decision-making, referred to as AI-Powered Clinical Decision Support (AI-CDS). Evidently, the use of GPT-4 to assist clinicians in their diagnoses holds promise for the future in making accurate, efficient, and early diagnoses to optimize healthcare outcomes and longevity of patients (Kulkharni and Singh, 2023).

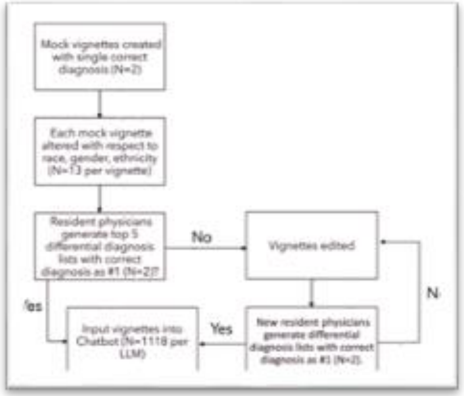
Academically, in 2011, IBM Watson competed against *Jeaopardy* champions, Brad Rutter and Ken Jennings, defeating them and redefining the role of AI in "intelligence". Chat GPT passed all three U.S. Medical Licensing Exams (USMLE), among other standardized and professional school exams, like the SATs and Bar Exam. This further underscores AI's intellectual prowess.

However, as a myriad of papers highlight the clinical strength, utility, intellectual prowess, and efficacy of AI-CDS, little research has been done thus far to assess the accuracy of these diagnoses with respect to race, gender, and ethnicity. Prayaga, et al. (2023) published a study analyzing the efficacy of an "an SMS-based refill reminder solution using conversational artificial intelligence" of a Medicare population in the U.S. to identify how patient demographics and social determinants of health impact successful engagement with AI to improve refill adherence. Their findings showed that whites, English speakers, people younger than 75 years old, and those with lower social determinants of health barriers were significantly more likely to request a refill via SMS. d'Elia, et al. (2023) also published a systematic scoping review of how AI can affect health inequities in primary care. After reviewing >100 articles, they discovered that "a lack of diverse representation in developing an AI system may lead to unintended inequities through: (1) a lack of an equity-lens during development, enabling an unfair problem formulation and (2) lead to unfair system effects external to the algorithm." In addition to access, trust of patients, dehumanization and biomedicalization, and agency for self-care, algorithm bias stemming from under-representation of certain populations was listed as a way in which AI can impact health inequities, further supporting the timeliness of this research project.

As previously mentioned, healthcare algorithms are statistical, mathematical, or informative computations that help guide medical decision making, differential diagnoses, and treatment. These algorithms constitute machine learning, which collects raw data, processes it, develops models, and deploys those models into the real world – every step of which provides opportunities for incorporation of bias. Bias can enter through lack of representation and diversity from the data used to train computer programs, as well as through the subconscious biases and assumptions made by the creators of the computer programs.

As AI becomes exponentially more advanced, lack of research into how, if at all, racial, ethnic, and gender biases are being perpetuated in the AI-CDS, highlights the urgent need for research on this topic. This project aims to elucidate the role of these demographic factors in AI-CDS to ensure that AI is being used judiciously and without perpetuating both hidden and overt biases in medicine that disproportionately put disadvantaged populations at risk of harm.

Methods



The top two chief complaints of interest – chest pain and changes in bowel habits – and their corresponding diagnoses – myocardial infarction and colorectal cancer, respectively – were identified. Next, mock vignettes were created with these chief complaints and the top five differential diagnoses written in descending order from most likely to least likely, with the correct diagnoses were listed as #1. Each vignette included the mock patient's race (white/black/Asian), gender (male/female), and ethnicity (non-Hispanic/Hispanic) in the first line introducing the patient.

Two internal medicine residents were randomly selected to read and list their top five differential diagnoses per vignette in order from most likely to least likely. To ensure there is no ambiguity or clinical complexity of the cases, both residents must have listed the correct diagnoses as number one. In the event that this did not happen, the mock vignette(s) were revised, and two new internal medicine residents were selected to write their top five differentials per vignette once more. This process was repeated until both residents successfully listed the correct diagnoses as #1, validating their use for LLMs.

In order to test the clinical accuracy of AI, we decided to use the following LLMs: OpenAI's Chat GPT 4o, Anthropic's Claude Opus 4.5, and Google Gemini 3 Pro. At the time this project was conducted, the latest and most advanced version of Chat GPT-4, Chat GPT-4o (i.e. Dr. GPT), was released and our model of choice for this project.

There is a total of 13 cohorts created that encompassed all the different combinations of race (white/black/Asian), gender (female/male), and ethnicities (non-Hispanic/Hispanic) used (Table 1). With alpha of 5% and power of 80%, it was determined to run each cohort 43 times to estimate the proportion of correct diagnoses for each cohort within 0.08 half-width, assuming 98% correct, to be able to conclude statistical differences compared to a null hypothesis of 90%. These cohorts were inserted into a randomized generator using Surveyselect within SAS 9.4 that dictated the order in which they would be run on each LLM.

The chat prompt, "Tell me the top five suspected diagnoses for the following symptoms in order or most likely/top diagnosis to least likely," followed by the mock vignette, were pasted into each LLM's chatbot. Again, each of the 13 cohorts consisted of 43 runs for each mock vignette, totaling 1118 runs for each LLM. In order to prevent the LLMs from learning and reinforcing information from previous inputs, the memory function on Chat GPT-4o was disabled, and the chat history was cleared before each new input text. Similarly, Claude was run in incognito mode, and Gemini was run using the "Temporary Chats" function. The differential-diagnosis lists and accuracy generated for each run were recorded.

Results

All 13 cohorts, which portrayed various combination of race (white, black, Asian), gender (male, female), and ethnicity (Hispanic, non-Hispanic) for two mock clinical vignettes, showed that Chat GPT-4o, Claude, and Gemini 3 Pro put the correct diagnosis as its top differential 100% of the time. (Figure 2, Table 2).

Due to lack of variation in the outcome, a confidence interval, as described in the power analysis was not possible. Instead, one sample rank-test was used to determine statistical significance compared to a null hypothesis of 90% correct. With 100% correct for each differential, it is determined this is significantly greater than 90% with a signed rank p-value of <0.001.

Cohort Number	Race	Ethnicity	Sex
1	Null	Null	Null
2	White	Non-Hispanic	Female
3	White	Non- Hispanic	Male
4	White	Hispanic	Female
5	White	Hispanic	Male
6	Black	Non- Hispanic	Female
7	Black	Non- Hispanic	Male
8	Black	Hispanic	Female
9	Black	Hispanic	Male
10	Asian	Non- Hispanic	Female
11	Asian	Non- Hispanic	Male
12	Asian	Hispanic	Female
13	Asian	Hispanic	Male

Table 1. The 13 cohorts encompassing the different combinations of race, gender, and ethnicities used. These cohorts were inserted into a randomized generator that dictated the order in which they would be run on the LLMs.

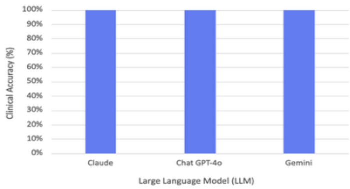


Figure 2. Assessing the number of times (as a percent) that each LLM (Claude, Chat GPT-4o, and Gemini) listed the correct diagnosis as #1.

					Chat GPT-4o		Claude		Gemini	
Cohort Number	Race	Ethnicity	Sex	Randomized Order	Vignette #1 Accuracy	Vignette #2 Accuracy	Vignette #1 Accuracy	Vignette #2 Accuracy	Vignette #1 Accuracy	Vignette #2 Accuracy
1	Null	Null	Null	11	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
2	White	Non-Hispanic	Female	9	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
3	White	Non-Hispanic	Male	1	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
4	White	Hispanic	Female	5	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
5	White	Hispanic	Male	8	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
6	Black	Non-Hispanic	Female	12	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
7	Black	Non-Hispanic	Male	13	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
8	Black	Hispanic	Female	3	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
9	Black	Hispanic	Male	7	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
10	Asian	Non-Hispanic	Female	2	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
11	Asian	Non-Hispanic	Male	6	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
12	Asian	Hispanic	Female	4	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*
13	Asian	Hispanic	Male	10	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*	43/43 (100%)*

* These percentages are statistically different than hypothesized 90% with p-value <0.001.

Table 2. Assessing the number of times that each LLM (Claude, Chat GPT-4o, and Gemini) lists the single correct answer per mock vignette as #1 on its' generated top 5 differential diagnosis list.

Conclusion

The results showed that variations in race, gender, and ethnicity do not impact the clinical accuracy of LLMs: Claude, Chat GPT-4o, and Gemini.

We purposely created mock clinical vignettes with clearer diagnoses to avoid ambiguity of the top differential as a confounding variable. Therefore, by controlling for ambiguity, we were able to isolate the accuracy of each LLMs ability to create accurate assessments and differential diagnoses.

As AI continues to become more prominent in medicine, AI-CDS holds promise in supplementing – not substituting – clinical decision-making for healthcare trainees.

Moving Forward

Acquire IRB approval to repeat this project with real patient cases and compare the accuracy of diagnoses generated by both clinicians and AI LLMs

Identify diagnoses that are biased towards certain demographics and assess if these LLMs perpetuate those biases.

Because this project is gender binary, our future work involves expanding this project to include more gender-neutral, non-binary identities from real patient cases to assess any impact this may have on AI's clinical accuracy.

References

Bakkar N., Kovalik T., Lorenzini I., Spangler S., Lacoste A., Sponaugle K., Ferrante P., Argentinis E., Sattler R., Bowser R. Artificial intelligence in neurodegenerative disease research: Use of IBM Watson to identify additional RNA-binding proteins altered in amyotrophic lateral sclerosis. *Acta Neuropathol.* 2018;135:227–247. doi: 10.1007/s00401-017-1785-8.
Brar Prayaga, Rena, et al. "Impact of Social Determinants of Health and Demographics on Refill Requests by Medicare Patients Using a Conversational Artificial Intelligence Text Messaging Solution: Cross-Sectional Study." *JMIR mHealth and uHealth*, vol. 7, no. 11, 18 Nov. 2019, p. e15771, https://doi.org/10.2196/15771.
Copeland, B.J. "Artificial Intelligence - Methods and Goals in AI | Britannica." *Encyclopædia Britannica*, 2019, www.britannica.com/technology/artificial-intelligence/Methods-and-goals-in-AI.
d'Elia, Alexander, et al. "Artificial Intelligence and Health Inequities in Primary Care: A Systematic Scoping Review and Framework." *Family Medicine and Community Health*, vol. 10, no. Suppl 1, Nov. 2022, p. e001670, https://doi.org/10.1136/fmch-2022-001670.
Hirosawa, Takanobu, et al. "Diagnostic Accuracy of Differential-Diagnosis Lists Generated by Generative Pretrained Transformer 3 Chatbot for Clinical Vignettes with Common Chief Complaints: A Pilot Study." *International Journal of Environmental Research and Public Health*, vol. 20, no. 4, 15 Feb. 2023, p. 3378, https://doi.org/10.3390/ijerph20043378.
Jha, Saurabh. "Algorithms at the Gate—Radiology's AI Adoption Dilemma." *JAMA*, 6 Oct. 2023, jamanetwork.com/journals/jama/fullarticle/2810594?guestAccessKey=91fd0be3-4244-484f-8362-ac f1d469b171&utm_source=silverchair&utm_medium=email&utm_campaign=article_alert-jama&utm_content=olf&utm_term=100623&adv=0016432608 11m, https://doi.org/10.1001/jama.2023.16049. Accessed 15 Oct. 2023.
Jindal, A. (2022). Misguided Artificial Intelligence: How Racial Bias is Built Into Clinical Models. *Brown Hospital Medicine*, *2*(1). https://doi.org/10.56305/001c.38021
Kulkarni, Prathit A., and Hardeep Singh. "Artificial Intelligence in Clinical Diagnosis: Opportunities, Challenges, and Hype." *JAMA*, 6 July 2023, jamanetwork.com/journals/jama/fullarticle/2807166, https://doi.org/10.1001/jama.2023.11440.
Kung, T. H., Cheatham, M., Medenilla, A., Sillos, C., De Leon, L., Elepaño, C., Madriaga, M., Aggabao, R., Diaz-Candido, G., Maningo, J., & Tseng, V. (2023). Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS digital health*, *2*(2), e0000198. https://doi.org/10.1371/journal.pdig.0000198
OpenAI. (2024). *Introducing GPT-4o and more tools to ChatGPT free users.* Openai.com. https://openai.com/index/gpt-4o-and-more-tools-to-chatgpt-free/
Marr, Bernard. "13 Mind-Blowing Things Artificial Intelligence Can Already Do Today." *Forbes*, 19 Nov. 2019, www.forbes.com/sites/bernardmarr/2019/11/11/13-mind-blowing-things-artificial-intelligence-can-already-do-today/?sh=41766ca86502. Accessed 15 Oct. 2023.
Strong, E., DiGiammarino, A., Weng, Y., Kumar, A., Hosamani, P., Hom, J., & Chen, J. H. (2023). Chatbot vs Medical Student Performance on Free-Response Clinical Reasoning Examinations. *JAMA internal medicine*, *183*(9), 1028–1030. https://doi.org/10.1001/jamainternmed.2023.2909
Sun, Yaoting, et al. "Artificial Intelligence Defines Protein-Based Classification of Thyroid Nodules." *Cell Discovery*, vol. 8, no. 1, 6 Sept. 2022, pp. 1–17, www.nature.com/articles/s41421-022-00442-x?utm_campaign=cd-individual-campaign, https://doi.org/10.1038/s41421-022-00442-x. Accessed 15 Oct. 2023.
Zahir Kanjee, et al. "Accuracy of a Generative Artificial Intelligence Model in a Complex Diagnostic Challenge." *JAMA*, vol. 330, no. 1, 3 July 2023, pp. 78–78, https://doi.org/10.1001/jama.2023.8288. Accessed 14 Aug. 2023.

Environmental Benefits of eConsent Adoption in Clinical Research Workflows

Becky King, MS
University of Pittsburgh

Motivation

- Paper-based consent creates avoidable environmental waste and can require participants to travel for in-person signatures.
- These requirements disproportionately affect rural, low-income, and mobility-limited populations.
- This project examines whether adopting REDCap eConsent workflows can reduce carbon emissions while maintaining accessibility and participant understanding.

Context

- Traditional consent relies on printed documents, physical storage, and in-person signatures, all of which generate waste and emissions.
- This work is novel in explicitly quantifying the *environmental impact* of digital consent workflows, including avoided participant travel, while framing eConsent as both a sustainability and health equity intervention.

University of Pittsburgh

Reduce carbon emissions and participant burden in clinical research through electronic consent workflows.

Estimated Environmental Impact per 1,000 Consent Signatures

Metric	Paper Consent	REDCap eConsent	CO_2e Saved
Paper and Printing	7,000 pages	0 pages	60 kg CO_2e
Participant Travel	800 miles	0 miles	320 kg CO_2e

≈380 kg CO_2e

Equivalent to 1 month of electricity for an average U.S. household

REDCap eConsent Workflow

1. Consent documents are created directly in REDCap using structured fields
2. eConsent settings are enabled (electronic signatures, version control)
3. Participants receive a secure electronic consent link
4. Participants review and sign electronically on their own device
5. Signed consents are securely stored with timestamps and audit trails

Potential Impact

Adopting eConsent can substantially reduce the environmental footprint of clinical research while lowering participation barriers. By eliminating required travel and paper handling, eConsent supports sustainability goals and improves access for participants who face transportation, mobility, or time constraints.

Acknowledgements

- University of Pittsburgh's SHRS Student Sustainability Group
- Vanderbilt University's RECap Team

Rowan-Virtua School of Osteopathic Medicine's Planetary Pulse: Charting a Course for Planetary Health Excellence

Hope Beyer OMS-II, Deborah Podolin, PhD

ROWAN-VIRTUA School of Osteopathic Medicine

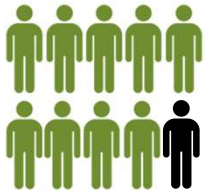
Establishing a Student Desire

Methods: Rowan-Virtua SOM students who have completed or are currently completing the pre-clerkship curriculum were asked to voluntarily complete a Qualtrics survey asking about their beliefs surrounding planetary health under IRB PRO 2025136.

Questions were modeled after Dr. Karly Hampshire's survey[8] completed on over 600 allopathic students in 2021 which demonstrated that a majority of medical students believe that climate change impacts population health outcomes but only a fraction felt their medical school was providing adequate education.

Survey responses were analyzed using descriptive statistics

Survey Results



90% of Rowan-Virtua SOM Students believe that physicians should know about climate change and its health effects for their clinical practices

Figure 1: Infographic depicting 90% (9 out of 10) surveyed Rowan-Virtua SOM students who answered "strongly agree" or "somewhat agree" to the question "physicians should know about climate change and its health effects for clinical practice". n=133

86% of Rowan-Virtua SOM Students **do not** believe that Rowan-Viruta SOM has provided adequate training on climate change and human health

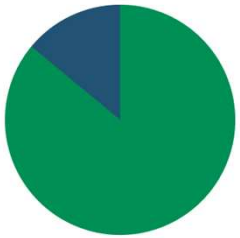


Figure 2: Pie chart representing the 86% of surveyed Rowan-Virtua SOM students who answered "definitely no" or "probably no" to the question "Rowan-Virtua SOM provides adequate education surrounding the health effects of climate change". n=133

Conclusion: Survey showed that majority of Rowan-Virtua SOM students believe planetary health concepts to be important aspects of physician training however, they do not feel as though their training is inclusive of this. This discrepancy establishes a student driven need for planetary health education at Rowan-Viruta SOM.

Introduction

- The World Health Organization has declared **climate change is the largest threat to global health**, disproportionately impacting underserved communities.[1,2]
- Osteopathic philosophy clearly outlines that "**environmental factors contribute to the etiology of disease and illness**" and that "**environmental factors need to be address as part of any management plan**".[4]

Objective

Understand the current gaps in planetary health education at Rowan-Virtua School of Osteopathic Medicine (Rowan-Virtua SOM) and provide a framework for implementing the desired changes.

Proposed Solutions

The health equity curriculum, a cross-track curricular component that highlights the social determinates of health, was identified as an area in need of resource updating that could be used to integrate planetary health topics and resources

Block	Original Health Equity Source	Pub Date	Planteary Health Equity Proposed Source	Pub Date
Hematology, Pulmonology, & Nephrology	"Collateral Damage" Video (26 min)	2008	Climate Change, Respiratory Health, and Equity: A Call to Action, Dr. Lisa Patel, Stanford Medicine Children's Health (23 min)	2023
	"Study Finds Wealthy More Likely to Get Transplants" Video (3 min)	2015	How some asthma inhalers are bad for the environment, Stanford Medicine (2 min)	2025
	"Living with Kidney Failure" (46 min)	2004	The Summer Series: An Intro to Extreme Heat, Health Climate America (19 min)	2025
	"CRISIS: Experiences of People with Sickle Cell Disease Seeking Health Care for Pain" (8 min)	2012	How Hurricane Helene caused a nationwide IV fluid shortage, PBS (6 min)	2024
Endocrinology & Reproduction	"The Great Invasion - Documentary on endocrine disruptors" Video (52 min)	2010	Code Green Podcast: Climate Change and Pregnancy (with Dr. Adelle Monteblanco and Julia Rothschild)	2024
	"Bad Sugar"	2008	Can air pollution make us more susceptible to diabetes? Deutsche Welle	2025
Gastroenterology & Nutrition	"In Defense of Food: An Eater's Manifesto Video (1hr 55 min)	2015	Rutgers-New Brunswick NJ Climate Change Resource Center "Climate Change and Agriculture in the Garden State" (14 min)	2024
	"Bridging the Great Health Divide Documentary" (53 min)	2021	Dr. Michael A. Klaper "The most powerful strategy for Healing People and the Planet" (20 min)	2018
Cardiology	"Unnatural causes: is inequality making us sick?" (54 min)	2008	Climate change and cardiovascular disease: implications for global health, Nature Reviews Cardiology (article)	2022
			Chagas Project - Ruth, Canal ACIJ (8 min)	2022
Brain & Behavior	"Crip Camp: A disability revolution" (1hr 46min)	2020	Gen Z Mental Health: Climate Stories, Climate Mental Health (9 min)	2022
	"Drugging our Kids" (45 min)	2018	Heat Intolerance and Psychiatric Medications, Dr. Deborah Serani (article) AND Psychotropic Medications and High Heat Don't Mix, Nina Dietz (article)	2025/2024

Table 1: Selected current required reading or viewing sources for the health equity curriculum as compared to student proposed planetary health equity proposed sources including their respective publication years (pub date). Red, yellow, and green publication years indicate source published prior to 2016, 2021, and 2026 respectively.

Student proposed planetary health equity curriculum fulfils the established student need and PHRC determined need for a planetary health curriculum. Adoption of the proposed changes would resolve these concerns and provide a framework for other medical schools attempting similar integrative models.

My sincere gratitude to Dr. Deborah Podolin for her support and guidance on this project. Partial funding provided by the Summer Medical Research Fellowship 2025.

Current Planetary Health Infrastructure

Methods: The Planetary Healthcare Report Card (PHRC) is a global effort to use a standardized metric-based categorized scale to evaluate current planetary health and sustainability content.[9] Through detailed curriculum review and faculty interviews of RV-SOM senior leadership, I, as a first-year medical student compiled discreate data collection in the following categories:

Based on compiled and available information, I followed PHRC template and submitted the report for external peer review. A final draft was published on the PHRC site in April of 2025[10].

Rowan-Virtua SOM 2025 PHRC Results

Section	Raw Score %	Letter Grade
Planetary Health Curriculum	50%	C
Interdisciplinary Research	41%	C-
Community Outreach and Advocacy	57%	C+
Support for Student-Lead Initiatives	87%	A
Campus Sustainability	25%	D
Overall	**52%**	**C**

Table 2: Rowan-Virtua SOM 2025 PHRC Report Card Results. Results reported based on PHRC April 2025 final draft. Values were calculated and rounded to nearest percent. The overall grade was calculated where the planetary health curriculum section is weighted as 30% and all other categories comprise 17.5% for a total of 100%. Letter grades correspond with PHRC curving where 80-100% = A, 60-79% = B, 40-59% = C, 20-39% = D, 0-19% = F Scores within top or bottom 5% awarded + or -, respectively.

Conclusion: The 2025 Planetary Health Report Card demonstrates that RV-SOM meets 52% of metrics, leaving room for much improvement but leading the way for US based osteopathic medical schools.

Cultivating a Greener Curriculum: A narrative of Synergy in the Planetary Health Report Card

Alex Ha[1], Philip Shih[1], Gustavo Valbuena, MD, PhD[1], Jyothi Marbin, MD[2]
[1]UCSF – UC Berkeley Joint Medical Program, Berkeley, CA [2]Pediatrics Department, UCSF, San Francisco, CA

Background

Climate change impacts on human health are increasing in frequency and severity, making adaptation more difficult.[1] With 3.6 billion people living in areas highly susceptible to climate change and an expected increase in global warming-associated mortality and morbidity[2], it is imperative to promote sustainability to mitigate the climate crisis and advance planetary health. The Planetary Health Report Card (PHRC) is an evaluation tool used to assess health education institutions' commitment to and integration of planetary health principles. Historically, the UCSF – UC Berkeley Joint Medical Program (JMP) scores well across multiple metrics.[3] For the sixth consecutive year, medical students at the JMP completed the PHRC to promote sustainability at this institution. This poster presents a summary of findings for the 2025 JMP PHRC report card.

Design

The team used the PHRC rubric to evaluate the JMP across five main domains:

- Curriculum: Assessment of the incorporation of planetary health principles into the curriculum, including course offerings, elective options, and integration across disciplines.
- Interdisciplinary Research: Evaluation of the extent to which the JMP fosters interdisciplinary research collaborations focusing on the intersection of health and environmental issues.
- Community Outreach and Advocacy: Analysis of initiatives aimed at raising awareness of planetary health issues within the community and advocating for policy changes or interventions.
- Support for Student-Led Initiatives: Examination of the resources, mentorship, and institutional support available for student-led initiatives related to planetary health.
- Campus Sustainability: Assessment of the environmental sustainability practices and initiatives implemented within the JMP campus, including carbon emissions, energy consumption, and sustainable infrastructure.

Data was obtained through faculty interviews, UC Berkeley School of Public Health's website, and UCSF and UC Berkeley's Office of Sustainability annual reports. Based on the results, recommendations for improvement were made.

Results

The JMP's overall grade was an A, which was a slight improvement from last year's score (A-)). The JMP excels in promoting interdisciplinary research and community outreach & advocacy, earning an A+ and A in these areas, respectively. Its exceptional score in interdisciplinary research is attributed to effective mentorship and financial support, culminating in four out of 32 Master's Thesis projects concentrating on environmental health. Its community outreach endeavors are highlighted by the numerous community advocacy opportunities related to planetary health offered by the UC Berkeley School of Public Health as well as ongoing partnerships with environmental activism leaders. Areas for improvement are centered around the curriculum and campus sustainability. While the UC Berkeley School of Public Health and UCSF School of Medicine offers many electives focused on sustainability and planetary health, the JMP's core curriculum falls short in its coverage of the impacts of climate change on health and healthcare systems. Within its discussion and case-based course for foundation medical sciences, only three out of the 33 cases encouraged students to further investigate planetary health-related topics. Regarding campus sustainability, efforts to increase food and beverage sustainability could be improved.

Section	Raw Score %	Letter Grade
Planetary Health Curriculum (30%)	(60/72) x 100 = 83%	A-
Interdisciplinary Research (17.5%)	(17/17) x 100 = 100%	A+
Community Outreach and Advocacy (17.5%)	(13/14) x 100 = 93%	A
Support for Student-led Planetary Health Initiatives (17.5%)	(15/15) x 100= 100%	A+
Campus Sustainability (17.5%)	(29/32) x 100 = 91%	A
Institutional Grade	**(Ax0.3 + Bx0.175 + Cx0.175 + Dx0.175 + Ex0.175) = 92%**	**A**

Table 1. JMP's PHRC scores by section

Discussion & Conclusions

The JMP scored well on the PHRC, earning an overall grade of A. There is room for improvement across all metrics, but especially in curriculum and campus sustainability. Recommendations to improve the JMP's curriculum score include integration of planetary health concepts into the core curriculum by leveraging student working groups and establishing a student position dedicated to curricular review. Faculty members involved in curriculum design are currently working on implementing on a longitudinal curriculum on climate change, set for Fall 2025. For campus sustainability, the JMP should mandate sustainability measures surrounding consumables (e.g. reusable foodware instead of single-use plastics) and waste disposal as well as use UC Berkeley's green event resources for official events. Despite six years of participation in the PHRC, the JMP did not have an official student position dedicated to sustainability. Through discussions with faculty, an official student liaison position has been established to bridge this gap.

Promoting planetary health should be at the forefront of medical education to ensure that future health professionals are equipped with the knowledge and skills necessary to address the climate crisis's impacts on human health in the years to come.

References

1. Climate Impacts on Human Health | Climate Change Impacts | US EPA. climatechange.chicago.gov. https://climatechange.chicago.gov/climate-impacts/climate-impacts-human-health.
2. IPCC. AR6 Synthesis Report: Climate Change 2023. IPCC. Published 2023. https://www.ipcc.ch/report/sixth-assessment-report-cycle/
3. Medicine. PHRC. Accessed June 12, 2025. https://phreportcard.org/medicine/

Ambient Air Pollution and Angiogenic Imbalance in Preeclampsia

RUTGERS Robert Wood Johnson Medical School

Dhruti Patel, Shreya Gupta, Gloria A. Bachmann, MD

Women's Health Institute
Improving the Health of Women Now and in the Future

Introduction

Preeclampsia is a leading cause of maternal and neonatal morbidity and mortality worldwide. It is defined by new-onset hypertension with proteinuria or end-organ dysfunction after 20 weeks of gestation. The disorder arises from abnormal placentation and an imbalance between antiangiogenic factors such as soluble fms-like tyrosine kinase-1 (sFlt-1) and proangiogenic factors such as placental growth factor (PlGF). Emerging evidence identifies ambient air pollution as a modifiable environmental risk factor for preeclampsia, with exposure to fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), and ozone (O_3) associated with increased sFlt-1/PlGF ratios and adverse pregnancy outcomes.[1–4]

Methods

A narrative review was conducted using PubMed and Google Scholar for articles published between 2020–2025 examining ambient air pollution and preeclampsia. Search terms included "preeclampsia," "angiogenic biomarkers," "sFlt-1," "PlGF," and "air pollution." Eligible studies included cohort, meta-analytic, and mechanistic research assessing pollutant exposure ($PM_{2.5}$, NO_2, O_3), angiogenic imbalance, and clinical outcomes.

Background

Exposure to ambient particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), nitrogen dioxide (NO_2), and black carbon during pregnancy is consistently associated with an increased risk of preeclampsia. Meta-analyses and large cohort studies demonstrate that each 10 μg/m³ increase in $PM_{2.5}$ exposure during pregnancy is associated with an 11–32% increased risk of preeclampsia, with the strongest effects observed for black carbon, a $PM_{2.5}$ constituent, which confers a 15–16% increased risk per 1 μg/m³ increment.[2-3][6-7][12] NO_2 exposure is also positively associated with preeclampsia, with pooled odds ratios ranging from 1.10 to 1.16 per 10 ppb increase.[4-6][11] These associations are robust across diverse populations and geographic regions, and are more pronounced among Black, Hispanic, and socioeconomically disadvantaged mothers.[3][11]

Biological plausibility is supported by mechanistic studies showing that $PM_{2.5}$, black carbon, and NO_2 exposures induce oxidative stress, endothelial dysfunction, and impaired placental vascularization.[5][8-9] These processes disrupt normal placental development and function, leading to angiogenic imbalance and increased risk of preeclampsia. Specifically, air pollution exposure increases oxidative stress and vascular inflammation, impairs trophoblast invasion, and alters angiogenic signaling pathways, including upregulation of antiangiogenic factors such as soluble fms-like tyrosine kinase-1 (sFlt-1).[5][8-9]

Results

Key findings from prospective cohort studies and meta-analyses indicate that **$PM_{2.5}$ and NO_2 exposures are associated with increased sFlt-1/PlGF ratio, elevated sFlt-1, and decreased PlGF**, reflecting placental dysfunction and heightened preeclampsia risk.[1] For example, in the LIFECODES cohort, $PM_{2.5}$ exposure during early pregnancy and NO_2 exposure during late pregnancy were significantly associated with increased sFlt-1/PlGF ratio, elevated sFlt-1, and decreased PlGF after adjustment for sociodemographic and clinical factors.[1] Meta-analyses report pooled odds ratios for preeclampsia risk with $PM_{2.5}$ exposure ranging from 1.11 to 1.32 per 10 μg/m³ increase, and for black carbon from 1.15 to 1.16 per 1 μg/m³ increase.[2-3][6-7][12] NO_2 exposure is associated with pooled odds ratios of 1.10–1.16 per 10 ppb increase.[4-6][11] These findings support a dose-dependent relationship between ambient air pollution exposure and preeclampsia risk, mediated by angiogenic biomarker dysregulation and placental dysfunction.

Pollutant	Association w/ Preeclampsia Risk	Susceptible Exposure Windows	Magnitude of Risk Increase	Mechanistic Insights
$PM_{2.5}$ (Particulate Matter ≤2.5μm)	**Consistently associated with increased risk**	1st, 2nd, 3rd trimester; entire pregnancy	OR 1.07–1.31 per IQR or 5–10μg/m³ increase	Induces oxidative stress, endothelial dysfunction, impairs placental vascularization, increases sFlt-1/PlGF ratio
Black Carbon	**Strongest $PM_{2.5}$ constituent effect**	2nd trimester; entire pregnancy; 3rd trimester	OR 1.12 per IQR; OR 1.15–1.16 per 1μg/m³ increase	Contributes to placental dysfunction, greatest effect among $PM_{2.5}$ constituents
NO_2 (Nitrogen Dioxide)	**Associated with increased risk**	1st, 2nd, 3rd trimester; entire pregnancy	OR 1.11–1.35 per 10μg/m³ increase	Promotes vascular inflammation, impairs trophoblast invasion, increases sFlt-1/PlGF ratio
Mixture Effects	**$PM_{2.5}$ mixture (esp. black carbon) increases risk**	Late 1st and 2nd trimester	HR 1.05 per quartile increase in mixture	Synergistic effects, black carbon contributes ~71% of $PM_{2.5}$ mixture risk
Population Impact	**Higher risk among Black, Hispanic, and low-SES mothers**	Varies by race/ethnicity and SES	Up to 3 cases/100 pregnancies reduced by lowering NO_2/BC	Disparities in exposure and susceptibility

Fig 1. This figure illustrates that **$PM_{2.5}$, black carbon, and NO_2 exposures during pregnancy are consistently associated with increased risk of preeclampsia**, with the strongest effects observed for black carbon as a $PM_{2.5}$ constituent. Susceptible exposure windows include the late first and second trimesters. Mechanistic pathways involve oxidative stress, endothelial dysfunction, and placental vascular impairment, leading to angiogenic imbalance (elevated sFlt-1/PlGF ratio). Population impact is greatest among Black, Hispanic, and socioeconomically disadvantaged groups, with hyperlocalized interventions showing potential to reduce preeclampsia incidence.[1-5][7-11]

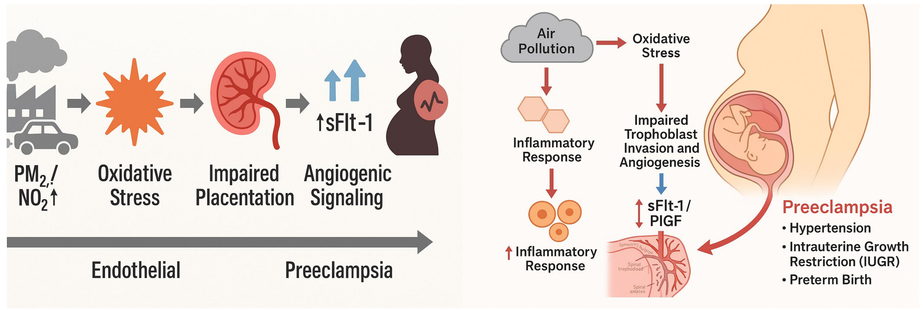


Fig 2-3. (2) Conceptual Pathway Linking Air Pollution to Preeclampsia; (3) Pathophysiology of Air Pollution–Induced Preeclampsia

Summary

- Air pollution is a modifiable risk factor for preeclampsia.
- Pollutants trigger oxidative stress, systemic inflammation, and endothelial dysfunction, leading to **abnormal placentation and angiogenic imbalance** (↑sFlt-1, ↓PlGF).
- Flexibility of PFPT helps patients with chronic symptoms achieve long term care as they can practice exercises at home, attend virtual visits, and use hand-held biofeedback stimulation.

Future Directions

- **Magnitude of preventable disease** – how much preeclampsia could be prevented if pollution were reduced.
- **Clinical recognition and biomarkers** – how exposure influences sFlt-1/PlGF ratios, angiogenic profiles, or disease severity could inform screening.
- **Equity and prevention strategies** – how recognizing air pollution as a modifiable risk factor could guide prenatal counseling, community interventions, or policy.

Acknowledgements

Thank you to Dr. Gloria Bachmann and the Women's Health Institute for their contributions and support.

References

- Exposure to Ambient Black Carbon and Particulate Matter During Pregnancy in Associations With Risk of Pre-Eclampsia: A Meta-Analysis Based on Population-Based Studies. Zhu J, Chen J, Wang K, et al. Environmental Pollution (Barking, Essex : 1987). 2024;343:123230. doi:10.1016/j.envpol.2023.123230.
- Association Between Particulate Air Pollution and Hypertensive Disorders in Pregnancy: A Retrospective Cohort Study. Sun Y, Bhuyan R, Jiao A, et al. PLoS Medicine. 2024;21(4):e1004395. doi:10.1371/journal.pmed.1004395.
- Ambient Air Pollution and Pregnancy-Induced Hypertensive Disorders: A Systematic Review and Meta-Analysis. Pedersen M, Stayner L, Slama R, et al. Hypertension (Dallas, Tex. : 1979). 2014;64(3):494-500. doi:10.1161/HYPERTENSIONAHA.114.03545.
- Air Pollutants and Adverse Pregnancy Outcomes: A Multi-Method Integration of Mendelian Randomization, Meta-Analysis, and Animal Models. Zhou W, Shao J, Huang J, et al. Ecotoxicology and Environmental Safety. 2025;302:118699. doi:10.1016/j.ecoenv.2025.118699.
- The Impact of Particulate Matter 2.5 on the Risk of Preeclampsia: An Updated Systematic Review and Meta-Analysis. Yu H, Yin Y, Zhang J, Zhou R. Environmental Science and Pollution Research International. 2020;27(30):37527-37539. doi:10.1007/s11356-020-10112-8.
- Maternal Health Outcomes Associated With Ambient Air Pollution: An Umbrella Review of Systematic Reviews and Meta-Analyses. Mazumder H, Rimu FH, Shimul MH, et al. The Science of the Total Environment. 2024;914:169792. doi:10.1016/j.scitotenv.2023.169792.
- Air Pollution and Pre-Eclampsia; Associations and Potential Mechanisms. Bearblock E, Aiken CE, Burton GJ. Placenta. 2021;104:188-194. doi:10.1016/j.placenta.2020.12.009.
- Hyperlocalized Measures of Air Pollution and Preeclampsia in Oakland, California. Goin DE, Sudat S, Riddell C, et al. Environmental Science & Technology. 2021;55(21):14710-14719. doi:10.1021/acs.est.1c02151.
- Ambient Air Pollution and Maternal Cardiovascular Health in Pregnancy. Decrue F, Townsend R, Miller MR, Newby DE, Reynolds RM. Heart (British Cardiac Society). 2023;109(21):1586-1593. doi:10.1136/heartjnl-2022-322259.
- Maternal Mechanisms in Air Pollution Exposure-Related Adverse Pregnancy Outcomes: A Systematic Review. Syama KP, Blais E, Kumarathasan P. The Science of the Total Environment. 2025;970:178999. doi:10.1016/j.scitotenv.2025.178999.
- Longitudinal Associations Between Ambient Air Pollution and Angiogenic Biomarkers Among Pregnant Women in the LIFECODES Study, 2006-2008. Zheng Y, McElrath T, Cantonwine D, Hu H. Environmental Health Perspectives. 2023;131(8):87005. doi:10.1289/EHP11909.

PennState College of Medicine

med.psu.edu

Integrating Climate Change and Health Into Medical Education: Exploring Medical Student Attitudes and Perspectives

Evelyn Marin MPH[1], Noah Stewart[1], Amanda Cooper MD[2]

1. Penn State College of Medicine

2. Department of Surgery, Penn State Health Hershey Medical Center

Objective

We developed a 4-week humanities elective centered around climate change and its effects on health for fourth year medical students and sought to learn more about students' attitudes and perspectives about climate change and health.

Methods

- Twenty-one students enrolled in the elective.
- Combination of virtual elective with optional in-person activities that included lectures, discussions, in-person facilities tour, and role-playing activities
- Curriculum focused on climate change and health topics including advocacy, climate smart pharmacy, and creating a heat action plan
- Students final project was presentation for an educational session for the preclinical medical curriculum that incorporated climate health topics
- We adopted a published survey to learn students' perspectives and attitudes about climate change and climate health education
- Independent T-tests and descriptive analyses were used to evaluate changes in responses

Results

Table 1. Attitudes Toward Climate Change & Health

Survey Question	Pre	Post	Δ
CC impacts population health	5.0	5.0	0.00
CC will affect future patients	5.0	5.0	0.00
CC will affect my personal health	5.0	5.0	0.00
Physicians should know about climate & health	5.0	4.9	–0.06
CC should be included in core curriculum	5.0	5.0	0.00

Table 2. Education and Preparedness Outcomes

Survey Question	Pre	Post	Δ
Medical school provides adequate education on CC and health	Probably not (2)	Might or might not (3)	+1.00
Prepared to discuss CC and its health effects with patients	Somewhat unprepared (2.3)	Somewhat prepared (4.4)	+2.10**
Prepared to advocate for CC and patients	Somewhat prepared (4.1)	Neither prepared or unprepared (3.6)	–0.49

Note: CC → climate health
5 = strongly agree

Discussion

- 18 and 16 students completed the pre- and post-survey respectively
- Students felt they were significantly better prepared to discuss with patients how climate change affects their health ($p<0.001$)
- Students had the option to participate in the elective and so may have had a high baseline of interest contributing their high level of agreement with statements
- Improvement in perception of education of climate change and health
- Slight decrease in advocacy preparation could be in part because students gained a better understanding of advocacy involvement

Conclusions

The Climate Health Elective is an effective approach to educate medical students about climate change and its impacts on human health.

References

SCAN ME

Contact

Amanda Cooper, MD
acooper2@pennstatehealth.psu.edu

PennState College of Medicine

med.psu.edu

Integrating Climate Change and Health Into Medical Education: Exploring Medical Student Attitudes and Perspectives

Evelyn Marin MPH[1], Noah Stewart[1], Amanda Cooper MD

1. Penn State College of Medicine
2. Department of Surgery, Penn State Health Hershey Medical Center

Objective

We developed a 4 week humanities elective centered around climate change and its effects on health for fourth year medical students and sought to learn more about students' attitudes and perspectives about climate change and health.

Methods

- Twenty one students enrolled in the elective.
- Combination of virtual elective with optional in-person activities that included lectures, discussions, and role-playing activities
- Curriculum focused on climate change and health topics including advocacy, climate smart pharmacy, and creating a health action plan
- Students final project was presentation for an educational session for the preclinical medical curriculum that incorporated climate health topics
- We adopted a published survey to learn students' perspectives and attitudes about climate change and climate health education
- Independent T-tests and descriptive analyses were used to evaluate changes in responses

Results

Table 1. Attitudes Toward Climate Change & Health

Survey Question	Pre	Post	Δ
CC impacts population health	5.0	5.0	0.00
CC will affect future patients	5.0	5.0	0.00
CC will affect my personal health	5.0	5.0	0.00
Physicians should know about climate & health	5.0	4.9	–0.06
CC should be included in core curriculum	5.0	5.0	0.00

Table 2. Education and Preparedness Outcomes

Survey Question	Pre	Post	Δ
Medical school provides adequate education on CC and health	Probably not (2)	Might or might not (3)	+1.00
Prepared to discuss CC and its health effects with patients	Somewhat unprepared (2.3)	Somewhat prepared (4.4)	+2.10**
Prepared to advocate for CC and patients	Somewhat prepared (4.1)	Neither prepared or unprepared (3.6)	–0.49

Note: CC → climate health
5 = strongly agree

- 18 and 16 students completed the pre and post-survey respectively
- Students felt they were significantly better prepared to discuss with patients how climate change affects their health ($p<0.001$)
- Students had strong baseline agreement with climate change and its impacts.
- Improvement in perception of education of climate change and health
- Slight decrease in advocacy preparation

Conclusions

The Climate Health Elective is an effective approach to educate medical students about climate change and its impacts on human health.

References

SCAN ME

Contact

Amanda Cooper, MD
acooper2@pennstatehealth.psu.edu

Climate-Smart Healthcare: Promoting Community Resilience through a Local Nutritional Initiative

Wake Forest University School of Medicine

Sydney Warner, MS3, Wake Forest University School of Medicine

Background

Climate-Smart Healthcare

- Focus on mitigation, resilience and leadership Resilience: how hospital system can best care for community health

Objective

Develop a circular system of existing networks that educates, empowers, and sustains community members' ability to reduce waste and support local, nutritious food supply

education & composting outreach program

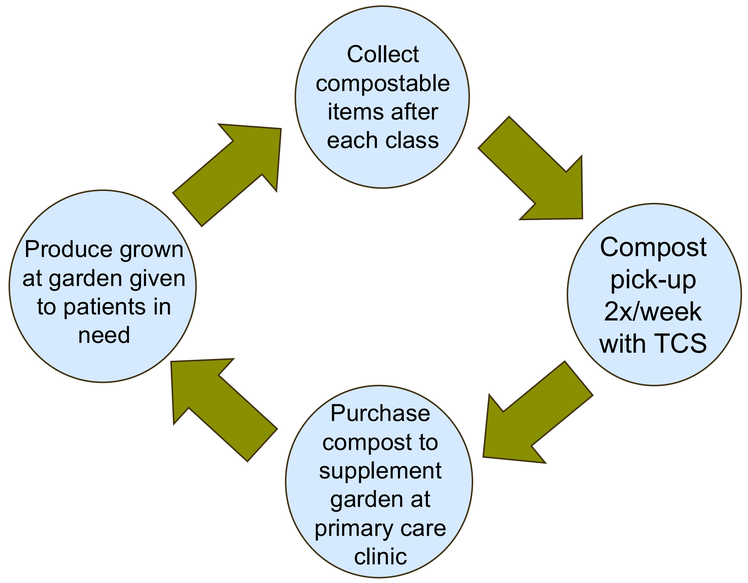
eco program

Education and Composting Outreach Program (ECO)

Circular Framework:

1) Partnership with Brenner Families in Training (Brenner FIT): Wake Forest University School of Medicine (WFUSM)/Atrium Health Wake Forest Baptist (AHWFB)-affiliated lifestyle program
2) Divert waste produced from cooking classes to local composting service for repurposing
3) Invest locally-made compost into a WFUSM/AHWFB hospital-affiliated garden
4) Deliver produce from garden to food-insecure patients

Structure and Function



ECO Program Pilot Results

Total waste diverted in fall 2025: 577.5 lbs

Challenges and Feedback

Training

- Streamline online training session for clarity and efficacy

Documentation

- Class leaders express difficulty in tracking number of bags after class
- Medical students may be more available to assist in tracking

Smooth Transition for a Sustainable Future

- Ensuring adequate tools and resources to self-sustain program

Next Steps

Garden Growing Day

- Invitation to all Brenner FIT leaders and participants to assist in maintaining hospital-affiliated garden using compost from local service
- Participants can their initial food waste is being repurposed to address the needs of others

Long-Term Education Retention

- Launching brief pre/post survey to gauge class leader education
- Consider extending education to class participants as desired

Acknowledgements

Special thanks to the the Wake Forest Program for Leadership and Character, Healthcare Without Harm, and AAMC for grant-funding this program. Special thanks to Brenner FIT and the Triad Compost Service for partnership.

Does Reproductive Decision-Making, in the Context of Climate Change or Extreme Climate Events, Vary Globally? A Scoping Review

Author: Evie Morgan (S2905748@ed.ac.uk)

University of St Andrews

Introduction:

Previous research has studied the influence of disasters on reproductive decision-making. Climate change is reported as the biggest threat to global health in the 21st century and extreme climate events are predicted to increase. Therefore, the climate crisis, as a variable influencing reproductive decision-making, is important to research, especially given the increasing prevalence of eco-anxiety.

Aims:

- To investigate the perceived impact that women feel climate change has on their reproductive decision-making.
- To evaluate the types of sources of evidence currently available which address climate change or events and reproductive decision-making.
- To map out how reproductive decision-making in the context of climate change varies depending on the country in which individuals live.
- To ascertain the types of outcome measures being used in the literature to evaluate reproductive decision-making.

Methods:

A scoping review was conducted, following the population, concept and context (PCC) format. Three databases were searched as well as a google search to identify grey literature sources in February 2025. Sources addressing the impact of climate change or extreme climate events on reproductive decision-making were included in this review. Relevant data was extracted from each source using a data charting form.

Search Terms

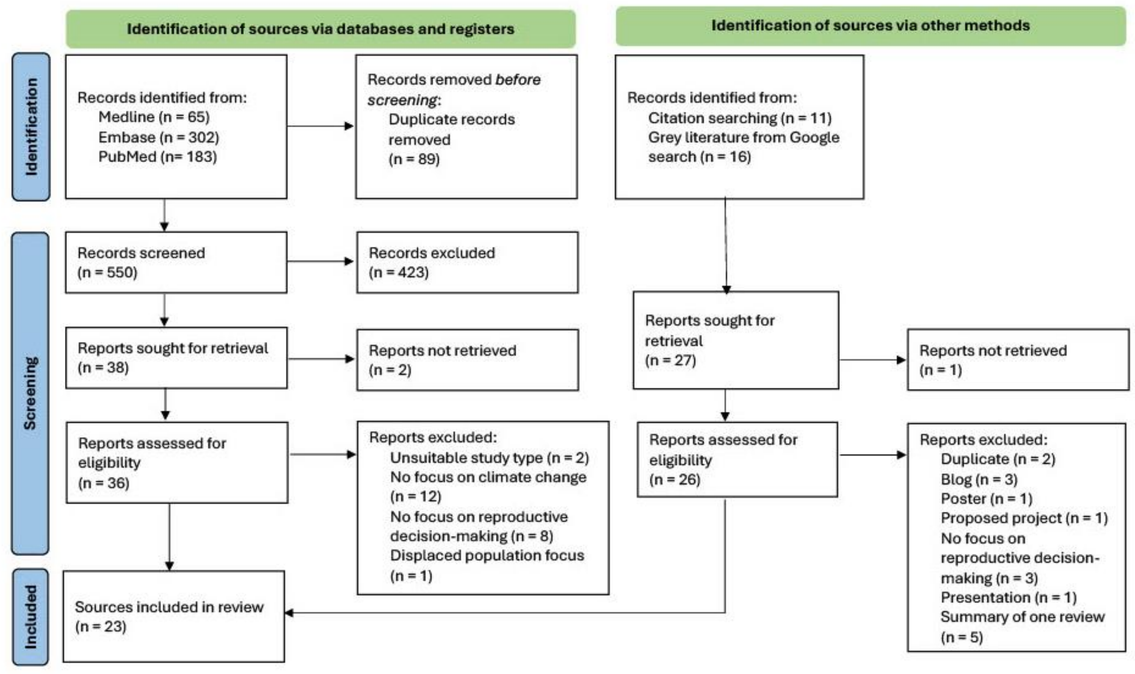


Figure 1. PRISMA flow diagram depicting the source selection process. 89 duplicate records were excluded before screening. 423 records were excluded after title and abstract screening. In total 62 sources were included in full text screening and 40 of these were excluded after full text screening with a final 22 sources included in this review.

Findings:

- 22 sources were included in this review, and they cover a range of different countries, as displayed in figure 2.
- Of the included sources, three different types of evidence were found. These included 12 quantitative studies, 8 qualitative studies and 2 opinion pieces. Of the quantitative studies, the majority were cross-sectional in nature and only 2 were longitudinal. 3 studies utilized a primary survey whereas the remainder of the quantitative studies were secondary dataset analyses.
- Three themes emerged from the sources including opinion vs action, individual vs collective responsibility and future impact on children, and these are discussed in more detail in figure 3.

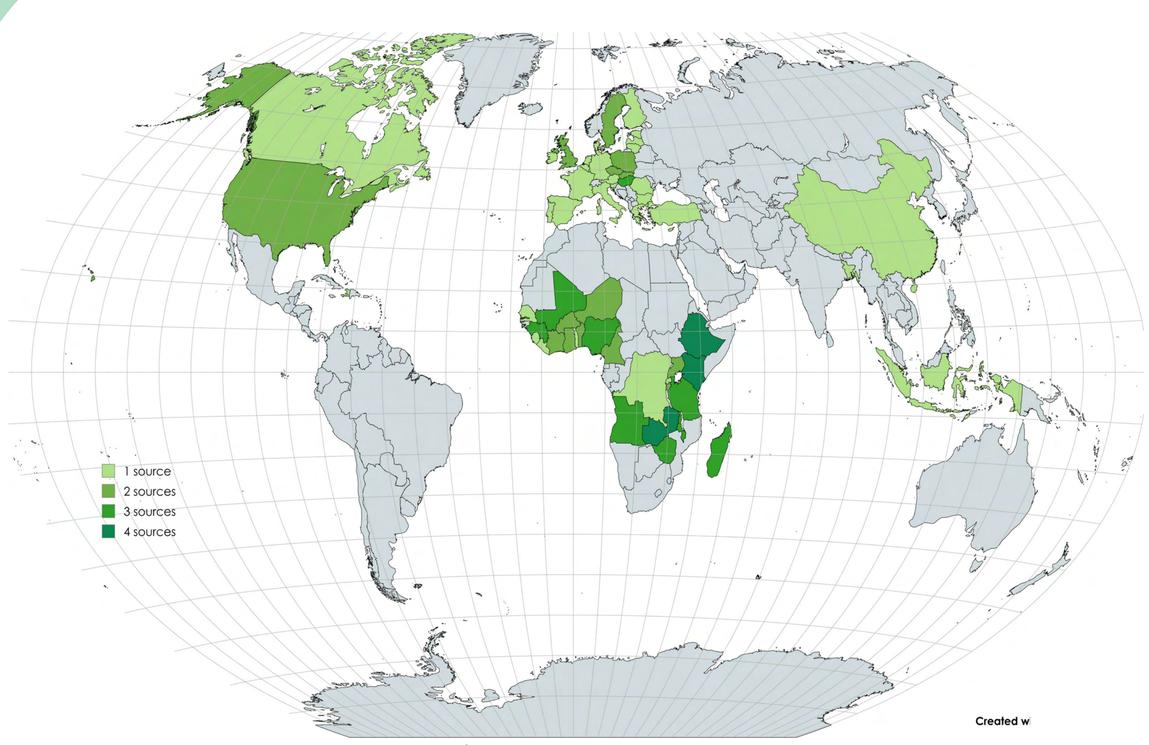


Figure 2. World map showing the countries with sources of evidence included in this review shaded in green, made with MapChart.

Gaps in the evidence:

- Lack of longitudinal data.
- Failure of studies to consider the additional and wide-ranging variables which influence someone's reproductive decision-making aside from climate change or extreme climate events.
- Lack of data on how extreme climate events affect reproductive decision-making in HICs as well as how climate concerns affect this process in LICs.

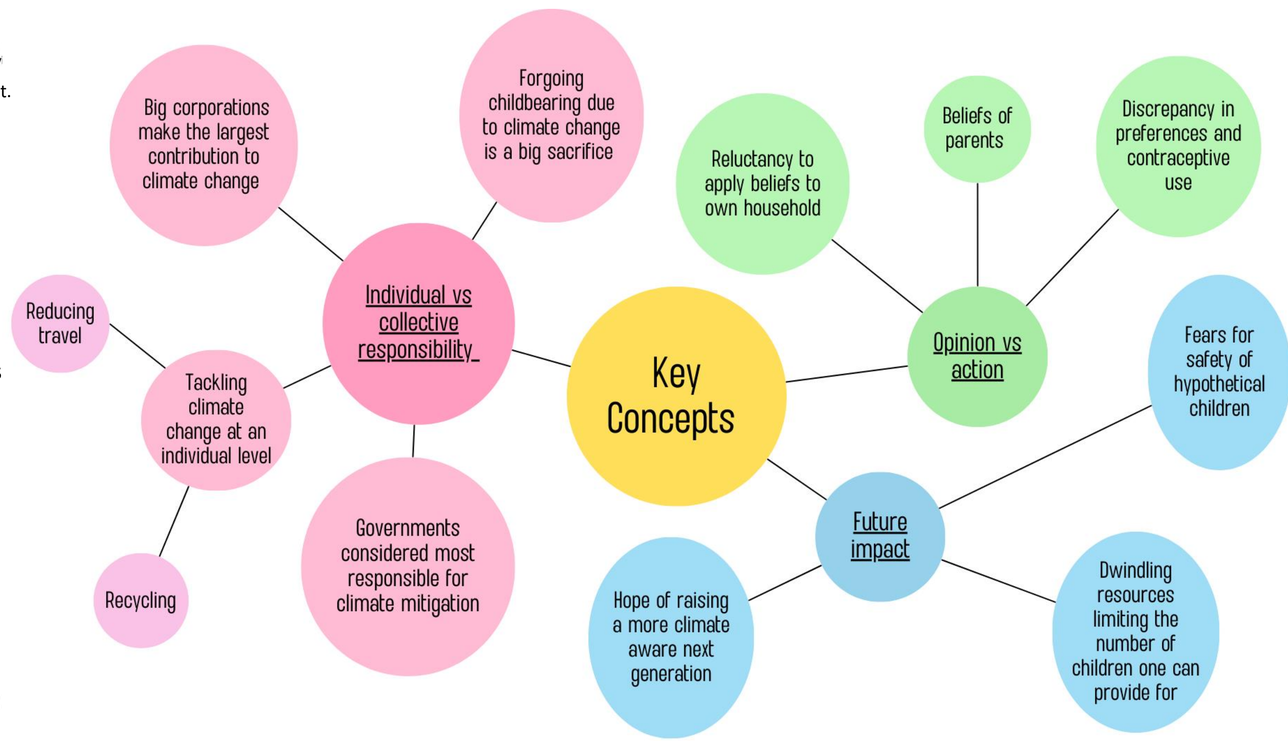


Figure 3. Mind map showing the three concepts relating to climate change and reproductive decision-making.

Conclusion:

- Reproductive decision-making, in the context of climate change or extreme climate events does vary globally.
- There is heterogeneity amongst the results with some studies reporting a significant negative relationship whereby climate concerns or events lead to reduced desire for childbearing whereas others report a positive relationship.
- Whilst the studies establish that climate change and extreme climate events are influencing some individual's reproductive decision-making , the magnitude of this influence is yet to be determined.
- Only 3 of the studies found a significant association between climate-related concerns and reproductive decision-making whereas others concluded an association which wasn't significant.
- Within the included studies, there is variation in the ways in which reproductive decision-making is measured. Three broad categories were identified including; general views on climate change or experience of extreme climate events, fertility preferences and fertility statistics.

Reference List

Recommendations:

- Future studies should incorporate a longitudinal study design. Since reproductive decision-making is a dynamic process and likely to change over time, this study design would help identify whether people's opinions on childbearing amidst the climate crisis align with the reproductive choices they go on to make. This study type would also allow the opinions of those before and after having children to be studied.
- Additionally, future research should seek to quantify how influential a variable climate change, or extreme climate events are on an individual's reproductive decision-making. This could be done by incorporating rating scales into studies to compare the influence of climate concerns or extreme climate events with other variables known to influence reproductive decision-making.
- Further research in this area could prove helpful to healthcare professionals who may be giving advice to individuals on choices like contraception.

The University of St Andrews is a charity registered in Scotland, No: SC013532

IMPLEMENTATION OF A STOOL PARASITE DECISION SUPPORT TOOL TO IMPROVE TEST UTILIZATION AND LABORATORY ENVIROMENTAL SUSTAINABILITY AT FROEDTERT & THE MEDICAL COLLEGE OF WISCONSIN

Kennah Konrad MS3, Dr. Macy Wood PhD, Dr. Christa Wagner PhD, The Medical College of Wisconsin, Milwaukee WI

INTRODUCTION & METHODS

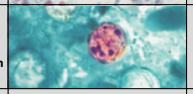
The Significance: Pathogenic intestinal parasite infections (IPIs) can lead to serious complications. Common symptoms include new onset persistent diarrhea (>10 days), abdominal pain, and weight loss and if left untreated can cause dehydration, malnutrition, anemia, and chronic GI issues. Early diagnosis and treatment are crucial, but prevalence varies by region.

Intestinal Parasites in Wisconsin and Beyond:
- Wisconsin: Most common are *Giardia lamblia* & *Cryptosporidium spp.*
- Appalachia, Hawaii, Puerto Rico, Guam, U.S. Virgin Islands & global tropical/subtropical regions: More diverse IPIs

The Problem: Ova & parasite (O&P) stool exams are overused & *Cryptosporidium/Giardia* antigen test & *Cyclospora, Cystoisospora*, & *Cryptosporidium* exam are ordered less frequently, despite being better aligned with the clinical picture.

The Solution: *Figure 1.* A new ordering algorithm with decision support guiding providers toward evidence-based test selection. This project's aim is to assess it's effectiveness by analyzing IPI test utilization 12 months before & after implementation.

A Comparative overview of diagnostic tests available and Wisconsin Diagnostics Lab (WDL) for intestinal parasite assessment, their clinical utility, and limitations

Test	Description/Method	Indications	Cost per Test	Labor Intensity	Time for Test Performance	Send out?	Special Considerations
O&P Exam		• Persistent diarrhea (>10 days) • Significant travel or immigration history to/from an endemic region	$17.00	High	1-1.5 hours	No	Does not detect *Cryptosporidium, Cyclospora*, or *Cystoisospora* Requires specialist to review
***Cyclospora, Cystoisospora, Cryptosporidium* Exam**		• Persistent diarrhea (>10 days) • Known risk factors for *Cyclospora, Cystoisospora*, or *Cryptosporidium*	$25.00	High	1-1.5 hours	Yes - ARUP	Organisms require special staining protocol that is performed at ARUP. Consider time and cost to ship ARUP
***Cryptosporidium/ Giardia* Antigen Test**		• Persistent diarrhea (>10 days)	$21.00	Low	10 mins	No	N/a

What Did We Do - Pre-Implementation:
- 146 (10–15/ month) of 3079 O&P orders placed in 2024 were randomly selected for chart review. Encounters & communications associated with O&P order were reviewed. Evaluated symptom presentation/ duration, travel history, & exposure to contaminated food/water.
- Cases were excluded if encounter documentation was inaccessible via Epic.
- Chart review conducted by a single reviewer using standardized data collection process.

IPI ORDERING ALGORITHM WITH INTEGRATED DECISION MAKING TOOL

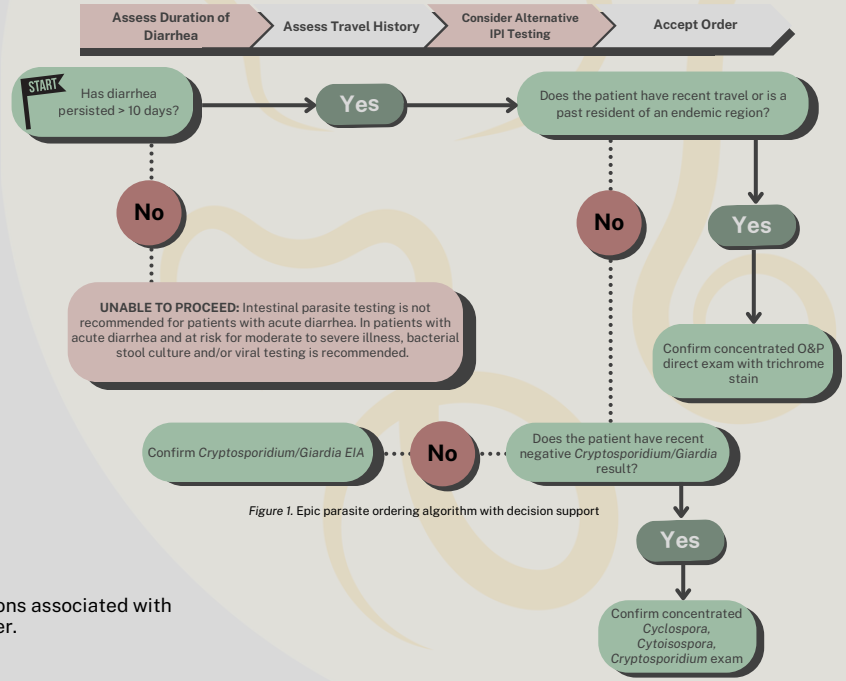
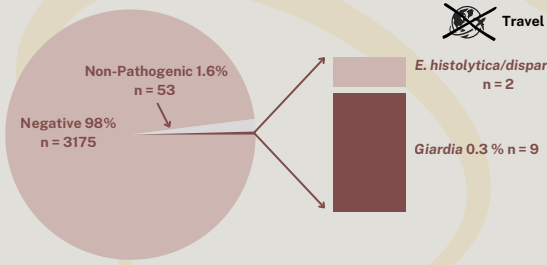


Figure 1. Epic parasite ordering algorithm with decision support

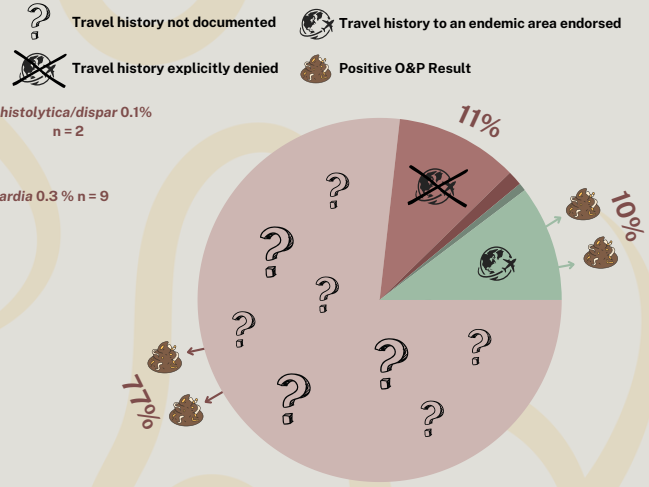
RESULTS

EPIC SLICER DICER RESULTS:



O&P Utilization by Location:
- Outpatient/Clinics - 45.2%
- WDL Clients - 34.5%
- Inpatient & Emergency Department - 20.2%

CHART REVIEW RESULTS:



CONCLUSIONS

- Ova and parasite (O&P) exams ordered without clear clinical indications contribute to unintended consequences, including unnecessary treatments, additional diagnostic testing, skewed differential diagnoses, increased healthcare costs for patients and institutions, laboratory waste, and diversion of laboratory resources from higher-yield testing.
- **Pre-implementation Assessment:**
  - 97% of O&P orders lacked clear clinical indications, supporting implementation of the ordering algorithm with integrated decision support
  - This suggests that there is substantial overutilization of O&P stool testing
- **Post-Implementation Outcomes:**
  - O&P testing decreased by 64% (average 230 to 83 tests/month)
  - Monthly positivity peaked at 7%
  - This indicates improved diagnostic yield
- **Projected impact:**
  - Under a conservative 10% test volume reduction scenario:
    - annual savings to patients exceeds $80,000 & $70,000 to the institution
    - Avoid greater than 100 pounds of waste generated by O&P testing
    - Actual reductions exceeded this scenario, reflecting greatly improved resource utilization and reduced unnecessary testing
- Overall, this demonstrates improved alignment with the triple bottom line framework through patient-centered care, environmental stewardship and cost reduction

Initial Integration of Climate and Health Curricula into Medical School Pre-Clinical Coursework

Isha Thapar,[1] Farah Hussain[1,2]

University of Pennsylvania Perelman School of Medicine[1], Department of Medicine, Hospital of the University of Pennsylvania[2] Philadelphia, PA, 19104, USA.

INTRODUCTION

- Climate change represents an urgent threat to public health, and is predicted to cause approximately 250,000 deaths globally every year.[1]
- Environmental health education is lacking in US medical schools, with only ~13% of medical students reporting that they received adequate instruction on this topic.[2]
- Physicians can play a vital role in treating patients suffering from the negative health effects of climate change and advising on preventative measures to reduce exposures.[3, 4]
- Through surveying course directors at the Perelman School of Medicine (PSOM), we found that there was a paucity of content on climate change and health in the preclinical curriculum. Course directors endorsed time and expertise as challenges to the integration of this subject into the curriculum.

Of Surveyed PSOM Medical Students:

92% support integrating climate and health content into education

82% feel climate change is relevant to patient care

Source: PSOM CSNA Survey[5]

METHODS

- PowerPoint slides were created for integration into existing lectures across the preclinical curriculum, covering topics ranging from the effects of air pollution on autoimmune diseases to the impact of heat stress on neurologic function. A review of existing curricular material was completed to ensure seamless integration of climate-related content.
- An intentional horizontal integration of climate material across the preclinical curriculum was utilized to emphasize the cross-disciplinary effects of climate change on all organ systems, rather than an isolated concern.

Materials Provided:

- 3-4 bullet points on connection of a certain disease/topic with climate change
- Suggested point of integration within an existing preclinical lecture
- Speaker notes for ease of presentation
- Cited references

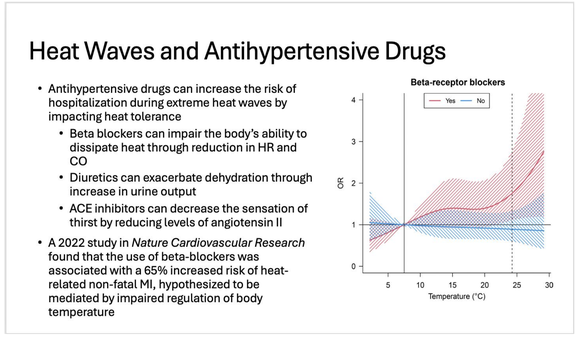


Figure 1. Example of Lecture Slide Suggested for Integration into the Cardiology Course

CONCLUSIONS

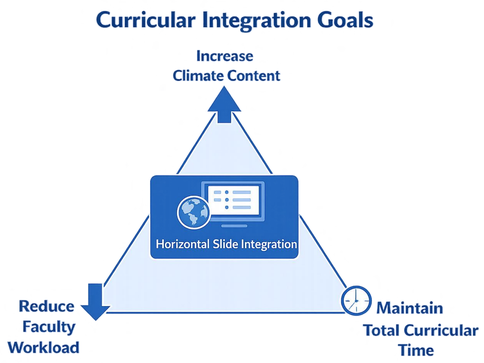
- Through discussion with course directors, we found that the most significant barriers to the integration of climate and health-related material was time in the existing curriculum and a perceived lack of expertise in climate change by lecturers. As such, our team successfully created evidence-backed content to provide to course directors to facilitate the ease of integration of this critical material.
- Novel climate change and health content was created for integration into a total of 27 preclinical lectures.
- This study provides a feasible method by which to encourage the integration of climate change and health content into the preclinical medical school curriculum to equip future physicians to face this emerging public health crisis.

Strengths & Limitations

Strengths	Limitations
Evidence-based	Faculty confidence presenting
Saves faculty tirne	Evaluation pending
Horizontal integration	

OBJECTIVES

1. **Identify gaps** in climate change and health content within the PSOM preclinical curriculum.
2. **Develop educational materials** that are evidence-based and organ system-specific for horizontal integration into existing preclinical lectures.
3. **Implement and disseminate materials** across preclinical courses to improve curricular exposure.
4. **Evaluate feasibility** and inform future curriculum refinement.



OUTCOMES

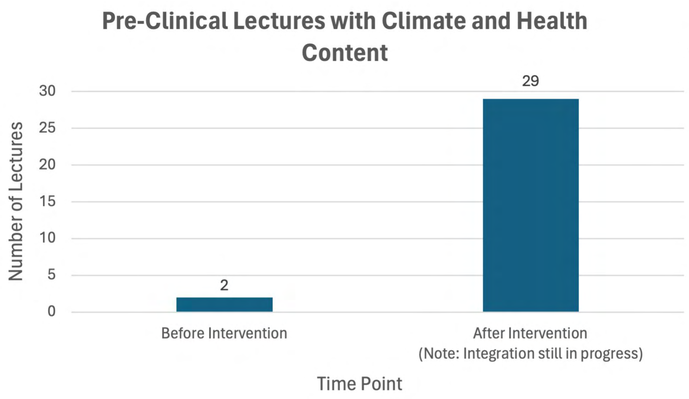


Figure 2. Pre- and post-intervention comparison of preclinical lectures incorporating climate change and health.

- Lecture slides were shared with course directors in the above preclinical courses.
- All course directors were receptive and are working to integrate this content into their curricula for future iterations of their courses.

FUTURE DIRECTIONS

- Future research will examine student satisfaction with this new climate and health content, as well as the effectiveness of this content for their learning. We also aim to evaluate faculty confidence in presenting these horizontally integrated slides.
- We are continuing to expand this model with the goal to integrate climate-related material in all preclinical courses.
- Concurrent exploration is ongoing to incorporate climate and health educational opportunities into clinical courses as well.

REFERENCES

1. Climate Change. Accessed February 14, 2026. https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health
2. Hampshire K, Ndovu A, Bhambhvani H, Iverson N. Perspectives on climate change in medical school curricula—A survey of U.S. medical students. *The Journal of Climate Change and Health*. 2021;4:100033. doi:10.1016/j.joclim.2021.100033
3. Maani N, Galea S. The Role of Physicians in Addressing Social Determinants of Health. *JAMA*. 2020;323(16):1551-1552. doi:10.1001/jama.2020.1637
4. Boland TM, Temte JL. Family Medicine Patient and Physician Attitudes Toward Climate Change and Health in Wisconsin. *Wilderness Environ Med*. 2019;30(4):386-393. doi:10.1016/j.wem.2019.08.005
5. Whidden E, Cunningham P, Campanile J, Hussain F. PlanetaryRx: Development of a Climate Health Interactive Online Curriculum for UME Students. Poster presented at: SGIM Annual Meeting; May 2025.

Assessing the Integration of Planetary Health (PH) in U.S. Medical Schools: A National Comparison with Sidney Kimmel Medical College (SKMC) at Thomas Jefferson University

Serena M. Gelfer[1], MPH, Scott Dale[1], MD

[1]Sidney Kimmel Medical College, Thomas Jefferson University

BACKGROUND

- **Climate change is a critical issue facing our planet** and has profound effects on the health of populations globally, disproportionately impacting those who are vulnerable and disadvantaged
- If the **global healthcare sector** were considered a country, it would be the **world's fifth largest emitter of greenhouse gases**
- A survey of 600 medical students across the United States (U.S.) revealed that **over 80% felt that climate change health impacts should be part of the core medical school curriculum**
- Despite this, studies have found that **medical students feel their curricula inadequately address this topi**c, and there is **no standardized planetary health curriculum required across undergraduate medical institutions**
- **"Planetary health" (PH)** includes topics such as the **health effects of climate change, sustainable healthcare practices, and the physician's role in advocacy and mitigation**
- The **Planetary Health Report Card (PHRC)** is a **metric-based tool** that **evaluates the PH curricula** at medicals schools globally, among other domains

OBJECTIVES

1. Assess the integration of PH content in the SKMC curriculum compared to medical schools nationally and regionally
2. Identify metrics associated with higher PH curriculum performance, as measured by total score

METHODS

- Cross-sectional comparative study using 2024-2025 PHRC data for all U.S. medical schools that participated (n=62)
- Used descriptive statistics to compare SKMC's PH curriculum to other medical schools nationally and regionally (northeast)
- Assessed for predictors of PH curriculum performance across schools nationally

DATA CONSOLIDATION

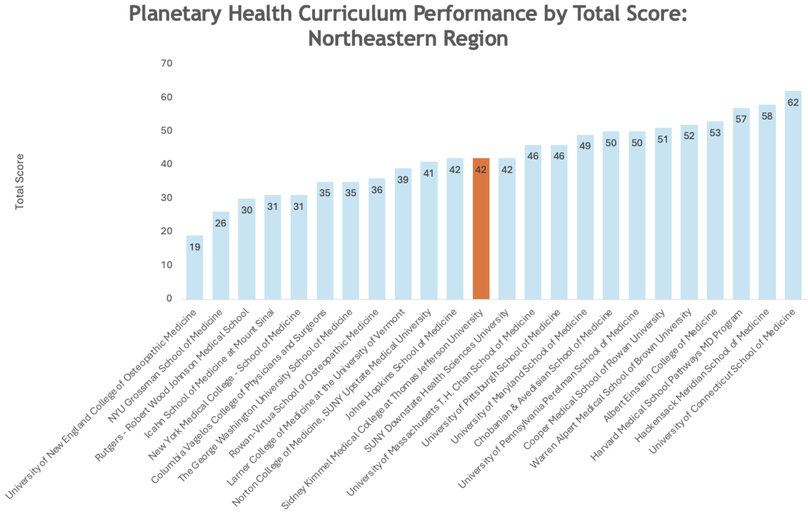
- June - July 2025
- Data were extracted from the Planetary Health Curriculum sections of PHRCs and consolidated into a single dataset using IBM SPSS Statistics (Version 31.0)

DATA ANALYSIS

- August - October 2025
- Descriptive statistics were generated to compare PH curricula on total scores and individual metric subscores
- Linear regression models were generated in SPSS to assess predictors of PH curriculum performance, measured by total scores

RESULTS

FIGURE 1:

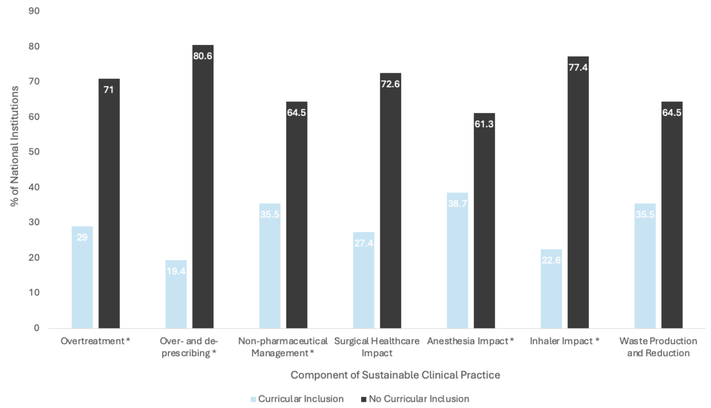


Mean total score for Northeastern region: 42.63

TABLE 1: Relative Underperformance for SKMC on Five Metrics

Metric	SKMC Score	National Mean Score	Regional Mean Score	% Medical Schools Performing at Higher Level than SKMC Nationally	% Medical Schools Performing at Higher Level than SKMC Regionally
Inclusion of elective PH content in curriculum	(Range: 0 - 3) 0	1.77	2.04	80.6	83.3
Addresses unequal health impacts of climate change globally	(0 - 3) 0	1.39	1.25	74.2	66.7
Addresses human-caused environmental threats relevant to local community	(0 - 3) 0	1.98	2.29	82.3	95.8
Status of active implementation of improving PH education	(0, 2, 4) 2	2.81	3.42	51.6	70.8
Employment of faculty member to oversee curricular inclusion of PH content	(0 or 1) 0	-	-	43.5	54.2

FIGURE 2: Inclusion of Key Components of Sustainable Practice



Asterisk (*) denotes SKMC is part of the group with no curricular inclusion

- SKMC received a total score of 42 for curricular PH inclusion, above the national average (40.34) and slightly below the Northeast regional average (42.63) *(Fig. 1)*
- Five metrics were particularly notable for underperformance for SKMC when compared to medical schools nationally and regionally *(Table 1)*
- Underperformance was notable for medical schools nationally, including SKMC, for inclusion of key components of sustainable clinical practice *(Fig. 2)*
- Longitudinal integration of PH content was a significant independent predictor of total curricular score (β=5.59, p<0.001) after adjustment for elective content and faculty oversight, while faculty oversight showed a borderline positive association (p=0.056)

CONCLUSIONS

By addressing gaps identified in this study and strengthening longitudinal curricular integration, SKMC can position itself as a regional and national leader in planetary health education

Medical schools, including SKMC, fall short in integrating key components of sustainable clinical practice, representing a clear opportunity to better prepare future physicians to practice medicine in the current era of climate change

Medical schools, including SKMC, can draw on successful approaches from peer PHRCs to strengthen planetary health curricula

- A limitation of this study is reliance on PHRC data collected independently by 62 medical schools

REFERENCES & ACKNOWLEDGEMENTS

SCAN FOR REFERENCES

SCAN TO LEARN MORE ABOUT THE PHRC

The authors thank the Planetary Health Report Card initiative for providing the data used in this study and the SKMC Scholarly Inquiry Health Policy & Systems track for their mentorship and support.

@ResearchAtJeff

An evaluation of climate health and sustainability initiatives at the Medical College of Georgia using a Planetary Health Report Card framework, 2024-2025

Karen Asher, BS; Erin Eroglu, BS; **Parmida Jamshidi, BS; Tejas Reddy, BS**; Heidi David, BA; Diana Danelia, BS; Suma Yellamraju, BS; Tyler Sacks, BS; Yu-hsuan Wu, BA

Medical College of Georgia, Augusta University, Augusta, Georgia, USA.

INTRODUCTION

Climate change has wide-reaching impacts affecting all life on Earth, including human health.[1] It is disruptive to our food systems, brings on water scarcity, decimates our biodiversity, precipitates natural disasters, and contributes to pollution, among many other impacts.[1,2] These changes in our environment breed disastrous health outcomes and pose a threat to communities globally, with the most severe consequences in the Global South.[2] Yet many medical schools do not prioritize these concerns or display any urgency in addressing them at their institutions.[3,4]

In response to these changes, it is important that future healthcare professionals be prepared to address the impacts of environmental changes on patient health.[3] Therefore, educational institutions should be held accountable for teaching students about the intersection between climate and health as well as fostering opportunities for students to research, volunteer, organize, and advocate within climate health.[3,4]

The Planetary Health Report Card (PHRC) was developed as a framework to evaluate professional schools based on their dedication to addressing climate health and has been used as a measure of growth by universities globally.[4] This tool can assist students in advocating for their education and ultimately for the health of their future patients.[4]

PURPOSE

Our goal was to evaluate the scope and quality of climate health curriculum, sustainability initiatives, and administrator support for related projects at the Medical College of Georgia (MCG) at Augusta University (AU) in the 2024-2025 academic year with the goal of identifying areas for longitudinal improvement.

METHODS

We assessed MCG's climate health engagement opportunities using the Planetary Health Report Card framework. The PHRC evaluates educational institutions in **five domains: curriculum, interdisciplinary research, community outreach and advocacy, support for student led initiatives, and campus sustainability.**

Each category was evaluated using a series of standardized metrics designed to identify planetary health initiatives, faculty support, and resources available to students. The time frame of interest was March 2024-February 2025. Our research findings were drawn from the 2024-2025 pre-clerkship syllabi and lectures, AU- and MCG-associated webpages, and MCG-affiliated student organizations. Based on our discoveries, we assigned a point value of 0-3 for each metric. Reviewers provided written justification for each scored metric. Each metric was independently reviewed and scored by at least 2 members of our team.

Categories were scored using the percentage total for each domain. A letter grade of A, B, C, D, or F was then assigned using quintiles in accordance with PHRC grading policy. Grades were further stratified with a possible plus or minus per PHRC policy. Overall grade for MCG was calculated as a weighted average of each category's score percentage.

For more information on Planetary Health Report Card:

RESULTS

Category	Summary of Findings	Grade
Curriculum	• Climate health curriculum relies on one core lecture titled "Sustainability in Healthcare" that discusses impacts of climate change on health outcomes, sustainability in the healthcare industry, and encourages medical student involvement in climate-healthcare. • There are no elective courses primarily focused on environment, safety and health (ESH) or planetary health. • There is no longitudinal integration of climate health across the curriculum.	D
Interdisciplinary Research	• No department or faculty members at MCG are predominantly concerned with planetary health or sustainability research. • The Institute of Preventive and Public Health at Augusta University is the only affiliated group promoting environmental and occupational health as part of their core research mission. • No online resources exist to identify sustainability research published at the school. • There is no established route for community members to voice opinions about MCG's research agenda.	F
Community Outreach and Advocacy	• Few community outreach programs exist to promote planetary health, and of these existing programs, the majority are student-led initiatives. • MCG does not directly partner with organizations to host programs or events centered around planetary health for its providers, patients, or the greater Augusta community.	D
Support for Student-Led Initiatives	• Student-led sustainability initiatives exist with faculty support and a general pool of funding from the school. • There is no dedicated faculty member, funding source, or structured program available for students to engage in sustainability-related causes.	C
Campus Sustainability	• AU promotes a student well-being page titled "Environmental Wellness" that provides information on recycling and the intersection of sustainability and diet, exercise, and mental health • MCG has made public transportation accessible to students yet prioritizes car transport. • Recycling bins are available but difficult to find throughout the Health Sciences campus • No data exists on efforts to decrease greenhouse emissions and energy usage or to suggest sustainable uses of MCG's endowment.	F+
Overall Grade		D

DISCUSSION

Our investigation reveals **MCG has room for improvement in every domain. Specific Recommendations include:**

Curriculum
- Most planetary health curriculum topics may be addressed through minor additions to existing core curriculum lectures or Case-Based Learning (CBL) small-group discussions, outlined further in discussions with faculty.
- Design an environmental history-taking Patient Centered Learning (PCL) patient encounter/simulation.
- Dedicate curriculum faculty member(s) to overseeing the incorporation of planetary healthcare themes throughout the coursework.

Interdisciplinary Research
- Encourage opportunities to attend planetary health symposiums and environment-related conferences.
- Improve student access to current sustainability research projects at our institution through a dedicated webpage.
- The Institute of Preventive and Public Health might work with community members to discuss environmental impacts on health within the realm of preventative medicine.

Community Outreach and Advocacy
- Seek partnerships with local and national organizations that are committed to advancing environmental educational opportunities, including The Hub and The Global Consortium on Climate and Health Education.
- Provide education on the health effects of environmental exposures and climate change for local members of the community, including patients and postgraduate healthcare providers. Examples might include educational seminars or a committee to create a webpage or brochure that individuals can access to learn more about the intersection between health and the environment/climate change.

Support for Student-Led Initiatives
- Establish easier access to ongoing student- or faculty-led climate health efforts by creating a centralized web page with information on current planetary health faculty mentors, research projects and sustainability initiatives.
- Expand funding for student-led quality improvement (QI) projects and integrate QI projects into the core curriculum.

Campus Sustainability
- Establish an Office for Sustainability to aid in achieving goals such as increasing recycling opportunities, prioritizing biking and walking spaces over car spaces, and continuing to expand current programs.

CONCLUSIONS

- Climate health is a growing concern that is impacting patients globally in an increasingly alarming manner.
- Engagement with climate health and sustainability initiatives is critical to understanding the changing face of medicine and the problems that our future patients will certainly face.
- Educational institutions such as the Medical College of Georgia have a significant role to play in the training of ecologically-aware physicians.
- Medical students can advocate for their learning and should demand opportunities to engage in this ever-more-important field.
- Utilizing the 2024-25 PHRC results, specific recommendations were provided to MCG faculty, including a planetary health curriculum designed to be integrated throughout the existing curricular schedule. By continuing to utilize the PHRC framework to track MCG's yearly progress, we may serve as a model for other health professional schools.

REFERENCES

1. Planetary Health Alliance. Accessed April 10, 2025. https://planetaryhealthalliance.org/
2. World Health Organization. Climate change. Accessed April 10, 2025. https://www.who.int/health-topics/climate-change#tab=tab_1
3. Rabin BM, Laney EB, Philipsborn RP. The unique role of medical students in catalyzing climate change education. J Med Educ Curric Dev. 2020;7:2382120520957653.doi:10.1177/2382120520957653
4. Planetary Health Report Card. Accessed April 10, 2025. https://phreportcard.org/

Building Climate Resilience among the Unhoused Population: Existing Assets and Identified Needs in Washtenaw County, MI

Samira Mehta[1*], Sanjana Kannikeswaran[1*], Simone Charles, PhD[2]

* = denotes co-presenters

[1]University of Michigan Medical School, [2]University of Michigan School of Public Health

BACKGROUND

- Unhoused individuals are disproportionately affected by climate change.[1]
- There is a lack of published first-hand narratives of the impacts of severe weather on health outcomes among the unhoused population.
- Michigan specifically has seen record-setting heat waves, unsafe air quality, heavy rain, and damaging ice and snowstorms in recent years.
- A climate emergency was declared in Washtenaw County in 2019[2]. Still, the county's proposed Climate Action Plan does not mention the unhoused population.

AIMS

- Evaluate the impact of climate change on health and health systems
- Identify existing community assets and resources that protect unhoused individuals from extreme weather accompanying climate change
- Highlight community-identified needs for future climate resilience in the unhoused community

METHODS

- Conducted a secondary qualitative data analysis of 17 1:1 interviews with unhoused individuals, shelter administrators, and healthcare workers
- Interviews and coding took place in two blocks (summer and winter) to limit recency bias
- Co-presenters conducted individual review, coding, and thematic analysis
- Used constant comparative analysis to discover salient themes
- Figures reflect themes compiled across all below demographics

Demographics	Total (n=17)
Role	
Unhoused Individual (UI)	11
Shelter administrator (SA)	2
Physician (P)	2
Social worker (SW)	2

RESULTS

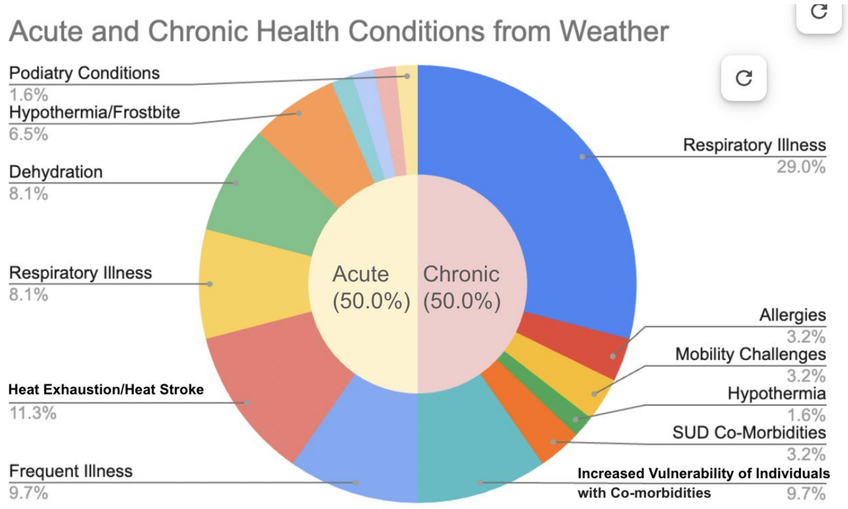


Figure 1. Acute and chronic health conditions reported in relation to severe weather.

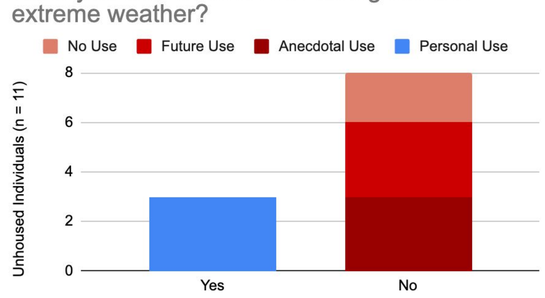


Figure 2. Usage of emergency department by unhoused individuals during times of extreme weather.

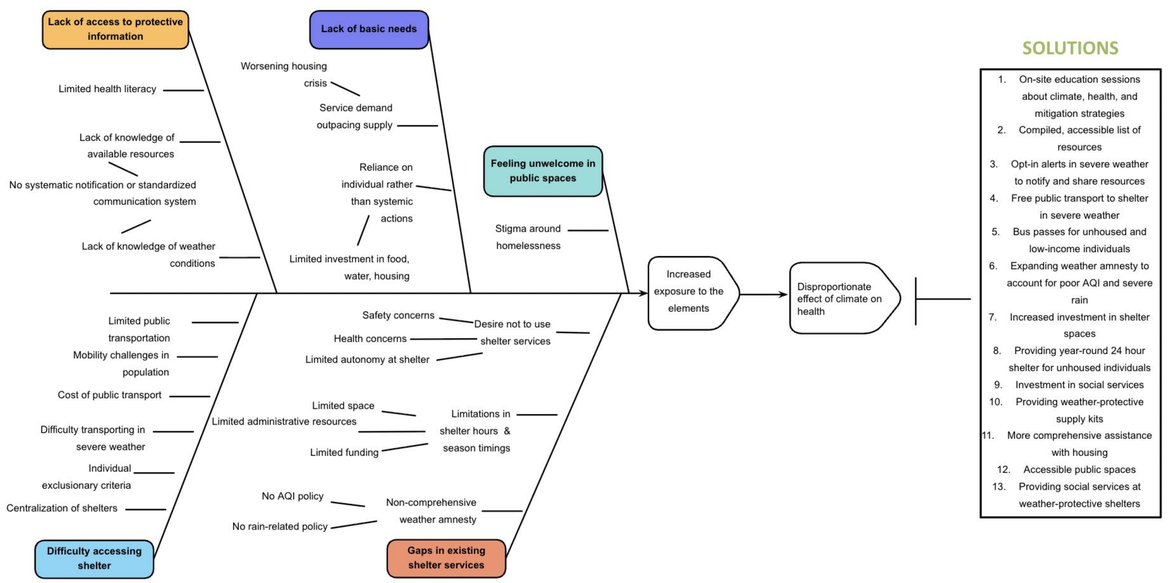


Figure 4. Fishbone diagram identifying root causes of disparate impact of climate change on unhoused individual as well as proposed solutions.

Existing resource	Number of quotes identifying as protective factor
Warming/cooling center spaces	21
Advocacy for unhoused within local govt.	6
Supplies to keep warm	5
Free food	5
Communication & collaboration among service providers	5
Organizations/programs that provide unhoused individuals with resources	5
Accessible water	4
Daytime shelter with basic needs services	4
Funding for services	4
Other services	16

Figure 3. Existing resources and community assets identified as weather-protective in interviews.

DISCUSSION

- Increasing severe weather has impacts on individual health and healthcare systems
- Identified issues are exacerbated by worsening housing crisis and stigma around homelessness
- Local support has been important in being able to provide and increase services in extreme weather. However, more systemic efforts have limited capacity.
- There is a need for increased availability and accessibility of weather-protective services
  - Specific needs focus on improved communication, transportation, extended shelter hours, and funding to expand current services.
- Limitations of work include smaller sample size and transcriptions from audio recordings

Future Work

- Develop a needs-based advocacy plan to build climate resilience for unhoused communities at local and state levels
- Combine qualitative data with quantitative data regarding ED visits (usage as shelter & health exacerbations) from unhoused individuals during severe weather

REFERENCES

1. Harris R. Eisenhardt, Thomas Peterson, Michael Schwebel. Establishing a methodology to measure vulnerability of unhoused populations to climate change in the United States. *Climate Risk Management*. Volume 45, 2024.
2. "Washtenaw County Climate Action Plan." *RRS*, https://www.recycle.com/project-collection/washtenaw-cap. Accessed 13 Feb. 2025.

Funding for the project was provided by the University of Michigan Medical School

Contact: skannike@med.umich.edu, samirame@med.umich.edu,

Transforming Knowledge into Action: A Climate Health Model in Medical Education at Vanderbilt University School of Medicine

Roma A. Kankaria[1], Lily Campbell Lewis[1], Curtis Baysinger, MD[2]
[1]Vanderbilt University School of Medicine, [2]Vanderbilt University Medical Center

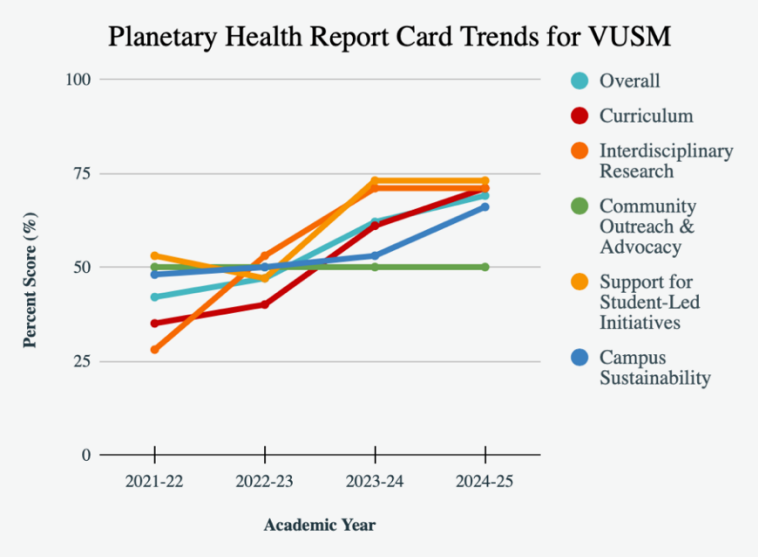
VANDERBILT School of Medicine

Background

- The climate crisis poses a profound threat to public health globally, and it is imperative that healthcare providers be equipped with the knowledge and skills to care for patients impacted by the changing climate
- At Vanderbilt University School of Medicine (VUSM), a group of students have been laying groundwork to train climate-conscious physicians
- In 2022, VUSM completed its first Planetary Health Report Card (PHRC) and used the findings to catalyze a four-year curriculum reform plan that proposed changes across all preclinical blocks, core clinical clerkships, and select electives
- As we continue to integrate planetary health content into our curriculum, we have expanded opportunities for students to translate this knowledge into action through community service, advocacy, and research

Progress Measured by PHRC

- From 2022 to 2025, as we gradually implemented climate health changes into VUSM, our PHRC grade increased from a C- to a B, and the curriculum score improved from 34.8% to 70.6% (2026 data still pending)



Education

Preclinical Curriculum

- Climate health concepts added to lectures and case-based learning in: Microbes & Immunity, Homeostasis, Renal & Digestion, and Reproduction & Endocrinology blocks
- Examples of topics added
  - Impact of heat on heart disease and polypharmacy
  - Effect of natural disasters on mental health and PTSD
  - Impact of air pollutants on COPD and arteriosclerosis

Clinical Curriculum

- OB/GYN clerkship: Discussion of the impact of rising temperatures on maternal-fetal health
- Prior sessions
  - Medicine clerkship: Taking a climate-conscious social history and patient counseling
  - Foundations of Healthcare Delivery longitudinal curriculum: Sustainability and healthcare costs

Service, Sustainability, and Research

- Composting in VUSM's library and lecture building
- Local park maintenance and clean-up days
- Volunteering with Nashville Food Project
- Sustainability guidelines for student events
- Planetary health research student and faculty panels
- Health equity research database

Advocacy and Outreach

Vanderbilt Discussion Series for 2026

Discussion topics led by Vanderbilt faculty:

- Impacts of extreme heat in urban communities
- Climate modeling, policy, and effect on greenhouse gases
- Climate change and LGBTQ+ health
- Public health advocacy
- Ethical considerations
- Climate change and infectious diseases

Partnerships Established

- VUSM Social Mission Committee
- VUSM Wellness Committee
- VUSM Tennessee Medical Association (TMA) chapter: Article discussion and op-ed writing workshop
- Vanderbilt Educational Garden Initiative (VEGI) and Rooted Community Health
- Vanderbilt Climate, Health, and Energy Equity Lab (CHEEL)
- Vanderbilt Nursing School, Law School, and undergraduate university

Advocacy Opportunities Advertised to Students

- Recovered Medical Equipment for the Developing World (REMEDY)
- Citizens Climate Lobby
- Clean Up Tennessee Valley Authority (TVA)
- TMA's Doctors' Day on the Hill

Acknowledgements

We would like to acknowledge the VUSM students in our MS4SF chapter and those who contributed to the PHRC's creation. We would also like to thank our faculty mentor Dr. Baysinger, the Deans, and other faculty who offered feedback and guidance on planetary health initiatives at VUSM.

International Trends in Planetary Health Education: Insights from the Planetary Health Report Card's Global Team

Fiona Conway, BA, BSc[1], Roma A. Kankaria, BS, BA[2], Jessica Mo, BS[3], Hope Beyer, BS[4], James Lee, MBBS, MSc[5]
[1]Dalhousie University School of Medicine, [2]Vanderbilt University School of Medicine, [3]Johns Hopkins University School of Medicine, [4]Rowan-Virtua School of Osteopathic Medicine, [5]East Kent Universities Hospitals Trust

Background

- The Planetary Health Report Card (PHRC) is an advocacy tool completed annually by student teams in healthcare education to track their own schools' progression, successes, and areas of improvement in planetary health education
- The report card consists of 52 specific metrics in several domains (with specific grading for each section) to allow for comparison of a school's grade from year to year
- Domains include
  - Curriculum
  - Research
  - Advocacy
  - Support for student initiatives
  - Campus sustainability
- Many schools have completed the PHRC (which began in 2019) several years in a row
  - This poster focuses on the 2024-2025 report card cycle

Objective

Three primary goals of this PHRC cycle:

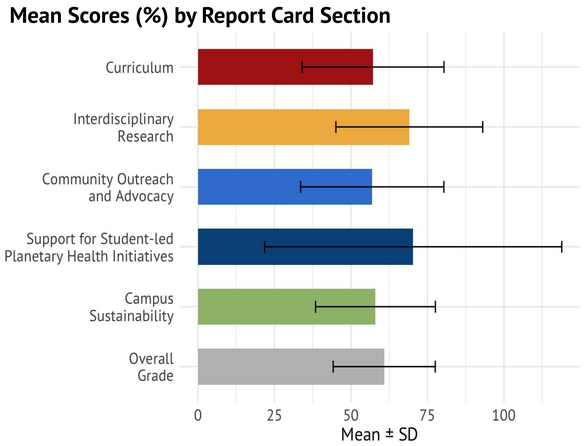
1. Operate a needs-based assessment tool to drive the development of planetary health education in health professional schools worldwide
2. Increase publication of PHRCs from more schools worldwide and from more healthcare professions
3. Encourage interdisciplinary collaboration

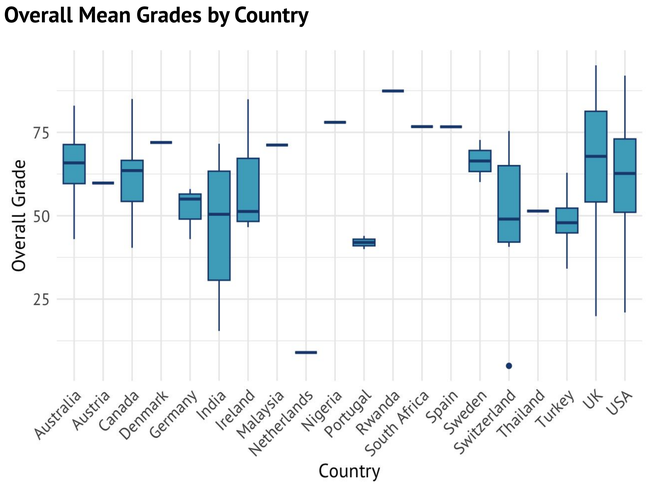
Methods

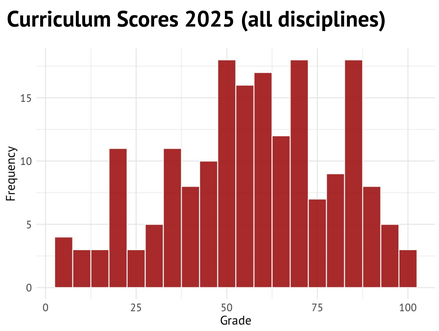
- To assess goal 1
  - Data from returning schools can be examined in order to determine if the PHRC correlates to better planetary health education
- To assess goal 2
  - The total number of countries and professions filling out the PHRC can be compared to previous cycles
- To assess goal 3
  - Future cycles will provide more definitive data on the success of the PHRCs push for more interdisciplinary collaboration, as numbers were very small this year

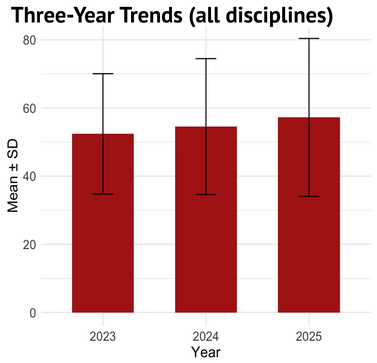
Results

- Related to goal 1: Mean curriculum scores have increased across disciplines for the past 3 years, and mean curriculum scores in medicine specifically have increased steadily since 2022
- Related to goal 2: The PHRC was completed in 188 schools, 21 countries, and 10 disciplines



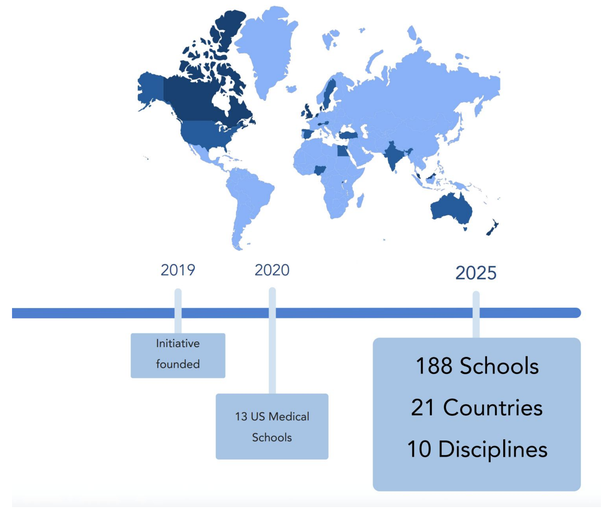






Conclusions

- While the PHRC is not a perfect standardized data set, the steadily increasing scores over the past 6 years, increased scores in schools that have participated in the report card over consecutive years, and consistently high scores for student-led initiatives strongly indicate that student voices are powerful factors in the push for better planetary health education in health professional training, and that the PHRC is a useful tool in that push
- The increase in new schools and disciplines as well as increased geographic diversity in participating schools this year are positive markers that the PHRC is useful to healthcare students in diverse contexts
- The standardization of sections 2-5 across disciplines (done to facilitate interdisciplinary collaboration) was associated with increased scores in these metrics
- As new-this-year schools continue to fill in the PHRC and as more schools work in interdisciplinary teams, a clearer picture will emerge of the impacts of repeated PHRC participation and interdisciplinary collaboration on improved planetary health education



References

The 2025 Planetary Health Report Card International Summary Report. April 2025. Planetary Health Report Card. Available from: phreportcard.org

Integrating Environmental Justice for the Ethical Use of Artificial Intelligence in Medical Education

Shubha Verma[1], Rebecca Philipsborn[1]
[1]Emory University School of Medicine

Introduction

Over the past 3-4 years, healthcare has seen a rapid uptake of generative artificial intelligence (GenAI) following the advent of widely available large language models (LLM), such as ChatGPT.[1] In response, medical schools are introducing curricula and tools to support trainee use of GenAI.[2]

Concerns about the negative impacts of GenAI on the climate and environment--and downstream impacts on patients--are growing.[3] The Association of American Medical Colleges (AAMC) champions teaching that the physical environment is a major determinant of health.[4] In acknowledging the environment's contribution to disease, healthcare systems must also responsibly limit their contributions to environmental degradation.

While GenAI has the capacity to improve medicine for individuals and communities, it is an emerging and poorly governed area of healthcare and education.

"Spiraling to the stars means understanding where we've been, where we are, and where we're going."
- Laura Harjo, *Spiral to the Stars*

"To depict one's people is to love them. In Continuum, Johnnie Diacon and Hotvlkuce Harjo show that Indigenous life is not past tense—it's now, it's tomorrow, and it's still unfolding."
- Miranda Kyle,
Curator of Indigenous Arts of the Americas

The Michael C. Carlos museum hosted an exhibit, *Continuum*, featuring work by Johnnie Diacon and Hotvlkuce Harjo.[6]

Outcomes

Key Themes:

Students learning how to apply GenAI are concerned about the natural resource consumption of their GenAI use.

Data centers are a rising threat in communities burdened by environmental justice challenges locally and globally.[7]

Ethical use of GenAI could include applications to improve environmental sustainability.[8]

Indigenous ideals emphasize the evaluation of systems through their impacts on life and community.

Objective

We aimed to create learning objectives on the ethical use of AI from an environmental justice standpoint for an AI curriculum in development at the Emory School of Medicine.

Approach

We used a multipronged approach to explore relevant themes and to propose learning objectives:

Collaboration: Working with AI Curriculum Team, we determined key areas of interest among the student body through a pilot activity and feedback survey.

Literature search: We focused on existing GenAI curricula at medical institutions as well as literature on the impacts of GenAI, datacenters, and healthcare on the environment.

Framework: We sought to learn from indigenous epistemologies and drew inspiration from a local indigenous art exhibit in considering AI-environment themes.[5]

Learning Objectives

1. Connect the impacts of GenAI on climate and the environment to patient health exposure risks.
2. Apply an Indigenous framework to the clinician role in resource stewardship and the ethical use of GenAI—both in their own practice and in the healthcare system.

Conclusion

The use of GenAI in medicine raises a paradox with patients and the planet at its center. This field continues to evolve rapidly – medical schools can join calls for GenAI transparency and governance.[9]

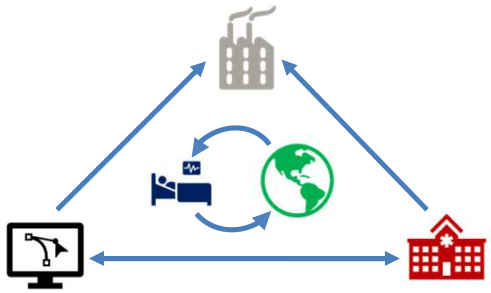


Figure 1: The paradox, illustrated above, highlights the potential for GenAI use in healthcare to have a negative impact on the environment, and consequently, on patient health.

Acknowledgements

Special thanks to the AI in medicine team at the Emory University School of Medicine for their collaboration.

References

1. Wachter RM, Brynjolfsson E. Will Generative Artificial Intelligence Deliver on Its Promise in Health Care? *JAMA*. 2024;331(1):65-69.
2. Boyle P. Medical schools move from worrying about AI to teaching it. Association of American Medical Colleges; 2015.
3. Fiske A, Radhuber IM, Willem T, Buyx A, Celi LA, McLennan S. Climate change and health: the next challenge of ethical AI. *The Lancet Global Health*. 2025;13(7):e1314-e1320.
4. Importance of Adding Environmental Health Content to Medical School Curricula. AAMC; 2016.
5. Pelletier SG. Experts See Growing Munn L. The five tests: designing and evaluating AI according to indigenous Māori principles. *AI & SOCIETY*. 2024/08/01 2024;39(4):1673-1681.
6. Continuum. Michael C. Carlos Museum: Michael C. Carlos Museum; 2025.
7. Marrinan C. Data Center Boom Risks Health of Already Vulnerable Communities. Tech Policy Press; 2025.
8. Cowls J, Tsamados A, Taddeo M, Floridi L. The AI gambit: leveraging artificial intelligence to combat climate change—opportunities, challenges, and recommendations. *AI & SOCIETY*. 2023/02/01 2023;38(1):283-307.
9. Verma S, Philipsborn R, James C, Sullivan G. A call to address the GenAI-environment paradox in Graduate Medical Education. *Journal of Graduate Medical Education (under review)*.

Advancing Planetary Health Education Through a Nature-Based Leadership Intervention

Wake Forest University School of Medicine

Sydney Warner, Kaycie Meinhardt, Jacob Corrales, Olivia Little, Elaina Alzaibak, Olivia Lannom, Allyson Howard-Green, Kameron Downs, Mia Guzynski, Aaron Levy, DO, Alexandre Guével, PhD, David Callaway, MD

2024-2025 Report Card Results

Curriculum	D+
Interdisciplinary Research	A-
Community Outreach and Advocacy	C-
Support for Student-led Initiatives	B-
Campus Sustainability	C-
Overall Grade	C

Initiatives

- Student Planetary Health (PH) Curriculum Integration Team
- **Climate Action Corps: enterprise-wide**
- Cross-collaboration with student organizations
- Advocacy and justice-based events
- Planetary Health Scholarly Program

Climate Action Corps (CAC)

Objectives: Train purposeful, empathetic, ecologically-minded healthcare leaders. Evaluate:

1. Systems Thinking (ST)
2. Connectedness to Nature (CN)
3. Sense of Purpose (SP)

Location: U.S. National Whitewater Center in Charlotte, NC

Training: Leadership, team/ solutions-building, wilderness medicine scenario

CAC: Methods

Pre-Post Survey: 3 scales for relevant characteristics:

- Systems Thinking Scale Revised (STSR)
- Connectedness to Nature Scale (CNS-7)
- Claremont Purpose Scale (CPS)

Normality verified for ST and CN; SP did not yield satisfactory for normality.

CAC: Results

Aim 1: Assess changes in CN, ST, and SP responses to survey due to the intervention (one-day event at Whitewater Center) via paired t-test (Figure 1).

Aim 2: Assess correlational relationships between changes in CN, ST, and SP. *Will be explored further in future work/next steps.*

CAC: Results

Construct	Pre Mean	Post Mean	Mean Change	p-value (<0.05)	Power
Systems Thinking	5.47	5.96	+0.49	0.0375*	59%
Connectedness to Nature	3.87	4.46	+0.59	0.0006**	99.7%
Sense of Purpose	4.10	4.06	-0.04	0.640	7.1%

Figure 1. Impact of One-Day Intervention on Nature-Based Leadership Characteristics in Medical Students and Professionals (n=9).

- Attendees showed statistically significant gains in ST and CN
- SP remained stable and did not show statistically significant gains in attendees after intervention

Conclusions and Next Steps

Brief, experiential interventions can meaningfully enhance systems-based and ecological perspectives among medical trainees

- Increasing PH education across preclinical and clinical curricula
- Develop, implement, and scale CAC projects
- Expand project- and research-based PH opportunities for students
- Expand CAC programming across themes and disciplines

Acknowledgements

Funded by the Kern Family Foundation. Special thanks to PHRC and Advocate Health.

Overlooked toll of climate change on migrant children in the Americas

Sebastian Pintea[1,2], Ava Acevedo[1,2], Juliet Horenziak[1,2], Anissa Kurani[2,3,4], Khushi Kohli[2,5], Stephanie Wang[2,5], Eugene T. Richardson M.D., Ph.D.[6,7], David Introcaso Ph.D.[8] & Abrania Marrero Ph.D.[9,10]

[1]Stanford University, [2]Health Disparities Think Tank, [3]Harvard Medical School, [4]Georgetown University School of Medicine, [5]Harvard College, [6]Department of Global Health and Social Medicine, Harvard Medical School, [7]Brigham and Women's Hospital, [8]Independent consultant, Washington DC, [9]Department of Nutrition, Harvard T.H. Chan School of Public Health, [10]Department of Global and Environmental Health, New York University School of Global Public Health

BACKGROUND

- Climate change is driving large-scale shifts in temperature, precipitation patterns, and extreme weather events across the Americas, disproportionately affecting low- and middle-income regions and populations with limited adaptive capacity, particularly children whose developing bodies are more susceptible to dehydration, malnutrition, and infectious disease during critical growth periods.[1]
- Latin America and the Caribbean currently has the highest proportion of child migrants in the world, with approximately 25% of migrants being children compared with 13% globally, largely due to climatic vulnerability compounded by social, economic, and political instability, with an estimated 50–70% of these children ultimately migrating to the United States.[2,3]
- Children experience climate stressors differently than adults because they have limited autonomy to access resources, greater physiological sensitivity to heat and air pollution, and increased vulnerability to food insecurity and trauma related to environmental degradation and household livelihood loss.[2]

AIMS

- This work examines the health impacts of climate change on non-citizen children from Latin America and the Caribbean across three stages of the migration pathway: while living in their country of origin, during the migration journey, and after arrival in the United States, with the goal of identifying gaps in U.S. healthcare and policy responses and proposing actionable strategies to better protect pediatric migrant populations.
- We synthesize climate, migration, and pediatric health literature to highlight how climate-related exposures accumulate across time and geography rather than resolving after migration, underscoring the need for integrated clinical and public health responses that recognize climate displacement as a pediatric health risk factor.

ANALYSES: THREE STAGES OF RISK EXPOSURE

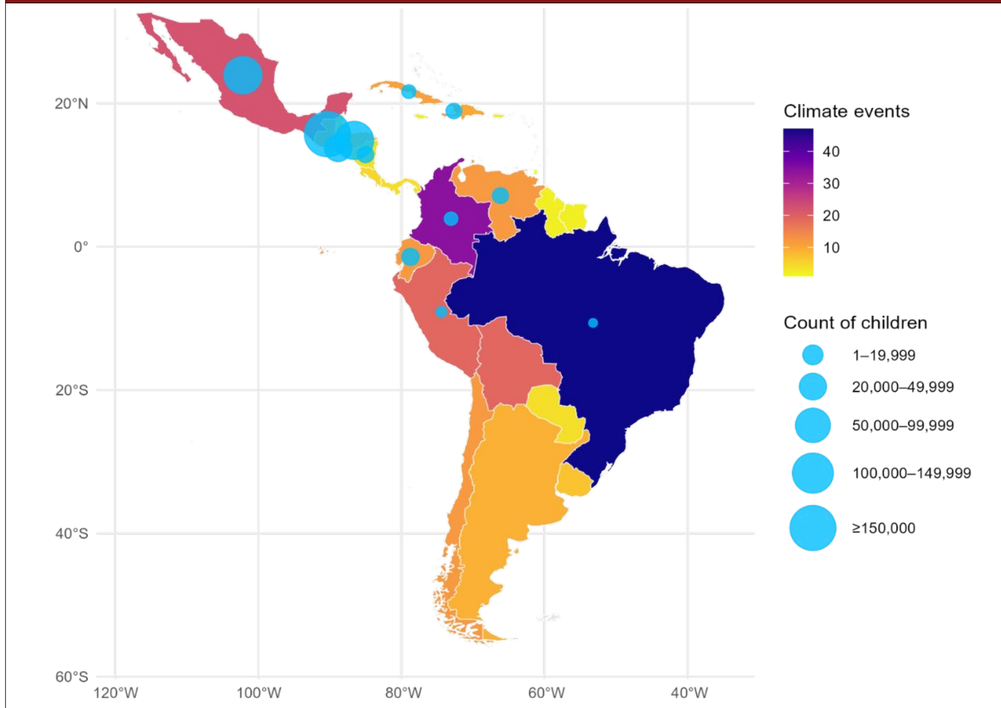


Figure 1. Counts of accompanied and unaccompanied children from LAC encountered by US Customs and Border Protection against the number of climate events occurring in each sending country, 2021 to 2024 (www.cbp.gov). Counts are cumulative. Climate events include floods, storms (e.g., hurricanes, tornados), droughts, fires, and landslides generally considered a disaster

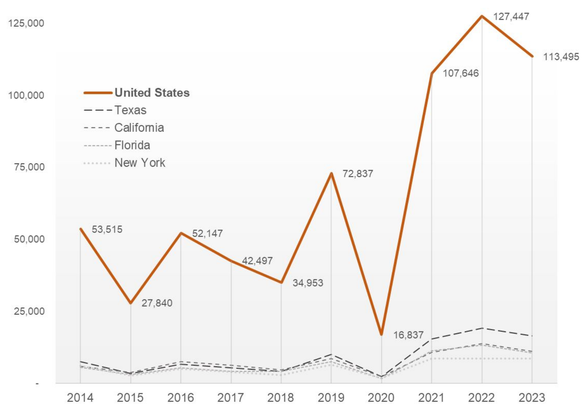


Figure 2. Unaccompanied children arriving without a parent or guardian at the US-Mexico border and released to sponsors, 2014 to 2023 (Migration Policy Institute, 2024). Data depicts both overall totals in the United States and by the top four receiving states.

Stage 1 | Country of origin
Climate hazards disrupt agriculture and livelihoods, increasing childhood exposure to malnutrition, dehydration, and infectious disease in highly vulnerable regions.

Stage 2 | Migration route (*Acute exposure*)
Children experience extreme heat, water scarcity, injury, and limited healthcare along migration corridors and in detention settings.

Stage 3 | Host country (U.S.) (*Chronic exposure*)
Settlement in heat- and pollution-prone states, combined with housing instability and barriers to care, sustains climate-related health risks after arrival.

KEY INSIGHTS

- Climate-related health risks accumulate across the migration pathway rather than resolving after arrival, creating overlapping environmental, psychological, and healthcare access burdens for migrant children.
- Immigration enforcement fear and medical mistrust reduce care-seeking, increasing the likelihood of untreated climate-related illness and mental health.
- Pediatric migrant health reflects the combined effects of climate exposure and legal status, requiring integrated, trauma-informed responses.

DISCUSSION AND POLICY

- Health systems should provide trauma-informed, culturally responsive care to reduce medical mistrust and fear of deportation among migrant families.
- Climate displacement and eco-anxiety should be included in clinical screening and referral pathways.
- Federally qualified health centers, schools, and migrant-serving clinics need stable funding to deliver integrated physical and mental healthcare.
- Non-citizen children displaced by climate change should be recognized as medically vulnerable and included in Medicaid-like coverage and climate adaptation programs.
- Youth-led and peer-based mental health programs can support recovery and restore agency after climate-related displacement.

REFERENCES

1. Chitre SD, Crews CM, Tessema MT, Plėštytė-Būtienė I, Coffee M, Richardson ET. The impact of anthropogenic climate change on pediatric viral diseases. Pediatr Res. 2024 Jan;95(2):496-507. doi: 10.1038/s41390-023-02929-z.
2. Buechner, M. (2023). UNICEF. https://www.unicefusa.org/stories/record-numbers-child-migrants-latin-america-and-caribbean-great-risk
3. Migration Policy Institute. (2024). https://www.migrationpolicy.org/programs/data-hub/charts/unaccompanied-children-released-sponsors-state-and-county

Impact of Acute PM2.5 Exposure from the 2023 Canadian Wildfires on Post-Operative Outcomes in Central Pennsylvania

Kayla Keenan, MHA[1], Lauren Kraker[1], Madison Wolkov[1], Amanda Cooper, MD[2]

[1] Penn State College of Medicine, [2]Penn State Health Department of Surgery

Introduction

- Fine particulate matter (PM2.5) is an air pollutant associated with adverse health outcomes, including premature mortality, increased cancer risk, and cardiopulmonary disease[1,2].
- Even short-term PM2.5 exposure has been linked to increased all-cause mortality[1,2].
- In June 2023, wildfire smoke originating from Canada rapidly spread across the northeastern United States. During this period, daily average PM2.5 concentrations peaked at 258.9 µg/m³, exceeding World Health Organization air quality guidelines by 17.3-fold [3].
- The health effects of acute environmental exposure events, such as the 2023 Canadian wildfires, remain poorly characterized.
- Further research is needed to understand how short-term PM2.5 exposure impacts surgical recovery, as prior studies have demonstrated associations between elevated PM2.5 levels and increased morbidity and mortality among patients undergoing procedures including hip fracture repair, endoscopic sinus surgery, and organ transplantation[4,5,6].

Objective

- To quantify the acute effects of elevated PM2.5 levels, specifically those resulting from the 2023 Canadian wildfires, on postoperative outcomes among surgery patients in rural central Pennsylvania.

Methods

- Data from the NSQIP database at Hershey Medical Center for surgical procedures performed between January to August 2023 was retrospectively collected.
- Surgical Procedures included were as follows: laparoscopic appendectomy, breast reconstruction, laparoscopic nephrectomy, lung wedge resection, and colectomy.
- Exclusion criteria included patients with a history of chronic lung disease (i.e. COPD), preoperative sepsis, or underwent complex, converted-to-open, or multi-procedural operations.
- Procedures performed during the June 2023 Canadian wildfires were compared to similar procedures conducted in the preceding six months.
- Outcomes included length of stay (LOS), 30-day readmission, pneumonia, sepsis, and 30-day mortality.
- PM2.5 exposure was stratified as high (≥101 µg/m³) or low (≤100 µg/m³) and was compared using independent t-tests.

Understanding Air Quality Index

PM2.5 Levels (µg/m³)	Level of Concern	Interpretation
0-100	Good to Moderate	Air pollution poses little or no risk to health
101-150	Unhealthy for sensitive groups	Sensitive groups are more likely to experience health impacts
151-300	Unhealthy to very unhealthy	Health alert: increased health risk for everyone
301+	Hazardous	Increased health risks with very negative outcomes

Figure 1. The U.S Air Quality Index (AQI) is a tool used by the EPA to measure outdoor air quality and health effects. For the purposes of this study, PM2.5 levels ≥101 µg/m³ and ≤100 µg/m³ were stratified by high and low exposure levels, respectively.

Results

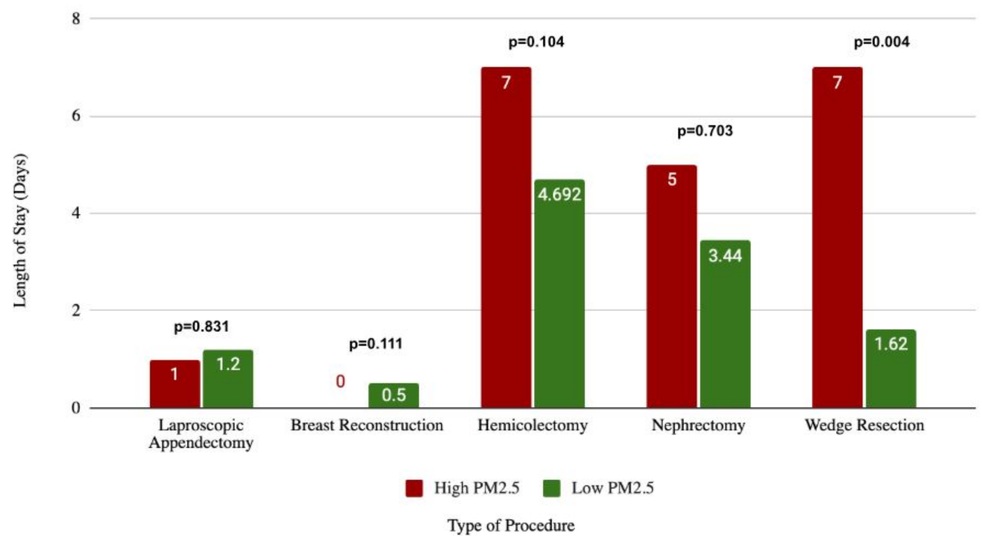


Figure 2. PM2.5 Exposure and Mean Length of Stay (LOS) by Procedure Type

- Mean PM2.5 during June 2023 procedures was 117 µg/m³ (peak 122 µg/m³), classified as Unhealthy for Sensitive Groups by the EPA.
- Higher PM2.5 exposure was generally associated with increased postoperative LOS.
- Wedge resection demonstrated a significant increase in LOS with high PM2.5 exposure (7.0 vs. 1.62 days; p = 0.004).
- Hemicolectomy and nephrectomy showed longer LOS with high PM2.5 exposure, though without statistical significance.
- No significant association was observed between PM2.5 exposure and postoperative mortality, pulmonary complications, sepsis, or unplanned readmissions.

Conclusions

- Patients undergoing wedge resection demonstrated a significant correlation between elevated PM2.5 levels and prolonged hospitalization.
- Acute environmental events, such as wildfire smoke exposure, may warrant consideration when scheduling non-emergent surgical procedures.
- Increased PM2.5 exposure may contribute to longer hospital stays, higher healthcare costs, and potentially worse postoperative outcomes.
- Notably, regions typically characterized by low to moderate baseline PM2.5 levels experienced measurable postoperative impacts during acute environmental exposure events, such as the 2023 Canadian wildfires.
- Further analysis of a larger sample size is needed to determine significance.

References

1. Orru, H., Ebi, K. L., & Forsberg, B. (2017). The Interplay of Climate Change and Air Pollution on Health. Current environmental health reports, 4(4), 504–513. https://doi.org/10.1007/s40572-017-0168-6

2. WHO. Review of evidence on health aspects of air pollution—REVIHAAP project: technical report. Copenhagen: WHO Regional Office for Europe; 2013.

3. Chen, H., Zhang, W., & Sheng, L. (2025). Canadian record-breaking wildfires in 2023 and their impact on US air quality. *Atmospheric Environment*, *342*, 120941.

4. Di Q, Dai L, Wang Y, Zanobetti A, Choirat C, Schwartz JD, Dominici F. Association of Short-term Exposure to Air Pollution With Mortality in Older Adults. JAMA. 2017 Dec 26;318(24):2446-2456. doi: 10.1001/jama.2017.17923. PMID: 29279932; PMCID: PMC5783186.

5. Chuang SH, Kuo YJ, Huang SW, Zhang HW, Peng HC, Chen YP. Association Between Long-Term Exposure to Air Pollution and the Rate of Mortality After Hip Fracture Surgery in Patients Older Than 60 Years: Nationwide Cohort Study in Taiwan. JMIR Public Health Surveill. 2024 Mar 18;10:e46591. doi: 10.2196/46591. PMID: 38342504; PMCID: PMC10985614.

6. Tullis B, Mace JC, Hagedorn R, Nguyen C, Stockard R, Massey C, Ramakrishnan VR, Beswick DM, Soler ZM, Smith TL, Alt JA, Gill AS. The Impact of Acute Perioperative Particulate Matter Exposure on Endoscopic Sinus Surgery Outcomes: A Preliminary Multi-site Investigation. Am J Rhinol Allergy. 2024 Jul;38(4):237-244. doi: 10.1177/19458924241246371. Epub 2024 Apr 16. PMID: 38623645.

Climate Change as a Mental Health Stressor: Emerging Risk and Clinical Considerations

Maaida Kirmani, Sayyeda Hasan (1), Vikas Reddy(1), Journie Gaeta (1), Dalia Salam Ahmed (1), Margaret Daher (1), Zehra Abbas (1), Dr. Robert Slater, MD, MPH (1)

Univ. of the Incarnate Word School of Osteopathic Medicine, San Antonio, TX 78221

Introduction

The consequences of climate change are seen both as acute and chronic events, which have a ripple effect on society through the environmental damage inflicted. This causes instability societally and even more concerning, there are often negative impacts on mental health.

Objective

This poster will outline the connections present between exposures to climate events and related mental health consequences. In the scope of this poster, man-made events are categorized as disasters directly caused by human action that also contribute to worsening climate change. Chronic events describe major shifts of weather patterns in each geographic area that last between months to decades.

Methods

Searching the Literature

A literature search was conducted from June-September 2025. Key terms used to examine mental health consequences included but not limited to "stress", "anxiety", "depression" along with "climate change", "environmental disaster" and "global warming". Keyword searches were conducted across multiple databases including the PubMed database, Clinical Key, and Google Scholar.

Identifying and Appraising Relevant Studies

Search parameters for selected articles limited it to publications written in English, published after 2000, and referenced topics related to the keyword search

Search terms were tailored to the assigned categories of climate change consequences.

Six reviewers screened individual articles and abstracts to narrow down the selection of relevant articles.

Data Extraction and Thematic Synthesis

Climate events were categorized as man-made acute events, acute natural disasters, and chronic events.

Following initial selection, the full text articles were further assessed and synthesized to assess the current knowledge available correlating mental health consequences of climate events.

Results

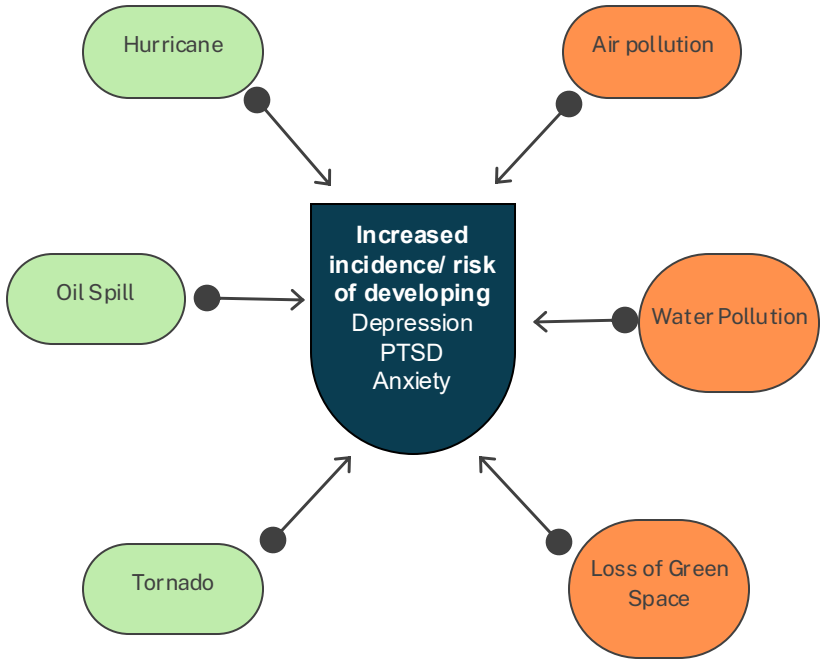


Fig 1. Web of Mental Effects of Chronic and Acute Environmental Events
Green indicating acute events. Orange indicating chronic events

Hurricane

- Katrina and Rita, 14.5% increase in poor mental health over seven years following the disasters

Oil Spills

- PAH exposure, heat stress, and displacement

Tornados

- Alabama and Missouri, 6.7% adolescents PTSD, 7.5% MDE following tornado

Air Pollution

- 18-39% increased odds of common mental disorders, NOx and NO2
- PM10, 33% increased odds for psychotic episodes

Water Pollution

- Flint, Michigan, persistent stress response

Loss of Green Space

- Chronic stress, depressed mood and anxiety
- Access = increased happiness, sense of purpose and subjective well-being. Improved attention and cognition

Results Cont.

Unfair Distribution of Effects on Vulnerable Populations

Throughout the course of the review a theme was seen in many of these studies not only do these environmental changes clearly show increased incidence and risk of developing of a variety of mental health issues along with increasing levels of stress these levels disproportionally effect vulnerable populations. While everyone is affected by these environmental disasters the data has shown POCs time and time again tend to be more greatly affected. When it comes to climate change disasters, it is often populations of lower SES groups who are most affected with mental health consequences. The burden of disease is higher in these vulnerable populations, and this was seen throughout multiple types of climate disasters. This is another aspect to examine when investigating the correlation between climate change and mental health conditions.

Discussion and Future Directions

Climate change needs to be recognized for both the detrimental environmental and mental health consequences it causes in order to build resilience and improve well being. This is a multifaceted issue that impacts individuals and communities globally regardless of duration or type of disaster. The variety in climate disasters is correlated to an increased presence of mental health manifestations such as increased rates of anxiety, depression, PTSD and suicide risks. The burden is amplified in vulnerable populations, which underscores inequities present when discussing resilience and intervention implementation. Concerns arise when noting the increased ecological grief and solastalgia which emphasizes that climate change encompasses physical changes and identity and emotional well being. Further steps in research include conducting a larger scale literature review on the impacts of chronic and acute climate health events and the corresponding impact on mental health. Additionally, select papers noted the disparities present within different minority and socioeconomic groups in regards to mental health impacts and climate event exposures. This could prove to be a useful direction to address present knowledge gaps and gain insight on potential interventions.

References

Rain to Sustain: The Community and Climate Health Impacts of Rainwater Harvesting in the Mexico City Region

Krishna Chandrasekhara, M.S.
Baylor College of Medicine, University of Pennsylvania Health & Societies

Introduction

- In Mexico City, **clean water access** has been a persistent challenge for its 20+ million residents.
- Rainwater harvesting has emerged as a sustainable solution to provide a more consistent supply of clean water.
- **Climate change** amplifies uncertainty with water supply.

Objective & Methods

- Understand how rainwater harvesting systems influence **health and wellbeing** among residents in the Mexico City region.
  - In the context of **increasing water scarcity** and **climate-related stressors**.
- Long-form **qualitative interviews** were conducted with ~30 community members across the Mexico City region
  - Study participants included **household residents** and **school administrators.**

Water Access Challenges

- During the dry season, water availability **fluctuates** and water is typically **expensive.**
- Mountainside communities do not have central water access.
- Water supply is not always clean and has been linked to **outbreaks of gastrointestinal (GI) and skin infections** at schools.
- Climate change has affected **groundwater availability.**

Impacts of Rainwater Harvesting

- Rainwater harvesting systems have improved **water security.**
  - Residents reported **reduced stress** about their water supply.
  - Harvested rainwater serves as a **reservoir** during the dry season.
- School administrators described **greater resilience** to climate-driven fluctuations in water supply.
- Instances of **contagious GI illnesses** and water-related skin infections **have notably decreased** among children.
  - Attributed to improved access to clean water for **hygiene and sanitation.**
- Climate change will affect the rainy season, which will impact the design of rainwater harvesting.

Conclusion

- Rainwater harvesting systems have enhanced community climate resilience by:
  - Stabilizing **water access**
  - Improving **mental health**
  - Reducing **waterborne illnesses**
  - Promoting equitable water access for **vulnerable populations**, including children
- Rainwater harvesting can be adopted in other **climate-vulnerable communities**.
- Climate change still presents **challenges to rainwater harvesting** that will require adaptation.

Acknowledgements

Special regards to the non-profit Isla Urbana, who assisted with coordinating interviews.

This project was funded by the Paul & Kathleen Barthmaier Award.

Rain to Sustain: The Community and Climate Health Impacts of Rainwater Harvesting in the Mexico City Region

Krishna Chandrasekhara, M.S.
Baylor College of Medicine, University of Pennsylvania Health & Societies

Introduction

- In Mexico City, **clean water access** has been a persistent challenge for its 20+ million residents.
- Rainwater harvesting has emerged as a sustainable solution to provide a more consistent supply of clean water.
- **Climate change** amplifies uncertainty with water supply.

Objective & Methods

- Understand how rainwater harvesting systems influence **health and wellbeing** among residents in the Mexico City region.
  - In the context of **increasing water scarcity** and **climate-related stressors**.
- Long-form **qualitative interviews** were conducted with ~30 community members across the Mexico City region
  - Study participants included **household residents** and **school administrators.**

Water Access Challenges

- During the dry season, water availability **fluctuates** and water is typically **expensive.**
- Mountainside communities do not have central water access.
- Water supply is not always clean and has been linked to **outbreaks of gastrointestinal (GI) and skin infections** at schools.
- Climate change has affected **groundwater availability.**

Impacts of Rainwater Harvesting

- Rainwater harvesting systems have improved **water security.**
  - Residents reported **reduced stress** about their water supply.
  - Harvested rainwater serves as a **reservoir** during the dry season.
- School administrators described **greater resilience** to climate-driven fluctuations in water supply.
- Instances of **contagious GI illnesses** and water-related skin infections **have notably decreased** among children.
  - Attributed to improved access to clean water for **hygiene and sanitation.**
- Climate change will affect the rainy season, which will impact the design of rainwater harvesting.

Conclusion

- Rainwater harvesting systems have enhanced community climate resilience by:
  - Stabilizing **water access**
  - Improving **mental health**
  - Reducing **waterborne illnesses**
  - Promoting equitable water access for **vulnerable populations**, including children
- Rainwater harvesting can be adopted in other **climate-vulnerable communities**.
- Climate change still presents **challenges to rainwater harvesting** that will require adaptation.

Acknowledgements

Special regards to the non-profit Isla Urbana, who assisted with coordinating interviews.

This project was funded by the Paul & Kathleen Barthmaier Award.

A Framework for Embedding Environmental Health into Core Clinical Clerkships Without Increasing Curricular Burden

Ritika Chanda, BS[1]; Kriti Shrestha, MS, BS[1]; Elena Iliadis, BS[1]; Joel Licor, BS[1]; Yusra Rafeeqi, BA[1]; Caroline Wellbery, MD, PhD[1,2]

[1]Georgetown University School of Medicine; [2]Department of Family Medicine, Georgetown University

Objective

To develop and implement a scalable framework integrating environmental health into core clinical clerkships by aligning evidence-based climate and sustainability topics with existing clerkship objectives.

Introduction

Environmental factors contribute to over **25% of the global disease burden**, with **23% of all deaths** worldwide attributable to environmental exposures[1]. Climate change increases clinically relevant risks, including heat-related illness, air pollution-associated respiratory disease, vector-borne illnesses, mental health effects of extreme weather events, and health inequities that disproportionately affect vulnerable populations[2]. Despite this substantial impact, environmental health education remains limited within U.S. medical school curricula, leaving physicians inadequately prepared to address patients' environmental health risks[3]. Integrating environmental health into core clinical clerkships represents a critical opportunity to bridge this gap.

Methods

Planetary Health Report Card (PHRC)

The PHRC was completed through review of course syllabi, publicly available institutional documents, and sustainability reports. The institution was evaluated across five domains: **curriculum**, research, outreach and advocacy, student involvement, and sustainability.

Literature Review

A targeted literature review was conducted to identify clinically relevant environmental health topics including vector-borne illness, flooding, heat-related illness, mental health, and soil contamination. Findings informed topic selection for curricular integration.

Curricular Integration

Integration opportunities were identified through review of clerkship objectives and educational materials, supplemented by discussions with clerkship leadership and current third-year medical students. Topics were embedded with existing objectives and activities to **minimize curricular burden**.

Results

The PHRC rubric identified significant gaps in environmental health education (**Institutional Score: C-**). A targeted literature review further highlighted the absence of foundational and clinically relevant environmental health topics in the existing curriculum. These gaps prompted curricular changes that could be implemented in two core clerkships for the 2026-2027 academic year: **Family Medicine and Pediatrics**. Favorable factors for integration in these clerkships included:

1. Clinical **relevance** to environmental exposures
2. **Feasibility** of integration into existing curricular activities
3. **Alignment** with established clerkship objectives
4. Existing **public-health focused activities**: *serving as platforms for integrating environmental health content*
5. A **pre-existing appreciation** for environmental health education by clerkship leadership

Family Medicine Integration

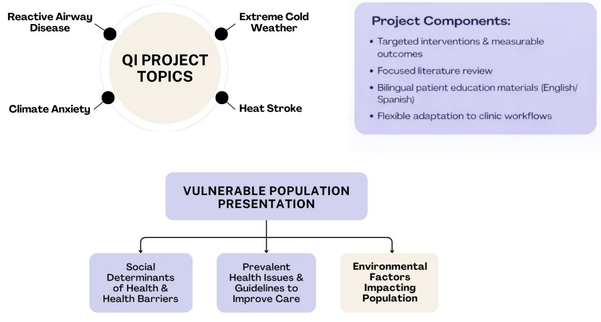


Figure 1. *Two pre-existing clerkship assignments were adjusted to incorporate relevant environmental health topics.*

Pediatrics Integration

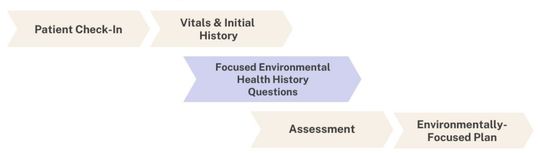


Figure 2. *An assignment was introduced to provided a structured framework for students to effectively integrate environmental health questions into routine patient encounters.*

Project Timeline

Figure 3. *Project timeline outlining the sequential phases of integrating environmental health into the core clerkship curriculum, including institutional assessment, literature review, curricular review and development, and implementation in March 2026.*

Limitations

Time constraints to onboarding the next cohort of third-year students limited our ability to pilot the interventions with the current cohort prior to formal implementation and to trial them across all clerkships or workshops to identify the most effective points of integration.

Conclusion

This project demonstrates a model for incrementally integrating environmental health into clerkship medical education without adding curricular burden, while highlighting it as an essential clinical competency for medical students.

Future Directions

The Planetary Health Report Card serves as an ongoing guide for incremental, sustainable curricular change that reinforces core planetary health competencies as essential skills.

To address our limitations, **student focus groups** will help refine the proposed curricular changes. Seamless integration and favorable evaluations will facilitate strategic implementation in additional core clerkships, especially supported by the newly developed **GCCHE Core Concepts for Health Professionals competency tool**[4].

References

1. Goldman RH, Zajac L, Geller RJ, Miller MD. Developing and implementing core competencies in children's environmental health for students, trainees and healthcare providers: a narrative review. BMC Med Educ. 2021;21(1):503. Published 2021 Sep 24. doi:10.1186/s12909-021-02921-3
2. Goshua A, Gomez J, Erny B, et al. Addressing Climate Change and Its Effects on Human Health: A Call to Action for Medical Schools. Acad Med. 2021;96(3):324-328. doi:10.1097/ACM.0000000000003861
3. Hampshire K, Islam N, Kissel B, Chase H, Gundling K. The Planetary Health Report Card: a student-led initiative to inspire planetary health in medical schools. Lancet Planet Health. 2022;6(5):e449-e454. doi:10.1016/S2542-5196(22)00045-6
4. Rosen L, et al. The Climate Health Curriculum Tool (CHCT): an assessment framework for integrating climate health education in US undergraduate medical curricula. BMC Med. In press. 2026.

Acknowledgements

We would like to thank Dr. Caroline Wellbery, Dr. Tobie-Lynn Smith, and Dr. Catherine Ingard Negri for their guidance and support throughout this project. We are also grateful to Dr. Anthony Fauci for contributing subject matter expertise and providing direction and insight into common environmental risks in the DMV area.

Virtual or In-Person? A Census of United States Residency Interview Formats for Match 2025

Zoe VanderHoek, BS, OHSU; Patrick Quinn, BA, MCW; Ryan Christ, DPhil, Yale; Brian Prigmore, MD, U of U Health; Molly Joyce, MPH, OHSU; Haley D. Smith, BS, OHSU; Ruth Carver Bondurant, MM, OHSU; Sydney Laxson, BS, OHSU; Elise Brannen, MD, OHSU; Fiona Stefanik, MD, OHSU; Jenny Rose Park, MD, UW; Lori Sun, BA, OHSU; Alexandra Hoffman, BS, OHSU; Eden VanderHoek, BS, OHSU; Derek Wong, BS, OHSU; Zachary Yellowman, MS, OHSU; Katherine Velicki, MD, Department of Orthopaedic Surgery, OHSU

Background

- Residency interviews became exclusively virtual during the COVID-19 pandemic.
- The AAMC recommends virtual interview format now to decrease costs for applicants, reduce environmental impact, and reduce recruitment bias

Purpose: This study seeks to elucidate the trends in United States residency interview formats and whether residency program characteristics are associated with choice of virtual versus in-person format

Methods

Study Design: Cross-sectional analysis of U.S. residency programs

Data collection:

- **Included:**
  - U.S. accredited programs including 4,863 programs across 23 specialties obtained from the Electronic Residency Application Service (ERAS)
- **Excluded**: Programs in Puerto Rico, military programs

- **Sources:** Program websites, direct contact with program coordinators

Primary outcomes: Interview format distribution across specialties
Secondary outcomes: Association of interview format with geographic region, Doximity reputation ranking, and class size

Statistical Analysis
Logistic regression used to evaluate whether specialty, region, or Doximity reputation ranking independently predicted interview format

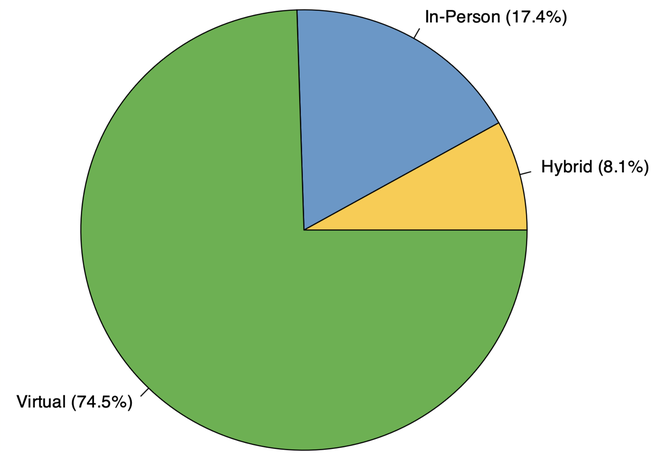


Figure 1: Residency Interview Format Breakdown

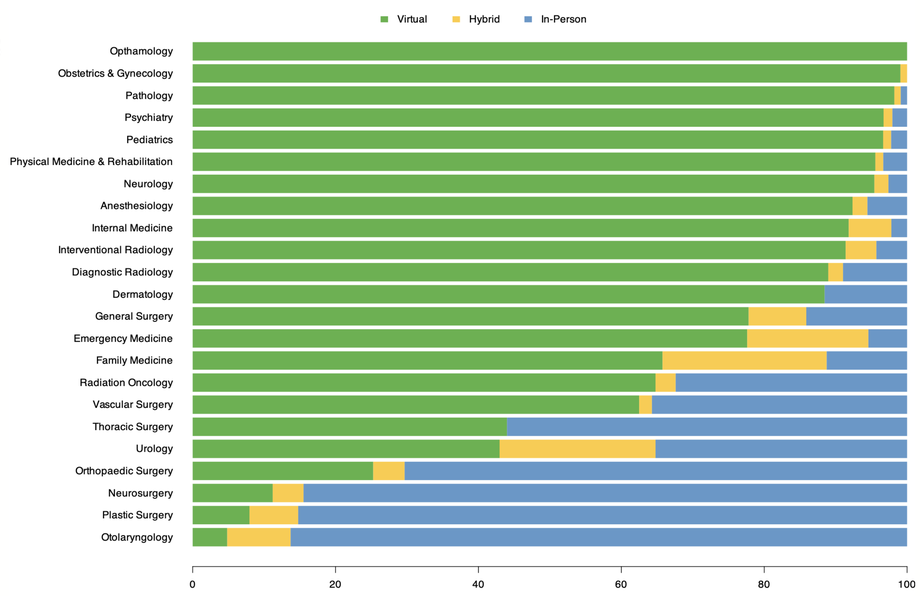


Figure 2: Interview Format Breakdown by Specialty

Results

Out of 4,014 verified programs, the majority maintained a virtual format.

- **Virtual**: 74.5%
- **In-Person:** 17.4%
- **Hybrid:** 8.1%

Divergence in Surgical Subspecialties

- While recruitment remains majority-virtual across all specialties, **specialty type** emerged as the primary driver of format selection ($p=2.2x10^{-16}$).
- Surgical subspecialties demonstrated a significant and standardized return to in-person interviews
  - **Otolaryngology:** 86.3% in-person format.
  - **Plastic Surgery:** 85.2% in-person format.
  - **Neurosurgery:** 84.5% in-person format.
  - **Orthopaedic Surgery:** 70.3% in-person format.
  - **Thoracic Surgery:** 56.0% in-person format.

Conclusions

- **Growing Specialty Divergence:** A stark divide has emerged between surgical fields and other specialties regarding recruitment.
- **Surgical Return to In-Person:** While 74.5% of all programs remain virtual, surgical subspecialties like Otolaryngology (86%) and Neurosurgery (85%) have largely returned to in-person formats
- **Primary Driver of Selection:** Specialty type is the main predictor of interview format, outweighing geographic region or Doximity prestige.

Next steps:

- Discussions with leaders of the AAMC and residency program directors to standardize interview format
- **Longitudinal Tracking** to assess if surgical fields continue to move away from virtual interview recommendations.

Evaluating the Necessity and Potential Harm of Laboratory Testing in Colorectal Surgery Patients

Presenting Author: Isabel Chris, BS (RUSH)

Co-Authors: Ashley Roberts, MD (RUSH); Arthur Cross-Najafi, MD (RUSH); Patricia Cintora, PhD (RUSH); Darren Nin, PHD (RUSH); John Konen, MD (RUSH); Ami Shah, MD (RUSH)

Introduction

Hospitals occupy a unique position as institutions dedicated to promoting and protecting human health. Paradoxically, they contribute substantially to environmental harm, in part through the extensive use of laboratory consumables and single use plastic medical supplies. Healthcare pollution accounts for 23,000 disability adjusted life-years (DALYs) lost annually, emphasizing the direct link between environmental degradation and health.

Objective: To evaluate postoperative laboratory utilization and identify predictors of unnecessary testing in elective colorectal surgery (CRS) patients, specifically addressing how low-value diagnostic practices exacerbate healthcare's planetary and clinical burdens.

Methods

This was a retrospective cohort study of 391 elective CRS patients from a single, urban academic medical center. The study was reviewed through completion of a Non-Human Subjects Research Assessment Form and was determined to be exempt from institutional review board oversight, as it involved retrospective analysis of de-identified data for quality purposes and did not constitute human subjects research. "Unnecessary" tests were defined as those performed on patients without documented complications.

Results

Among 391 patients, 69.8% underwent testing without clinical indication, reflecting protocolized overutilization. This practice carries a heavy ecological cost; benchmarks for similar unnecessary tests demonstrate an annual burden of 28,576–42,012 kgCO2e, equivalent to driving a passenger car to 230,000km. Despite this high environmental footprint, routine labs across specialties prompt intervention in only 0.4–4% of cases.

Table 1. Overall patient demographics surgical characteristics.

N	391
Age [years]	58.8 (15.3)
Sex	
Male	210 (53.7%)
Female	181 (46.3%)
ASA class	
1	3 (0.8%)
2	174 (44.5%)
3	208 (53.2%)
4	6 (1.5%)
Type of surgery	
Left hemicolectomy/sigmoidectomy	124 (31.7%)
Right hemicolectomy/ileocecectomy	104 (26.6%)
Low anterior resection	59 (15.1%)
Colostomy takedown/reversal	39 (10.0%)
Ileostomy reversal	65 (16.6%)
Approach	
Laparoscopic	67 (17.1%)
Open	138 (35.3%)
Robotic	186 (47.6%)
Total lab tests during admission	16 (10-26)
CBC	4 (2-6)
BMP	3 (2-5)
CMP	0 (0-0)
Mg	3 (2-6)
Phos	3 (2-6)
Other	1 (1-3)
Length of stay [days]	5 (3-6)
Labs/day	3.4 (3-4)
Complication	116 (29.7%)
Underwent unnecessary lab tests*	273 (69.8%)

Conclusions

Unnecessary laboratory testing in uncomplicated CRS patients is a primary driver of medical waste and environmental degradation. Transitioning from uniform protocols to evidence based, risk stratified guidelines is essential for making operating rooms greener, offering a clear pathway to reduce the healthcare industry's carbon footprint and operational costs without compromising safety.

Combining Institutional Values and Collective Action to Develop a Focused Climate and Health Equity Elective in New York City

Isabel O'Malley-Krohn, BS[1]*, Harrison Fillmore, MD[1], Hannah Weinstein, BA[1], Lee Yang, BS[1], Sarabesh Natarajan, MSc[1], Filippo Ravalli, MPH[1], Abigail Macher, BA[1], Hetty Cunningham, MD[1], Cecilia Sorensen, MD[1]

[1]Columbia University Vagelos College of Physicians and Surgeons, New York, NY, USA; *Presenter

Abstract

Objectives: We recently implemented a longitudinal Climate & Health Equity curricular thread into the pre-clinical and clinical curriculum at a medical school. Here, we describe the development of an additional in-depth climate-focused fourth-year elective.

Methods:
1) Top-down approach: Used learning objectives developed for the pre-clinical and clinical curricula to propose a two-week elective syllabus;
2) Collective Action: Presented findings to develop connections with faculty and local groups;
3) Education: Worked with medical school administration and faculty to list elective and create schedule;
4) Community Impact: Plan to evaluate impact through annual survey producing iterative changes.

Results: Syllabus development established the educational aim focused on policy development, advocacy, and research methodologies specific to climate health and environmental justice. Three initial lecturers were identified. Presenting the pre-clinical and clinical Climate & Health Equity curriculum at a medical center climate day yielded seven more connections. Further administrative input yielded nine total planned lectures for the two-week elective. Asynchronous materials and final schedule are in development.

Conclusions: Integration of climate concepts adds to core institutional values, creating a positive feedback loop that unites individuals at all levels of training with shared values and increases community awareness through a combination of top-down and collective action approaches. Future elective development will incorporate feedback from the preliminary class.

Introduction

- In the Spring of 2024, we began development of a new longitudinal Climate & Health Equity curricular thread at Columbia University Vagelos College of Physicians & Surgeons (VP&S)
- The curricular thread focused on climate health and climate justice education in medicine as it was relevant to each phase of the VP&S curriculum
- To date, the curriculum has been integrated into the pre-clinical and clinical curricula
- **Here we describe the last phase of integration: the development of an in-depth climate-focused fourth-year elective**

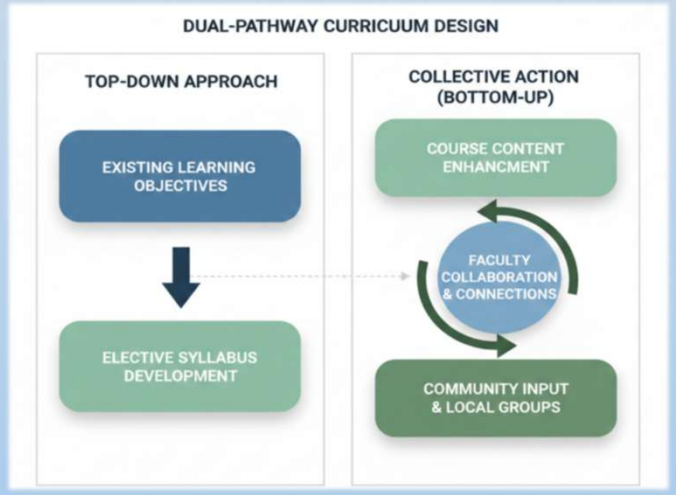
Methods

1) **Top-down approach:** Use learning objectives previously developed for the entire curricula to propose a two-week elective syllabus *(Table 1)*
2) **Collective Action:** Present findings to develop connections with faculty and local groups
3) **Education:** Work with administrators and faculty to list elective and create schedule
4) **Community Impact:** Evaluate impact through annual survey producing iterative changes *(in progress)*

Table 1: Example Learning Objectives Relevant to 4th-Year Elective

Theme	Learning Objectives
Applications & Practices	4.1 Identify **climate vulnerabilities in healthcare facilities and community services** and evaluate their ability to respond to severe weather and/or climate events (MEPO 6.2-3; LCME B, D)
	4.2 Identify resources for **implementing environmentally sustainable clinical practices** that prioritize prevention, telehealth, and actions that reduce the climate impact of pharmaceuticals (MEPO 3.2, 5.1, 6.3; LCME B)
	4.3 Learn how to **empower patients** to understand, combat, and protect themselves from the effects of climate change. (MEPO 1.1, 4.1-2, 5.1, 6.4, 7.2; LCME B, D)

Figure 1: Curriculum Roadmap for Elective Development



Results

Top Down:
- Learning Objectives
- 3 presenters (preceptors)

Collective Action:
- Curriculum Feedback
- 7 more presenters

Planned Curriculum will focus on **policy development**, **advocacy**, and **research methodologies** specific to climate health and environmental justice

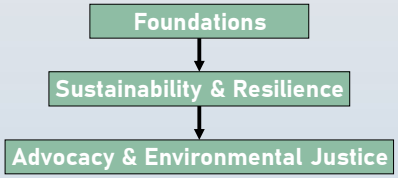


Figure 2: Format of Curriculum by Topic

Discussion

Why Integrate Climate Concepts?
- Add to core institutional values
- Create a positive feedback loop to unite individuals at all levels of training with shared values and increase community awareness
- Continuous progress through feedback from learners and teachers
- Decentralized opportunities to expand – individuals may apply or carve out scope for their project

How? Top-down and collective action approaches
Challenges: Momentum - student-led objectives may be vulnerable to turnover of medical school

Future Directions

- Long term collaboration with local groups (*ongoing*)
- Iterative feedback starting with 1st year of pre-clinical and clinical course integration (*expected 2026*)
- Feedback from first iteration of elective *(expected late 2026, early 2027)*
- Integrating Health Justice Summer Opportunity

COLUMBIA | MAILMAN SCHOOL OF PUBLIC HEALTH
GLOBAL CONSORTIUM ON CLIMATE AND HEALTH EDUCATION

Contact
Isabel O'Malley-Krohn
Columbia University Vagelos College of Physicians and Surgeons
630 W 168th St, New York, NY 10032
ieo2106@cumc.columbia.edu

NewYork-Presbyterian
Columbia University Irving Medical Center

UMKC School of Medicine Sustainability Report per the Planetary Health Report Card

Simrin Phatak[1], Cameron Quick[1]
School of Medicine, University of Missouri Kansas City[1]

Introduction

The Planetary Health Report Card (PHRC) is a student-led initiative launched in 2019 to assess and enhance how health professional schools incorporate planetary health into their education and operations. It serves as a metric-based tool for evaluating and improving planetary health content in health professional schools.

Each year, student teams, with faculty mentorship, evaluate their institutions across five key categories:
1. **Planetary Health Curriculum**: Assessing the integration of environmental and climate-related topics into the curriculum.
2. **Interdisciplinary Research**: Evaluating the institution's involvement in research that intersects health and environmental sciences.
3**. Institutional Support**: Reviewing the support provided by the institution for planetary health initiatives.
4. **Community Outreach and Advocacy**: Measuring engagement with communities on environmental health issues.
5**. Campus Sustainability**: Assessing the sustainability practices of the campus itself.

In 2025, UMKC School of Medicine (SOM) ranked 61st of 62 participating schools in the United States, with sister institution UM-Columbia forging ahead in the 47th spot. The PHRC is gaining momentum, with over 150 medical schools around the world utilizing it as a tool for assessing planetary health readiness.

Methods

Data collection for the Planetary Health Report Card was varied depending on the subgroup of the PHRC being considered. For example, the "Curriculum" and "Interdisciplinary Research" portions included reviewing large databases of course curriculums, and pre-existing or ongoing research projects. Lectures or projects were then identified as pertaining to PHRC guidelines by auditing for keywords such as "sustainability" or "environmental health". Other portions of the PHRC namely "Community Outreach and Advocacy" and "Support for Student-Led Initiatives" consisted of extrapolating objective information into usable metrics for the PHRC from conversations with students and mentors about efforts undertaken in sustainability initiatives. Lastly, data collection for "Campus Sustainability" entailed breakdown of campus energy infrastructure from multiple sources. Within the five subgroups exist many objectives, adding to a summative total of 51, which allow for the conversion of qualitative into quantitative data with a unique numerical score. For instance, one objective might read, "The institution has programs and initiatives to assist with making lab spaces more environmentally sustainable (2 points)", and if methodology findings align with the goal, then two points are awarded to the respective subgroup that account toward the final grade.

Results

The summative findings of the Planetary Health Report Card are a **final "letter grade" of D** for UMKC's School of Medicine (SOM). This score is based on evaluating five core pillars of the PHRC and averaging the assigned a letter grade to each based on numerical input.

- **Planetary Health Curriculum** scores were brought down by a notable absence of instruction addressing cardiovascular, neuropsychological, infectious and mental conditions being potentiated by changing climate patterns, as well as a paucity in coverage of global health's disproportional health effects on minority populations.
- While UMKC SOM faculty are actively involved in **Interdisciplinary Research** across a variety of fields, a lack of organizational leadership through a centralized planetary health research institute makes participation difficult.
- Community service projects relating to the food recovery aspect of planetary health exist on the SOM and undergraduate campus via the Roo Pantry program. This ties into the **Community Outreach and Advocacy** portion of the PHRC. Our school's affiliation with local partners including Children's Mercy Hospital Garden and KC Can Compost provide sustainably grown food from the garden to families and composting services. The newly launched newsletter from UMKC SOM Health Sciences District Sustainability Committee provides students with quarterly information on sustainability in healthcare on and off campus and added a few points as well.
- The School of Medicine performed best in the **Support for Student-led Planetary Health Initiatives** category. The recent creation of the **Heath Sciences Sustainability Committee**, along with **hosting guest lectures** regarding the intersection of planetary health and medicine, provide opportunities for students to engage with sustainable healthcare. Presently these are minimally included in Planetary Health Curriculum (D-) or Interdisciplinary Research (D-) sectors.
- The School of Medicine performed worst in **Campus Sustainability**, which reflects the school's emissions and power supply in terms of sustainability. Going into the project, this was expected. Currently, there is no plan to reduce our carbon footprint, or a task force assigned to create one.

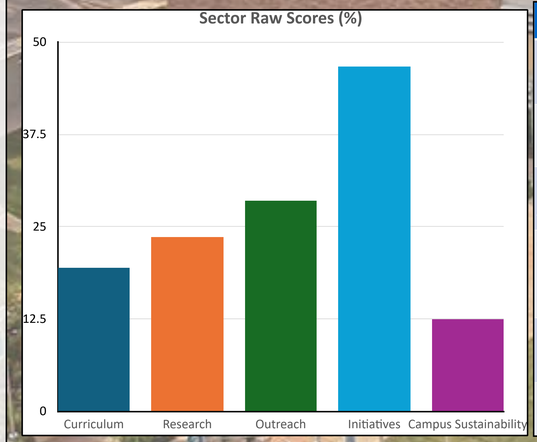


Fig. 1

Section	Raw Score	Letter Grade
Planetary Health Curriculum (30%)	19.44%	D-
Interdisciplinary Research (17.5%)	23.53%	D-
Community Outreach and Advocacy (17.5%)	28.57%	D
Support for Student-led Planetary Health Initiatives (17.5%)	46.67%	C
Campus Sustainability (17.5%)	12.50%	F
Institutional Grade	**26%**	**D**

Discussion

In reviewing the five pillars of planetary health at UMKC School of Medicine (SOM), the **three lowest ranking categories** include campus sustainability (12.5%), planetary health curriculum (19.4%). and interdisciplinary research (23.5%).

Finally, and equally urgent, UMKC SOM lacks physical facilities sustainability strategic plan, energy efficiency or sustainability coordinator, and relies on no renewable energy for facility power. The current trajectory of facility use involves depending on aging and energy-inefficient buildings for educational opportunities. Planetary health initiatives has thus far received significant support from university administration, with the creation of a student-lead sustainability committee, facilitation of volunteer activities with environmental focus, and bringing in a national speaker for planetary health training. Continued improvement will require notable personnel and monetary support but offers a chance for relevant advancement in a growing area of medicine.
UMKC does not utilize any renewable energy systems on the existing SOM campus, however one minor project to retrofit an older building is underway. It is the installation of a steam line between the Health Sciences Building and the SOM to improve efficiency in heating the SOM. Currently in the works over an existing parking lot is the construction of the Healthcare Delivery and Innovation Building. RDG architecture firm responsible for the HDIB mentions "high-performance façade [maximizing] daylight and [reducing] energy use in response to solar angles through varied scales of glazing", contributed to a raised point total. UMKC SOM's curriculums and research initiatives for sustainable healthcare exist in the realms of environmental toxins i.e. lead and small particle pollutants, but rarely in the context of marginalized communities, or how healthcare itself can be conducted sustainably, keeping our point total relatively low in those areas.

Recommendations

Curriculum
- Incorporate a Planetary Health Module into the year 1-2 didactical curriculum plan, with a minimum of 6 hours of lecture material

Interdisciplinary Research
- Offer a planetary-health related scholarship to facilitate research and/or QI projects
- Establish a mentor-mentee planetary health program

Community Outreach
- Initiate an institution-wide recycling initiative where partner hospitals have uniform policy and support
- Fund patient-information brochures regarding planetary-health related conditions and recommendations

Support
- Create a subpage within the UMKC SOM website for planetary health that includes research opportunities, strategic plan, and curriculum
- Make a significant financial investment into planetary health advancements

Campus Sustainability
- Create strategic facilities plan that includes energy reduction of 30-50%, according to DOE's recommendation, including;
- Conversion of all fluorescent lighting to LED (Phase 1) + Incorporation motion detectors in all rooms to decrease energy usage through lights

References

Clayton, S., Manning, C., Speiser, M., & Hill, A. N. (2021). *Mental health and our changing climate: Impacts, inequities, responses*. American Psychological Association and ecoAmerica

"Planetary Health Report Card." *Planetary Health Report Card*, 23 Apr. 2025, phreportcard.org.

Planetary Health Education at the University of Buckingham Medical School, 2025-2026

Laiyba Wasim, Muhammad Mubtagha Wasim, Anfaal Khan, Devasena Ajith

INTRODUCTION

- The Planetary Health Report Card (PHRC) is an internationally utilized, metric-based tool established to increase awareness regarding PH and promote accountability in health care professional schools
- The PHRC is completed annually by student-led teams who document and grade PH initiatives at their institution
- We used the PHRC to assess the University of Buckingham Medical School across five PHRC education domains for the 2025-2026 academic year

METHODOLOGY

- Information regarding PH and sustainability at the university was collected across the PHRC five domains – curriculum, interdisciplinary research, community outreach and advocacy, support for student-led initiatives, and campus sustainability
- Information sources included university and affiliated NHS trust websites, faculty mentor and the previous year's PHRC
- Each domain was assigned an individual score and a grade between A to F
- Domain scores were added to generate an overall score and grade for the institution

RESULTS & DISCUSSION

<u>Overall Grade: D (36%)</u>

Curriculum : C (55%)
Initiative(s): PH is integrated in various modules throughout phase 1 (e.g., respiratory and gastrointestinal systems, health psychology) & in student selected component in phase 2.
Suggestion: Include PH in cardiovascular and reproductive health modules

Interdisciplinary Research: C (41%)
Initiative(s) implemented: PH research is being supported at the university despite it being a teaching focused institute. Occupational and environmental health department, and sustainability strategy group have been established. The university is a member of the Global Consortium on Climate Health.
Suggestion: Establish an interdisciplinary department for PH research

Community Outreach and Advocacy: B- (7%)
Initiative(s) established: In the past, multiple in-person and online courses and talks on PH have been organized and delivered by the university. However, this was not continued in 2025.
Suggestion: Organize community facing PH courses and events several times a year

Support for Student-Led Initiatives: C (40%)
Initiative(s) established: Student-led initiatives like the environmental society are encouraged
Suggestion: Establish formalized support and resources for long term PH projects

Campus Sustainability: D- (22%)
Initiative(s) established: LED lighting upgrades, water saving measures and recycling initiatives have been implemented, reducing energy consumption.
Suggestion: Expand recycling facilities and publish progress reports on campus sustainability goals regularly.

Pollution-Sensitive Asthma Exacerbations and Subsequent Dermatologic Morbidity in Atopic Dermatitis

Amanda N. Duong, BS[1]; Samantha Efobi, MS, BS[1]; Rhea Kodkani, BA[1]

[1]Drexel University College of Medicine

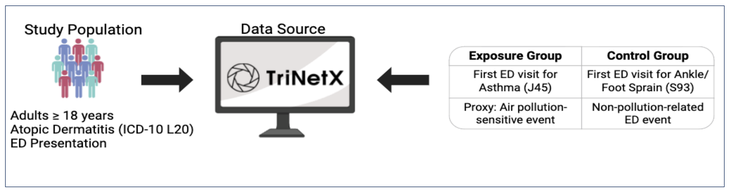
Abstract

Environmental pollution is increasingly recognized as a contributor to atopic dermatitis (AD) severity through mechanisms including aryl hydrocarbon receptor activation, oxidative stress, inflammation, and skin barrier disruption. To evaluate the association between atopic dermatitis and pollution we conducted a retrospective cohort study, using the TriNetX US Collaborative Network, of adults (≥18 years) with AD (ICD-10 L20) presenting to the emergency department (ED). The exposure cohort was indexed to a first ED visit for asthma (J45) as a proxy for air pollution–sensitive events, while controls were indexed to a first ED visit for ankle or foot sprain (S93). Cohorts were propensity score-matched on age, sex, and race/ethnicity. After matching (n=20,720 per cohort), the 30-day composite outcome of dermatologic flare–related conditions (cellulitis, cutaneous abscess, pruritus, contact dermatitis) occurred more frequently following asthma ED visits compared with sprain visits (5.42% vs 4.43%; RR 1.23, 95% CI 1.13–1.33; p<0.0001), with a significant increase in cutaneous abscesses (RR 1.57, 95% CI 1.15–2.14). These findings suggest that pollution-sensitive asthma exacerbations are associated with increased short-term dermatologic morbidity in adults with AD, supporting a climate and pollution-related impact on skin health.

Introduction

- Environmental pollution is an increasing contributor to systemic disease burden and is associated with greater severity and healthcare utilization in atopic dermatitis (AD).
- Each 10-µg/m³ increase in ambient pollutants (e.g., sulfur dioxide, nitrogen dioxide) is associated with increased AD emergency and outpatient visits [1].
- Air pollutants worsen AD through aryl hydrocarbon receptor activation, oxidative stress, pro-inflammatory signaling, and disruption of skin barrier function [2,3].
- The Atopic March links AD with asthma and other allergic diseases, reflecting shared barrier dysfunction and environmental triggers [4].
- Because AD and asthma show similar associations with pollution and climate factors, asthma exacerbations may serve as a proxy for environmental exposure burden.
- Real-world TriNetX data evaluating pollution-related outcomes in AD are limited, creating a gap in population-level understanding of environmental impacts.
- This study uses TriNetX data to evaluate the impact of air pollution on AD outcomes, using asthma exacerbation emergency visits as a proxy measure of environmental exposure burden.

Methods



In this retrospective study with TriNetX US collaborative Health Network, cohorts were propensity score–matched on age, sex, and race/ethnicity. The primary outcome was a 30-day composite of dermatologic flare–related conditions: cellulitis, cutaneous abscess, pruritus, and contact dermatitis.

Results

	AD + ED Asthma (N = 20,720)		AD + ED Sprain (N = 20,720)			
Demographics	Patients	% of Cohort	Patients	% of Cohort	P-Value	Std diff.
Current Age	40.1 ± 20.0	100%	40.6 ± 20.1	100%	0.0233	0.0223
Age at Index	34.3 ± 20.9	100%	34.8 ± 20.9	100%	0.0358	0.0206
Sex						
Female	13,743	79.21%	13,692	78.20%	0.5964	0.0052
Male	6969	20.76%	7022	21.80%	0.5819	0.0054
Ethnicity						
Hispanic or Latino	2315	10.13%	2380	11.00%	0.3137	0.0099
Not Hispanic or Latin	15,372	70.53%	15,331	68.84%	0.6457	0.0045
Unknown Ethnicity	3033	19.34%	3009	20.16%	0.7383	0.0033
Race						
White	11,052	67.59%	10,937	66.47%	0.2576	0.0111
Black or African	6612	22.14%	6419	22.05%	0.0412	0.0201
Asian	819	3.05%	863	3.05%	0.2734	0.0108
Native Hawaiian or Other Pacific Islander	129	0.44%	180	0.56%	0.0036	0.0286
American Indian or Alaska Native	97	0.58%	125	0.70%	0.0595	0.0185
Other Race	939	4.53%	1011	4.88%	0.0949	0.0164
Unknown Race	1072	5.17%	1185	5.72%	0.0144	0.0241

Table 1. Baseline characteristics of atopic dermatitis (AD) and emergency department (ED) asthma versus atopic dermatitis (AD) and emergency department (ED) sprain control cohorts, after propensity score matching.

Outcomes	AD + ED Asthma	AD + ED Sprain Risk	Risk Difference	P-Value	Risk Ratio	Relative Risk
Cellulitis and Acute Lymphangitis	0.941%	0.893%	0.048%	0.6063	1.054	5.40%
Pruritus	0.806%	0.700%	0.106%	0.2112	1.152	15.20%
Allergic Contact Dermatitis	0.338%	0.285%	5.300%	0.332	1.186	18.60%
Irritant Contact Dermatitis	0.097%	0.092%	0.001%	0.8727	1.053	5.30%
Unspecifified Contact Dermatitis	0.811%	0.787%	2.400%	0.7826	1.031	3.10%
Cutaneous Abscess, Furnucle and Carbuncle	0.492%	0.314%	0.179%	0.0041	1.569	56.90%

Fig 1. Risk differences (Asthma minus sprain) and risk ratios for the 30-day incidence for dermatological outcomes. Positive values indicate a higher risk with asthma. Statistical significance was defined as p<0.05.

- Propensity-matched cohorts were highly comparable (N = 20,720 per cohort) with minimal residual imbalance across demographics.
- AD + ED asthma was associated with significantly increased risk of cutaneous bacterial infection (RR 1.57; +56.9% relative risk increase; +0.18% absolute risk difference; p = 0.004).
- Pruritus and allergic contact dermatitis demonstrated modest relative risk increases (RR 1.15 and 1.19, respectively), though differences were not statistically significant.
- Cellulitis/lymphangitis and unspecified contact dermatitis subtypes showed minimal risk differences (RR ~1.03–1.05; non-significant).
- Absolute event rates remained low across outcomes, suggesting relative risk elevations were driven by small absolute differences.
- Overall pattern suggests infection-driven risk predominance rather than broad inflammatory dermatosis amplification in AD + ED asthma patients.

Discussion

- Pollution-sensitive asthma exacerbations were associated with increased short-term dermatologic morbidity among patients with atopic dermatitis, highlighting a climate-associated impact on skin health consistent with pollution-related skin barrier disruption and systemic inflammation.
- These findings reinforce prior research, suggesting a common shared mechanism: air pollutants induce pro-inflammatory changes that compromise airway and skin barrier integrity.
- Clinically, our findings highlight the need for counseling patients in more pollution-prone areas, patient education, and a more integrated method to disease management.
- Physicians should remain better informed about local air pollution trends to better anticipate and reduce pollution-associated exacerbations. Most importantly, our findings support the role dermatologists have as climate advocates, highlighting their unique role in addressing skin health and environmental change through education and policy engagement.

Future Prospects

- Future studies could determine lag windows and see if certain pollutants present with a characteristic lag period (same day exacerbation, exacerbation 1-7 days post exposure, or a cumulative exposure). The findings of this study would best inform when patients are most vulnerable after pollution increases.
- A future direction is to investigate the synergistic effects of various pollutants like PM2.5, PM10, NO2, SO2, O3 on atopic dermatitis exacerbations in the ER.

Acknowledgements

We thank TriNetX for access to the comprehensive clinical database.
The figure in the Methods section was created using BioRender.com. Scan the QR code for references.

Pollution-Sensitive Asthma Exacerbations and Subsequent Dermatologic Morbidity in Atopic Dermatitis

Amanda N. Duong, BS[1]; Samantha Efobi, MS, BS[1]; Rhea Kodkani, BA[1]

[1]Drexel University College of Medicine

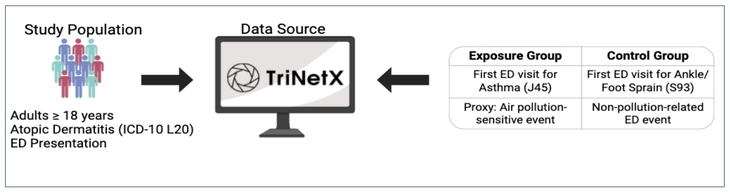
Abstract

Environmental pollution is increasingly recognized as a contributor to atopic dermatitis (AD) severity through mechanisms including aryl hydrocarbon receptor activation, oxidative stress, inflammation, and skin barrier disruption. To evaluate the association between atopic dermatitis and pollution we conducted a retrospective cohort study, using the TriNetX US Collaborative Network, of adults (≥18 years) with AD (ICD-10 L20) presenting to the emergency department (ED). The exposure cohort was indexed to a first ED visit for asthma (J45) as a proxy for air pollution–sensitive events, while controls were indexed to a first ED visit for ankle or foot sprain (S93). Cohorts were propensity score-matched on age, sex, and race/ethnicity. After matching (n=20,720 per cohort), the 30-day composite outcome of dermatologic flare–related conditions (cellulitis, cutaneous abscess, pruritus, contact dermatitis) occurred more frequently following asthma ED visits compared with sprain visits (5.42% vs 4.43%; RR 1.23, 95% CI 1.13–1.33; p<0.0001), with a significant increase in cutaneous abscesses (RR 1.57, 95% CI 1.15–2.14). These findings suggest that pollution-sensitive asthma exacerbations are associated with increased short-term dermatologic morbidity in adults with AD, supporting a climate and pollution-related impact on skin health.

Introduction

- Environmental pollution is an increasing contributor to systemic disease burden and is associated with greater severity and healthcare utilization in atopic dermatitis (AD).
- Each 10-µg/m³ increase in ambient pollutants (e.g., sulfur dioxide, nitrogen dioxide) is associated with increased AD emergency and outpatient visits [1].
- Air pollutants worsen AD through aryl hydrocarbon receptor activation, oxidative stress, pro-inflammatory signaling, and disruption of skin barrier function [2,3].
- The Atopic March links AD with asthma and other allergic diseases, reflecting shared barrier dysfunction and environmental triggers [4].
- Because AD and asthma show similar associations with pollution and climate factors, asthma exacerbations may serve as a proxy for environmental exposure burden.
- Real-world TriNetX data evaluating pollution-related outcomes in AD are limited, creating a gap in population-level understanding of environmental impacts.
- This study uses TriNetX data to evaluate the impact of air pollution on AD outcomes, using asthma exacerbation emergency visits as a proxy measure of environmental exposure burden.

Methods



In this retrospective study with TriNetX US collaborative Health Network, cohorts were propensity score–matched on age, sex, and race/ethnicity. The primary outcome was a 30-day composite of dermatologic flare–related conditions: cellulitis, cutaneous abscess, pruritus, and contact dermatitis.

Results

	AD + ED Asthma (N = 20,720)		AD + ED Sprain (N = 20,720)			
Demographics	Patients	% of Cohort	Patients	% of Cohort	P-Value	Std diff.
Current Age	40.1 ± 20.0	100%	40.6 ± 20.1	100%	0.0233	0.0223
Age at Index	34.3 ± 20.9	100%	34.8 ± 20.9	100%	0.0358	0.0206
Sex						
Female	13,743	79.21%	13,692	78.20%	0.5964	0.0052
Male	6969	20.76%	7022	21.80%	0.5819	0.0054
Ethnicity						
Hispanic or Latino	2315	10.13%	2380	11.00%	0.3137	0.0099
Not Hispanic or Latin	15,372	70.53%	15,331	68.84%	0.6457	0.0045
Unknown Ethnicity	3033	19.34%	3009	20.16%	0.7383	0.0033
Race						
White	11,052	67.59%	10,937	66.47%	0.2576	0.0111
Black or African	6612	22.14%	6419	22.05%	0.0412	0.0201
Asian	819	3.05%	863	3.05%	0.2734	0.0108
Native Hawaiian or Other Pacific Islander	129	0.44%	180	0.56%	0.0036	0.0286
American Indian or Alaska Native	97	0.58%	125	0.70%	0.0595	0.0185
Other Race	939	4.53%	1011	4.88%	0.0949	0.0164
Unknown Race	1072	5.17%	1185	5.72%	0.0144	0.0241

Table 1. Baseline characteristics of atopic dermatitis (AD) and emergency department (ED) asthma versus atopic dermatitis (AD) and emergency department (ED) sprain control cohorts, after propensity score matching.

Outcomes	AD + ED Asthma	AD + ED Sprain Risk	Risk Difference	P-Value	Risk Ratio	Relative Risk
Cellulitis and Acute Lymphangitis	0.941%	0.893%	0.048%	0.6063	1.054	5.40%
Pruritus	0.806%	0.700%	0.106%	0.2112	1.152	15.20%
Allergic Contact Dermatitis	0.338%	0.285%	5.300%	0.332	1.186	18.60%
Irritant Contact Dermatitis	0.097%	0.092%	0.001%	0.8727	1.053	5.30%
Unspecifified Contact Dermatitis	0.811%	0.787%	2.400%	0.7826	1.031	3.10%
Cutaneous Abscess, Furnucle and Carbuncle	0.492%	0.314%	0.179%	0.0041	1.569	56.90%

Fig 1. Risk differences (Asthma minus sprain) and risk ratios for the 30-day incidence for dermatological outcomes. Positive values indicate a higher risk with asthma. Statistical significance was defined as p<0.05.

- Propensity-matched cohorts were highly comparable (N = 20,720 per cohort) with minimal residual imbalance across demographics.
- AD + ED asthma was associated with significantly increased risk of cutaneous bacterial infection (RR 1.57; +56.9% relative risk increase; +0.18% absolute risk difference; p = 0.004).
- Pruritus and allergic contact dermatitis demonstrated modest relative risk increases (RR 1.15 and 1.19, respectively), though differences were not statistically significant.
- Cellulitis/lymphangitis and unspecified contact dermatitis subtypes showed minimal risk differences (RR ~1.03–1.05; non-significant).
- Absolute event rates remained low across outcomes, suggesting relative risk elevations were driven by small absolute differences.
- Overall pattern suggests infection-driven risk predominance rather than broad inflammatory dermatosis amplification in AD + ED asthma patients.

Discussion

- Pollution-sensitive asthma exacerbations were associated with increased short-term dermatologic morbidity among patients with atopic dermatitis, highlighting a climate-associated impact on skin health consistent with pollution-related skin barrier disruption and systemic inflammation.
- These findings reinforce prior research, suggesting a common shared mechanism: air pollutants induce pro-inflammatory changes that compromise airway and skin barrier integrity.
- Clinically, our findings highlight the need for counseling patients in more pollution-prone areas, patient education, and a more integrated method to disease management.
- Physicians should remain better informed about local air pollution trends to better anticipate and reduce pollution-associated exacerbations. Most importantly, our findings support the role dermatologists have as climate advocates, highlighting their unique role in addressing skin health and environmental change through education and policy engagement.

Future Prospects

- Future studies could determine lag windows and see if certain pollutants present with a characteristic lag period (same day exacerbation, exacerbation 1-7 days post exposure, or a cumulative exposure). The findings of this study would best inform when patients are most vulnerable after pollution increases.
- A future direction is to investigate the synergistic effects of various pollutants like PM2.5, PM10, NO2, SO2, O3 on atopic dermatitis exacerbations in the ER.

Acknowledgements

We thank TriNetX for access to the comprehensive clinical database.
The figure in the Methods section was created using BioRender.com. Scan the QR code for references.

Legacy Asbestos Exposure as an Environmental Justice Threat in a Changing Climate: A Risk-Assessment Perspective

Jaspreet Kaur Dhaliwal, BDS, MPH, Diti Shah, BDS, MPH, Dr. Lindsay Tallon, PhD

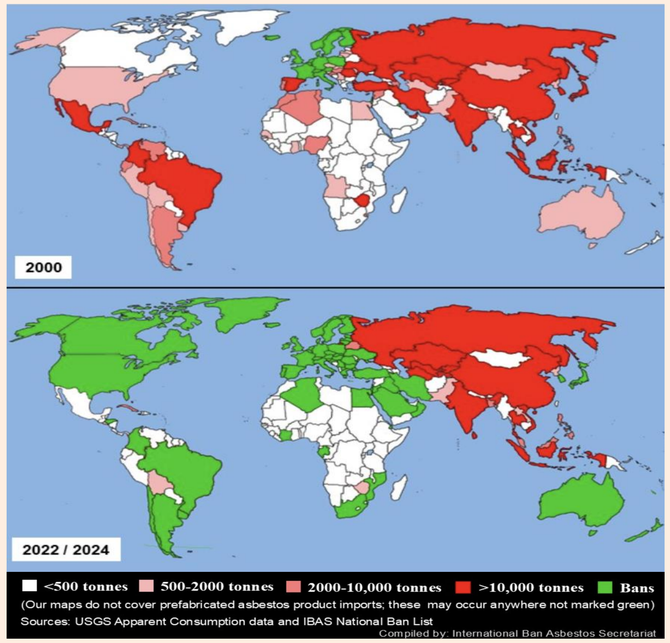
Massachusetts College of Pharmacy and Health Sciences

Introduction

- Legacy asbestos remains a persistent carcinogenic hazard and there is no safe level of exposure for asbestos.
- Climate stressors (e.g., flooding/extreme weather) plus renovation/demolition can disturb asbestos-containing materials (ACMs) in older housing + water infrastructure, increasing exposure opportunities.
- Environmental justice lens: underserved communities may face higher risk due to aging buildings, occupational vulnerabilities, and unequal access to remediation/abatement.
- **Health impacts:** asbestos exposure is linked to serious diseases including asbestosis, lung/laryngeal cancer, pleural disease, and malignant mesothelioma (often after long latency)
- **Objective:** Assess legacy asbestos exposure as an environmental justice issue in the context of climate change and infrastructure stress.

Methods

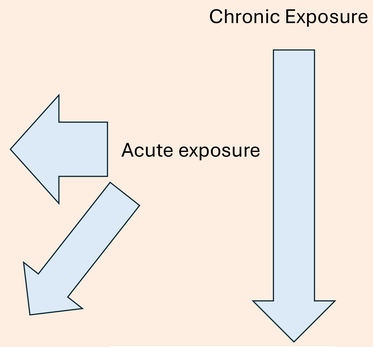
- **Study design:** Systematic literature review with a public health risk-assessment framing.
- **Database searched:** PubMed.
- **Search limits/filters:** English; human studies; free full text; publication years 2005–2026.
- **Key search terms:** “Asbestos”; “Housing quality and asbestos”; “Mesothelioma OR Asbestosis”; “asbestos health risk”.
- **Grey literature / additional sources:** Targeted searches of public health and government agency sources (e.g., CDC, ATSDR, EPA).
- **Eligibility:** Included human studies/reports relevant to legacy asbestos/ACM exposure and public health outcomes; excluded non-human/lab-only/non-U.S./not relevant.
- Identified 81 records + 12 additional sources; screened 93; full texts assessed 91; excluded 79; not retrieved 2; included 12 studies.



Pleural Plaques

Asbestosis

Pleural Mesothelioma



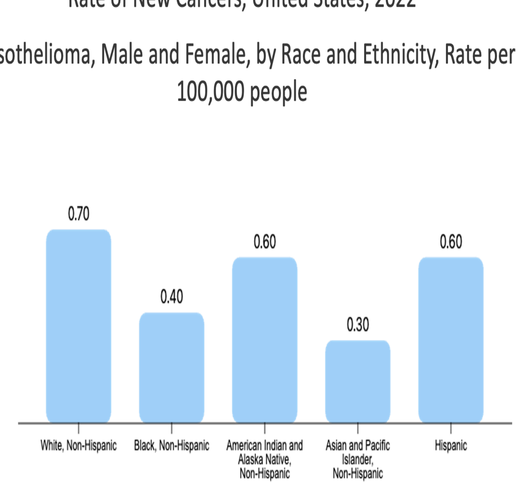
Key points

1. CEL = Cancer Effect Level (level associated with statistically significant increased risk of cancer)
2. Intermediate exposure = 15–364 days; chronic exposure = ≥365 days.
3. Exposure units for human studies are often reported in fiber-years/mL (f-yr/mL), which reflect cumulative workplace inhalation exposure levels associated with disease outcomes.

USCS-ExpandedCancer-Chart

Sex	Age-Adjusted Rate	Case Count	Population
Male and Female	0.6	2669	333271411
Male	1.0	1877	164963406
Female	0.4	792	168308005

Exposure Setting	Exposure Metric	Effect Level (ppm or fibers-yr/mL)	Outcome/Effect	Reference
Intermediate Exposure	Systemic (Rat)	~10 (hyperplasia)	Respiratory hyperplasia	Nitschke et al., 1981
Chronic Exposure	Rat (18 mo)	20	CEL — Multiple organs	Wong et al., 1982
Chronic Exposure	Rat (89–104 wk)	10	CEL — Lung tumors and nasal tumors	NTP, 1982
Chronic Exposure	Mouse (79–103 wk)	10	CEL — Lung tumors, hemangiosarcoma	NTP, 1982
(Note A)	Estimated upper-bound cancer risk levels show a range of lifetime exposure associated with excess cancer risk of 1×10^{-4} to 1×10^{-7} (fiber-yr/mL)	—	See Figure 3-1	EPA/ATSDR risk assessments



Source - U.S. Cancer Statistics Working Group. U.S. Cancer Statistics Data Visualizations Tool. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute;https://www.cdc.gov/cancer/dataviz, released in June 2025.

Health Impacts

- Lung cancer – increased risk from inhaled fibers.
- Mesothelioma – fatal cancer of lung/abdomen linings.
- Asbestosis – scarring of lung tissue → difficulty breathing.
- Pleural disease – pleural thickening/fluid impairing lungs.
- Other cancers – evidence suggests asbestos may cause cancers of the larynx, ovary, stomach, and colorectum.
- Progressive respiratory impairment – chronic inhalation leads to long-term lung damage and reduced quality of life.

Public Health Recommendation

- Inspect & assess older buildings/infrastructure for asbestos-containing materials (ACMs) before any work begins (CDC).
- Prioritize disturbed ACMs (highest risk); undisturbed ACMs may be managed safely if left intact and monitored.
- Use certified/trained abatement contractors and follow EPA-recommended procedures for any removal or remediation.
- Encapsulate/enclose ACMs when appropriate (often a cost-effective control option).
- Implement an Operations & Maintenance (O&M) program (routine checks, safe work practices, training) to prevent re-disturbance.
- Ensure safe disposal of asbestos waste (hazardous waste landfills) and strengthen policy enforcement to reduce exposure.

Results

- Review of CDC and EPA data confirms asbestos as a known human carcinogen.
- No safe exposure threshold has been established.
- Highest exposure levels occur during disturbance of asbestos-containing materials (ACMs).
- Occupational settings show significantly greater risk than environmental background exposure.
- Construction, abatement, and firefighting workers experience the greatest exposure burden.
- Secondary household exposure is documented through take-home fibers.
- Health outcomes most strongly associated with exposure include.
- Asbestosis, lung cancer, mesothelioma, and pleural disease
- Asbestos-related diseases demonstrate a long latency period (20–30 years).
- Despite regulatory controls, legacy asbestos in older buildings continues to contribute to ongoing exposure risk.

Acknowledgment

We thank MCPHS faculty and Prof. Lindsay Tallon for guidance.

References

Rethinking Waste in the Birth Center - Small Changes Big Impact

By Laura Weill and Hannah Kelley

Objectives:

- **Identify** sources of unnecessary waste and cost in the Birth Center
- **Implement** initiatives through staff education and changes to supplies
- **Quantify** environmental and financial impacts of initiatives
- **Reduce** red bag waste by reducing upstream waste production and adding landfill waste stream to the operating rooms
- **Start** medical supplies donation program in Birth Center

Methods:

- **Work flow observation:** Shadow midwives, doctors and nurses in procedures such as vaginal births, c sections, and dilation and curettage.
- **Identify areas of high waste and cost:** Informal interviews with staff and assessing purchasing records.
- **Intervention Design and Implementation:** Create educational presentations for the staff, collaborate with management and Sustainability Department.
- **Waste Audit and Data Collection:** Waste audits using Zabble app in L&D ORs, supply usage data, unit costs, and disposal costs were obtained from institutional purchasing records. CO_2 savings were calculated from red bag steam sterilization data.

Results:

- Foley urine emptying, BP cuff/monitor belt standardization, and tap water substitution projected to save **$17,000 in annual cost** and substantial CO_2 reductions.
- Placement of landfill bins in L&D ORs diverted **>70 lbs of non-bloody waste in one week** with **<10% contamination**.
- The Medical Supply Donation program donated **over 1000 lbs** of medical supplies in three months.

Conclusion:

- **Small, low-barrier workflow changes** can produce meaningful environmental and financial benefits in Labor & Delivery.
- Sustainability interventions can be implemented **without compromising patient safety or clinical efficiency**.
- These strategies are **scalable and transferable** to other hospital units.

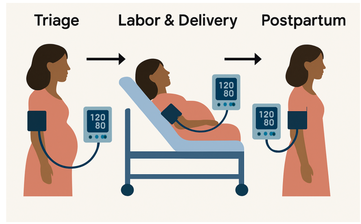
Foley Catheter Initiative:

One major initiative in this project focused on reducing unnecessary red-bag waste generated from Foley catheter disposal practices. Currently, Foley bags are discarded with urine still inside, adding significant waste to the red bag which must be steam sterilized before entering the landfill, an energy intensive and costly process.

By adopting the improved practice of emptying urine into the toilet before disposal, the unit can reduce yearly waste management costs by more than **$5,000 and cut over 3,600 kg of CO_2 emissions each year**. This intervention not only lowers environmental impact, but also supports more sustainable, cost-effective clinical workflows.

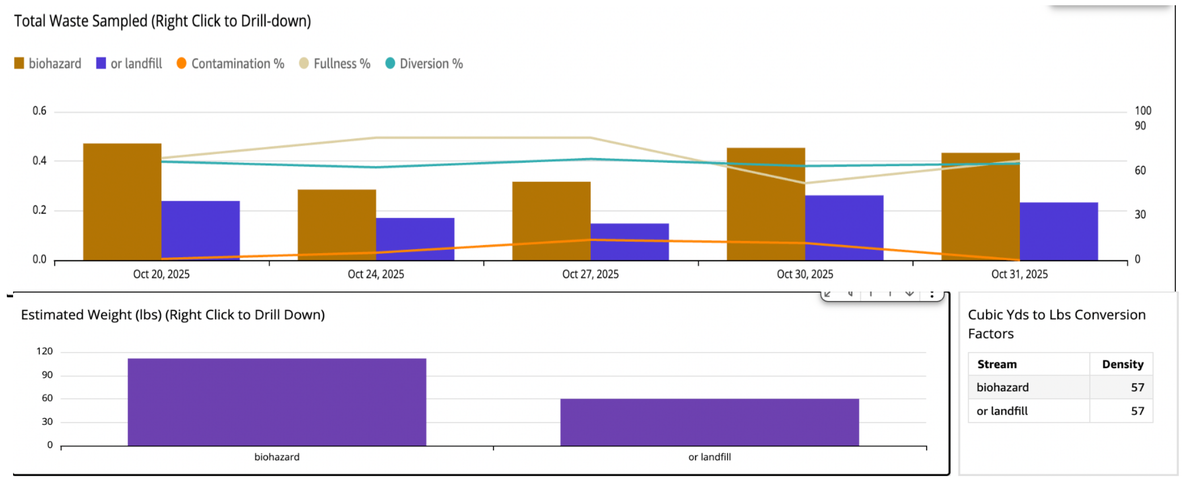
Blood Pressure Cuff and Monitor Belt Initiative

Multiple blood pressure cuffs and monitor belts are used per one patient: one in triage, another in L&D, and another in postpartum. If we keep the same BP cuff and pair of monitor belts on the patient throughout their Birth Center stay, this would **save 1,095 lbs of waste and $11,544.89** a year on BP cuffs and monitor belts. The project demonstrates how small operational changes can create meaningful environmental and financial benefits within the Birth Center.



Placing Landfill Bins in the OR

After shadowing several procedures in the OR and talking to staff members it was concluded that overuse of the red bag waste for landfill waste is one of the most urgent issues. A landfill bin was placed in each of the three ORs to collect non-bloody waste. The UCSF Health Sustainability Department has audited the L&D ORs and found that **over 70 lbs** was diverted from the red bag waste to the landfill stream, with an average of **<10% contamination.**



Medical Supplies Donation

UCSF Health has partnered with Medcycle Network, a non profit that donates unopened, unused, unexpired medical supplies to local San Francisco clinics to serve and support people who are uninsured and underinsured. The donation program was implemented in the Birth Center in September and has been a huge success in diverting what would have been waste to be used in giving back to the community. Over **1000 lbs** of medical supplies have been donated to local clinics from UCSF Health.

Iodine Bottle Initiative

The Birth Center's newest initiative is transitioning from using iodine bottles to swabs. This change is **cost efficient:** Currently the bottles are over $1, whereas the iodine swabs are only $0.07 per unit. This change helps keep the **quantity appropriate** as swabs provide a more appropriate and controlled amount of iodine for typical procedures. Iodine bottles are around **0.1 lb of plastic** and are classified as hazardous waste which poses a threat to human health when not properly disposed of.

Tap Water for Wound Irrigation

Switching from sterile water on the delivery tray, to tap water is one of the current proposed initiatives. A study at UMAss Med School studied the rate of infection when irrigating wounds with sterile water, saline or regular tap water and found no difference in the rate of infections.

Making the transition to tap water could **save UCSF Health up to $11,000 a year in the Birth Center alone.**

Using tap water at all hospitals instead of sterile water or saline could **save 11 million plastic bottles from being produced, shipped, stored and disposed of.**

BUILDING COMMUNITY-LED RESILIENCE: A TAILORED INTERVENTION FOR EXTREME HEAT IN NORTH FAIR OAKS

Riya Bhatia and Julianne Park

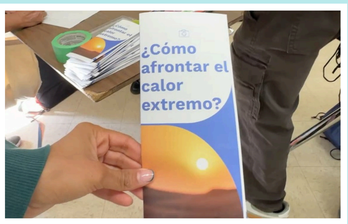
Introduction

Extreme heat is an increasingly frequent and severe consequence of climate change, putting millions of people at risk of heat exhaustion, heat stroke, exacerbation of chronic disease, and mortality. Unfortunately, these events disproportionately impact communities like North Fair Oaks in the Bay Area.

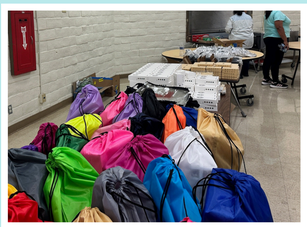
North Fair Oaks, an unincorporated community in San Mateo County, is predominantly Latino, immigrant, and low-income. Structural underinvestment, absence of local governance, socioeconomic vulnerability, and barriers to accessing resources hinder community resilience and amplify climate-related health risks during extreme heat events.

Objective

1. To develop and implement a community-informed culturally competent extreme heat preparedness intervention
2. Create a framework for community-tailored disaster preparedness and climate-health resilience in frontline communities.



Spanish Extreme Heat Brochure



Extreme Heat Kits

Student volunteers distribute resources

Residents line up to collect resources

Methodology

01 **Identification**: After identifying extreme heat as a threat to North Fair Oaks, we explored current efforts to address the problem and partnered with Climate Resilient Communities (CRC).

02 **Listening Session:** We attended the North Fair Oaks communities monthly resilience meeting at which, we pitched the idea of *Extreme Heat Kits* and gathered community input on experiences with extreme heat, barriers to resource access, and knowledge gaps.

03 **Tailoring**: Integrating the community input and requests, we designed a tailored workshop meeting both cultural and logistical needs

Results Part 1:

Stage 1: Listening Session (May 2025)
~ 40 resident attendees
Barriers identified included: reluctance to leave home and use cooling centers, preference for Spanish-language and visual materials due to low literacy, and greater interest in community-based education

Physician-led Extreme Heat Presentation

Stage 2: Extreme Heat Kit Distribution & Educational Workshop (July 2025)
~ 60 resident attendees
Format:

- CRC introduction and launch workshop
- San Mateo Emergency Department disaster preparedness demonstration
- Stanford Medicine heat related illness spanish presentation by Dr. Lisa Patel, covering heat illness, protecting vulnerable populations, labor protections during heatwaves, and other community questions
- Stanford Climate & Health provides instructions to people on how to build kit
- Build-your-own kit session! Distributed over 60 extreme heat kits containing rechargeable fans, medication cooling pouches, electrolytes, power banks, Spanish-language pamphlet

Fans for extreme heat kits.

Results Part 2: Scalable Framework for Community-Tailored Disaster Preparedness

From this intervention, we developed the ***LISTEN–ACT*** framework to guide community-tailored disaster preparedness in other settings. By recognizing that vulnerabilities and effective solutions vary by context, the model centers structured community engagement while remaining adaptable to each community's language, culture, and lived realities. By combinging local specificity and standardized methodology, ***LISTEN–ACT*** provides a scalable and replicable approach to equitable, community-driven climate resilience.

L isten/learn from community
I dentify key problem
S ynthesize solution
T ailor to local specific needs
E quip with culturally relevant resources
N avigate logistics (funding,etc.)

A ctivate solution/execute
C ross-collaborations
T rack/monitor/evaluate

Next Steps:

1. Building on the success of this pilot, the LISTEN-ACT model will be applied to future projects in different regions, communities, and climate-health contexts, demonstrating its scalability and adaptability.
2. While this project focused on immediate, home-based solutions for extreme heat, future efforts will emphasize *sustainable*, long-term resilience by addressing structural vulnerabilities amd strengthening community systems within local infrastructure and resources.

Silent Strain: Community Health Risks Near Expanding Data Center Infrastructure

Prit Patel[1], Sneha Sundar[2], Erin Miller MD[1]

1. Wayne State University School of Medicine
2. Michigan State University College of Osteopathic Medicine

Objective

Artificial Intelligence (AI) has been finding itself in more scientific spaces in the past couple of years. While AI can be quite useful, it is important to examine the environmental and health consequences that manifest from the emissions produced by the infrastructure required to support the energy and computing demands. There are established links between industrial emissions and cardiopulmonary and metabolic diseases, however, there is limited quantitative data evaluating the effects of data centers and the communities they are placed in. In this study, we used spatial analysis to analyze how environmental exposures, industrial emissions, and demographic indicators surrounding U.S. data centers relate to population health outcomes.

Methods

Data Collection

Im3 open source– List of Data Centers in Michigan
EJScreen 2024 (EPA) – Demographics + Environmental Indicators (3 & 10 mi)
eGRID 2023 (EPA) – Power Plant Emissions + Generation (3, 10, 20 mi)
WorldPop 2023 – Population Counts

- Created 3-, 10-, and 20-mile buffers around 1242 data centers and aggregated data using population-weighted means in QGIS
- One-way ANOVA with Turkey post hoc tested distance-based differences
- Poisson regression models used to estimate
- Health outcomes analyzed included prevalence of hypertension, cancer, asthma, and COPD

Visualization

Spatial maps created in **QGIS**, plots using **Python**

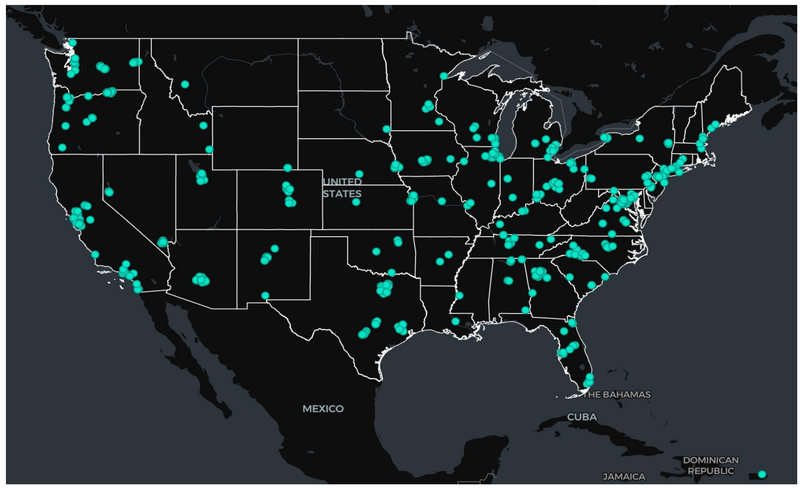
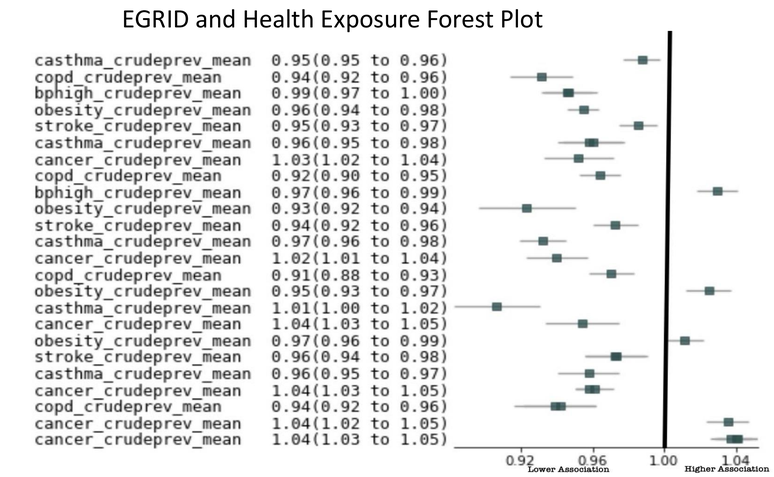
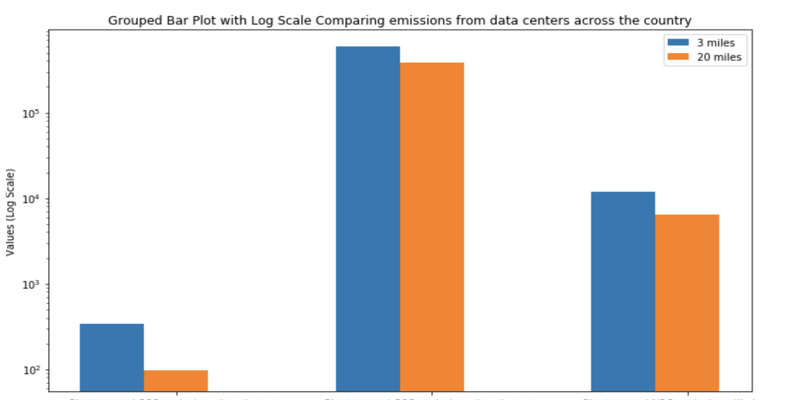


Figure 1: Locations of Michigan data centers (yellow) and Corresponding Power Plants (red). Buffers of 3 (purple), 10, and 20 (green) miles were drawn around each data center to quantify surrounding population characteristics (EJScreen) and power-plant emission burdens (eGRID). Data shown in QGIS.





Results

Communities near data centers were more densely populated, more racially diverse, and had a higher proportion of children, with greater potential exposures to hazardous waste sites, powerplant emissions, and contaminants in drinking water (ANOVA, $p<0.05$).

Of 631 exposure-health pairs, 35 demonstrated significantly greater prevalence ratios closer to data centers, including 26 from EJScreen and 9 from eGRID (Poisson, $p<0.05$)

Notable significant relationships included
- traffic proximity with COPD (PR=1.09, CI: 1.6-1.12, $p<0.001$),
- diesel particulate matter concentration with COPD (PR=1.05, CI:1.02-1.08, $p<0.001$)
- plant SO_2 emissions with cancer (PR=1.04, CI: 1.03-1.05, $p<0.001$).

Discussion

- Stronger near facility associations for asthma, COPD, and cancer ➔ data centers may intensify existing exposure disease burdens
- Local air pollution, infrastructure, and social vulnerability can further amplify chronic disease risk
- For medical students and clinicians, awareness of health gradients may inform chronic disease management, preventative screening, counseling, and advocacy work as data center use increases
- Provides context to encourage medical personnel to become more involved in transition into clean energy

Irrigation of Traumatic Lacerations in the ED: Evidence on Tap Water as an Alternative to Sterile Saline – A Scoping Review

Annik Irving BS[1], Mary Neil Hodl MS,[1] Evan Wade BA[1], Bea Calvert MA, MLIS, AHIP[2], Kerstin Honer Zu Bentrup PhD[1], Marc Futernick MD[3], FACEP, Ann-Christine Duhaime MD[4]

INTRODUCTION

Effective wound irrigation is essential for preventing infection and promoting healing in traumatic lacerations. Sterile saline has traditionally been regarded as standard of care for irrigation. However, tap water has also been proposed as a practical, low-cost alternative. Multiple randomized controlled trials and systematic reviews have shown equivalent infection rates between tap water and sterile saline. Despite this growing body of evidence for tap water as an alternative irrigation fluid, barriers to widespread implementation include concerns about water quality, absence of standardized guidelines, and variability in technique.

METHODS

This scoping review adhered to the PRISMA-ScR framework and followed established guidance for evidence mapping. Comprehensive searches of PubMed, Embase, CINAHL, and Scopus combined search terms related to emergency care, wound irrigation, and fluid type. Titles and abstracts were screened using Covidence. Data extraction included study design, population characteristics, intervention details, infection outcomes, and cost analyses. Findings were synthesized narratively.

Inclusion Criteria	Exclusion Criteria
All ages	Puncture, penetrating, and gunshot wounds
Acute and traumatic sutured dermal lacerations irrigated and repaired in the ED	Elective surgeries or non-traumatic wounds, lesions, or incisions
Animal and human bites	Non-human subjects
All classes of wound contamination	Non-peer-reviewed opinion papers, commentary, case studies, and literature responses
All patient characteristics	Full text in languages other than English
Follow-up period less than or equal to 1 year	No comparison of infection rates
U.S. and international studies	Surgical irrigation comparisons
Peer-reviewed literature, gray literature, and position papers	

Table 1: Study Inclusion and Exclusion Criteria

RESULTS

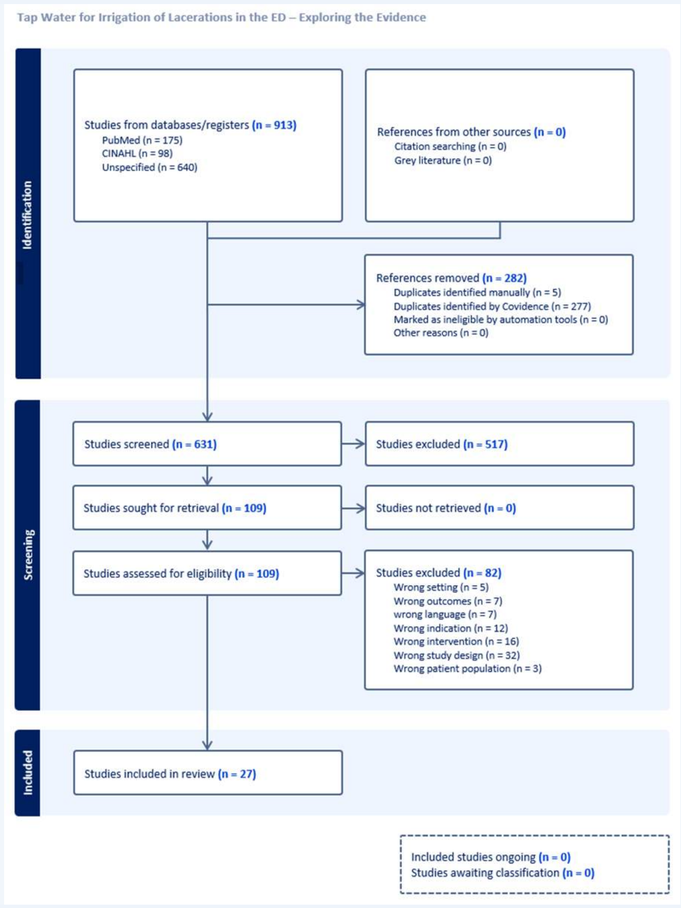


Fig 1. PRISMA flow diagram

A total of 913 records were identified; after screening and eligibility assessment, 27 studies were included. These comprised randomized controlled trials (n = 10), systematic reviews (n = 5), and observational studies (n = 12).

Across six randomized controlled trials, infection rates did not differ significantly between tap water and saline irrigation. Systematic reviews corroborated these findings.

Two studies specifically emphasized irrigation pressure as a critical determinant of infection risk. High-pressure irrigation reduced infection rates approximately five-fold compared to low-pressure methods. Large-volume irrigation was also associated with improved outcomes.

Two studies evaluated economic impact. Moscati et al. estimated annual U.S. savings of $65.6 million if tap water replaced saline for ED wound irrigation. Valente et al. reported similar cost reductions in pediatric settings.

Definitions of infection, irrigation protocols, and follow-up durations varied widely, limiting comparability. Few studies addressed vulnerable populations such as pediatric or immunocompromised patients.

DISCUSSION

This scoping review found no clinically significant difference in infection rates between wounds irrigated with tap water and those irrigated with sterile saline, reinforcing the growing body of evidence challenging the assumption that sterile saline is essential for infection prevention.

Prior studies have emphasized that irrigation technique, including pressure and volume, may be more influential than fluid type. Cost analyses further highlight tap water's potential economic benefits.

Several limitations of this review warrant consideration, including small sample size, heterogeneity in study characteristics, studies originating from high-resource settings, and underrepresentation of unique populations.

Further research should focus on comparison across populations, cost-effectiveness analyses, and development of evidence-based guidelines that prioritize irrigation technique over fluid sterility.

CONCLUSION

This review provides a foundation for re-evaluating irrigation practices and highlights critical gaps that must be addressed to optimize wound care globally.

As a scoping review, the goal of this study was to survey the existing landscape of literature rather than to apply systematic review methodology; therefore, it cannot support a formal recommendation of tap water over sterile saline for irrigation.

That said, in settings where tap water is regularly tested and uncontaminated, particularly in high-income countries, the literature consistently supports tap water as an alternative to sterile saline for irrigation of traumatic lacerations in the Emergency Department, especially when viewed through a cost-effective and resource-conscious lens.

AFFILIATIONS

1. Tulane University School of Medicine
2. Matas Rudolph Library of Health Sciences, Tulane University
3. U.S. Acute Care Solutions
4. Harvard Medical School

Created with BioRender Poster Builder

Virtual or In-Person? A Cross-Sectional Study of United States Residency Interview Formats for Match 2025

Patrick Quinn, BA, Zoe VanderHoek, BS, Ryan Christ, DPhil, Brian Prigmore, MD, Molly Joyce, MPH, Haley D. Smith, BS, Ruth Carver Bondurant, MM, Sydney Laxson, BS, Elise Brannen, MD, Fiona Stefanik, MD, Jenny Rose Park, MD, Lori Sun, BA, Alexandra Hoffman, BS, Eden VanderHoek, BS, Derek Wong, BS, Zachary Yellowman, MS, Katherine Velicki, MD - Department of Orthopaedic Surgery, Oregon Health & Sciences University

Background

- Since the United States medical residency Match process was established in 1952, US residency interviews have traditionally been conducted in person.[1]
- An abrupt transition to virtual interviews occurred during the COVID-19 pandemic following a mandate by the Coalition for Physician Accountability to conduct interviews virtually for the 2020-2021 applicant season.[2]
- Over the last 5 years since the COVID 19 pandemic, residency programs across the US have experimented with virtual, in-person, and hybrid interview formats.
- Attending in-person residency interviews routinely costs applicants over $5,000, involves substantial amounts of time, and can burn the equivalent of 440 gallons of gasoline per applicant per cycle. [3-7]

Objectives

- This study aimed to determine residency interview formats across 23 specialties in the United States for 28,760 US seniors applying for residency during the 2024-2025 application season.
- The primary outcome of the study was the percentage of United States medical residency programs that conducted virtual, hybrid, and in-person interviews respectively.

Results

- Residency interview format was successfully determined for 4014 of 4863 total programs (82.5%), leaving 849 programs unknown.
- Most common sources used to determine interview format were email and phone correspondence with program coordinators (1816, 45.2%), program websites (1345, 33.5%), and specialty-specific databases (586, 14.6%).
- Most interviews were held virtually (2989, 74.5%), although some were conducted via in-person (700, 17.4%) and hybrid (325, 8.1%) formats ($p < 2.2 \times 10^{-16}$).
- In-person interviews were most favored by otolaryngology (86.3%), plastic surgery (85.2%), neurosurgery (84.5%), orthopaedic surgery (70.3%), and thoracic surgery (56.0%).
- Hybrid interviews were most common in family medicine (23.0%), urology (21.8%), and emergency medicine (17.0%).
- The Northeast (77.1%) and the West (76.4%) conducted higher rates of virtual interviews compared to the Southeast (73.2%), Midwest (73.0%), and Southwest (70.7%).

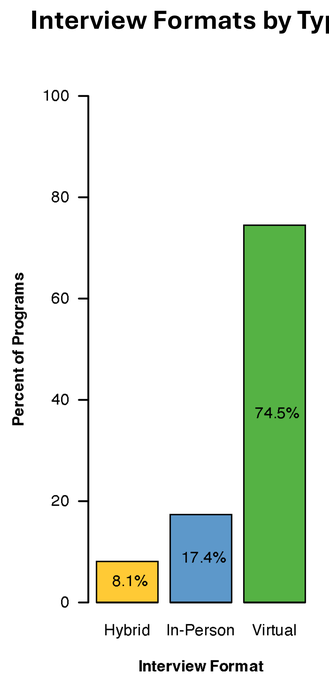


Fig. 1. Total Percentages of Virtual, Hybrid, and In-Person Residency Interviews in the United States across 23 Specialties

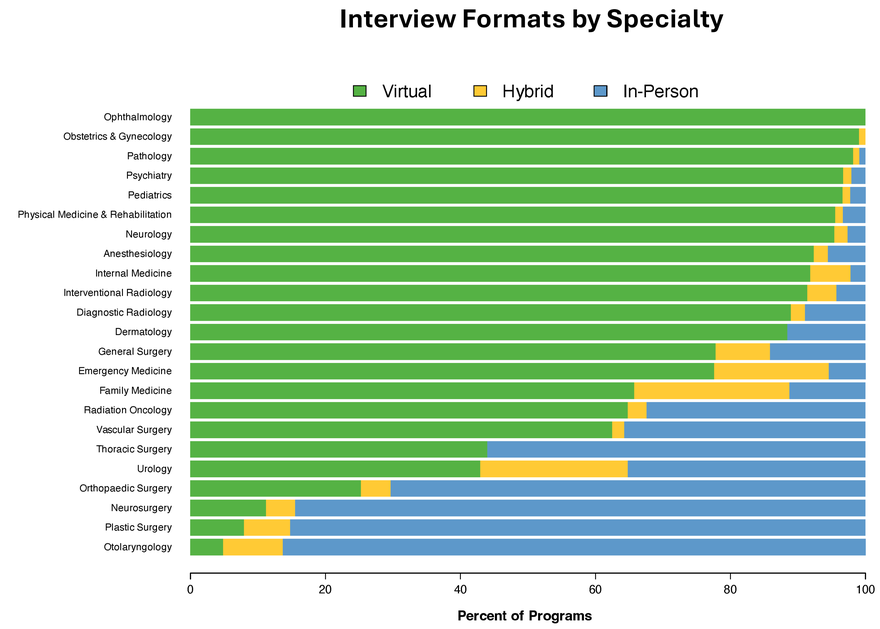


Fig. 2. Residency Interview Formats by Specialty

Methods

- A comprehensive list of all residency programs within 23 specialties were compiled to determine program interview formats for Match 2025.
- Main information sources included specialty-specific databases, individual program websites, and emails with program coordinators.
- Interview format, location, and Doximity reputation ranking were assessed for each residency program.
- Pearson's Chi-squared tests were conducted to determine statistical significance between interview format trends and state, region, and Doximity ranking.

Discussion

- Since the COVID-19 pandemic, a 2024 AAMC recommendation supporting the virtual interview format, along with previous studies, have indicated the success and efficacy of the virtual interview format. [8]
- A program's specialty, more than its geographic location or perceived prestige, has the greatest influence on interview format type.
- Differing interview formats across residency specialties offers increased complexity, equity challenges, additional student debt burdens, and a substantial global impact on climate change.
- Despite cost savings and reduced CO_2 emissions, studies still indicate lack of unanimous agreement on the effectiveness of the virtual interview format. [9-10]

Conclusion

- Due to their substantial convenience, cost savings, and reduced carbon emissions, we recommend that virtual interviews be considered wherever possible.
- In specialties that are unwilling to universally adopt the virtual interview format, a hybrid approach could be considered.
- In a time when 70% of medical students carry educational debt and the planet has exceeded 1.5°C of warming, it is time to optimize the residency interview process.

References

1. Roth AE. The Origins, History, and Design of the Resident Match. JAMA. 2003;289(7):909–912.
2. Antono B, Willis J, Phillips RL Jr, et al. The Price of Fear: An Ethical Dilemma Underscored in a Virtual Residency Interview Season. J Grad Med Educ. 2021 Jun;13(3):316-320.
3. Gorgy M, et al. Comparison of cost changes due to the COVID-19 pandemic for Dermatology residency applications in the USA. Clin Exp Dermatol. 2022 Mar;47(3):600-602.
4. Gordon AM, et al. Costs of U.S. Allopathic Medical Students Applying to Neurosurgery Residency: Geographic Considerations and Implications for the 2020-2021 Application Cycle. World Neurosurg. 2021 Jun
5. Susarla SM, et al. The Perception and Costs of the Interview Process for Plastic Surgery Residency Programs: Can the Process Be Streamlined? Plast Reconstr Surg. 2017 Jan;139(1):302e-309e.
6. Kraft DO, et al. Applicant Perspectives on Virtual Otolaryngology Residency Interviews. Ann Otol Rhinol Laryngol. 2022 Dec;131(12)
7. Fogel H, et al. The Economic Burden of Orthopedic Surgery Residency Interviews on Applicants. Iowa Orthopaedic Journal. 2016; 36:26-30.
8. Lenze NR, et al. Evaluation of Residency Applicant Preferences for Continuing Virtual Interviews: A National Database Analysis. J Grad Med Educ. 2025 Feb;17(1):63-70.
9. Asaad M, et al. The Experience of Virtual Interviews in Resident Selection: A Survey of Program Directors in Surgery. J Surg Res. 2022 Feb
10. Mun F, et al. AAMC Guidance on Interviewing for the 2022-2023 Residency Application Cycle: Orthopaedic Program Director Perspectives. JBJS Open Access. 2022 Dec 8;7(4):e22.00075.