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Climate students: As the impact of climate change is felt more directly in communities around the US, medical students have joined the call for their institutions to revisit the traditional graduate medical education curriculum.

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Pressured By Students, Medical Schools Grapple With Climate Change

In Miami, Florida, aspiring clinicians apply lessons learned while reaching out to the region's most vulnerable communities.

BY MICHELE COHEN MARILL

On Memorial Day weekend 2020, the skies opened up over Miami, Florida. Sheets of rain skidded off roofs, flooded streets, and overflowed canals, with three inches pouring down in a single hour. The rain continued to flow overnight and into the next day. Although it wasn't a hurricane or even

a tropical storm, the two-day rainfall surpassed any weather event in the past six years. "It's hard to believe we're only a couple weeks into the rainy season," a Miami television anchor remarked. "And we're drowning already," said his co-anchor.¹

A month later a Saharan dust cloud from across the globe enveloped Miami in stifling heat that barely budged with

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nightfall. On June 30, 2020, temperatures reached 98°F—the second-hottest on record for that date. Even opening a window could be hazardous, though, if it didn't have a screen: By the end of June the Florida Department of Health had already logged fourteen cases of mosquito-borne West Nile virus in Miami-Dade County² compared with only two cases in all of 2019.³

Living in South Florida brings near-constant awareness of the consequences of climate change. This threat isn't abstract—it's tangible, now, and when students at the Florida International University (FIU) Herbert Wertheim College of Medicine visit households in vulnerable low-income communities as part of their training, the impact is pronounced. The medical school was founded in 2006 with a mission to graduate "socially accountable" physicians, and its students learn about health disparities and engage in community service as part of their programs. All medical students participate in the Green Family Foundation Neighborhood Health Education Learning Program (NeighborhoodHELP), joining with nursing, physician assistant, and social work students and supported by university outreach workers as they provide wellness and chronic disease management in nearby communities. As they screen patients for risk factors and connect them with resources, the students see first-hand the health impacts of climate change: the added burdens of heat, mold, air pollution, and a lack of green space.

One patient lost her retail job during the coronavirus disease 2019 (COVID-19) pandemic lockdown and couldn't afford to fix her air conditioner, even as record-setting heat in April triggered her asthma. Amid news coverage, an emergency medicine physician gathered donations and bought her a new unit. Meanwhile, FIU medical students urged



Sea rising: Miami-Dade County resident Louis Fernandez walks along a flooded street caused in part by high tides due to the lunar cycle, according to the National Weather Service. Fernandez's neighborhood occupies Ground Zero in the US for any climate-related sea level rise.

their patients to get some exercise by taking walks, but the lack of trees in the neighborhoods meant that the pavement was broiling, and people stayed inside.

To participating students and anyone else paying attention, Neighborhood-HELP reveals an unequal burden: Climate events accentuate health inequities, particularly in low-income communities.⁴ Learning about social determinants of health is already a part of the FIU medical school curriculum. Now, medical students are pressing for the health effects of climate change to be taught as well.

Students Samantha Rodriguez and Miranda Ricart were just finishing their second year of medical school in the spring of 2020 when the pandemic halted their expected clinical rotations. They had already begun meeting with six other students who shared their concerns about climate-related health effects. Now they had an unexpected window of time to explore their ideas and try to influence the medical school curriculum.

They began researching and creating slides that could be seamlessly inserted into lectures. It is a delicate task because the lectures are already packed with essential material. The students decided to meet one-on-one with professors and

suggest ways to insert climate-related information or substitute clinical examples with climate-related ones.

Rodriguez sums up the pitch: "We are willing to do this. Are you willing to work with us and apply it?" That quest has become surprisingly commonplace at medical schools across the US as medical students take a transformative role in shaping what future physicians learn about the impact of climate on health.

Medical schools are influenced by their students. Researchers at the Columbia University Mailman School of Public Health surveyed members of the Global Consortium on Climate and Health Education in 2017 and 2018. Of fifty-nine schools of public health, medicine, nursing, or other health professions that responded to the question, 80 percent reported that student interest was a factor in establishing or developing curricula on climate health.⁵

"Students have been one of the most important groups working on this because of their energy," says Brittany Shea, project director of the consortium, which was founded at Columbia University. "They really expect to see change. They're forming groups and working with their faculty and going to their administrations to demand change."

Adding A Climate Change Context

A national network of climate-focused medical students grew organically as they first discovered like-minded classmates and then learned about similar efforts at other academic institutions. They are spurred forward by faculty members who share their climate health concerns.

Polls show that in general, young adults are more alarmed about climate change and more attuned to its effects than older Americans.⁶ It is at the top of their minds. At Emory University School of Medicine, in Atlanta, Georgia, Ben Rabin and Emaline Laney began thinking about the climate crisis even in their first-semester lectures in 2018. "It seemed like environmental health was the big elephant in the room that wasn't explicitly addressed at any point in our learning," says Rabin, who is now a third-year medical student.

Rabin and Laney organized an hour-long interdisciplinary lunch panel on climate and health. The robust turnout surprised them, especially considering how valuable each hour of the day is to medical students. Serendipitously, Laney had landed a spot on a student-run curriculum committee, which makes recommendations to faculty and administrators.

Beginning with the spring semester in 2019, Rabin and Laney began taking notes about where they thought climate-related information would be relevant in lectures. Later, they conducted literature searches to tie climate effects, such as heat or increased air pollution and rising ground-level ozone, to specific organ systems, such as the heart, kidneys, and lungs. Rebecca Philipsborn, an assistant professor of pediatrics at the Emory School of Medicine, had integrated climate impact into the curriculum for pediatric residents on the global health track, and she supported Rabin and Laney as they crafted a proposal for the medical school.

"The content is already there," says Laney. "We're trying to contextualize the pathophysiology [as it relates] to climate." Their proposal was endorsed by the medical school's Executive Curriculum Committee in October 2019, with implementation beginning with the class of 2024.

An extensive research base supports the need to address climate-related health effects in medical school curricula. In 2009 a commission of the *Lancet* and the University College London Institute for Global Health called climate change “the biggest global health threat of the twenty-first century.” Rising global temperatures produce deadly heat waves, increased transmission of vector-borne diseases, more severe weather events, widespread food insecurity due to lower crop yields, and water shortages, the *Lancet* Commission stated.⁷ Health hazards, including stress and other mental health effects, disproportionately affect children, pregnant women, older adults, low-income communities, and people of color in risk-prone areas, according to volume II of the Fourth National Climate Assessment, a 2018 multiagency report of the US Global Change Research Program.⁸

Climate change has been viewed from a population health lens, but it should be framed as an issue for medical practice, says Aaron Bernstein, a pediatrician and interim director of the Center for Climate, Health, and the Global Environment at the Harvard T. H. Chan School of Public Health, in Boston, Massachusetts. It affects individual disease risk and severity. For example, heat alters the properties of some medications, and some common drugs, such as beta blockers and antidepressants, increase the risk for heat-related illness. Physicians need to caution patients about heat exposure and the effects of heat on their prescriptions, Bernstein says.

Although practicing physicians might not view climate as a front-burner issue, medical students grasp its relevance. That is why they are leading efforts to incorporate climate health in the core curriculum, Bernstein says. “I don’t think this happens without them. Period,” he says of their advocacy. “I don’t think that’s overstating it.”

Few Med Schools Teach Climate Health

Teaching about climate and health has been in a slow evolution since the first course on “Human Health and Global Environmental Change” began at the Harvard School of Medicine in 1997 at the urging of Sen. John Kerry and Vice President Al Gore.

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During the next two decades, climate health became a common topic in schools of public health and gained traction in some medical schools, either integrated into the core curriculum or as an elective course. Yet in the Global Consortium on Climate and Health Education survey, 71 percent of fifty-nine respondents reported that they encountered challenges such as lack of staff time, resources, or funding; competing priorities; or lack of space in the core curriculum.⁵

In August 2019 the International Federation of Medical Students’ Associations surveyed medical student representatives at 2,817 medical schools in 108 countries. Only 414 medical schools (14.7 percent) included climate change and health in the curriculum, and another 337 schools (12 percent) had student-led or informal activities.⁹

The push to teach about climate health in US medical schools has gained powerful momentum from the American Medical Association (AMA), the nation’s largest and most influential physician organization, and from the advocacy of dozens of medical societies. In June 2019 the AMA adopted a resolution endorsing the teaching of climate and health in “undergraduate, graduate, and continuing medical education such that trainees and practicing physicians acquire a basic knowledge of the science of climate change, can describe the risks that climate change poses to human health, and counsel patients on how to protect themselves from the health risks posed by climate change.”¹⁰

Todd Sack, author of the resolution, is a Jacksonville, Florida, gastroenterologist and hepatologist who created a program called My Green Doctor,¹¹ a free practice management tool to help physicians introduce sustainability and climate change preparedness into their offices and clinics. He worries that doc-

tors might not be prepared to address a looming public health crisis stemming from climate change.

“A whole generation of doctors now are graduating unprepared to be leaders in the community,” Sack says. “They can lead on tobacco, they can lead on seat belts, but they can’t lead on this number-one challenge of our century.”

In its resolution, the AMA committed to “make available a prototype presentation and lecture notes on the intersection of climate change and health.”¹⁰ The momentum to implement the resolution has been affected by the COVID-19 pandemic, a spokesperson said. The AMA is one of twenty-nine medical societies, representing more than 600,000 physicians, that have joined the Medical Society Consortium on Climate and Health to raise awareness about the health effects of climate change. In 2019 the consortium and a broad coalition of health and medical organizations issued a policy action agenda, calling climate change “a true public health emergency” and urging the integration of “climate solutions into all health care and public health systems.”¹²

As physicians become more attuned to the way global warming affects their patients, “many of them are educating their patients about what they see as the increased risk,” says Mona Sarfaty, director of the consortium.

One missing link has been residency training. In September 2020 Philipsborn, Bernstein, and other medical faculty members with a special interest in climate health issued a framework for resident education on climate change. It includes a detailed matrix of proposed learning objectives, teaching formats, and curricular points. For example, one entry related to clinical practice notes that climate-related illnesses may include heat exhaustion, heat stroke, syncope, heat-related nephropathy, electrolyte imbalances, asthma or chronic obstructive pulmonary disorder exacerbations, pollution and wildfire smoke exposure, seasonal allergies, gastroenteritis (viral or bacterial), malnutrition, micronutrient deficiency, poor glycemic control in diabetics, and heart failure exacerbations.¹³

Residency training is largely influenced by the specialty associations. For example, the American Academy

of Pediatrics issued a policy statement on global climate change and children's health in 2007 (and a revised version in 2015)¹⁴ and set up a Climate Change and Health Task Force. Philipsborn regularly talks to her pediatric residents about the ways in which climate change affects children. The lessons became visceral and poignant to her in 2017, when Hurricane Irma swept across Puerto Rico and Florida and some evacuated newborns ended up in her clinic at Hughes Spalding Hospital in Atlanta.

"The babies were OK and everything worked out," she says. "But imagine being a new mother in that scenario, completely separated from your support system, your home, and your medical home." The takeaway for pediatric residents: Be prepared to care for patients displaced by severe weather events and make sure your patients have a disaster preparedness plan.

A Report Card

Medical students aren't waiting for their degrees before adding their voices to these efforts to boost education on climate health. Some students have become members of the physician network of Health Care Without Harm, a non-profit organization focused on environmental health and sustainability in the health care sector. And they are building their own networks. "They are passionate, they're committed, they're visionary, they're organized, they're strategic," says emergency medicine physician Amy Collins, Health Care Without Harm senior clinical adviser. "I expect them to continue to evolve and emerge as really effective national climate health leaders."

In August 2019 Harleen Marwah reached out to Collins for help connecting with other medical students in the Health Care Without Harm network. They called their fledgling effort Medical Students for a Sustainable Future. Within a year the group had grown to include more than 270 medical students from 80-plus medical schools. The organization joined the Medical Society Consortium on Climate and Health, created an Earth Day video highlighting a commitment to climate health, and launched a Journal Club on Climate and Health to spark national Zoom-based conversations about pertinent articles.

Medical Students for a Sustainable Future maintains a website, monthly bulletin, and framework of committees. (So far, their only funding has come from a small, anonymous parental donation to pay for web hosting.)

"Thinking about climate change and how it's going to affect my patients is essential to being a good physician," explains Marwah, a fourth-year medical student at George Washington University, in Washington, D.C., who was inspired in part by her experience as a youth delegate at international climate meetings in Peru and Paris in 2014 and 2015 when she was a graduate student in global health.

"Part of the oath I'll take when I graduate next year is to do no harm," she says. Doing no harm inherently implies thinking about this broader responsibility and this broader duty."

Karly Hampshire began medical school at the University of California San Francisco (UCSF) in the fall of 2018 with a similar conviction. In November the Camp Fire began raging uncontrollably across northern California, enveloping San Francisco in a thick, gray smoky haze. Yet as Hampshire listened to a lecture on respiratory illness, she was struck by a glaring omission: Not a word was said about smoke from the wildfire, the health threat of air pollution, and the link to climate change.

UCSF has actually been at the vanguard of climate health, as one of the first medical schools to offer courses on the topic. But Hampshire and some of her classmates wanted more breadth and depth. They formed the Human Health and Climate Change Club, an interprofessional group encompassing UCSF medical, pharmacy, nursing, and dentistry students. Then, in 2019, Hampshire and other medical students began devising a Planetary Health Report Card, patterned after the Racial Justice Report Card, a national, student-driven effort by a group called White Coats for Black Lives that gauges the racial justice curriculum and climate at schools of medicine.

The Planetary Health Report Card includes metrics in five areas: curriculum, research, community engagement and advocacy, support for student-led initiatives, and campus sustainability. For example, offering an elective on "the im-

pact of climate change on the changing patterns of infectious diseases" confers one point; its inclusion in the core curriculum merits two points.¹⁵

Thirteen medical schools participated in the initial report card, which was released in July 2020. They scored from a B to a C-, with grades that showed some bright spots and areas for improvement. (UCSF ranked third, and its joint medical school with the University of California Berkeley ranked first.) More than fifty schools have expressed interest in participating in the 2021 report card, including schools in the United Kingdom, Hampshire says.

High scorers could gain an edge in attracting students. Hampshire and colleagues surveyed 600 medical students at twelve geographically diverse medical schools across the country and found broad support for climate health in the curriculum. Eighty-four percent said they feel that health effects of climate change are already occurring, and only 13 percent felt that their school was currently providing adequate education on the topic. The survey results, which have not yet been published, showed no differences based on geographic region.

"I get the sense that this is a very beginning of a massive movement towards planetary health in medical schools," says Hampshire, who is in her third year. "People, especially of my generation, are realizing the massive public health emergency of climate change, and they want to do something about it."

Slide By Slide

A recent summer day unfolds in a COVID-19-normal way at Florida International University, with streams of lectures and discussions on Zoom: Three hours in the morning, three hours in the afternoon. Samantha Rodriguez sits on the couch in her living room, and a few miles away Miranda Ricart settles in the bedroom she has turned into an office, absorbing lectures while third-year clinical rotations are suspended. Outside, the air is soupy and hot, hovering at a humid 91°F—just another torrid day in a summer that has broken records for the warmest lows and most blistering highs.

At the end of the day, they muster their energy for one more call—one that reflects more on the future of medicine than on their own education. In a

Zoom meeting with associate professor Gregory Schneider, they offer suggestions for adding climate change seamlessly into certain lectures.

“Ultimately, the goal of all of this is to start the conversation and provide you with an abundance of information that you can select for lectures as you see fit,” Rodriguez says. “We won’t be insulted if you don’t take it.”

Schneider, a family medicine physician, is course director of a series called the “Community Engaged Physician,” which is required in each year of FIU’s medical school. The point is to inspire students to think about ways in which low-income communities experience health disparities—so of course he is pleased that Rodriguez and Ricart are making these connections.

Together they move through the slides like collaborators on a presentation. The first one illustrates how environmental factors contribute to disparities. A proposed slide for a “Neighborhood and the Built Environment” lecture on epidemics and pandemics cites a recent study linking particulate matter in air pollution to higher death rates from COVID-19.

“This is the next lecture, ‘Preventive Medicine,’ slide 7,” Ricart says. “It was just giving examples of household-centered care.” The lecture defines primary, secondary, and tertiary preventive measures that patients can take. “We have a slide of examples of preventive measures that relate to climate change and this practice question about what [type of measure] an air conditioning unit would be. It would prevent an asthma attack, so it would be tertiary,” she says.

Schneider ponders the idea, then warms to it. “This would be a new way to use that thinking,” he says. “That’s interesting. I like that.”

After an hour, the students have a few items on a follow-up list. It is time to turn to their main workload. “Now I’m going to try to drink a lot of coffee and study,” Ricart says before signing off.

Since the pandemic has disrupted their regular routines, Schneider has been heartened to see how many students have turned their attention to helping the community, even with COVID-19 restrictions. Medical students in South Florida—from FIU, the Univer-

sity of Miami, Nova Southeastern University, and Florida Atlantic University—help run the Dade County Street Response Disaster Relief Team, which provides health education, medical services, and disaster response to vulnerable communities, including the homeless. They began distributing masks, hand sanitizer, and information about COVID-19, as well as food and hygiene products. FIU students launched a telehealth service for homeless people who were isolated in Miami-area hotels because of COVID-19. Other students began working on a project to combat food insecurity. But in other ways, the pandemic limited potential hands-on opportunities for students. In response, many turned their focus to pursuing more systemic changes.

“In the pandemic, students who really want to make a difference are suddenly at home and not able to do anything,” Schneider says. “They have a lot of energy. Trying to figure out how to channel that productively is the kind of challenge I like.”

For some students, engaging in the community service and patient advocacy helped lift a veil to reveal clear connections between climate and health. Angeliqe Gadson, a third-year FIU medical student from Tampa, Florida, and community coordinator of the Dade County Street Response Disaster Relief Team, was worried about how poor communities prepare for hurricanes. As part of her outreach work, she joined Florida Clinicians for Climate Action, a coalition of health professionals and organizations, and learned how global warming triggers more intense storms.

Gadson became one of the eight FIU medical students working with professors to add climate health to lectures and PowerPoint presentations. By the end of the summer they had developed a massive document of proposed changes. “It’s really just coming together as a team that we are able to make change,” Gadson says.

‘Connecting The Dots’

The low-slung apartment complex is spartan and drab. No trees or bushes adorn the strip of mottled grass, as if it isn’t worth the effort to beautify. This neighborhood is in an unremarkable grid of Miami, but it could be in Liberty

City, Little Haiti, Opa-Locka, Miami Gardens, or even a sliver of South Miami that hasn’t yet gentrified—places where people struggle to pay their rent and have little money left over for food, utilities, and medicine.

This is the terrain of internist Cheryl Holder, who brings health care to people who are uninsured or financially struggling and who teaches FIU medical students about social determinants of health through the NeighborhoodHELP program. As an associate professor and interim associate dean of diversity, equity, inclusivity, and community initiatives, she helps guide students through the program, which is supported by the Green Family Foundation.

In NeighborhoodHELP, students visit the same households from their second through fourth years in medical school, helping patients address their health challenges in the context of the home environment. For example, the students routinely look for fall risks such as loose rugs or uneven flooring. But they also screen for health-related social needs such as food insecurity, lack of transportation, and difficulty paying for utilities. They are evaluated on the basis of rubrics that set expectations for how they conduct the assessments and provide education and recommendations to the households.

From September 2010 to August 2016, interprofessional student teams conducted 7,452 visits to 848 households. The teams identified about 1,400 issues related to social determinants of health that had a legal remedy, such as health care access or immigration concerns. In surveys conducted after the first two years, households reported that they made fewer visits to the emergency department and received more preventive health care.¹⁶

Now, NeighborhoodHELP is beginning to incorporate climate health risks, such as lack of air conditioning or intact screens on windows or doors. “Connecting the dots kind of hits you slowly,” says Holder, president of the Florida State Medical Association and cofounder of Florida Clinicians for Climate Action. “I started repeatedly visiting these homes in the summer that had no air conditioning. We would melt, practically. The students would sweat, I would sweat, the households would sweat.”

On a January morning, before the spring heat wave and a couple of months before COVID-19 led to a temporary halt of in-person household visits, Ricart joined a NeighborhoodHELP team in the living room of an eighty-year-old woman with heart disease. The woman wore a light pink house dress and sat in a large leather chair, slowly flapping a paper fan through the still, damp air. Her walker was an arm's reach away. The woman complained about feeling so breathless that she couldn't go to church or visit friends, but she said her cardiologist told her she didn't qualify for a Medicare-provided oxygen tank.

As the hour drew to a close, Ricart felt the uncomfortable stickiness that clings in Miami's air and saw beads of sweat glistening on the faces of her colleagues. It was only afterward that Ricart began to "connect the dots." With air conditioning, wouldn't this woman's cardiac symptoms be more manageable? If January temperatures were uncomfortable in her home, how would she fare in the spring and summer months?

And if someone's home environment

could have a significant effect on health, shouldn't that be a part of a physician's inquiry? Her personal epiphany about climate and health grew into a broader commitment to influence the education of future physicians.

In June 2020 Rodriguez and Ricart gave a climate health presentation to the Florida Medical-Legal Partnership, a collaboration of health care providers and lawyers. It was followed by workshops in which lawyers drafted template letters that doctors can give to patients who want to ask their landlords for mold remediation to ameliorate respiratory symptoms or for the repair or installation of screens to protect against mosquito-borne diseases.

Rodriguez and Ricart also helped create a NeighborhoodHELP rubric on climate health risks, which faculty members would use to evaluate how medical students conduct "a home assessment to identify environmental health risk factors" and provide "relevant patient education on the risks identified."

"I definitely think that [household] experience is a clear example of how

you cannot begin to understand another person's life from an office visit. And at its core, that is what we are trying to reveal in the curriculum changes," Ricart says. "Climate change is one subject that health professionals often do not broach, partly because they do not see the immediate connections to health and partly because we do not know what we can do about it."

Ricart and other medical students are findings ways to support and educate patients amid a growing climate health risk. And by working to reshape the core curriculum in medical schools, they ensure that future physicians will do the same. ■

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NOTES

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