

An Interprofessional Approach to Prepare Medical Residents and Fellows to Address Climate- and Environment-Related Health Risks

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Physicians are entering the workforce in the context of rapid climate and environmental changes, meriting explicit training on their impacts on health.^{1,2} Arguments for inclusion of climate change education in medical curricula³ have yielded meaningful strides in some graduate medical education (GME) programs,⁴ in alignment with recent American Medical Association policy.⁵ Yet, trainees have expressed broader concerns over deficits in their preparation for future public health threats.⁶ These largely reflect challenges in delivering climate change education, including: (1) effectively incorporating climate and health content into dense didactic content and intensive clinical rotation schedules; and (2) weaving climate and health content into a curriculum when faculty may lack transdisciplinary expertise. Based on experience offering a team-taught, interprofessional education (IPE) course in climate and health at Oregon Health & Science University (OHSU),⁷ we believe that interprofessional, collaborative teamwork can help prepare residents and fellows to address “wicked problems”⁸ related to climate impacts on health. IPE is an efficient and effective approach to provide critical foundational knowledge, support application to practice, and develop essential teamwork skills.

An IPE Model for Climate and Health: Teamwork Makes the Dream Work

At OHSU, we introduce climate and health topics through IPE in undergraduate medical education (UME) (see online supplementary data), with participation by faculty members across health care disciplines (family medicine, obstetrics, psychiatry, psychology, nutrition, public health, and nursing) and students from the Schools of Medicine, Nursing, Public Health,

and Dentistry, as well as the College of Pharmacy.⁷ Collaboration with more than 10 instructors across professions and fields offers a novel and efficient approach to teach complex and wide-ranging material while modeling how teamwork is used to accomplish common goals. Weekly videoconference meetings enable further collaboration and opportunities for scholarship, grand rounds, and additional educational offerings. Throughout these endeavors, faculty mentors collaborate with upper-level medical students, residents, and fellows, providing additional training for emerging physician-leaders in climate and health; engagement in such mentored experiences has the added benefit of reducing burnout risk in residents and fellows by stimulating a sense of accomplishment and support at a critical time in their careers.⁹

Our students demonstrate understanding of climate health risks, synthesize knowledge, and communicate impacts through group poster projects and interactive blogs, where they explore how interprofessional teams can address climate and health issues collaboratively (see online supplementary data). Residents and fellows could further develop action-oriented solutions, aligned with their specialty, to address specific aspects of climate and health for improved patient care or climate change mitigation in clinical environments with emphasis on application to practice (TABLE). For example, anesthesiology residents and fellows could advocate for adoption of alternatives to volatile anesthetics to reduce greenhouse gas emissions.^{10,11} Trainees in psychiatry may explore innovations in the composition and functioning of mental health interprofessional care teams, such as evaluating approaches that focus on wraparound services¹² that might improve responsiveness to both acute and chronic climate-related health risks in vulnerable populations.

To accommodate scheduling needs of residents and fellows as they balance clinical duties, as well as those of faculty instructors, IPE modules can be offered in seminar- or workshop-style formats. Focused sessions could delve deeper into team-led case studies or

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Editor's Note: The online supplementary data contains further data from the study.

TABLE

Extension of Interprofessional Learning in Climate Change Education From Undergraduate to Graduate Medical Education

Domain	UME Focus		GME Focus	
	Learning Objective	Example Product	Learning Objective	Example Product
Advocacy	- Identify ways to advocate for patient or population health in a changing climate - Develop persuasive writing skills - Demonstrate ability to contextualize health risks associated with climate change, particularly for vulnerable populations	Interprofessional group poster presentation that includes: - Problem statement - Background/context - Proposed solution - Conclusions/next steps - Visual and written communication	Participate in discipline- or specialty-specific advocacy efforts at national, state, and local levels	- Presentation at national society meetings (eg, anesthesiology residents at OHSU participate in American Society of Anesthesiologists Legislative Conference) - Potential topics: reducing carbon footprint of health care, upholding climate justice principles, or articulating patient support needs in adapting to climate change/extreme weather events (eg, pediatrics, obstetrics/gynecology, family medicine)
Risk assessment and communication	- Identify climate-related health risks for vulnerable populations - Communicate climate-related health risks for vulnerable populations to different audiences	- Blog or forum posts requiring peer comments and feedback - Interprofessional group poster project	- Act upon knowledge about climate risks to patient well-being by communicating with care teams through documentation and interprofessional collaboration - Develop a discipline- or specialty-specific screening tool to identify climate health risks - Perform case study analysis to identify acute and chronic health risks associated with climate change	- Interprofessional group project: novel approaches to capture climate risks in medical charting (colleague/ collaborator-facing) - Climate risk screening tool (patient-facing; eg, family medicine, emergency medicine) - Case study analysis
Teamwork	- Set group norms and rules of engagement for group project - Develop cooperation goals for individuals or groups within and across interprofessional teams - Identify and reflect on opportunities to extend cooperation efforts to achieve collaboration	- Interprofessional group project - End-of-term interprofessional learning reflection	Collaborate in interprofessional teams (eg, decision-making, patient care, advocacy)	- Collaboration workshop and share-out (synchronous): interprofessional groups reflect on collaboration methods and opportunities through case studies, role play, and real-world examples - Collaboration workshop (asynchronous): interprofessional group members share input on a case study/example off-line, with scheduled check-ins to review group findings and recommendations
Professional knowledge and identity	Define roles and domains of expertise among group members during interprofessional group project work	Reflection on interprofessional group project, including documentation of roles and responsibilities/ division of labor, contribution of trainee's own profession to the topic	Increase knowledge of discipline- or specialty-specific health impacts of climate change	- Summary of recommendations on the use of different types of anesthesia to mitigate greenhouse gas emissions - Infographic explaining health risks stemming from climate change for particular medical field or body system

Abbreviations: UME, undergraduate medical education; GME, graduate medical education; OHSU, Oregon Health & Science University.

simulations that provide rich, tailored learning experiences for training in identification and treatment of climate-related illnesses and conditions,^{13,14} as well as documentation and communication of patient risk factors. For example, application of health informatics and advances in electronic medical records could help capture and integrate climate-related health risks.^{15,16} The *New England Journal of Medicine's* interactive climate tool is an excellent starting point to probe climate impacts on health for different specialties.¹⁷ Didactic sessions could be delivered in person or online by faculty with specific expertise from different disciplines/departments across the home institution, or by external collaborators, allowing course instructors to recruit specialists from a broader group of professionals and provide important networking opportunities for faculty and trainees. Focused, intensive sessions offer an opportunity to model and socialize the practice of preshift meetings (group huddles), which have been reported by residents as essential components of successfully working in interprofessional teams.¹⁸

Benefits of Teamwork for Medical Residents, Fellows, and Established Physicians

Teamwork offers important benefits for physicians and their patients. Engagement in teamwork allows physician trainees to consider challenging issues with a broader perspective and to recognize their position in a larger system, showing them that they can—and should—lean on collaborators and colleagues to solve complex problems. In this sense, role-modeling teamwork across disciplines furthers development of professional identity and a shared community as physicians approach new challenges.¹⁹ IPE bolsters development of professional identity²⁰ by asking trainees to consider their individual and collaborative roles in the larger health care system. Importantly, teamwork and collaboration among medical professionals improves quality of care.²¹

Teamwork can benefit health care workers in supporting their efforts to uphold duty of care responsibilities²² in the era of climate change. Advocacy (for patients, public health, and social responsibility) is associated with physician professional identity in the 21st century.²³ Health care workers have an important voice in climate change advocacy, including raising awareness of its health impacts,²⁴⁻²⁶ working toward reduction in waste and emissions in health care settings, and calling for divestment from fossil fuels.²⁷⁻²⁹ Climate change can be a politically charged topic,³⁰ with climate activism carrying personal and professional risks,³¹ including potential erosion of trust from patients with skeptical views about climate change or creation of workplace tension with colleagues who

feel that physicians should remain impartial.^{32,33} As such, climate activism can create a sense of isolation among medical professionals.³³

Interviews with climate change mitigation advocates in medical professions suggest that connecting with like-minded colleagues is a means to strengthen agency to effect change while lowering potential costs of activism³³ and engendering a sense of meaning in health care work, which has the benefit of reducing burnout risk.^{34,35} Burnout is particularly severe among medical residents^{36,37} and often accompanies a feeling of isolation.³⁸ Notably, reports of burnout tend to be lower among physicians who feel supported in collaborative teams,³⁹ further underscoring the importance of developing strong teamwork skills by residents and fellows. Education on team-oriented and collaborative approaches is an excellent opportunity to socialize the importance of support structures that promote physician well-being and thus physician retention.⁴⁰

Climate and Health Education for GME: A Scaffolding Approach

The large number of climate-related health risks and impacts, and the complexity of potential solutions or mitigators, can be daunting to learners and challenging for instructors to cover in didactic content and clinical settings. Medical education must include both general and specific aspects of health impacts associated with climate change so that physicians are equipped to recognize and address health threats.⁴ The transition in scope and complexity from UME to GME is well suited to a scaffolding approach⁴¹ to efficiently teach cooperative and collaborative teamwork strategies⁴² that support integration and application to clinical practice. Scaffolding is an instructional method that guides learning of complex topics through provision of organizational structures and frameworks^{43,44}; learners first identify structures and relationships (“structural skills”) before applying their knowledge across scenarios and in context (“dynamical skills”). This strategy is referred to as “future-scaffolding skills.”⁴⁵ To adequately prepare trainees, climate education should start during UME, with emphasis on awareness, foundational knowledge, systems thinking, and insight about where their career path could fit within environmental and climate sectors. As trainees advance to residency and fellowship programs, the foundational knowledge can be integrated, deepened, and applied through mentored experiences in clinical practice.

Summary

Graduate medical education must prepare physicians for a future in which health is strongly impacted by

climate change, and must support them in serving patients and the community in a consistent and coordinated manner. These goals are best achieved through education and experience in teamwork and interprofessional skills. IPE is an efficient way to cover climate and health content in medical curricula, cultivate an atmosphere of collaboration and partnership, role model a collaborative approach, and equip trainees with essential knowledge and skills for their careers.

References

- Soloman CG, Larocque RC. Climate change—a health emergency. *N Engl J Med*. 2019;380(3):209-211. doi:10.1056/NEJMp1817067
- Romanello M, di Napoli C, Green C, et al. The 2023 report of the Lancet countdown on health and climate change: the imperative for a health-centred response in a world facing irreversible harms. *Lancet*. 2023;402(10419):2346-2394. doi:10.1016/S0140-6736(23)01859-7
- Wellbery C, Sheffield P, Timmireddy K, Sarfaty M, Teherani A, Fallar R. It's time for medical schools to introduce climate change into their curricula. *Acad Med*. 2018;93(12):1774-1777. doi:10.1097/ACM.0000000000002368
- Philipsborn RP, Sheffield P, White A, Osta A, Anderson MS, Bernstein A. Climate change and the practice of medicine: essentials for resident education. *Acad Med*. 2021;96(3):355-367. doi:10.1097/ACM.0000000000003719
- American Medical Association. Climate Change Education Across the Medical Education Continuum H-135.919. Accessed May 23, 2024. <https://policysearch.ama-assn.org/policyfinder/detail/%22climate%20change%22?uri=%2FAMADoc%2FHOD.xml-H-135.919.xml>
- Kuijper FM. The urgent need of an ecological transition in medical training to address tomorrow's challenges. a medical student's perspective. *J Climate Change Health*. 2021;4:100039. doi:10.1016/j.joclim.2021.100039
- Hatfield J, Domingo A, Ivic Lanciotti K, et al. An interprofessional, solutions-oriented approach to raising awareness about the impacts of climate change on human health for health profession students. *Int J Gynaecol Obstet*. 2023;160(2):453-454. doi:10.1002/ijgo.14464
- Rittel HWJ, Webber MM. Dilemmas in a general theory of planning. *Policy Sci*. 1973;4(2):155-169.
- Carter AE, Anderson TS, Rodriguez KL, et al. A program to support scholarship during internal medicine residency training: impact on academic productivity and resident experiences. *Teach Learn Med*. 2019;31(5):552-565. doi:10.1080/10401334.2019.1604355
- Devlin-Hegedus JA, McGain F, Harris RD, Sherman JD. Action guidance for addressing pollution from inhalational anaesthetics. *Anaesthesia*. 2022;77(9):1023-1029. doi:10.1111/anae.15785
- Bernat M, Boyer A, Roche M, et al. Reducing the carbon footprint of general anaesthesia: a comparison of total intravenous anaesthesia vs. a mixed anaesthetic strategy in 47,157 adult patients. *Anaesthesia*. 2024;79(3):309-317. doi:10.1111/anae.16221
- Winters NC, Metz WP. The wraparound approach in systems of care. *Psychiatr Clin North Am*. 2009;32(1):135-151. doi:10.1016/j.psc.2008.11.007
- McMichael C, Nayna Schwerdtle P, Ayeb-Karlsson S. Waiting for the wave, but missing the tide: case studies of climate-related (im)mobility and health. *J Migr Health*. 2023;7:100147. doi:10.1016/j.jmh.2022.100147
- Sorensen C, Garcia-Trabanino R. A new era of climate medicine—addressing heat-triggered renal disease. *N Engl J Med*. 2019;381(8):693-696. doi:10.1056/NEJMp1907859
- Gray K. Climate change, human health, and health informatics: a new view of connected and sustainable digital health. *Front Digit Health*. 2022;4:869721. doi:10.3389/fdgh.2022.869721.
- Atasoy H, Greenwood BN, McCullough JS. The digitization of patient care: a review of the effects of electronic health records on health care quality and utilization. *Annu Rev Public Health*. 2019;40:487-500. doi:10.1146/annurev-publhealth-040218-044206
- Salas RN, Soloman CG. The climate crisis—health and care delivery. *N Engl J Med*. 2019;381(8):e13. doi:10.1056/NEJMp1906035
- Soones T, O'Brien BC, Julian KA. Internal medicine residents' perceptions of team-based care and its educational value in the continuity clinic: a qualitative study. *J Gen Intern Med*. 2015;30(9):1279-1285. doi:10.1007/s11606-015-3228-3
- Koh EYH, Koh KK, Renganathan Y, Krishna L. Role modelling in professional identity formation: a systematic scoping review. *BMC Med Educ*. 2023;23(1):194. doi:10.1186/s12909-023-04144-0
- Cruess RL, Cruess SR, Boudreau JD, Snell L, Steinert Y. Reframing medical education to support professional identity formation. *Acad Med*. 2014;89(11):1446-1451. doi:10.1097/ACM.0000000000000427
- Weiss KB, Bagian JP, Nasca TJ. The clinical learning environment: the foundation of graduate medical education. *JAMA*. 2013;309(16):1687-1688. doi:10.1001/jama.2013.1931
- Picard EI, Roobertson GB. *Legal Liability of Physicians and Hospitals in Canada*. 4th ed. Thomson Carswell; 2008.
- van Gils-Schmidt HJ, Salloch S. Physicians' duty to climate protection as an expression of their professional

- identity: a defence from Korsgaard's neo-Kantian moral framework. *J Med Ethics*. 2024;50(6):368-374. doi:10.1136/jme-2023-109203
24. Howard C, Moineau G, Poitras J, et al. Seeding a planetary health education revolution: institutional sign-on challenge. *Lancet*. 2023;402(10418):2173-2176. doi:10.1016/S0140-6736(23)02526-6
 25. Veidis EM, Myers SS, Almada AA, Golden CD, Clinicians for Planetary Health Working Group. A call for clinicians to act on planetary health. *Lancet*. 2019;393(10185):2021. doi:10.1016/S0140-6736(19)30846-3
 26. Etzel RA, Ding J, Gil SM, et al. Pediatric societies' declaration on responding to the impact of climate change on children. *J Climate Change Health*. 2021;4(10224):100038. doi:10.1016/j.joclim.2021.100038
 27. Charles J, Lois AN, Mukhopadhyaya C, Maibach E, Patz JA. Health professionals as advocates for climate solutions: a case study from Wisconsin. *J Climate Change Health*. 2021;4(3):100052. doi:10.1016/j.joclim.2021.100052
 28. Wolff J, Schenk E. Climate-smart and climate-ready health systems—the time is now. *J Climate Change Health*. 2021;4:100046. doi:10.1016/j.joclim.2021.100046
 29. Webb D, Hanssen ON, Marten R. The health sector and fiscal policies of fossil fuels: an essential alignment for the health and climate change agenda. *BMJ Glob Health*. 2023;8(8):e012938. doi:10.1136/bmjgh-2023-012938
 30. Hulme M. (Still) disagreeing about climate change: which way forward? *Zygon*. 2015;50:893-905. doi:10.1111/zygo.12212
 31. Wiltfang GL, McAdam D. The costs and risks of social activism: a study of sanctuary movement activism. *Soc Forces*. 1991;69(4):987-1010. doi:10.2307/2579299
 32. Jameton A. The importance of physician climate advocacy in the face of political denial. *AMA J Ethics*. 2017;19(12):1222-1237. doi:10.1001/journalofethics.2017.19.12.sect1-1712
 33. Lindemer A. The costs of climate activism for medical professionals: a case study of the USA, the UK, and Germany. *Lancet*. 2023;7(9):e770-e776. doi:10.1016/S2542-5196(23)00145-6
 34. Lu MA, O'Toole J, Shneyderman M, et al. "Where you feel like a family instead of co-workers": a mixed methods study on care teams and burnout. *J Gen Intern Med*. 2023;38(2):341-350. doi:10.1007/s11606-022-07756-2
 35. Ben-Itzhak S, Dvash J, Maor M, Rosenberg N, Halpern P. Sense of meaning as a predictor of burnout in emergency physicians in Israel: a national survey. *Clin Exp Emerg Med*. 2015;2(4):217-225. doi:10.15441/ceem.15.074
 36. Shalaby R, Oluwasina F, Eboireime E, et al. Burnout among residents: prevalence and predictors of depersonalization, emotional exhaustion and professional unfulfillment among resident doctors in Canada. *Int J Environ Res Public Health*. 2023;20(4):3677. doi:10.3390/ijerph20043677
 37. Dyrbye LN, West CP, Satele D, et al. Burnout among U.S. medical students, residents, and early career physicians relative to the general U.S. population. *Acad Med*. 2014;89(3):443-451. doi:10.1097/ACM.0000000000000134
 38. Karcz E, Zdun-Ryzewska A, Zimmerman A. Loneliness, complaining and professional burnout of medical personnel of psychiatric wards during COVID-19 pandemic—cross-sectional study. *Healthcare (Basel)*. 2022;10(1):145. doi:10.3390/healthcare10010145
 39. Ishak W, Nikraves R, Lederer S, Perry R, Ogunyemi D, Bernstein C. Burnout during residency training: a literature review. *J Grad Med Educ*. 2009;10(4):236-242. doi:10.1111/tct.12014
 40. Anderson A, Simpson D, Kelly C, Brill JR, Stearns JA. The 2020 physician job description: how our GME graduates will meet expectations. *J Grad Med Educ*. 2017;9(4):418-420. doi:10.4300/JGME-D-16-00624.1
 41. Bailey JM, Jamani S, Klavon TG, Jaffe J, Mohan S. Climate crisis learning through scaffolded instructional tools. *Educ Develop Psychol*. 2021;85-99. doi:10.1080/20590776.2021.1997065
 42. Cortázar C, Nussbaum M, Alario-Hoyos C, Goñi J, Alvares D. The impacts of scaffolding socially shared regulation on teamwork in an online project-based course. *Internet High Educ*. 2022;55(3):100877. doi:10.1016/j.iheduc.2022.100877
 43. Wood D, Bruner J, Ross G. The role of tutoring in problem solving. *J Child Psychol Psychiatry*. 1976;17(2):89-100. doi:10.1111/j.1469-7610.1976.tb00381.x
 44. Hogan K, Pressley M. *Scaffolding Student Learning: Instructional Approaches and Issues*. Brookline Books; 1997.
 45. Levrimi O, Tasquier G, Barelli E, et al. Recognition and operationalization of future-scaffolding skills: results from an empirical study of a teaching-learning module on climate change and futures thinking. *Sci Educ*. 2021;105(6):281-308. doi:10.1002/sce.21612



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