

ORIGINAL RESEARCH

Personal and professional impacts of medical students' sustainable behaviors: A pilot study

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Background and Objectives

Medical students have contributed substantive efforts to integrate climate and health education into medical curricula. In this pilot study, we sought to gauge the impact of students' personal commitment to pro-environmental behavior change as a potential means to further promote climate and health engagement through peer and community awareness.

Methods

The authors recruited 10 medical student participants to commit to a selection of well-supported pro-environmental behaviors recommended in the website [Regeneration.org](https://www.regeneration.org), such as reducing food waste. Monthly check-in responses to written questions were analyzed using thematic analysis, an established method for isolating themes from qualitative data. A post-participation exit survey gauged students' attitudes and future priorities related to their experience.

Results

Ten students completed the study. The thematic analysis identified 4 themes: 1) benefits and challenges of pursuing sustainable behaviors; 2) increased awareness about such behaviors; 3) ambivalent engagement with peers; 4) ambivalence about the broader environmental impact of sustainable behaviors. In the exit survey, students consistently asserted increased awareness of their environmental impact and concern about the future. Among preferred options for promoting sustainability in a future professional role, medical students selected leading by example and working to reduce the carbon output of health care facilities.

Discussion

While medical students demonstrated a high level of personal satisfaction and adherence to sustainable behaviors, their commitment did not translate importantly to conversations with others, activism, or sense of professional responsibility. Commitment to sustainable behaviors could have greater impact if supported by institutional incentives and incorporated as a learning tool for counseling patients about ways to protect their health while reducing harmful exposures to climate change.

INTRODUCTION

The world's temperatures have already frequently exceeded preindustrial levels; exceeding a threshold defined as 1.5°C by the Intergovernmental Panel on Climate Change, beyond which extreme weather tipping points pose an increasingly critical threat to human health and survival.¹ Heat impacts account for the most direct and well-documented harms to human health, a palpable concern given that temperatures are projected to rise an additional 7°F (3.89°C) by the end of this century,² well beyond the threshold of human adaptation. Higher temperatures have been associated with a 7.8% increase in emergency department visits due to heat-related conditions, such as cardiovascular events, respiratory exacerbations, and fluid imbalances.³ Excessive heat also potentiates the mortality risk due to air pollution,⁴ and contributes to wildfire-associated risks, which, according to a recent study of long-term impacts, resulted in an annual excess of 10 000 US deaths.⁵ Heat also extends the geographic scope of insect vectors and airborne allergens.⁶ This well-understood trajectory towards a hotter world has amplified an urgent call to prepare medical students to care for patients affected by climate-related heat, wildfire pollution, natural disasters, and many other health impacts of climate change and, equally important, join efforts to reduce health care sector greenhouse gas emissions.⁷

According to the Association of American Medical Colleges (AAMC) survey from 2020-2021, 55% of medical schools had some required content on the health effects of climate change, mostly embedded in preclinical lectures or as part of courses addressing social determinants of health.⁸ For example, Georgetown University has incorporated student-generated curricular content on climate impacts in a number of preclinical courses. In addition, brief, video-based workshops offer an introduction to environmental disparities and medical waste; meanwhile, an ancillary Environmental Track was founded in 2018 that is currently provisionally led by the author (C.W.). Across many US medical schools, systematic longitudinal curricular integration of climate and health is still nascent amid many competing institutional priorities.⁹ Pending a current interinstitutional effort to implement interprofessional competencies to fill the existing knowledge and practice gap in climate health education,¹⁰ medical students continue to be important drivers of institutional change.

Given medical student-driven climate awareness, for this study, we examined whether personal commitment to proenvironmental behaviors could strengthen institutional implementation of climate and health education through a bottom-up promotion of environmental awareness, for example, by conducting waste audits in their learning environments focused on waste reduction.¹¹ Personal behaviors can include a spectrum of commitments, ranging from dietary and transportation choices to participation in political action, grassroots engagement, and advocacy.¹² We wanted to know whether

individual noncurricular decisions about modeling a sustainable lifestyle could have a broader impact, raising awareness in general and focusing on sustainability in the medical sector in particular (for example, by judiciously reducing unnecessary medical waste), thereby influencing others to follow suit or otherwise impacting institutional receptivity to sustainability education and commitments.

Medical students form a uniquely bonded community, beginning in the first 2 nonclinical years, when learners experience themselves as a cohesive and interconnected group with shared academic courses, schedules, and requirements. Given that individual behavioral decisions are only as effective as their reach, we posited that a broader understanding of behavior could be especially pertinent in the medical setting where medical students are not just private individuals, but are also being prepared for a professional role where they have greater influence on change. Noting that group buy-in amplifies the impact of individual sustainable behaviors (SBs),¹³ we anchored our study question in research that contextualized proenvironmental behaviors and awareness within established communities.¹⁴ Communities, which share a sense of group identity,¹⁵ are more likely to facilitate socioenvironmental impact at scale.¹⁶

We thus hypothesized that medical students committing to personal SBs would not only regard their actions as self-empowering, but would also raise proenvironmental awareness among peers and promote these behaviors as integral to their professional responsibilities by serving as role models and counseling their patients.¹⁷⁻²⁰ In sum, we sought answers to the following 2 questions: (1) what is the quality of medical students' commitment to environmental SBs and (2) how does this commitment impact climate awareness, conversation with peers, and professional climate engagement.

METHODS

Study Design

This uncontrolled pilot study used a thematic analysis approach, collecting and analyzing written documentation of students' experiences of and commitment to SBs, with a follow-up exit survey.

Participant Recruitment

Participants were recruited through an email sent to all enrolled medical students at our institution. The email contained a concise overview of the study, its purpose, expected time commitment, and benefits of participation. The target was to recruit 8 to 12 students; 11 students attended an introductory informational meeting, during which participants were instructed to generate a so-called punch list (a self-selected list of SBs tailored to the student's preferences and guided by the environmental website [Regeneration.org](https://www.regeneration.org/),²¹ which organizes effective interventions aligned with

evidence-based individual, group, and company actions). Ten participants engaged in 4 monthly open-ended emailed check-ins—an arbitrary temporal span that took into consideration medical students' conflicting schedules across all 4 years while allowing enough time to assess the durability and impact of students' commitments. Participants responded monthly to written open-ended questions about their progress, challenges, and any changes resulting from their SB list. The check-in questions can be found in the Appendix.

We (C.W. and I.S.) conducted a thematic analysis of the qualitative data from the open-ended check-ins to identify recurring concerns ([Table 1](#)). Responses to check-ins were compiled into a secure spreadsheet and cataloged by participant ordered numerically. Adhering to established methods in the field,²²⁻²⁴ we used an inductive, constructivist approach. After reviewing responses, we each separately conducted an analysis and generated initial codes to capture the essence of participants' individual responses. Next, we generated themes by analyzing and synthesizing overlapping initial codes. We then combined our analyses and synchronized the codes and themes. These themes were then reviewed, revised, and edited as needed to identify the underlying messages revealed in participant responses. In concluding this iterative process, we finalized the themes based on their pertinence to our research hypothesis.

At the end of the 4-month period, participants each completed a post-survey through Qualtrics (version October, 2023) to evaluate the impact of study participation on medical students' current and future environmentally oriented attitudes and actions.

RESULTS

The SBs from [Regeneration.org](#) that participants chose to follow for the duration of the study included behaviors such as commitment to a plant-based diet, recycling, and active transport (walking, biking). All 10 participants completed the monthly check-in questions.

Thematic Analysis

The iterative process outlined above generated 4 final themes and several subthemes. These themes are summarized below and are also listed in [Table 1](#) with supporting examples.

THEME 1: MEDICAL STUDENTS IDENTIFIED BENEFITS AND CHALLENGES OF INTEGRATING SBS INTO DAILY LIFE

Subtheme 1: Among the benefits mentioned, pride, satisfaction, and a sense of accomplishment were paramount.

"I felt great about myself when I was able to get in extra exercise and save money by refraining from calling Ubers." Student 2

Table 1. Thematic analysis themes and sub-themes

Theme	Subthemes	Subtheme details	Examples
Identification of benefits and challenges of integrating Sustainable Behaviors (SB) into daily life.	Subtheme 1: Pride, satisfaction and a sense of accomplishment	- Medical school demands as a deterrent towards SB integration. - Time investment as a considerable factor in deciding whether to routinely engage in SBs - Saving money as motivation to adhere to SBs.	"I was able to get in extra exercise and save money" (S1) "I enjoyed being thoughtful about my actions" (S2) "I learned a lot about myself and sustainable behaviors" (S3) "SBs overlap with principles that I value such as self-discipline, frugality, and the type of conscientiousness that avoiding waste for its own sake can bring about." (S4)
	Subtheme 2: Demands of medical school as a major obstacle to SB adherence	- Seeing positive impact on individual's physical and mental health as incentive towards SBs - More likely to apply simple changes that do not impede regular schedule; behaviors that more dramatically impact routine are less likely to be adhered to	"anything that isn't conducive to easing that burden of stress ends up being neglected" (S1) "my experience as a med student contradicts how I achieve my punchlist" (S5)
Engaging in SB promoted reflection and self-awareness	Subtheme 1: Enhanced mindful behavior and its moral implications	- Emotional valency (positive/negative) towards individual progress. - Acknowledgement of difficulty in breaking old habits - Finding small, manageable steps in change to be most effective - Realizing written down actionable items are most effective for achieving conscious change - Difficulty in remembering to implement SBs when busy or occupied - Positive reinforcement as the biggest motivator for long-term adherence to SBs	"I have learned to be patient with myself" (S5) "My punchlist has led me to critically examine each of my choices on a daily basis" (S6) "Things that are going well include increased general mindfulness about my environmental footprint and also more consistent motivation to make choices that align with my punch list since making it" (S7) "They are things that I have always thought about but now having an external factor that has helped me centralize these actions in my mind" (S4) "This study has made me more aware of how to live a more sustainable lifestyle. " (S5)
Engaging with others' behaviors.	Subtheme 1: increased awareness of others' behaviors, and intermittently, with close contacts	- Hesitancy to engage in conversation due to fears of appearing morally righteous or controversial - Frustration in regards to systematic environmental barriers that negate individual efforts	"Group sustainability is more fun than solo sustainability." (S2) "I have become more aware of the waste my roommates create and have tried to encourage them to recycle their waste. I am also more conscious of the cars people drive and how cars with poor fuel efficiency have a great impact on the environment" (S4) "discussing sustainable behaviors with my partner has been successful" (S8)

		- Awareness of others'/institution's non-sustainable/harmful behaviors - Engaged in conversation describing their involvement in the study rather than negotiating change	"I have started encouraging my mom and sister to incorporate plant protein instead of animal protein into some of their meals." (S5)
	[Subtheme 2] reluctance to engage with others' behaviors—with the exception of close friends and partners		"I have not spoken to others about sustainability more than I usually do." (S7) "it's difficult to discuss such topics simply because people have differing opinions on climate change" (S9) "I wish I had figured out more ways for it to come up naturally without the risk of sounding morally righteous," (S10)
Focus on the environmental impact of their SBs.		- Moral/ethical obligation towards SBs - SBs resonating with previously instilled values and principles - Realization of waste reduction - Re-examining the environmental impact of travel - Reliance on public transportation as a simple way to reduce carbon footprint - Struggling to rectify individual changes in the face of more impactful societal issues	"I don't think I believe that climate change is changeable at the individual level and find that the most important interventions are at the level of policies against corporations." (S4) "I am struggling to feel like I am making a big impact on the earth" (S3)
How adherence to SB on a personal level might eventually evolve into a more impactful, professional		- Expressing hope that SBs practically contribute to environmental impact. - Focus on the personal changes through this exercise in shaping professional and individual outlook - Considering ways to integrate SBs in their professional life and practice in addition to medical school changes	"[I] find that the most important interventions are at the level of policies against corporations." (S4) "Everyday conversations will continue to push forward the movement towards a more sustainable future." (S6) "I am cognizant of the effects of these behaviors both on myself and the community." (S6) "not just through our own normal every day civilian behaviors, but also through potential changes to medical protocol." (S1) "Being a medical student reminds me that our health and our environments are intimately linked." (S2)

Subtheme 2: Students frequently mentioned the demands of medical school as a major obstacle to SB adherence, including academic priorities, or specifically due to insufficient time for other tasks (for example, for meal preparation).

"Medical school is a central priority in my life...and is also a source of stress and pressure. So, anything that isn't conducive to easing that burden ends up being neglected." Student 1

THEME 2: ENGAGING IN SB PROMOTED REFLECTION AND SELF-AWARENESS

Medical students emphasized the routine and associated discipline their commitment imposed. SB also enhanced mindful behavior and its moral implications.

"[The SBs] helped...instill values such as discipline, moderation, and cost-effectiveness." Student 1

Subtheme 1: SB also enhanced mindful behavior and its moral implications.

"The punch list has held me more accountable...made me think twice about the choices I am consciously making." Student 2

THEME 3: ENGAGING WITH OTHERS' BEHAVIORS

Subtheme 1: The punch list increased awareness of others' behaviors, and, intermittently, conversations with close contacts.

"I have become more aware of the waste my roommates create and have tried to encourage them to recycle their waste." Student 3

"Discussing sustainable behaviors with my partner has been successful." Student 8

Subtheme 2: Reluctance to engage with others' behaviors. Several factors hampered engagement with friends and peers around SB. Medical students did observe others' behaviors more actively, but were hesitant to discuss these. Reasons included a fear of offending peers, a sense of privacy about personal actions/behaviors in general, and a preference to speak more abstractly about environmental issues.

"I wish I had figured out more ways for it to come up naturally without the risk of sounding morally righteous, which I was afraid of." Student 6

THEME 4: PERCEPTIONS OF THE ENVIRONMENTAL IMPACT OF SBS

Though personally and even morally satisfying, SB commitments provoked ambivalence about any significant impacts on the environment.

"The presence of my punch list has led me to critically examine each of my choices on a daily basis and anticipate its effects on the broader environment around me." Student 4

"The conclusion I came to is that I value these activities not for their impact on the environment but for their impact on qualities that I found important for my personal life." Student 1

"...[H]ow flying there and back and having layovers might offset any of the smaller efforts to reduce my carbon footprint." Student 7

“I feel like I am actively harming my own health with overconsumption of red meat, so I am less likely to consume it. This does not extend as much to other climate-friendly practices because I don’t think I believe that climate change is changeable at the individual level and find that the most important interventions are at the level of policies against corporations.” Student 1

Exit Survey

At the end of the study, the majority of participating medical students agreed or strongly agreed that they positively changed their behaviors based on their selection from Regeneration. org (see [Table 2](#) for tabulated results). All agreed that this project increased their awareness of their carbon footprint and felt that climate change would personally impact them in the near future. The preferred future actions resulting from this study included leading by example (n = 9) and decarbonizing operations of their health and educational institutions/creating a climate-ready health workforce (n = 5).

DISCUSSION

In this study, we hoped to find that medical students committing to SBs could have a broader effect on the community, both in strengthening their own resolve to contribute to proenvironmental behavioral change and leading by example, that is, discussing their actions with their peers and serving as advocates for a professional future that models SBs in their institution.

Medical students’ postsurvey responses indicated an overall strong commitment to their SBs and heightened awareness of their relationship to climate change, with students strongly endorsing their commitment as role models and to patients and decarbonization of the health care sector. On the more granular level of their monthly discursive responses, however, medical students identified numerous obstacles to engagement with SBs and proenvironmental actions. In addition, only 2 students spontaneously mentioned their SBs in the context of their future roles as professionals (in contradistinction to the more robust positive commitments in the exit survey).

Because SB practices did not seem to encourage medical students to share their experience with their peers or connect their behaviors with their professional roles, the potential to influence the community of medical students or engage at a higher level about sustainable practices was not realized. It is possible that a broader top-down mandate to practice sustainable behaviors would have a more decisive influence on the culture of the medical school. For example, there is some evidence in both medical and nonmedical settings that leadership can influence a more sustainable workplace²⁵⁻²⁷—an institutional approach that in the medical setting could accelerate individual actions to reduce greenhouse gas emissions and medical waste.

Table 2. Exit survey

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Total
Behaviors students selected from Regeneration.org						
Healthier diet: Less meat/dairy/more fruits and vegetables	2	4		2		8
Walk/use public transportation/ carpool	3	3	1			7
Packaging waste/recycling/ medical waste	2	2	1			5
Composting					2	2
Less food waste	2	1				3
Other waste (water, lights, buying stuff)	1	3	1			5
Statements						
This project increased my awareness of my personal carbon footprint	4	6				
I am concerned that the impacts of climate change will affect me personally in the near future	8	2				
This project impacted how much I spoke with my peers about SB	3	2		5		
This project inspired me to take the following broader action on the impacts of climate change. (Check all that are applicable)*						
Engage the public to create public will for smart climate & health policies						5
Engage policymakers to create political will						4
Engage corporate policymakers to create corporate will.						2
Engage our own health and educational institutions (universities, hospitals, clinics, etc.) to decarbonize our operations and to create a climate-ready health workforce.						6
Lead by example (in our private lives and our professional lives)						8
No further action						0

* Number of students who checked each option are tallied in last column

Early organizational and institutional commitments that promote individual, group, and programmatic health-related proenvironmental efforts within curricular and institutional expectations and goals^{18,20,28} can help learners cultivate a sense of professional responsibility to address the health impacts of climate change. Individual proenvironmental behaviors are a start, although they are just one aspect of a slew of interventions needed to ratify the importance of a climate-aware medical culture.

Strengths and limitations

This study investigating peer-to-peer impact of sustainable behaviors among medical students is, to our knowledge, the first to gauge the personal and interprofessional effects of SBs. Given that this was a pilot study, we intentionally limited participation to 8 to 12 students. To help offset the small sample size, we sought discursive answers to monthly open-ended questions such as “What is going well?” and “Does your experience as a medical student in any way reinforce, contradict, or have no influence on working with your punch list? Please briefly explain.” These questions helped minimize directing students to specific answers, so that according to the tenets of thematic analysis, we could discern themes that arose spontaneously among the students’ answers while minimizing prompting. The open-ended nature of the questions may explain why few students mentioned their professional role in relation to SBs. In contrast, responses to the exit survey, which explicitly asked about future commitments, were notably more positive. This suggests that the open-ended questions may have been more effective in capturing what genuinely mattered to students within their medical school experience, without introducing social desirability bias. Nonetheless, in our recruitment notice, we mentioned “medical students’ experience incorporating their own chosen environmentally healthy behaviors into their everyday lives,” which would clearly have attracted students with interests in sustainability. Despite the obvious limitation of this small mostly observational study with self-selected participants, its findings likely represent the most robust positive response that can be expected regarding the possibilities and promises of SB under current conditions in medical education.

CONCLUSIONS

Individual SBs do matter because they are the mainstay of climate and health-related direct patient care and counseling. Most environmental and climate health curricula and competencies recommend that health professionals discuss such behaviors with their patients.²⁹⁻³¹ These include encouraging use of active transport and prioritizing a plant-based diet, as well as practicing preventive behaviors such as staying indoors when air quality is poor or seeking air conditioning during heat waves. AAMC competencies emphasize learning from personal experiences (self-reflection) as a means to provide better care to patients.³² Columbia University’s Global Climate Change Health Education initiative, in cooperation with the AAMC, to develop a tool for evaluating climate curricular content, emphasizes in its Practice-based Learning and Improvement domain the ongoing connection between physicians’ self-reflection on their climate-related health responsibilities and patient care. Steering students towards an evidence-based list of SBs may be one way of satisfying this competency. Thus, a future study can more robustly evaluate the role of personally selected SBs practiced in the context

of a self-reflection competency that emphasizes SBs. As one student commented: “This experience has made me more conscientious about points of action for climate friendly actions” (S2); another student noted that his commitments “increased general mindfulness.” (S8) A larger randomized trial assessing competencies in the Practice-based Learning and Improvement domain—comparing students assigned to focus on SBs with a control group encouraged to define their own approach to self-reflection—could help determine whether engaging with SBs augments meaningful interaction with patients and clinical practices around environmental health topics.

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SUPPLEMENTARY MATERIALS

Appendix

Download: <https://gmr.scholasticahq.com/article/145062-personal-and-professional-impacts-of-medical-students-sustainable-behaviors-a-pilot-study/attachment/304303.docx>
