



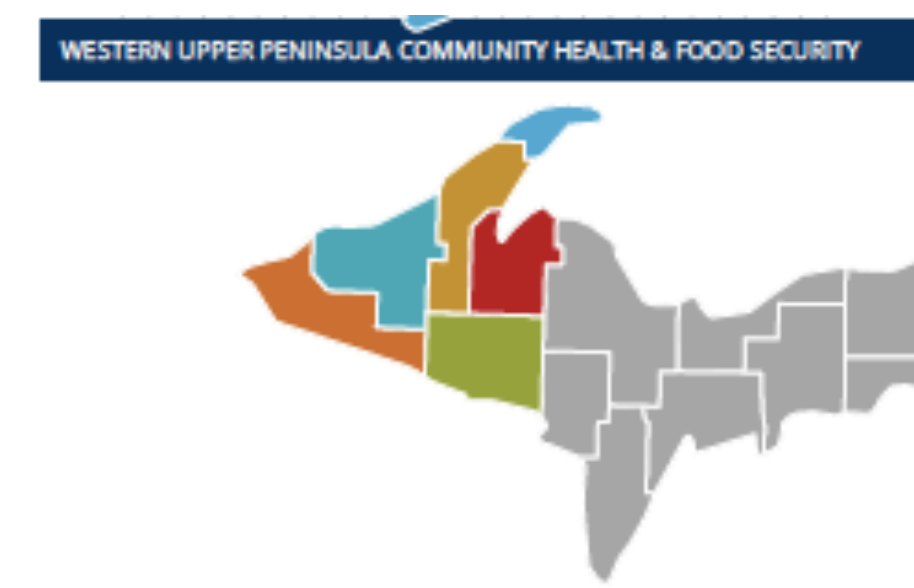
Climate Change & Human Health

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Summary

Climate change is the greatest threat to human health in the twenty first century and future physicians have an important role to play in our mitigation and adaptation efforts. Through increasing temperatures, rising sea levels, extremes of precipitation and severe weather, climate change will have a dramatic impact on human health in the coming decades. It is projected that by 2030, over 250,000 deaths will be attributed to climate change each year. The nature of this mortality is multifactorial and impacts every system of the human body. Heat related mortality, diarrheal illness, vector borne illness, and malnutrition will likely be the primary drivers of climate related deaths. Not only will climate change affect the health of all of our patients, but the United States healthcare system is a large contributor to carbon emissions. For example, in 2007 the US healthcare system released an estimated 504 million metric tons of carbon dioxide equivalents, or roughly 8-10% of total US emissions. The effects of a warmer planet are no longer a problem for a future generation of physicians. The medical profession is beginning to react to these changes and projections—but not fast enough.



Dow Sustainability Fellowship

Our Dow Sustainability Fellowship Team completed a local food systems planning project in collaboration with the Western Upper Peninsula Planning and Development Region (WUPPDR) and the Western Upper Peninsula Food System Council. These organizations partnered with our team to advance sustainable food systems planning in the western Upper Peninsula. Communities in this region lack access to nutritious foods for a variety of reasons which this team worked to identify throughout the course of this project. We accomplished our objective through the creation of individual community health profiles and the development of a food systems planning tool kit for local municipalities. The planning tool kit was created based on the results of a comprehensive analysis of local and national food planning and policy documents as well as interviews with city and regional planners across the state of Michigan. The profiles were completed for the six counties in the western Upper Peninsula. They consist of seven categories including demographics, public health, food resources, social services, institutional factors, the natural landscape and the built environment. These profiles will serve as a basis for helping WUPPDR understand gaps and community needs associated with access to adequate food resources. In addition, it serves as the foundation for future work to map available food resources in the western Upper Peninsula. Another key aspect of this project involved creating a policy language component to assist WUPPDR in supporting sustainable food systems planning in local municipalities. Finally, a food policy master planning catalog was developed through research, stakeholder conversations, and client engagement and will serve as a key resource for WUPPDR to inform opportunities to support local food systems planning.

RISE Mini-Grant

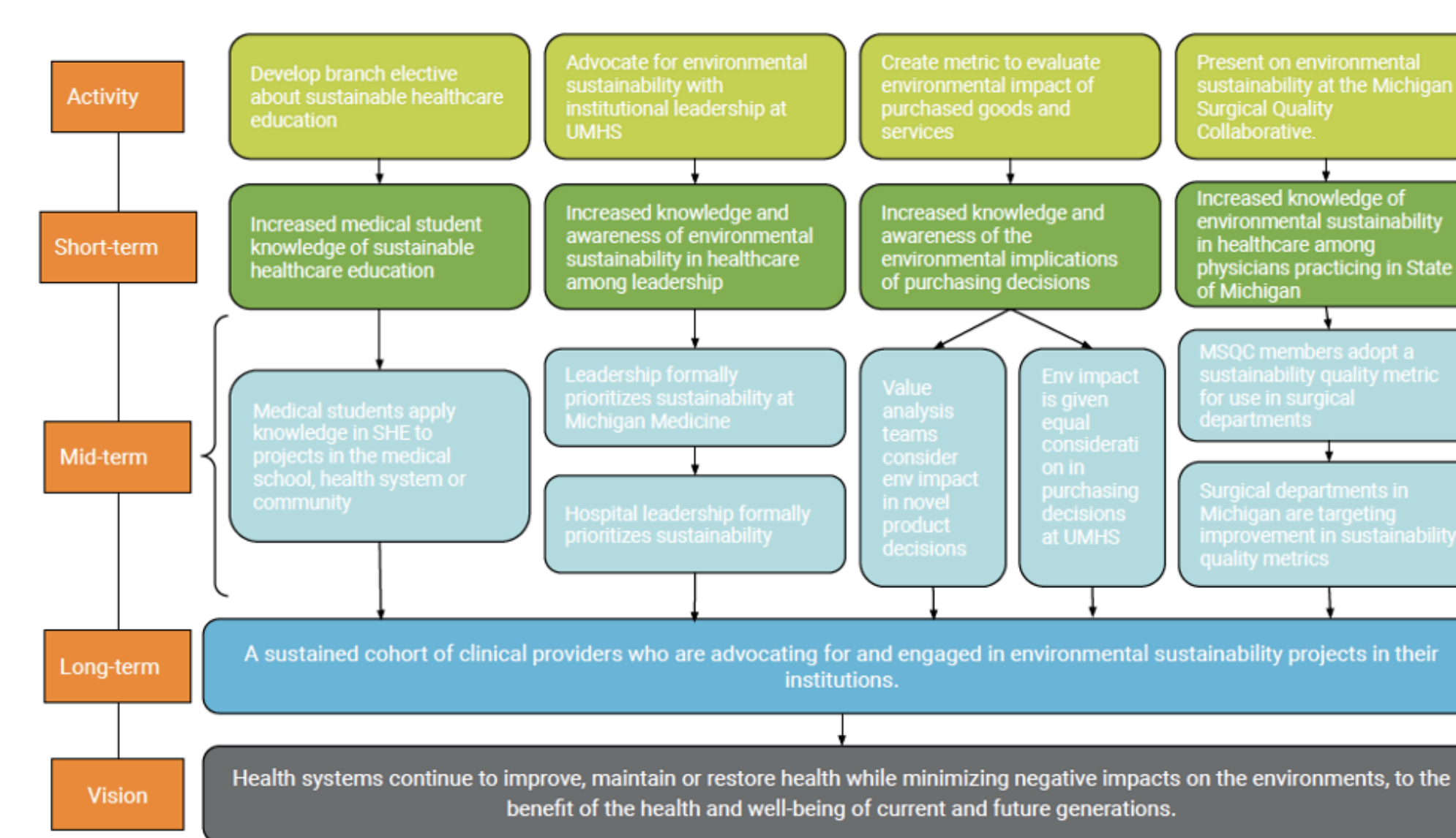


Figure 1: Theory of Change for transformation of medical education around climate change

Student Needs Assessment

A student needs assessment was distributed to all medical students in January of 2020. The results guided the development of the elective course and were presented at the virtual AMEE Conference in September 2020.

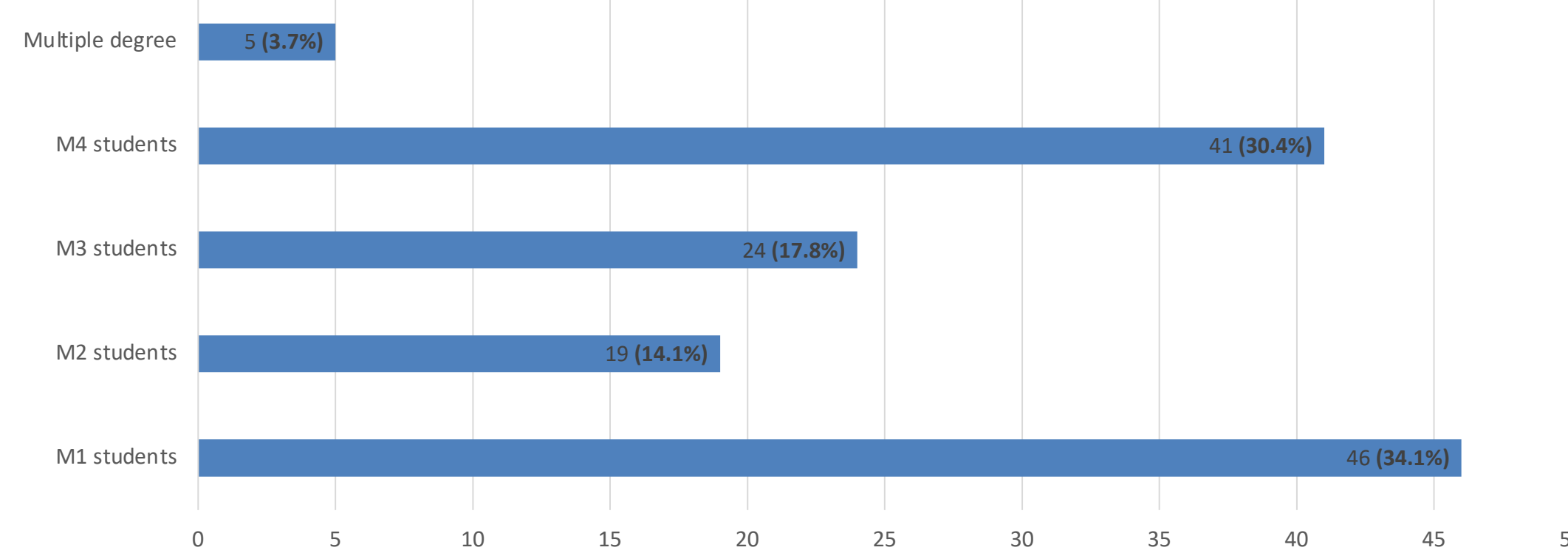


Figure 2: Medical students who completed the needs assessment by class

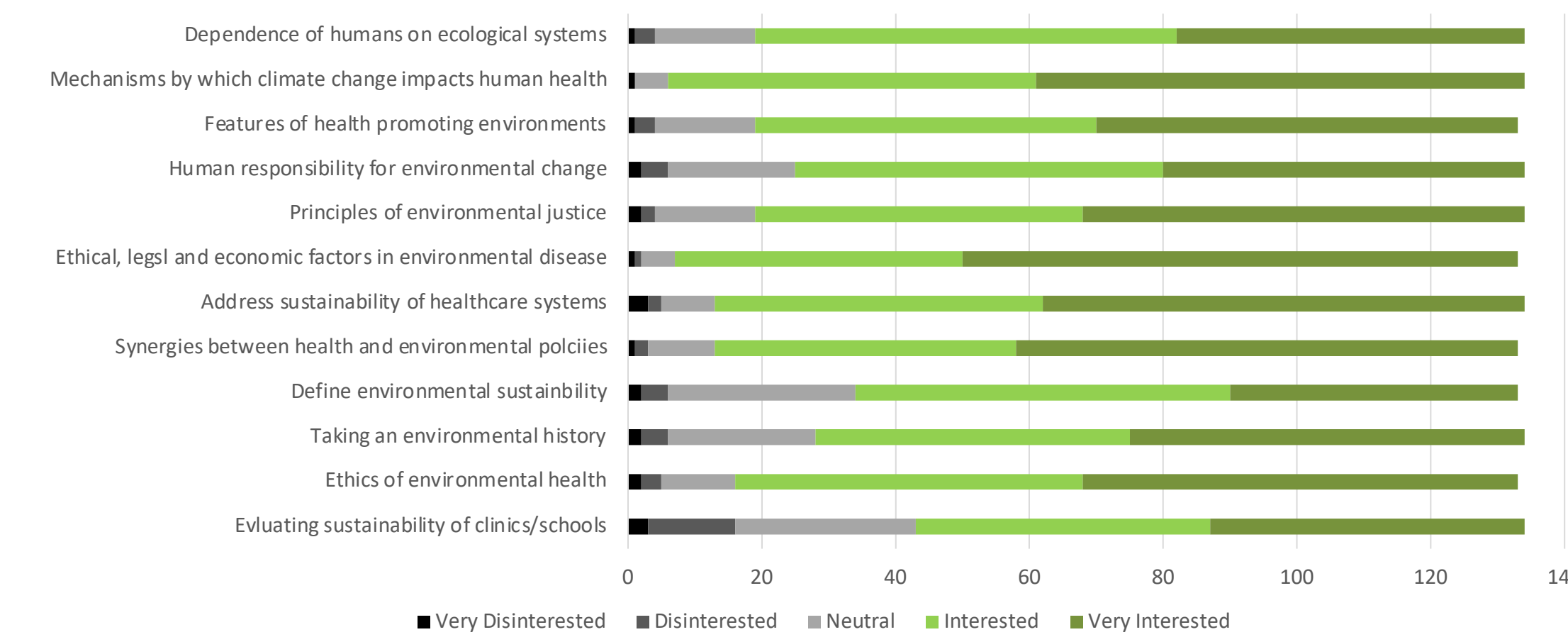


Figure 3: "How interested are you in learning more about the following topics?"

Elective Course: EMERGMED 8401

The course explored the relationship between our planet's changing climate and human health. Students received an introduction to the topic of climate change and other threatened planetary boundaries, an understanding of the current and predicted impact on human health, and opportunities for mitigation of and adaptation to these changes. Course activities consisted of didactic lectures, group discussions, activities, and guest speakers. During this course, students designed a project engaging these topics in a healthcare or community setting, created a group presentation focused on the impact climate change will have on their future specialty, and wrote a narrative piece on an aspect of this topic they found most important.

Learning Objectives:

1. Explain the basic science of climate change and discuss the contribution of human activity to global environmental change.
2. Describe the mechanisms by which human health is affected by environmental change, for example through changes in disease vectors, exposure to extreme weather, migration, and reduced food security.
3. Understand the inequitable distribution of health impacts as a result of climate change, and evaluate strategies to advance environmental justice and equity.
4. Recognize the environmental impact of healthcare nationally and globally, and be able to apply best practices to improve environmental sustainability of clinics, hospitals and health systems.
5. Understand how to communicate about climate change and its health impacts to patients, colleagues and other health professionals, policy-makers, and the public.
6. Articulate the roles and responsibilities of physicians in mitigating and adapting to the impact of climate change on human health.

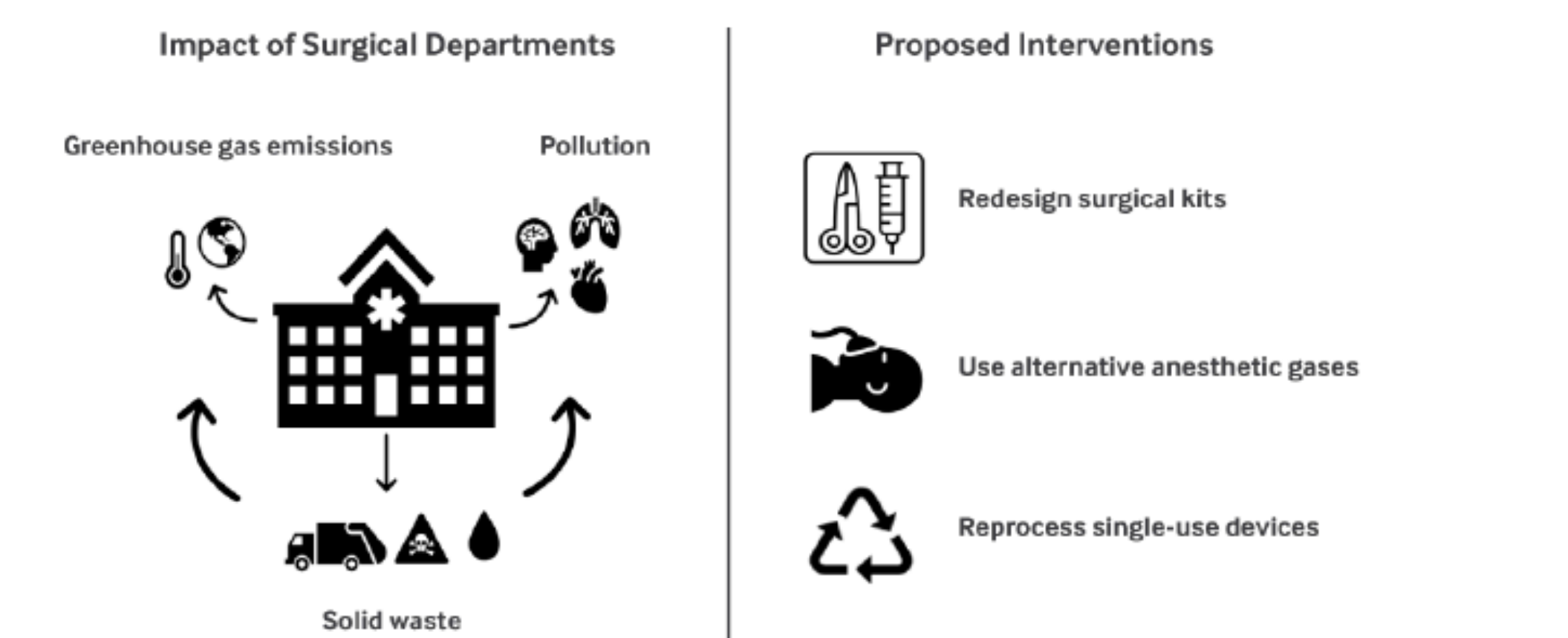
Project Proposal	Description
Pediatrician perspectives on the role of climate change discussion in well child visits	Conduct a needs assessment of primary care pediatricians including the barriers to integrating anticipatory guidance about climate change into pediatric well child visits.
Biannual Solarize Ann Arbor event for healthcare professionals	Organize semi-annual educational presentation for Michigan Medicine health professionals to learn about opportunities for home solar installations.
Assessing compost bin utilization in the University of Michigan Hospital cafeteria	Collect information through observation and survey about current use of consumer compost bins within Michigan Medicine and opportunities for improved utilization.
Development of a travel related carbon emissions model to aid in planning for residency interviews after the COVID-19 pandemic	Build an online calculator to estimate environmental and health impact of applicant travel for residency interviews and use model to make policy recommendations that limit impact.
Good riddance to bad foam	Creation of a 'polar bear' art piece from landfill-bound pink foam positioners as a catalyst for the discontinuation of this tool as a routine prophylaxis against neuropathy in surgical procedures.
Post-traumatic growth in healthcare workers during the COVID-19 pandemic	Conduct a research survey of Michigan Medicine employees, about the relevant 'positive' mental health outcomes from the trauma of the pandemic, including post-traumatic growth.
One bag, two bag, red bag, blue bag: Biohazardous waste audit in the Emergency Department	Perform waste audit of 'red bag' biohazardous waste in the emergency medicine department at Michigan Medicine to measure current misuse and recommend opportunities to limit unnecessary incineration.
Implementing climate change Doctoring session with 'climate health history' practice	Creation of a new doctoring session for University of Michigan medical students focused on the health impacts of climate change and use of climate-related Standardized Patient session.
Surgical eye protection sustainability improvement scheme	Conduct quality improvement project focused on limiting disposable eye protection waste in the Michigan Medicine operating rooms.

Monday	Tuesday	Wednesday	Thursday	Friday
January 6th	January 7th	January 8th	January 9th	January 10th
Read articles: Climate Change and Human Health	None	Read article: 'One Lecture' Summary of Climate Change	Read Chapter 1: Climate Change and Human Health	Read article: 'Temperature related Press 11 hour', Sam
Week 1	Guest speaker: Climate Change (1.5 hours), Sam	Guest speaker: Overview of climate and health (1.5 hours), Sam	Guest speaker: Overview of climate and health (1.5 hours), Sam	Guest speaker: 'Temperature related Press 11 hour', Sam
Read articles: Climate Change and Human Health	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'
Week 2	Guest speaker: 'Substantively, climate change and human health' (1.5 hours), Sam	Guest speaker: 'vector-borne and water-borne diseases' (1.5 hours), Sam	'My climate story' (1.5 hours), Sam	Discussion: 'Environmental health equity' (1.5 hours), Sam
Read articles: Climate Change and Human Health	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'
Week 3	Guest speaker: 'Sustainability in anesthesiology' (1 hour), Sam	Guest speaker: 'Sustainability in anesthesiology' (1 hour), Sam	Guest speaker: 'Sustainability in anesthesiology' (1 hour), Sam	Guest speaker: 'Sustainability in anesthesiology' (1 hour), Sam
Read articles: Climate Change and Human Health	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'
Week 4	Guest speaker: 'Sustainability in healthcare' (1 hour), Sam	Guest speaker: 'Sustainability in healthcare' (1 hour), Sam	Guest speaker: 'Sustainability in healthcare' (1 hour), Sam	Guest speaker: 'Sustainability in healthcare' (1 hour), Sam
Read articles: Climate Change and Human Health	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'	Read article: 'Climate Change and Human Health'

Figure 4: Schedule of course activities, including guest lecturers

Triple Bottom Line in Surgery

Published in *NEJM Catalyst Innovations in Healthcare Delivery*, I described a framework by which surgical departments could consider "cost" more holistically. **Summary:** The health care industry is responsible for significant greenhouse gas emissions and waste production annually, with operating rooms producing a disproportionate share. The triple bottom line is a framework that helps organizations to consider the environmental, social, and financial "costs" of their actions. Surgical departments can incorporate this model to reduce environmental impact and achieve financial savings while still providing excellent patient care.



Left panel: Producing energy to power lights and equipment creates carbon dioxide, methane, and ozone as byproducts. Additionally, unmetabolized anesthetic gases, when released into the atmosphere, are potent greenhouse gases. These greenhouse gases absorb and emit energy in the atmosphere, contributing to climate change. Pollutants such as particulate matter, ozone, nitrogen dioxide, and sulfur dioxide are emitted during biohazard incineration and can have direct negative effects on human health. Solid waste from hospitals can contain toxic materials or produce liquid waste breakdown that pollutes ground water, and an aerobic breakdown of organic materials produces methane, a potent greenhouse gas.
Right panel: Potential immediate and long-term opportunities to achieve the triple bottom line in surgery.