UCSF Department of Medicine
ZUCKERBERG
SAN FRANCISCO GENERAL

ADDRESSING THE HEALTH IMPACTS OF CLIMATE CHANGE

Climate change is one of the most important public health crises of our day. The impact of this threat may fall most heavily on populations such as the patients we treat at ZSFG and similar ones globally. This month, the Annals of Internal Medicine highlighted this focus in an American College of Physicians Position Paper on Environmental Health. In this issue we highlight faculty members who are taking leadership roles in addressing this challenge.

Climate change continues to reshape the environment with detrimental health effects both locally and globally

Bringing Everyone Together

Sheri Weiser, MD, MA, MPH, Professor, ZSFG Division of HIV, Infectious Diseases and Global Medicine, has spent decades investigating how food and housing insecurity contribute to increased risk of HIV. In 2014, she led an intervention designed to address the root causes of poverty in Kenya. "Our participants described how unprecedented drought and flooding were driving their food insecurity," said Dr. Weiser. Extreme weather also contributed to poor health outcomes in unexpected ways, such as increased risk of acquiring HIV and other sexually transmitted infections, gender-based violence, and their ability to access medications because of flood-related road and clinic closures. All this kept her up at night. "I wondered, is there a way to bring this into my professional life?" Dr. Weiser recalled.

Sheri Weiser, MD

She began collaborating with Arianne Teherani, PhD, Professor of Medicine and Education Scientist in the UCSF School of Medicine Center for Faculty Educators. After they co-developed workshops to infuse themes of climate change and sustainability into the curriculum, the UC Office of the President invited them to expand their work across all 10 UC campuses. "It became clear how woefully inadequate climate and health education was throughout all the health professional schools, and that there was a screaming demand from students for more content," said Dr. Weiser.

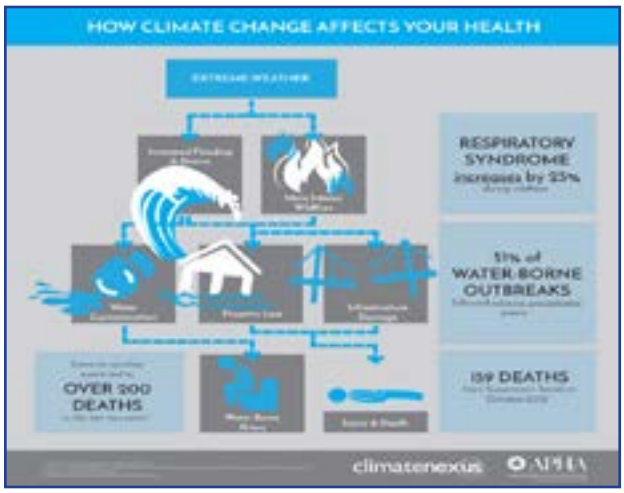
Building on their experience, she and Dr. Teherani co-founded the UC Center for Climate, Health and Equity, which launched in May 2022. The center includes faculty leads at each of the 10 UC campuses, plus more than 40 affiliated faculty and staff. Their mission is to harness the expertise and leadership of the health sector to drive ambitious climate action for health, and health action for the climate, through four intersecting pillars: research, education, health systems and policy.

"It's really exciting, because we're starting to forge important national and international connections," said Dr. Weiser. The center works closely with University of California Health, departments of public health in San Francisco, Fresno, Los Angeles and the State of California, and community partners

"Leveraging the entire University of California gives us a very important advantage, and people have reached out to partner with us because it's the UC Center, rather than just one institution," said Dr. Weiser. The center also is distinctive because of the way it incorporates clinical practice and health systems into its scope. "Most centers focused on health and climate are based in schools of public health, but because of our strong partnerships with UC Health, we have a broader mission," she said.

For example, the center is working to transform health systems, which are estimated to contribute up to five percent of global carbon emissions. "If we don't get our own house in order, how can we be a voice for change?" asked Dr. Weiser. Seema Gandhi, MD, Professor, UCSF Department of Anesthesiology, is working to decarbonize anesthesia practices UC-wide, including decreasing the use of desflurane gas and nitrous oxide, both of which are potent greenhouse gases.

Similarly, the UCSF Green Radiology Initiative is working to change clinician prescribing practices.



Graphic : APHA

"According to radiology national clinical guidelines, first-line radiology imaging for a particular abdominal condition might be either ultrasound or MRI [magnetic resonance imaging]," said Dr. Weiser. "Since an MRI uses a thousand times more energy, why would it not be ultrasound first? If you don't get the answer you need, then you can go to the MRI." Building on these successes, the center is launching the country's first clinical decarbonization fellowship, funding faculty members to take the lead on decarbonizing their departments.

UCSF medical student Karly Hampshire, a center fellow, also co-founded the Planetary Health Report Card, which uses a "Rate My Professor" model to enable health professions students to evaluate how well their institutions are addressing on a number of metric-driven criteria related to planetary health.

Research is another pillar. "We hope to get a big cadre of scientists across the UC system working on climate and health, negotiate with the National Institutes of Health to fund more of this work, and set up more community partnerships to co-create interventions and solutions," said Dr. Weiser. The center has funded seed grants on climate and health equity, and plans to establish climate and health grand rounds as well as student research-in-progress discussion groups.

The center is also creating a robust data dashboard – a one-stop repository for California climate and health data. "It takes a lot of work to clean and compile health data so that it's useable, and to integrate it with climate data," said Dr. Weiser. This can be prohibitively expensive and time-consuming for individual investigators to attempt. By making high-quality data sets easily available, the center hopes to help faculty, fellows and students more easily conduct research at the intersection of climate and health.

"For example, if someone wanted to investigate climate change and rising incidence of cocci, we will have a compiled data set," said Dr. Weiser, referring to coccidioidomycosis, or "Valley fever," a disease caused by a fungus that grows in the soil and is especially common in California's Central Valley. "We hope to use these data sets to generate a lot of high-impact policy-relevant publications."

Education is another core area of focus. "All health professionals need to leave their training with some basic literacy on climate and health," said Dr. Weiser. To develop a statewide climate health emergency response team, the center and its partners are expanding climate and health education for first responders and paramedics, including all park medics who rotate through UCSF Fresno. They are preparing emergency medical services (EMS) personnel to take on more responsibilities during acute climate events, helping prevent hospitals from becoming overwhelmed. "If there's a heat wave, EMS could start fluids in the field for someone who is dehydrated, monitor them, and keep in touch with physicians instead of immediately bringing them to the hospital when it's already really full," she said.

The center will also help trainees become more effective at addressing causes of climate change. "There's a tremendous amount of eco-anxiety right now, and one antidote to that is action," said Dr. Weiser. Elissa Epel, PhD, Professor and Vice Chair of UCSF Department of Psychiatry, is spearheading a UC-wide Climate and Mental Health Council, and the center hopes to develop a course called *From Distress to Activation*. Another course is *Climate Change, Health and Social Justice*, developed by UCSF School of Nursing Assistant Professor Orlando Harris, PhD, MPH, FNP; Professor Susan Chapman, PhD, MPH, RN; and doctoral student Ashley Moore MS, RN. Students create educational infographics and videos and post them to Instagram and TikTok.

The center will also launch a climate education ambassador program, in which faculty-student pairs from the UCSF schools of medicine, nursing, dentistry and pharmacy work to revamp their curriculum.

Additionally, the center is conducting climate health policy workshops across California. These will bring together policymakers, environmental justice and community groups, academics and health partners to identify priority issues and develop community partner projects in response. The center will also analyze all of California's local, regional and state climate action plans, assess strengths and gaps in how health and equity are incorporated, and compile a set of best practices to maximize health equity. They will also conduct stakeholder interviews to identify barriers and ways to facilitate integration of health equity into climate policies.

"All climate health impacts are disproportionately experienced by people of color, low-income individuals, and other vulnerable populations such as homeless people, those who have recently migrated, the elderly, very young, and women," said Dr. Weiser. "It's impossible to think about addressing climate and health without thinking about equity.…This is the biggest health crisis of our time. It's going to shape medicine for the next century. We want to bring all the health professions to the table, because we need everyone's expertise."

Engaging with Communities

Neeta Thakur, MD, MPH, Associate Professor, ZSFG Division of Pulmonary and Critical Care Medicine, sees firsthand how wildfire smoke and other effects of climate change impact her patients in the ZSFG Chest Clinic and hospital. "Social and environmental hazards are concentrated in specific communities," she said. "I've been engaged with environmental justice research, and since 2018 I've become increasingly involved in the climate space, including extreme heat and wildfire events."

In August 2020, she gave expert testimony to the U.S. Congress's House Committee on Oversight and Reform on behalf of the American Thoracic Society. Dr. Thakur outlined how heat waves,

ozone (the primary ingredient in smog), wildfires and pollen affect patients, particularly those who are poor and come from communities of color.

Because of her deep expertise in environment justice and collaborating with community stakeholders to co-develop effective intervention strategies, in 2021 Dr. Thakur was invited to serve on the U.S. Environmental Protection Agency (EPA)'s Clean Air Scientific Advisory Council Particulate Matter Review Panel. The group was charged with making recommendations about monitoring and regulating air pollution.

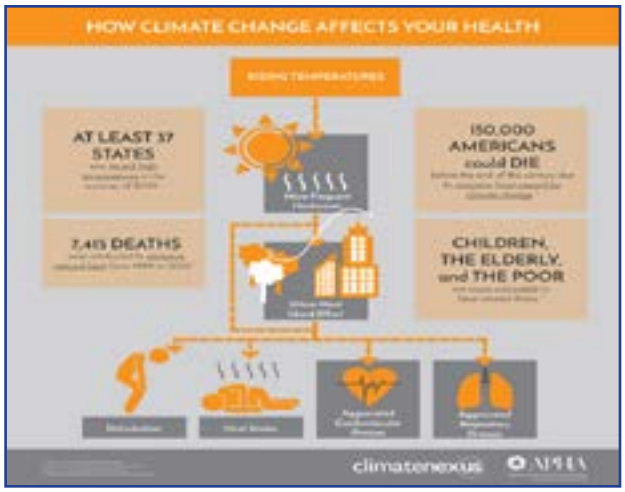
They focused much of their work on fine particulate matter, also known as PM2.5, which are inhalable particles with diameters of 2.5 micrometers or less. It takes about 30 of these particles to equal the width of a human hair. PM2.5 penetrate deep into the lungs and are thought to be especially harmful. Studies suggest that PM2.5 exposure is associated with increased risk of poor cardiovascular and lung health, as well as preterm births.

Neeta Thakur, MD

After evaluating the latest scientific evidence, the panel unanimously agreed that the current acceptable standard for annualized exposure to PM2.5, which is 12 micrograms per meter cubed (12 μg/m^3), was insufficiently protective of public health and should be lowered. Dr. Thakur and a majority of her fellow panelists recommended lowering the standard to 8 to 10 μg/m^3, while a minority of the panelists recommended a range of 10 to 11 μg/m^3.

Pollution is often concentrated in low-income communities of color such as Richmond CA, while more affluent communities such as Marin have cleaner air. "While many U.S. communities are [currently] below this 12 standard, there were enough communities above it that bringing everybody down to an 8 to 10 level would have a lifesaving impact and also improve cardiovascular outcomes," said Dr. Thakur. As one of only a few panelists focused on environmental justice, she made important contributions to the group discussion. "It was a priority [for me to] make the argument for equity, and to push for disproportionate benefits for communities that experience the greatest hazards," she said. The EPA is considering the panel's recommendations and will likely make a final decision in the coming months.

"It was illuminating to serve on that committee, because it gave me a much better understanding of how research studies are used to set policy in the U.S.," said Dr. Thakur. "It made me rethink how I and others should restructure our research." For example, the panel's lengthy report includes a summary of current research gaps. "The first thing I'd advise people to do is to read that section and try to frame your study to answer those questions so your research is additive rather than duplicative," she said.



Graphic : APHA

In addition to her policy work, Dr. Thakur also received two recent grants related to climate change. The EPA has funded her and her team to learn more about the health effects of short-term surges in PM2.5 due to wildfire smoke. "There are times when the PurpleAir maps are in the red or maroon zone, but then it drops all the way down to yellow," she said. "For those few hours that it's at a really high level, does that matter more than the average over a 24-hour period? That's a question we don't know the answer to yet."

In addition to discovering more about the effects of acute versus longer-term exposure to high levels of PM2.5, Dr. Thakur hopes to find out more about how these surges impact low-income communities. "Most of the information we collect from PurpleAir sensors are in affluent neighborhoods," she said. She is partnering with the Tenderloin Housing Clinic and Brightline Defense Project, an environmental nonprofit organization, to place PurpleAir sensors in single-room occupancy (SRO) hotel rooms. These supportive housing units tend to be more "leaky" and less well-insulated, making them more vulnerable to wildfire smoke infiltration. Also, many SROs are in older buildings without HVAC systems to filter the air. On hot days, residents cool rooms by opening windows, which can further expose them to high levels of PM2.5. She hopes to learn more about how this affects these vulnerable populations.

Dr. Thakur is also principal investigator on a grant from the Patient-Centered Outcomes Research Institute (PCORI), working with the community to identify and develop effective interventions to protect against the harmful effects of heat waves and wildfire smoke. In partnership with the San Francisco Department of Public Health and the San Francisco Office for Resilience and Capital Planning, she is working with community organizations to better understand low-income residents' concerns and recommendations for effective countermeasures. "There are a slew of interventions that work, such as cooling centers, weatherization and communication campaigns," she said. "But what does the community want? We have to find out what components and adaptations will make it successful and useable."

Dr. Thakur and her colleagues are using a participatory action research framework to train community experts on research methods, working together to co-develop questions and strategies. "For example, does a cooling center operate only during heat waves, or is it open throughout the year?" she asked. "Can it also be a 'resilience center' – an all-stop hub that focuses on being a clean air and cooling center? And for folks who say that cooling centers are completely useless if they have no way to get there, could we have a cooling center in the community room of an SRO?" Her team has grant funding to pilot implementation of one community-prioritized strategy, hopefully serving as a starting point for increasing climate resilience.

"It's very hard to find avenues to directly address structural racism if you approach it through a social determinant lens," said Dr. Thakur. "But because of growing concerns around climate change, there is a unique funding opportunity and government investment to make communities more resilient to the effects of climate change. If implemented right, with an equity lens in partnership with communities, we have a unique opportunity in history to undo generations of wrong policy. That's my motivation to do climate work."

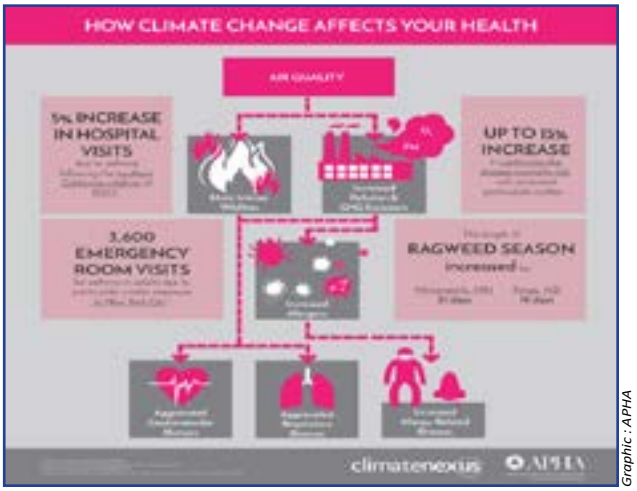
Protecting Older Adults

Just as the effects of climate change disproportionately affect communities of color and people who are poor, they also have an outsized impact on another vulnerable group: older adults.

"Just like everything else in geriatrics, older adults have multifactorial vulnerabilities to heat extremes and wildfires," said geriatrician Anna Chodos, MD, MPH, Assistant Professor of Medicine in ZSFG Division of General Internal Medicine. "They tend to have a reduced thirst response, and are more likely to be on medications for conditions such as high blood pressure or heart failure that regulate thirst or make them urinate a lot. They're more likely to have a cognitive, hearing or vision disability that might impair their ability to get help. And because access to technology has been structurally and systematically worse for older people, they're not as tapped into emergency [alert] systems."

Anna Chodos, MD

For the last five years, Dr. Chodos has been working to improve primary care education about climate change and health in older adults, in partnership with the San Francisco Department of Public Health and private, public and nonprofit agencies throughout Northern California through the UCSF Geriatrics Workforce Enhancement Program. "Geriatrics can help us create a patient-centered, age-friendly health system way of thinking about climate change that addresses how we care for older adults, who are going to be the most susceptible to these changes," she said. "On the individual health care provider level, how will we change our practice, whether it's in primary care, the emergency room or the hospital?"



Graphic: APHA

She recalls volunteering at a Red Cross shelter in 2017 after the devastating Tubbs Fire. "They had to evacuate a community of older people with lifelong severe disabilities who needed very intensive care, as well as an assisted living facility," said Dr. Chodos. "There were a lot of older people with disabilities, at all different levels of function and support. That has very different implications for how to structure a shelter and organize services."

Part of her educational efforts focus on helping the community understand how the effects of climate change can have serious consequences, even in a relatively temperate city like San Francisco. "We are understanding more and more that extreme heat exposure is relative," said Dr. Chodos. "It doesn't have to be 109 degrees to have an impact, and the fact that we don't necessarily think of ourselves as a hot city needs to change."

According to a story map developed by the San Francisco Department of Public Health (tinyurl.com/ExtremeHeatSF), San Francisco buildings have one of the lowest rates of air conditioning and weatherizing in the country, making it more difficult for older adults to control the temperature in their homes. Also, because it usually takes the human body about two weeks to acclimate to extreme temperatures, Bay Area heat waves can have a greater impact – particularly on elders.

She is also concerned about the intersection of aging, poverty, cognitive disabilities like dementia, and the reality of more older adults live alone. "People don't think of age as a social determinant of health, but it's where a lot of the other social determinants concentrate," said Dr. Chodos. "And poverty is actually concentrated in older people. They have a lot more medical expenses, and people are living a lot longer, so whatever they saved for retirement really dwindles."

This constellation of factors, combined with climate change, can have deadly consequences. "We've structurally created a society where many older, lower-income people move to marginalized [rural] areas that are more vulnerable to wildfires, because that's where they can afford to live," said Dr. Chodos. "If you look at the wildfire death toll, it tends to be older people with mobility issues, and there's increasing evidence that they are one of the groups most vulnerable to heat extremes and fires."

The importance of rethinking the health care system to care for older adults as the climate changes is even more important, since seniors are an ever-growing share of the population. "Aging is reshaping our world, with a much larger portion of the population in the older age group than ever before," said Dr. Chodos. "We can't use [demographic] information from 20 years ago to model our response. What resources are we going to need? How should we prepare? Clearly, medical practice will have to change, as we look for diseases we didn't have to look for before, or change medication regimens depending on climate and weather. We also need to continue working to connect health care with the right social and support services, so people will have meaningful supports to address the impacts of climate extremes." "Recognizing that we will be an older person when the worst effects of climate change are being felt will hopefully motivate us to take action now and be good stewards of the planet," Dr. Chodos said.

Elizabeth Chur

Editors: Neil Powe, Laurae Pearson, Brooks Bigart