

Columbia Public Health

STORMY WEATHER
Climate Chaos

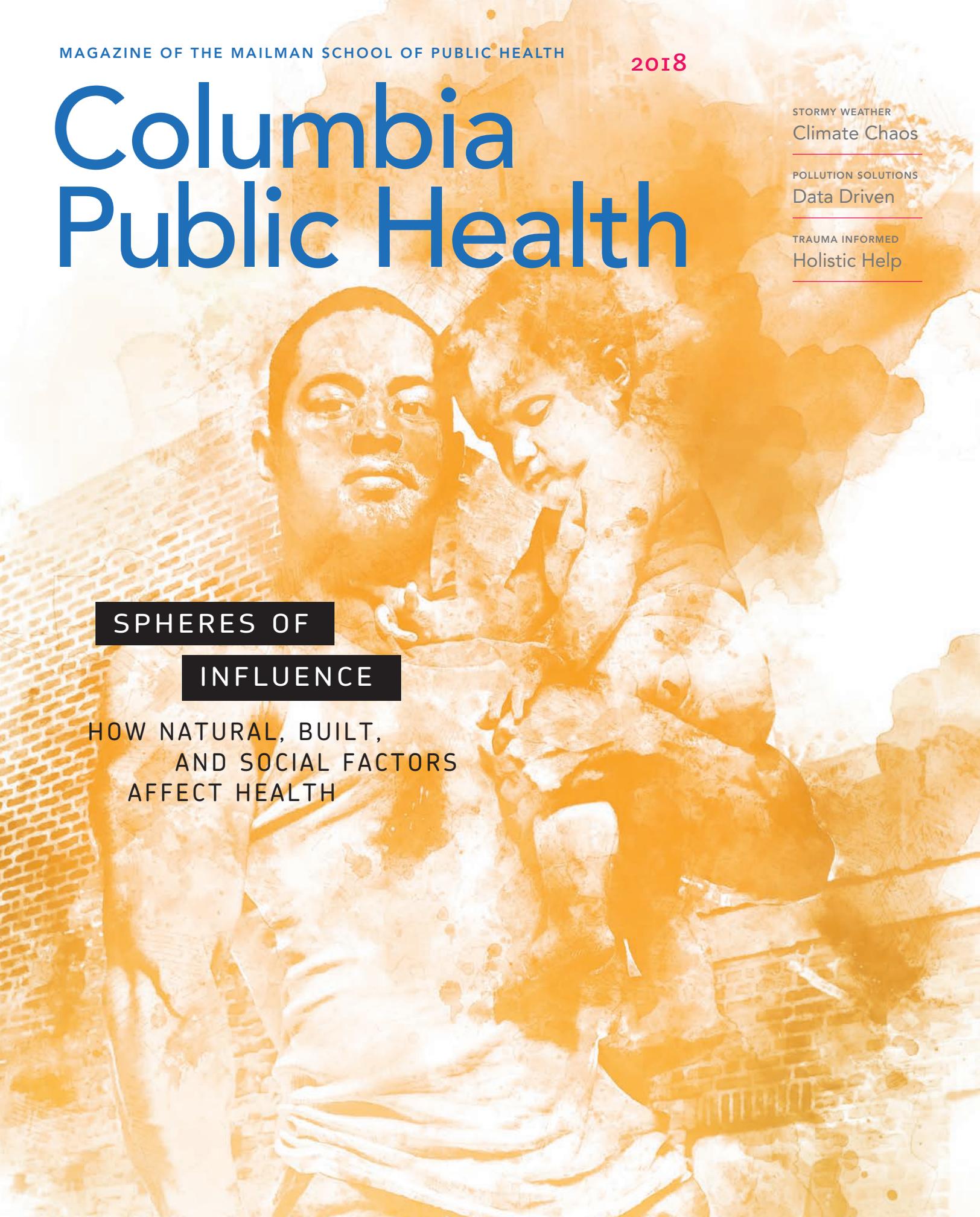
POLLUTION SOLUTIONS
Data Driven

TRAUMA INFORMED
Holistic Help

SPHERES OF

INFLUENCE

HOW NATURAL, BUILT,
AND SOCIAL FACTORS
AFFECT HEALTH



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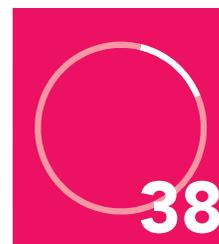
When Hurricane Maria slammed Puerto Rico, research colleagues on the ground helped Columbia Mailman School faculty, students, and staff identify ways to promote health. BY NANCY AVERETT

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In 1998, the family of industrialist and philanthropist Joseph L. Mailman honored his legacy. Two decades later, we look back at what their vision has wrought.



Mission Possible: Evidence-Based Solutions



[Here] we highlight the power of Columbia Mailman scientists collaborating across disciplines, a 21st century approach vital to solving the complex and critical problems affecting our health.



From the air we breathe to the neighborhoods we inhabit, the geographic places and social spaces we move among profoundly affect humanity, setting the stage for our health, as well as for chronic disease.

In this special, themed issue of *Columbia Public Health*, we detail how our natural, built, and cultural environments shape human health across the lifespan, document their role in chronic illness, and report on evidence-based interventions that can turn the tables on disease and promote well-being.

Scientists have already shown that 70 percent of a population's health emerges from the exposures of daily living, precisely the focus of public health-led prevention and health promotion. Sometimes they affect our present health—as when air pollution triggers asthma attacks, or a safe and pedestrian-friendly neighborhood supports a person's efforts to manage diabetes. And sometimes these exposures alter our trajectory, as when contaminated drinking water sets the stage for heart disease or childhood stressors affect adult breast cancer risk.

A growing body of evidence suggests that in combination, as they so often appear in our modern environment, such exposures escalate our risks. And when they are curtailed, the corresponding health risks can likewise be attenuated. Protecting our health, then, requires collective agreement and action to control these hazards.

In the articles that follow, we highlight the power of Columbia Mailman scientists collaborating across disciplines, a 21st century approach vital to tackling the complex and critical issues affecting our health. To enhance our ability to investigate the most complex problems—which invariably emerge at the intersection of multiple disciplines—I've recruited Gary Miller, PhD, as our inaugural vice dean for research strategy and innovation. (See page 6.) Dr. Miller will partner with our faculty to identify avenues where interdisciplinary teams can accelerate the power of science to build better health futures for us all.

A similar commitment to innovation motivated Jody Wolfe, Josh Mailman, and their mother, Phyllis Mailman, two decades ago, when the family set out to endow Columbia's School of Public Health and honor the legacy of Joseph L. Mailman, the School's eponym, with our current facility at 722 W. 168th St. By providing a dedicated physical space to serve as the School's intellectual and social home base, the Mailman family has spurred the kinds of conversations and collaborations that emerge from sustained connections and regular contact—the kind of contact at the heart of team science.

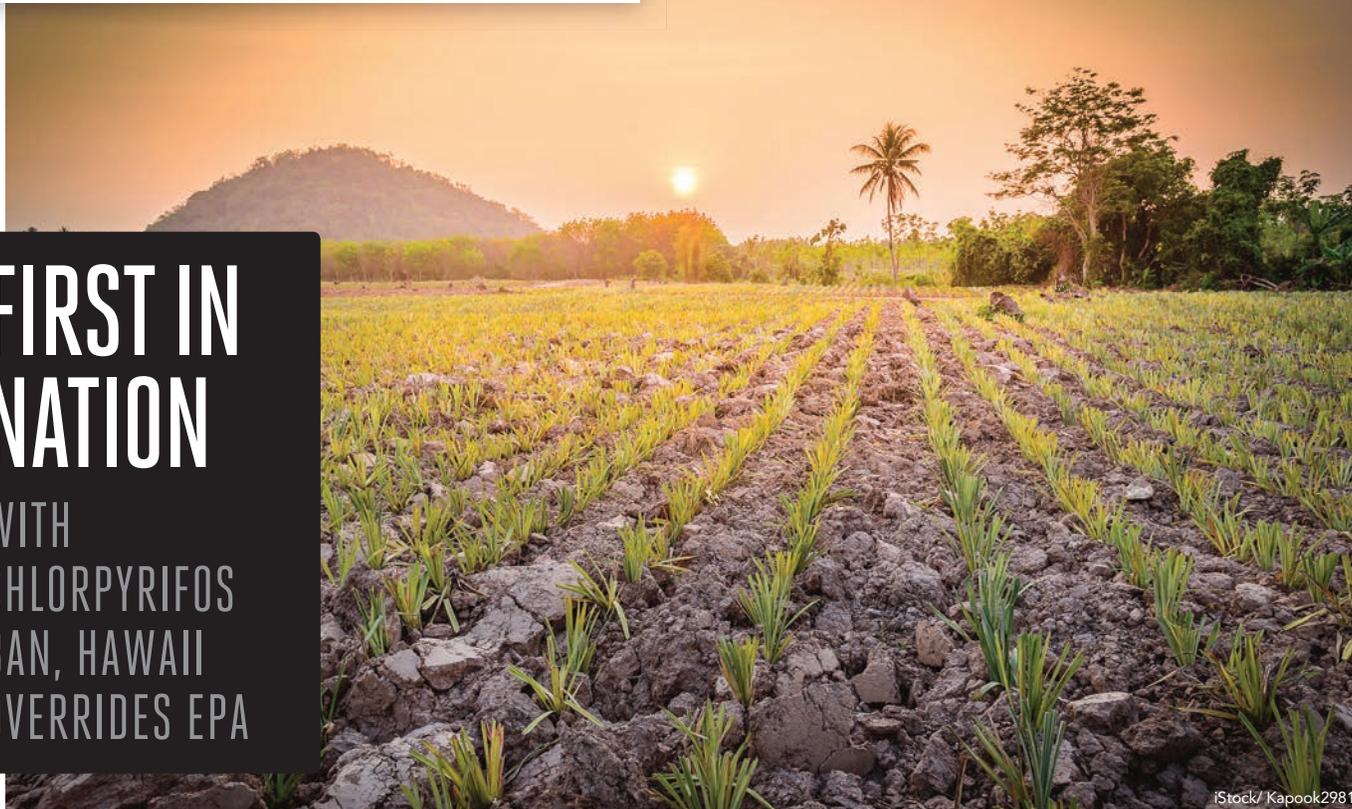
As we look forward to the School's centennial in 2020, we continue to seek opportunities to leverage all that's been achieved in our first century and propel our pursuit of 21st century science for solutions.



Dean Linda P. Fried, MD, MPH

FIRST IN NATION

WITH
CHLORPYRIFOS
BAN, HAWAII
OVERRIDES EPA



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IN JUNE, HAWAII BECAME THE FIRST STATE IN THE U.S. TO BAN CHLORPYRIFOS, THE MOST WIDELY USED PESTICIDE IN THE COUNTRY AND A NEUROTOXIN LINKED TO DEVELOPMENTAL DELAYS AMONG CHILDREN. In 2000, the federal government banned nearly all residential and indoor uses of the organophosphate. Its application in agricultural and industrial settings has remained a source of fierce debate; in 2017, then-Environmental Protection Agency head Scott Pruitt denied a petition to outlaw the compound, which has been registered for use in the United States since 1965.

Prior to a unanimous vote by Hawaii’s state legislature in favor of the bill in May, Virginia Rauh, ScD, professor of Population and Family Health and one of the nation’s leading chlorpyrifos researchers, traveled to Honolulu, where she met with Governor David Ige and state legislators to explain scientific analyses of the health risks of exposure during prenatal and early childhood development. Over the past 15 years, Rauh and collaborators at

the Columbia Center for Children’s Environmental Health have studied the chemical, finding that the greater a person’s exposure during pregnancy, the lower her child’s IQ score. Another study documented exposure-related structural changes to children’s brains in areas governing attention, planning, and other executive functions. Ongoing research is investigating movement and motor symptoms that might relate to early Parkinson’s disease.

“I walked the legislators through what our research has found in the cohort of children here in New York City,” says Rauh. “We’ve studied chlorpyrifos before and after the residential ban in 2000, and the differences in exposure levels are stark. Given the ongoing agricultural applications in many parts of the country, children continue to be exposed to levels of chlorpyrifos that have been associated with a range of cognitive and motor deficits. Such risks are unacceptable and preventable with sound public health policy.”

HONOR ROLL

A SAMPLING OF AWARDS

* **John Santelli**, MD, MPH, professor of Population and Family Health, awarded \$3.5 million by the NIH to investigate structural and social transitions among adolescents and young adults in Uganda.

* **ICAP**, awarded \$25 million from the U.S. President’s Malaria Initiative.

* **Karolynn Siegel**, PhD, and **Eric Schrimshaw**, PhD, Sociomedical Sciences, awarded \$2.5 million to study HIV risks.

* **Joseph Graziano**, PhD, and **Ana Navas-Acien**, MD, PhD, professors of Environmental Health Sciences, awarded \$3.3 million by the NIH to investigate the health effects and geochemistry of arsenic.

* **Chelsea Clinton**, MPH ‘10, **George Fotiades**, **Yusuf K. Hamied**, **Ellen Kaden**, and **Lila R. Preston**, new members of the Columbia Mailman School Board of Overseers during the 2017–2018 school year.



A PLACE AT THE TABLE

STUDENTS TAP THEIR LEADERSHIP POTENTIAL

"If they don't give you a seat at the table," Shirley Chisholm, the first black woman elected to the U.S. Congress, once declared, "bring a folding chair." This past winter, Columbia Mailman School students Misty Downey, MPH '18, Caroline Johnson, MPH '18, Audrey Nuamah, MPH '18, and Chelsea Wynn, MPH '18, took Chisholm's injunction to heart, launching Columbia Emerging Women's Leadership (CEWL).

Nearly 80 percent of employees who work in healthcare are women, but they comprise only 40 percent of key healthcare industry decision-makers. "Women face unique challenges related to health and success in the public health industry," says Nuamah, "and these challenges are often compounded by intersectional factors such as race, sexual orientation, and religion, among others."

The group's first event, "What Do You Need to Lead?" served as a needs assessment; participants detailed their hopes for an organization dedicated to cultivating women as leaders.

The second event, "Workplace Bootcamp: A Mini-Series for Women to Start (and Stay) Strong On the Job," addressed that feedback. Participating faculty provided guidance on developing an elevator pitch, navigating gender dynamics in the workplace, building interviewing skills, and handling workplace harassment.

"Learning from women who have come before us and supporting those who will come after is crucial," says Nuamah. "In order to break the glass ceiling, we must all use our collective strength. Until then, we will continue to bring our own folding chairs." 🍷



photo: Tim Paul

A BOLD BEGINNING
IN PURSUIT OF EQUITY AND UNITY

AT THE 2018 COMMENCEMENT, 600 STUDENTS WERE AWARDED A MASTER'S DEGREES AND 40 RECEIVED THEIR DOCTORAL DEGREES. SETH BERKLEY, MD—CEO OF GAVI, THE VACCINE

ALLIANCE, AND RECIPIENT OF THE DEAN'S VISIONARY LEADERSHIP AWARD—GAVE THE KEYNOTE ADDRESS. Since its inception in 2000, Gavi has supported the immunization of more than 640 million children in low-income countries and, as a result, prevented more than 9 million deaths. Essie Essamba Quakyi, MPH '18, (Department of Sociomedical Sciences), was the student speaker chosen by a committee of students, faculty, and staff.

"Now we're focused on the missing child," said Berkley of his vision for Gavi to vaccinate another 300 million children by 2020. "We want to increase coverage and increase equity by finding the areas we haven't been able to adequately reach, including some middle-income countries that are lagging behind."

At the inaugural Students of Color Graduation Celebration, which honored the theme "unity across difference," participants received kente cloth stoles. The first of its kind for a school of public health, the event was organized by the Black and Latinx Student Caucus and Advocates for Asian American Health, with help from the Office of Student Affairs and the Office of Diversity, Culture, and Inclusion. Then-New York City Health Commissioner Mary Bassett, MD, MPH, gave the keynote address. "You are so lucky to have family that extends beyond blood ties and extends to the solidarity of people with whom we share an identity, as people of African descent and people of color," said Bassett, an adjunct professor in the Department of Epidemiology. "There may come a day when we don't need this solidarity, but that time hasn't come." 🍷

HONOR ROLL

* **Danting Liu**, MPH '18, named president of the Mailman School Graduate Student Association, reconstituted in 2018 with a five-member executive board, representatives from all six departments, and a doctoral council.

* **Chelsea Samone Wynn**, MPH '18, winner of the Campbell Award for "exceptional leadership and Columbia Spirit" and **Celia Anne Wright**, MPH '18, awarded the Bernard Challenor Spirit Prize for "building community, across department boundaries at the Mailman School."

* **Darby Jack**, PhD, assistant professor of Environmental Health Sciences, awarded \$2.5 million by the NIH to document children's lung development following a cookstove intervention to reduce indoor air pollution.

* **Wafaa El-Sadr**, MD, MPH '91, founding director of ICAP, recognized on CNN's list of nine foreign-born Americans "who helped make America great," for her work to provide women and their families with services to treat and prevent HIV/AIDS.



MUMBAI-BOUND

GIFT PROMOTES FACULTY EXCHANGE

photo courtesy of CIPLA

IN JANUARY, MUMBAI-BASED SCIENTIST YUSUF KHWAJA HAMIED, CHAIRMAN OF INDIAN GENERICS PHARMACEUTICAL GIANT CIPLA, PROVIDED THE FIRST INSTALLMENT OF A \$1 MILLION GIFT TO ESTABLISH A FACULTY EXCHANGE PROGRAM TO ADVANCE SCIENCE AND IMPROVE PUBLIC HEALTH OUTCOMES IN INDIA. A champion of global access to affordable medications for HIV/AIDS, tuberculosis, asthma, and other ailments chiefly affecting developing countries, Hamied has provided for approximately 15 Columbia Mailman School faculty—selected by the dean of the school and the director of Columbia’s Global Center

in Mumbai—to travel to India each year. Participants will pursue residencies of three to ten weeks, develop collaborative projects, and conduct research with faculty at Indian institutions. Collaborating Indian scientists will in turn take residencies at the Columbia Mailman School. The gift also provides for a lecture series and workshops, including an annual lecture in New York related to public health in India, as well as development of pedagogical resources, publications, webinars, podcasts, and outreach materials to disseminate research findings and public health data that emerge from the program. [↗](#)

TEAM EFFORT

\$9.6 MILLION FOR ME/CFS



IN SEPTEMBER 2017, THE CENTER FOR INFECTION AND IMMUNITY (CII) RECEIVED A FIVE-YEAR, \$9.6 MILLION GRANT from the National Institutes of Health to create the Center for Solutions for Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (CfS for ME/CFS).

The CfS for ME/CFS is one of three inter-disciplinary, inter-institutional research groups—together with a data management and coordinating center—created to advance understanding of the disease in order to develop effective means to diagnose, treat, and prevent ME/CFS. As many as 2.5 million Americans have ME/CFS, a debilitating disease characterized by extreme fatigue after exertion that is not relieved by rest and other symptoms, including muscle and joint pain and cognitive dysfunction; there are no laboratory tests for diagnosis or specific treatments.

W. Ian Lipkin, MD, director of CII and John Snow Professor of Epidemiology, leads the CfS for ME/CFS, which will pursue basic research and develop tools to help physicians and individuals with ME/CFS monitor the course of illness. In laboratory studies, the investigators will analyze molecular footprints of potential bacterial, fungal, and viral triggers, together with corresponding immune responses, including autoantibodies. Other studies will analyze metabolites and gene expression in individuals with ME/CFS after physical activity and mine databases for insights into clinical features, comorbidities, and subtypes that

could refine laboratory analyses and enhance their care. Scientists will also work with the ME/CFS community, including clinicians and people with ME/CFS, to design a mobile app called myME/CFS that will track symptom severity in tandem with stressors and interventions. Aggregated data from the app may yield insights into triggers that initiate or exacerbate disease, including links between infection and disease in a subset of patients. Overall, the CfS for ME/CFS studies may lead to the development of animal models of ME/CFS and/or clinical trials of antibiotics, pre- and probiotics, antifungals, antivirals, or immunomodulatory treatments.

“ONE OF OUR GOALS IS TO DISSOLVE BARRIERS AMONG SCIENTISTS, CLINICIANS, INDIVIDUALS WITH ME/CFS, AND ADVOCATES,”

says Dana March, assistant professor of Epidemiology and deputy director and administrator of CfS for ME/CFS. “By connecting with the global digital ME/CFS community, we aim to increase the visibility and reduce the stigma of what many have described as an invisible population.” [↗](#)

THE BIG QUESTION

GARY MILLER

WHEN IT COMES TO UNDERSTANDING HOW CHEMICAL POLLUTANTS AFFECT OUR HEALTH, GARY MILLER, PHD, TAKES A HOLISTIC APPROACH. INSTEAD OF EXAMINING ONE CHEMICAL AT A TIME, HE INVESTIGATES THEIR SYNERGY, STUDYING HOW COMBINED EXPOSURES ACROSS THE LIFESPAN—KNOWN AS THE EXPOSOME—RAISE THE RISK FOR DISEASE. A leading proponent of this wide-angle approach, Miller has orchestrated broad research collaborations across disciplines to make progress on diseases like Parkinson's. As the Columbia Mailman School's new vice dean for research strategy and innovation—and a faculty member in the Department of Environmental Health Sciences—he envisions a role as a “scientific matchmaker,” bringing together researchers from disparate areas to explore questions so complex they demand a multidisciplinary team's expertise.



photo: Ann Watson, Emory Univ. Photo/Video

How do you explain the exposome? It's the soup we live in. Every day, our bodies are exposed to complex mixtures of chemicals—pesticides, flame retardants, heavy metals, and so on. Traditionally, researchers have studied one chemical at a time, at high doses. Today, it's possible to look at low levels of dozens, even hundreds, of chemicals to understand how they combine to affect our health in a way that is more true to life.

Who are your collaborators? In my own research into Parkinson's disease, I've partnered with clinicians, surgeons, engineers, systems biologists, physicists, and biochemists. That's just one disorder. Another project required that we demonstrate the utility of a microneedle-based collection system to sample biological fluids. The work required expertise in engineering, metabolomics, bioinformatics, and environmental health sciences.

Why cast your net so wide? Moving the needle on the most difficult, entrenched, and multifaceted public health challenges—whether Parkinson's disease or obesity or climate change—demands a strong commitment to interdisciplinary research, both from investigators and the institution as a whole. When you are deliberate about building the right kinds of teams, you get the most creative and transformative results. The whole really is bigger than the sum of its parts.

What role does big data play? The old model was focused on the individual investigator. With the Human Genome Project, we saw the value of putting together bigger teams. Now there are large investments in precision medicine.

Once we looked at health outcomes in 50 people; today, we're looking to do it in a population of 100,000 or more. The only way to do this is by developing sophisticated teams of scientists with a variety of skills.

How does the institutional culture of the School measure up? I've been struck by the level of enthusiasm and willingness to try new things and be daring. There is a sense of urgency. People here want to do something important because there are so many important public health problems to solve. The energy here is a lot like a start-up, even though the School has been around for nearly a century. 🍷

"THE RIGHT KINDS OF TEAMS . . . GET THE MOST CREATIVE AND TRANSFORMATIVE RESULTS."

Of Mice and Microbes

New York City house mice carry bacteria responsible for mild to life-threatening gastroenteritis in people, and some of these bacteria may be resistant to antibiotics, according to a report in *mBio* authored by W. Ian Lipkin, MD, the John Snow Professor of Epidemiology and director of the Center for Infection and Immunity (CII)—with scientists at CII and the Centers for Disease Control and Prevention.

Lipkin and colleagues at the CII collected 416 mice from residential buildings at seven sites across New York City over a period of one year. A genetic analysis of their droppings revealed that the mice carry several gastrointestinal disease-causing bacteria, including *C. difficile*, *E. coli*, *Shigella*, and *Salmonella*, a leading cause of bacterial food poisoning in the U.S., with 1.4 million reported cases annually along with 15,000 hospitalizations and 400 deaths. They also found evidence of genes mediating antimicrobial resistance to several common antibiotics.

A second study, also published in *mBio*, provides a detailed look at viruses present in the droppings. The researchers found 36 viruses, including six new viruses, none of which are known to infect humans. A previous study of rats in New York by investigators at CII found several of the same pathogens, including *E. coli*, *Salmonella*, and *C. difficile*. “New Yorkers tend to focus on rats because they are larger and we see them scurrying around in streets or subways,” says Lipkin, who is senior author of both papers. “However, from a public health vantage point, mice are more worrisome because they live indoors and are more likely to contaminate our environment, even if we don’t see them.”



Long Road to Diagnosis

AN ESTIMATED 75,000 AMERICANS LIVE WITH GENETIC CONDITIONS THAT RESULT FROM FAILURES OF THE MITOCHONDRIA—intercellular compartments responsible for creating more than 90 percent of the energy needed by the body to sustain life and support organ function.

According to a survey of 210 people with physician-diagnosed mitochondrial disease—recruited through the National Institutes of Health-funded Rare Diseases Clinical Research Network—on average, patients see more than eight physicians before receiving a diagnosis and more than half are misdiagnosed at least once before finally learning that their rare and often debilitating symptoms are due to a mitochondrial disease.

Professor of Biostatistics John L. P. (Seamus) Thompson, PhD, designed the 25-item survey with former student Johnston Grier, MPH '16, and colleagues at Columbia University Irving Medical Center. The team detailed their findings in *Neurology Genetics*: Participants reported more than 800 distinct symptoms and most underwent several diagnostic procedures—an expensive and sometimes invasive and painful experience—including blood tests, muscle biopsies, brain MRIs, and genetic assessments. Common misdiagnoses reported by survey respondents included psychiatric disorders, fibromyalgia, chronic fatigue syndrome, and multiple sclerosis.

Clearing the Air

A new report on e-cigarettes from the National Academies of Sciences, Engineering, and Medicine offers the most comprehensive health assessment of the devices—alternately indicted as a gateway to addiction and championed as a tobacco cessation game-changer—to date.

“Over the last few years, there has been a proliferation of different kinds of e-cigarettes, as well as differences in how they are being used,” says Professor of Environmental Health Sciences Ana Navas-Acien, one of the report’s expert authors. Navas-Acien is an authority on the link between exposure to metals—a potential risk with the heated coils used

in the devices—and risk for diabetes and heart disease, as well as in measuring exposure to secondhand smoke. The report—which compiles results from more than 800 scholarly analyses, as well as testimony from industry, retailers, and users—is hardly the final word on e-cigarettes, says Navas-Acien. “There is a lot of high-quality science we still have to do.”



Bio Burden

For nearly a decade, scientists have attributed inconsistent outcomes associated with tenofovir, a microbicide gel used to prevent HIV, to variability in individual use. Research by scientists at the Centre for the AIDS Programme of Research in South Africa (CAPRISA) and the Columbia Mailman School, published in *Nature Medicine*, shows that biological factors also affect tenofovir’s efficacy. Genital inflammation significantly increases the risk of HIV infection, independent of the consistency with which a person uses the microbicide for topical pre-exposure prophylaxis (PrEP). “This study gives us an important clue to enhance HIV prevention,” says senior author Salim Abdool Karim, PhD, director of CAPRISA and a professor of Epidemiology. “It is not only adherence-related behaviors but also biological processes in the vagina that need to be addressed to prevent HIV and enhance the effectiveness of topical PrEP.”

Aging Well

A team led by John Rowe, MD, Julius B. Richmond Professor of Health Policy and Aging, has developed a barometer that estimates how countries are adapting to the dramatic increases in the number and proportion of older persons. Named for the agency that funded the effort, the John A. Hartford Foundation Index of Societal Aging comprises five social and economic indicators that reflect the well-being of older persons in 30 countries and which can be followed over time and compared across nations. “Now that previously unimagined numbers of older persons are living longer,” says Rowe, “it is critical that we shift from our prior sole focus on the characteristics of individuals and their immediate environments to one that includes a strategy for the entire society to successfully adapt to an aging population.”

PRODUCTIVITY & ENGAGEMENT

US
Japan
Sweden
Norway
Estonia
Ireland
UK
Finland
Denmark
Netherlands
Germany
Austria
Slovenia
Belgium
Spain
Poland
Italy
Hungary

WELL-BEING

Japan
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Italy
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Poland
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EQUITY

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Netherlands
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Estonia
Belgium
Germany
Hungary
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Poland
Austria
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Spain
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US
Japan
Italy

COHESION

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Estonia

SECURITY

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Ireland
UK
Belgium
Estonia

RESEARCHERS IDENTIFIED FIVE DOMAINS—PRODUCTIVITY AND ENGAGEMENT, WELL-BEING, EQUITY, COHESION, AND SECURITY—WITHIN WHICH NATIONAL METRICS WERE AVAILABLE TO INFORM COMPARISONS AMONG 30 COUNTRIES.

Heart-Healthy: A Mayor's Legacy

Health promotion was a significant legislative focus of New York City Mayor Michael Bloomberg, whose three terms in office exemplified a “health in all policies” approach to everything from heating fuel and transportation regulations to cigarette tax rates.

In an analysis in *Cities and Health*, a team of Columbia Mailman School researchers in Epidemiology, Sociomedical Sciences, and Health Policy and Management reports that 7.4 percent of the 3,745 pieces of legislation introduced during the Bloomberg administration had the potential to impact New Yorkers’ cardiovascular health, coinciding with a local decline in heart disease not observed on the national level. The team focused on four factors associated with cardiovascular health: air pollution exposure, physical activity, dietary intake, and tobacco

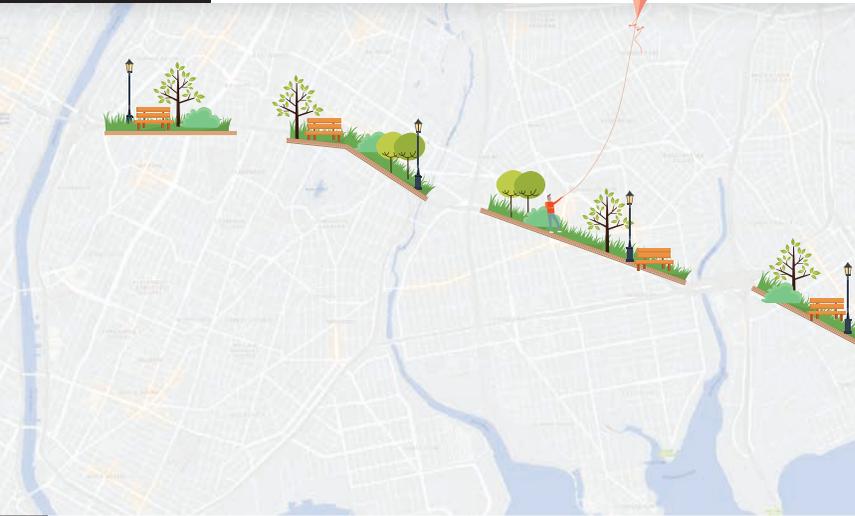
smoke exposure, which is the risk factor most targeted by legislative efforts.

“Over the past 15 years, there has been growing attention to a ‘health in all policies’ approach by local, regional, and national governments to improve the well-being of all communities and people,” says first author Brennan Rhodes-Bratton, MPH, a doctoral candidate in the Department of Sociomedical Sciences.

“Local health promotion efforts and multi-sectoral municipal policies have the potential to efficiently reach large numbers of urban residents and impact their health.”

Each year during the Bloomberg Era, with the exception of 2012, saw the enactment of at least one risk factor-related bill. For comparison purposes, the team also examined enacted legislation from four years preceding and following the Bloomberg administration. “This is the first comprehensive examination of New York City’s legislation in relation to the plausible impact on residents’ health,” says Rhodes-Bratton. “Future research on how these policies impact segments of the population—the young, older adults, and people residing in socio-economically depressed neighborhoods—are the missing pieces and will be equally important for informing legislative efforts.”





Highway to Health

The 6.5-mile Cross-Bronx Expressway cuts through neighborhoods with some of the worst air pollution and highest rates of diabetes, obesity, and asthma in New York City. Building a park on a deck above the highway could turn those numbers around.

In a paper published in the *American Journal of Public Health*, a team led by Peter Muennig, MD, MPH '98, a professor of Health Policy and Management, and developed in the School's Global Research Analytics for Population Health (GRAPH) details how a 2.4-mile span of green space would benefit each of the 226,608 people living nearby both in terms of life expectancy and monetary gains. Improved health and longevity resulted from fewer pedestrian accidents, reduced pollution, and increased exercise options. As a result, each resident would gain nearly two months of quality-adjusted life years, a combined measure of health and longevity. In the simulation, monetary gains—\$1,629 per person, mainly from increased property values—more than made up for the project's steep price tag, estimated at \$757 million. "It is extremely rare for social policy investments to save both money and lives," says Muennig.

"Turning a highway into a park is a bit like a seatbelt or vaccine for a whole neighborhood."

Smoke Signals

LEGALIZATION OF MEDICAL MARIJUANA—NOW SANCTIONED IN 29 STATES—HAS NOT BEEN ASSOCIATED WITH AN UPTICK IN RECREATIONAL USE OF THE SUBSTANCE AMONG U.S. ADOLESCENTS, ACCORDING TO A STUDY BY DEBORAH HASIN, PHD, PROFESSOR OF EPIDEMIOLOGY. The researchers analyzed the results of eleven separate studies dating back to 1991 using data from four large-scale U.S. surveys. No significant changes, increases, or decreases occurred in adolescent recreational use following enactment of medical marijuana laws. A separate analysis in *Prevention Science* by Christine Mauro, PhD, assistant professor of Biostatistics, showed that daily use of marijuana as well as past month rates rose for both men and women aged 26 and older in states with medical marijuana laws in effect. "The \$8 billion cannabis industry anticipates tripling by 2025," says Hasin. "Obtaining a solid evidence base about harmful as well as beneficial effects of medical and recreational marijuana laws on adults is crucial given the intense economic pressures to expand cannabis markets."

Safer Sex

Preliminary reports from the Sexual Health Initiative to Foster Transformation (SHIFT), a major study of sexual assault and sexual health among Columbia University and Barnard College undergraduates, have been published in *PLOS ONE*, *Trauma, Violence, and Abuse*; and *Global Public Health*. "SHIFT helps us think more critically about how to create healthier communities on college campuses," says SHIFT co-director Jennifer S. Hirsch, PhD, a professor of Sociomedical Sciences. "To address campus sexual assault, we need a systems-based public health approach that recognizes the multiple power asymmetries that create vulnerability to assault. Preventive programming should address the drivers of widespread use of alcohol, but we also need a life-course perspective. Most parents spend more time talking with their children about how to cross the street safely, or about choosing healthy foods, than about sex as a normal part of a satisfying life."

Design for Diabetes

IN THE FIRST STUDY TO DIRECTLY EXAMINE THE RELATIONSHIP BETWEEN THE URBAN ENVIRONMENT AND BLOOD SUGAR CONTROL AMONG PEOPLE WITH DIABETES, RESEARCHERS AT THE COLUMBIA MAILMAN SCHOOL AND THE NEW YORK CITY DEPARTMENT OF HEALTH AND MENTAL HYGIENE HAVE FOUND A LINK BETWEEN THE NEIGHBORHOOD FOOD, BUILT, AND ECONOMIC ENVIRONMENT WHERE A PERSON LIVES, AND THEIR ABILITY TO ACHIEVE GLYCEMIC CONTROL. *The American Journal of Epidemiology* published the team's results, which suggest that areas with greater resources to support healthy eating and physical activity are associated with improved glycemic control.

The odds of individuals achieving glycemic control in the most supportive

residential neighborhoods were two and a half times greater than those in the least supportive. Furthermore, those living in the most supportive residential neighborhoods achieved glycemic control in fewer months than individuals living in the least supportive neighborhoods.

“Our study is the first to look at a wide range of built and economic features of a residential environment and how they may affect a person’s

ability to control their diabetes,”

said Andrew Rundle, DrPH '00, associate professor of Epidemiology. “And until now, no study had evaluated whether these cumulative exposures were associated with glycemic control in a large multiracial, multiethnic population.”



Hot Mess

Beginning in the 1970s, manufacturers added polybrominated diphenyl ethers (PBDEs) to couches, textiles, electronics, and other consumer products as flame retardants. Due to their persistence in the environment and evidence of human health effects, they were phased out beginning in 2004, with newer flame retardants—whose health effects are unknown—taking their place.

Two studies from the Columbia Center for Children’s Environmental Health—published in the *Journal of Exposure Science and Environmental Epidemiology* and in *Emerging Contaminants*—detail the persistence of PBDEs in children’s bloodstreams and confirm that toddlers have the highest exposure to flame retardants, likely because of the amount of time they spend on the floor.

“These findings reinforce the decision to phase out PBDEs from consumer products,” says senior author Julie Herbstman, PhD, associate professor of Environmental Health Sciences. “However, it’s important to remain vigilant. Since the phase-out of PBDEs, we have begun to detect in children other flame-retardant chemicals, which are likely being used as replacements.”



Growing Pains

How Does Puberty Affect Breast Cancer Risk?

Nancy Averett | Illustrations by A. Richard Allen

Hand sanitizers, disinfectant wipes, bleach—these mainstays of American domesticity affect how children’s immune systems develop. That’s the idea behind the hygiene hypothesis: Kids today have high allergy rates because their immune systems have been insufficiently primed by early exposure to germs.

Jasmine McDonald, PhD, an assistant professor of Epidemiology, theorizes that hygiene might be fueling another epidemic: breast cancer.

The human immune system evolved to protect against life-threatening diseases so we could survive to reproduce, she explains. And for most of human history, identifying and combating pathogens—whether measles, mumps, and other contagions for which vaccines are now available, or the millions of microbes in our environment obliterated by modern cleaning products—was a singularly energy-intensive process.

“In Westernized countries, the immune system isn’t being fully primed early in life,” says McDonald. “Since growth can be priori-

tized over fighting infections early on, young children’s bodies may shift into puberty earlier.”

Scientists already know that the sooner a person begins menstruating or developing breasts, the greater her risk for breast cancer. And girls in Western countries are hitting those milestones at progressively earlier ages. Meanwhile, breast cancer and other cancer rates are rising globally, and scientists don’t understand precisely how early-life factors influence that trend. McDonald wants to know what role environmental factors play.

That’s where LEGACY comes in. LEGACY (Lessons in Epidemiology and Genetics of Adult Cancer from Youth) is a cohort of 1,040 American and Canadian girls aged 6 to 13 and their mothers. Half have a family history of breast cancer. The study’s investigators collect blood, urine, and saliva; measure breast development and body mass index; and administer behavioral questionnaires to the participants. McDonald is using data from LEGACY to investigate the association between common childhood viruses and the timing of pubertal outcomes—breast development, appearance of pubic hair, and menstruation. “Going forward,” she says, “I want to look beyond the common viruses to include the entire virome.”

LEGACY was established in 2011 by Professor of Epidemiology Mary Beth Terry, PhD ’99, to investigate the synergy of nature and nurture in the decades preceding a cancer diagnosis. “It came about through the merging of two lines of research—genetics and

Survivors Unite

“We need to know if [breast density] information is being used differently . . . so that we can possibly prevent disparities in screening and early detection from developing.”

environmental factors,” says Terry, who used a \$3 million grant from the National Cancer Institute to create the cohort and now serves as its principal investigator, examining how estrogen-promoting chemicals in beauty products, air pollution, viruses, diet, and the like affect female physiology. “We knew a lot about the genetic heterogeneity of breast cancer, but we also knew that early life matters. With this cohort, we are measuring how breast tissue changes during adolescence and if environmental exposures during that window can help us understand the disease.”

The emphasis on puberty that led to LEGACY arose after Terry became principal investigator of the Breast Cancer Family Registry (BCFR), which follows people at increased risk of breast and ovarian cancer due to family history or genetic mutations. While BCFR investigators, as a whole, take a variety of perspectives, Terry has a particular emphasis on environmental triggers. In 2017, the *British Journal of Cancer* published her finding that even among women with high-risk breast cancer genes, exposure to moderate or high levels of PAH, a chemical byproduct of combustion, increases their risk of developing the disease.

Pollutants and pathogens aren’t the only environmental factors under the microscope. Lauren Houghton, PhD, assistant professor of Epidemiology, hypothesizes that stress may influence pubertal timing and breast cancer risk. Her current project

Breast cancer investigators don’t have to dig deep to uncover profound disparities within and among racial and socio-economic groups. While black women, for example, are slightly less likely to develop breast cancer, their risk of dying from the disease is substantially higher than that of white women.

In 1990, a group of black women in Arkansas partnered with cancer researchers to develop a lay health adviser program to bridge racial and cultural divides with healthcare providers and promote breast and cervical cancer screening among black women. Today, the Witness Project offers programs nationwide, with more than 400 advisers serving 15,000 women a year.

In her research, Assistant Professor of Sociomedical Sciences Rachel Shelton, ScD, MPH, seeks to identify the social and contextual factors that influence disparities in cancer prevention and screening among low-income African American and Hispanic populations, including the role of social networks, social support, and experiences of discrimination and mistrust. For the past decade, she’s partnered with the Witness Project, seeking out features that could be replicated by others intent on understanding and addressing disparities. “The most successful sites are those with a strong partnership with an academic or cancer center,” says Shelton, whose analyses of the program have appeared in *Translational Behavioral Medicine* and in *Implementation Science*. “They had more organizational support and structure, and they were more likely to pay the advisers a stipend.”

Shelton also seeks to understand the lay health advisers themselves. She has found that many first chose to volunteer because of a personal connection to cancer and later came to appreciate the support and friendships they had made. “All of them ended up staying in the program because of the social networks they built through this sisterhood of other women,” she says.

This past summer, Shelton began a new phase of her research. Using a four-year, \$785,000 grant from the American Cancer Society, she’ll study Witness Project program sites across the country. “There’s a huge gap in having evidence-based programs in low-resource, ‘real-world’ community settings,” she says. “I want to understand how these programs can be implemented and sustained over time in these settings that actually need them.”

The background features a stylized illustration in shades of orange and light brown. On the right side, there is a profile of a person's head and neck, rendered with soft, watercolor-like textures. In the center and left, a bridge with multiple arches spans across the scene, also depicted with a similar artistic style. The overall composition is layered and artistic, with the text overlaid on the bridge section.

9 OUT OF 10
PEOPLE BREATHE
AIR CONTAINING
HARMFUL LEVELS
OF POLLUTANTS.

AIR- BORNE

WHEN POLLUTION TAKES ITS TOLL

ALLA KATSNELSON

WHEN ENVIRONMENTAL ENGINEER MARIANTHI-ANNA KIOUMOURTZOGLOU, SCD, BEGAN HER POSTDOC IN 2013, SCIENTISTS HAD ALREADY DOCUMENTED A WIDE RANGE OF ADVERSE HEALTH OUTCOMES ASSOCIATED WITH AIR POLLUTION: CARDIOVASCULAR DISEASE, LUNG DYSFUNCTION, AND INCREASES IN OVERALL MORTALITY. EVIDENCE WAS ALSO BEGINNING TO MOUNT ON HOW AIR POLLUTION AFFECTS THE CENTRAL NERVOUS SYSTEM. KIOUMOURTZOGLOU WAS FASCINATED BY THE POSSIBILITY THAT INHALED PARTICLES MIGHT DIRECTLY AFFECT BRAIN FUNCTION.

Since then, evidence for this notion has begun to add up. In March, Kioumourtzoglou—now an assistant professor of Environmental Health Sciences—published a landmark paper in the *American Journal of Epidemiology* demonstrating an association between long-term exposure to air pollution and the onset of depression. She also participated in a related study pinpointing a link between air pollution and anxiety symptoms.

Those studies examined tens of thousands of older women—specifically, participants in the long-running Nurses' Health Study. Kioumourtzoglou is now expanding her scope to investigate how

air pollution influences anxiety levels in children, as well as how it affects onset and progression of neurological disorders such as amyotrophic lateral sclerosis, also called Lou Gehrig's disease.

It's hard to overestimate the breadth of negative impacts that air pollution has on public health. According to the World Health Organization, 9 out of 10 people breathe air containing harmful levels of pollutants. Indeed, in urban areas of low- and middle-income countries, exposure to unhealthy levels of air pollution are well-nigh universal, says Andrea Baccarelli, MD, PhD, department chair and Leon Hess Professor of Environmental Health Sciences and director of the Columbia Mailman School's Laboratory of Precision Environmental Biosciences. Yet even in New York City and other U.S. urban areas, variation in particulate matter levels from week to week and from neighborhood to neighborhood makes many communities subject to serious health threats with every breath.

HARD SCIENCE

It is in part precisely because the problem is so pervasive that it can be challenging to probe. Most studies focus on the overall

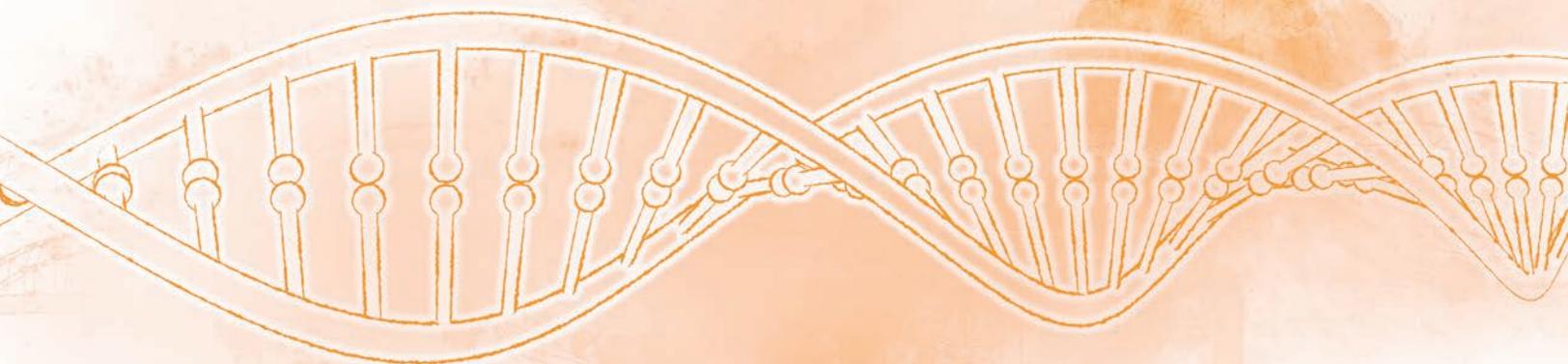
level of fine particles in the air, but which types of particles are to blame for what? Does pollution do harm in specific time windows—early development, say, or in old age? And how can researchers assess impacts that might not be captured by gross measures such as doctor or hospital visits, and deaths? Kioumourtzoglou, Baccarelli, and others at the School, including health economist Matthew Neidell, PhD, and epidemiological risk modeling expert Deliang Tang, DrPH '96, are tackling these crucial questions.

One aspect of this research explores the biological mechanisms by which air pollution confers damage. Baccarelli was among the first in the field of epidemiology to investigate its effects on the so-called epigenome—not the DNA sequence that makes up our genes, but the protein tags surrounding the DNA that determine how and when our genes are expressed. An epigenetic marker called methylation is known to decrease with age; in 2015, Baccarelli—

with colleagues at Harvard University—showed that environmental pollutants accelerate epigenetic aging.

“The idea is that the epigenome is like our flight recorder,” he says. “It’s like an archive of all that we do with our bodies.” Exposure to air pollution, his team found, ratcheted up people’s “epigenetic age” by decreasing the amount of methylation. The increase is small—just 6 months older, he says—“but if you think that all of us are exposed to different levels of air pollution, it’s incredible.”

Baccarelli’s research suggests that air pollution can speed cognitive aging by as many as five years, potentially contributing to the etiology of neurodegeneration. More recently, Kioumourtzoglou’s team was the first to show that long-term exposure to fine particles accelerates such neurodegenerative conditions as dementia, Alzheimer’s, and Parkinson’s. And the hazards don’t stop there: In November 2017, *Lancet Planetary Health* reported Baccarelli’s find-



“THE EPIGENOME IS LIKE OUR FLIGHT RECORDER. IT’S AN ARCHIVE OF ALL THAT WE DO WITH OUR BODIES.”

ing that high levels of air pollution were associated with an elevated risk of bone fractures and with lower bone density levels in adults, particularly in low-income communities where residents are often exposed to high pollution levels.

GENETIC LEGACY

More recently, Baccarelli’s laboratory has been exploring the link between air pollution and damage to organelles within our cells called mitochondria, which generate energy to fuel many cellular processes. These organelles have their own DNA, and accu-

mulating data from his lab and others suggest that pollution drives mutations that accrue in mitochondrial DNA, which can be passed from pregnant mothers to their babies. Other work supports this intergenerational outcome. Tang, associate professor of Environmental Health Sciences, reported last July from a long-running study in a coal-producing region of China that infants exposed to high levels of pollution showed marked changes to their DNA.

Tang’s work has earned its place as a case study promoting policy changes to curb air pollution. But there’s also hope for interventions on an individual level, by creatively tapping into a deep well of knowledge of the science of biochemistry. In a small but tightly controlled clinical study of 10 people published last spring

“OURS IS THE FIRST EMPIRICAL EVIDENCE FOR WAYS THAT WE CAN QUANTIFY THESE SUBTLE HEALTH EFFECTS THROUGH ECONOMIC IMPACT.”

as two papers, in the journals *Scientific Reports* and *Proceedings of the National Academy of Sciences*, Baccarelli’s team showed that a surprising low-cost intervention—vitamin B—could ameliorate some of air pollution’s detrimental impacts on blood pressure and wipe out its interference with methylation. “Our small pilot study suggests that maybe vitamins can help to reduce the effects of air pollution,” Baccarelli explains. “The next step for us is to do a large randomized trial to test whether this could be applied on a large scale.”

INNOVATIVE APPROACHES

Beyond chronicling the vast range of health effects air pollution can have, Columbia Mailman School researchers are also building new tools to expand the breadth of the questions that epidemiologists can ask—and answer. For Kioumourtzoglou, that means finding ways to get a granular view of the many components of air pollution, as well as the interactions among chemicals within the human body and how such mixtures affect health. “What I find most challenging is how we can translate the very complex chemistry into a statistical model and make some health-related inferences about what we see,” she says.

In January, the National Institute of Environmental Health Sciences awarded Kioumourtzoglou funds to develop methods to build toxicological data into statistical models and analyze the health effects of simultaneous exposure to multiple pollutants in large, epidemiological data sets. To test-drive the tools she and her team develop, Kioumourtzoglou will study the effect of prenatal exposure to polychlorinated biphenyls (PCBs) on neurodevelopment, the effect of a mixture of metals on cardiovascular health,

and the effect of multiple air pollutants on emergency cardiovascular admissions. “The goal is to detect common exposure patterns,” she says, “to better inform regulations and targeted interventions.”

Meanwhile, Neidell, an associate professor of Health Policy and Management, has been developing more expansive ways to gauge the fallout from air pollution, beyond what medical data contain. “We wanted to capture the more subtle changes,” he says, “where you don’t necessarily have a healthcare encounter, but you certainly do have some kind of impact on health.”

He and his colleagues investigated whether worker productivity might be sensitive to air pollution levels, as indicated by ozone and particulate matter data. “Imagine you have a perfect measure of somebody’s output in a day,” he says. “If their health is off a bit, the idea is that their productivity is going to be sensitive to that.” Indeed, whether they tracked California fruit pickers in orchards and fruit packers in factories, or urban workers at call centers in China, heightened air pollution drove a downturn in productivity. The studies are described in a January policy paper in *Science*.

For pickers, the effect was dramatic—when ozone levels fell by about 10 parts per billion—roughly the decrease seen in response to major policy changes—productivity jumped by 3 to 10 percent. For office workers, the effect was an order of magnitude smaller, at about 0.3 percent, but Neidell believes it is still important. “If we talk about the economy growing at 1 or 2 or 3 percent, 0.3 percent is a considerable fraction of that,” he says. “Ours is the first empirical evidence for ways that we can quantify these subtle health effects through economic impact.”

ALLA KATSNELSON writes about biology, medicine, and health for BBC Focus, Nature, Scientific American, and others.

(TOXIC) NEEDLE IN A HAYSTACK

In 1969, Monsanto executives held a top-secret meeting. Public anxiety was mounting over the human health hazards of polychlorinated biphenyls (PCBs), one of the company's top revenue streams. "We could go out of business," says one of the suits. Or, says another, "Sell the hell out of them." Memorialized in handwritten minutes buried for decades in company archives and made public through legal proceedings, details are online at ToxicDocs.org.

The world's largest searchable database of internal corporate documents on industrial pollutants, ToxicDocs was featured in a special issue of the *Journal of Public Health Policy*. "This enormous stash of material represents the unvarnished opinions and inside dealings of the companies that make some of the most toxic products," says project principal David Rosner, PhD, MPH, the Ronald H. Lauterstein Professor and co-director of the Center for History and Ethics of Public Health at the Columbia Mailman School, which developed and maintains the site. "Corporate archives are curated by the companies to cast themselves in a favorable light. ToxicDocs tells the whole story."

Making sense of the 20 million pages that comprise ToxicDocs was like "searching for a needle in a haystack," says Merlin Chowkwanyun, the assistant professor of Sociomedical Sciences who led the effort to digitize and index the material, which is now machine-readable and searchable by keyword. The School's investment in high-performance computing—the art of pooling thousands of servers and applying their collective power to ambitious tasks—was critical to the effort, says Chowkwanyun.

Additional investigative tools are still in development, with the support of a three-year grant from the National Science Foundation. Among the new tools, one will allow users to identify patterns, such as common phrases and recurring names of people and entities, across clusters of documents. This "relationship miner" will also feature a graphical representation that illustrates the strength of connections between keywords. Other tools will distinguish among document types—memos exchanged among executives, unpublished scientific studies, public relations campaign plans, letters to policymakers, and classified meeting minutes, for example—and show the rise and fall of certain terms over time.

"A single document by itself doesn't tell the whole story," says Chowkwanyun. "ToxicDocs connects the dots. This larger data set paints a much bigger picture."

HEART- BREAKER

HOW A HEAVY METAL WREAKS HAVOC

KELLY MAYS MCDONALD

PHYSICIANS HAVE LONG KNOWN THAT HIGH DOSES OF ARSENIC WREAK HAVOC WITH OUR BRAINS, OUR SKIN, AND EVEN THE VERY DIVISION AND REPLICATION OF OUR CELLS. PHYSICIAN-SCIENTIST ANA NAVAS-ACIEN, MD, PHD, HAS MADE IT HER MISSION TO REVEAL WHAT EXTENDED LOW-DOSE EXPOSURE TO THE ELEMENTAL METAL DOES TO THE HUMAN HEART.

Most Americans understand heart disease as an artifact of lifestyle choices—too much couch time, not enough kale, too many cigarettes, not enough yoga. Research by Navas-Acien among indigenous communities residing in the Dakotas, Oklahoma, and Arizona suggests that arsenic, a naturally occurring element common in the soils of North America’s High Plains and in parts of South Asia, might also affect people’s susceptibility to the disease.

In 2016, Navas-Acien joined the Columbia Mailman School as a professor of Environmental Health Sciences and the director of Columbia’s Superfund Research Program (SRP). Since it was founded 18 years ago by Joseph Graziano, PhD, professor of Environmental Health Sciences and of Pharmacology, Columbia SRP has abided by the mission to provide high-quality research on the effects of arsenic and other toxic metals in the environment. The group investigates the effect on human health of arsenic and other co-occurring toxic metals in the groundwater and soil of rural communities, and works to reduce human exposure.

Columbia SRP was established in the aftermath of a 1970s-era campaign in Bangladeshi villages to replace polluted surface



water sources with freshly dug wells. In the late 1990s, scientists traced skin lesions and a host of other maladies in the region to those wells, which had inadvertently exposed tens of millions of people to upward of 100 parts per billion (ppb) of arsenic in their well water. (The World Health Organization and Environmental Protection Agency have set a threshold of 10 ppb.)

In addition to their work in Bangladesh, Graziano and his team have linked less extreme arsenic exposure to reduced performance among elementary schoolers in rural Maine, revealed how chronic exposure affects human DNA, and developed methods of removing toxic metals from a superfund site in Dover, New Jersey. Last year, Graziano handed off leadership of Columbia SRP to Navas-Acien with an eye toward what she can bring to rural populations in the U.S. “In her work in Native American populations,” he says, “Ana actually replicated what we saw in Bangladesh.”

Navas-Acien has spent much of the past decade digging into data from the Strong Heart Study, a National Institutes of Health (NIH) project launched in 1988 to investigate the cardiovascular health of indigenous Americans. More recently, she’s become co-director of a spin-off project in three participating communities to investigate the adoption of water filtration systems, potentially the best way to mediate arsenic exposure in that region. Filtration is a comparatively straightforward proposition for municipal water districts. But for people who use private well water for drinking and cooking, filtration requires a point-of-access system installed in every home. And unfortunately, each system relies on a filtration cartridge that must be replaced every 3–12 months, at the residents’ expense.

As a result, mediation efforts often exacerbate the socioeconomic disparities already present in a community. “The state of New Jersey is providing a zero-interest-rate loan so that families can afford filtration systems,” says Navas-Acien. “But in American Indian communities, that’s really difficult. Most families can’t afford the point-of-entry filtration systems.” Even replacing the fil-

ters can be difficult for inhabitants of reservations, due to both financial and logistical barriers, due to the lack of nearby services and providers. In 2018, Navas-Acien launched a new project to assess the effect of very low arsenic exposure—often through food, primarily rice—in a multi-ethnic population in six urban settings across the U.S.

In addition to her work on arsenic, Navas-Acien investigates the role of other heavy metals in heart disease and strategies to ameliorate their health effects among those who have already suffered chronic exposure. In 2013, an NIH study demonstrated that chelation effectively removes many heavy metals from the human body; patients with a high risk of mortality before the trial showed profound improvement after chelation. “That was a bit of a major disruption to standard clinical practice,” says Navas-Acien, who sees particular promise for those with symptoms due to lead and cadmium exposure. Since 2016, Navas-Acien and her team have worked on a follow-up NIH chelation trial with Regina Santella, PhD, professor of Environmental Health Sciences and vice dean of Faculty Affairs and Research.

Throughout their involvement in the Strong Heart Study, Navas-Acien and her research partners have worked closely with tribal leaders and elders to ensure their sovereignty over their data and their communities, a process Navas-Acien says has been personally and professionally transformative. “We are in a time when data sharing is important, mandatory,” she says. After centuries of being the unwilling participants in hundreds of scientific investigations, indigenous communities are wary of being disenfranchised and dehumanized by the medical establishment. “They have really made me a better scientist because of understanding that we need to truly listen to and respect the participants in our studies. We’re trying to do this together.” 🍷

Farmer-in-training *KELLY MAYS MCDONALD* reports on natural history and social movements for *Vice* and *the Village Voice*.





BENEATH US

NEW INSIGHTS INTO POLLUTED SOIL

KELLY MAYS MCDONALD

MARKUS HILPERT, PHD, HAS A QUIRKY ROUTINE WHEN REFUELING HIS CAR. SAYS THE ENVIRONMENTAL ENGINEER: "I'M ALWAYS LOOKING DOWN." BY REGULATION, GAS STATIONS ARE PAVED WITH THICK SLABS OF CONCRETE TO PROTECT THE SOIL BELOW. BUT NO SURFACE IS COMPLETELY IMPENETRABLE, SAYS THE ASSOCIATE PROFESSOR OF ENVIRONMENTAL HEALTH SCIENCES.

There's always a possibility that errant drops of fuel can travel through the concrete and contaminate the soil and groundwater below, potentially affecting the health of nearby communities who rely on well water.

Hilpert models the mechanics of particle permeation—the paths that different types of materials take as they move through granular substrates like soil, sand, and concrete. Due to its high vapor pressure, gasoline evaporates in all directions, including down. In 2017, *Sustainability* published Hilpert's analysis of how small quantities of fossil fuel infiltrate concrete. Petroleum particles are attracted to granular surfaces like concrete, and his team found

that nearly half of the diesel and gasoline they poured out slowly but surely worked its way through concrete slabs. The smaller the drop, the more likely the infiltration.

Hilpert's academic training draws on physics, civil engineering, ecology, hydrology, and geoinformatics, giving him an expansive view of the ground beneath our feet as a living ecosystem: "You have a significant amount of biological activity," he says. "It's a habitat."

Hilpert's holistic view extends beyond the city limits and into the rural exurbs, which are home to industrial animal agriculture. From 2012–2014, he led a study examining the role of concentrated animal feeding operations, or CAFOs, in soil contamination. In samples taken from a former storage site for chicken waste on Maryland's Eastern Shore, a region heavily populated by CAFOs, the team found that the soil retained the genetic material of antibiotic-resistant bacteria, years after the site had been repurposed.

"If you live in the countryside," says Hilpert, "this manure can be spread everywhere."



IN RURAL AND URBAN COMMUNITIES ALIKE, THE CONSEQUENCES OF SOIL CONTAMINATION COULD BE A MATTER OF LIFE OR DEATH.

Each industrial chicken farm houses tens of thousands of animals in close proximity, and each of those birds receives antibiotics as a matter of course. As a result, both antibiotic byproducts and antibiotic-resistant bacteria accumulate in the inordinate amount of manure the birds produce.

As an industry practice, that waste—chicken litter to industry insiders—is mounded into massive piles, which, by state regulation, typically sit undisturbed for a set number of months, under the assumption that pathogens die off during that time. After this waiting period, the piles may legally be dispersed throughout the region for use as fertilizer, an application for which supply wildly exceeds demand.

Hilpert’s team analyzed the bacteria in soil samples taken from the area surrounding those piles of litter. In addition to recording the soil content of the antibiotic tetracycline, they documented a particularly worrisome effect of a basic fact of bacteriology—bacteria can absorb genetic traits from their neighbors. The

team found that “naïve” soil bacteria had picked up DNA from antibiotic-resistant bacteria in the chicken manure, allowing them to pass the trait to other bacteria, without ever having been exposed to antibiotics themselves.

“You have these bacteria in the soil,” says Hilpert. “And then, you can potentially have people who are exposed to the soil—you could have children who play with the soil.” Furthermore, as rainwater trickles through the soil and becomes groundwater, rural Americans who rely on well water may also be exposed to the antibiotic-resistant bugs, without ever even touching the soil, itself.

Soil warrants a closer look, says Hilpert. In rural and urban communities alike, the consequences of its contamination could be a matter of life or death. [↗](#)

Farmer-in-training KELLY MAYS MCDONALD covers the intersection of natural history and social movements for Vice and the Village Voice.

TOBACCO, TOO

Many rehab facilities make what could be called a deal with the devil: They permit clients to continue smoking tobacco cigarettes during treatment. “The opioid addiction is prioritized, because that can kill immediately,” says Daniel Giovenco, PhD, MPH, assistant professor of Sociomedical Sciences. “But clients may ultimately end up dying from their tobacco addiction.”

And even with the tremendous spike in opioid deaths recently, he points out, diseases related to tobacco use are still far bigger killers.

Tobacco use should be addressed alongside any other substance use disorders, says Giovenco, whether it's opioids, alcohol, or other drugs. And he also believes that, as with opioid use itself, harm reduction is critical. Some forms of tobacco, such as smokeless tobacco or vaping products, are less dangerous than cigarettes. But the tobacco companies aren't currently allowed to suggest that one of their products is “safer” than another, and Giovenco says health agencies are often reluctant to make statements endorsing harm reduction.

In any case, he says, harm reduction efforts have the greatest potential when they are equally accessible to everybody, which isn't currently the case. For a study funded by a 2016 NIH Director's Early Independence Award, Giovenco and his colleagues visited stores selling tobacco all over New York City. “The most harmful products were more likely to be advertised, heavily promoted, and cheaper in neighborhoods that were predominantly African-American,” he says, as well as in low-income neighborhoods and places with low levels of education. Less risky products, on the other hand, were more likely to be found in more affluent neighborhoods.

There are similar disparities in both treatment options and harm reduction efforts for opioids, with similar implications. “Innovative technologies really have potential to improve public health,” says Giovenco, “but they are often first adopted by people who are already at an advantage. Any kind of innovative approach should be equally accessible across strata to reduce health disparities.”

— Alisa Roth

BEYOND THE BODY COUNT

UNDERSTANDING THE OPIOID EPIDEMIC

ALISA ROTH

In 2016, 115 people a day died of an opioid overdose in the U.S.

THE STATISTICS ARE STARK: In 2016, 115 people a day died of an opioid overdose in the U.S. That's more than 40,000 people over the course of the year. These are alarming figures on their own, and even more horrifying when you consider that they represent a 30 percent increase in the number of deaths compared to 12 months prior. This is an epidemic that does not discriminate. The number of overdoses rose across age, race, and geography; they were present in rural, suburban, and urban areas. And while death rates from all kinds of drug use have gone up in the past few years, the numbers make it clear that opioids are especially lethal. In both 2015 and 2016, they accounted for well over half of all overdose deaths in the United States.

But the death rates are only the beginning, says Guohua Li, DrPH, MD, the M. Finester Professor of Epidemiology and Anesthesiology. By focusing on the fatalities, we risk missing the extent of the crisis and, with that, important opportunities for intervention. "This epidemic has been defined by fatalities," says Li, who is also founding director of the Columbia Mailman School's Center for Injury Epidemiology and Prevention. "The consequences for population health go far beyond the body count."

For starters, he points to the enormous number of babies with prenatal exposure: He estimates that 5 of every 1,000 babies are born dependent on opioids. Fetal alcohol syndrome, by comparison, occurs in somewhere between 0.2 and 1.5 of every 1,000 births. But while the government estimates that fetal alcohol syndrome costs about \$2 million over the course of a person's lifetime, we don't know what the costs—financial or physical—will be for a person born dependent on opioids.



Five of every 1,000 babies are born dependent on opioids.

Prescription opioids were detected in more than 7 percent of drivers killed in motor vehicle crashes; in 1995, the number was only 1 percent.

COST ACCOUNTING

Other, more easily quantified economic costs have been documented in recent years, from people whose substance use keeps them from working to lost productivity, including companies operating below capacity because they simply can't find enough eligible workers who can pass a drug test.

Public safety is a growing concern, too. Li's research has long focused on motor vehicle fatalities. Those had been declining for almost 30 years, he says, until around 2014 when they started to go up again. He believes opioid use—or a combination of opioid and alcohol use—is at least partly to blame. In a 2017 analysis published in the *American Journal of Public Health*, he reported that prescription opioids were detected in more than 7 percent of drivers killed in motor vehicle crashes; in 1995, the number was only 1 percent. Following that study, the U.S. Department of Transportation (DOT) issued new rules, stating that drug testing in DOT-regulated industries, such as commercial trucking, must now include synthetic and prescription opioids.

COORDINATED CARE

The scale and urgency of the crisis means that it's hard, as Li notes, for authorities to focus on much beyond emergency response: trying to treat addiction and prevent more overdose deaths. But even that is difficult, says Pia Mauro, PhD, assistant professor of Epidemiology. For one thing, she says, there needs to be more access to community-based treatment. In a 2016 study, she found that although nearly half of all people with a substance use disorder had a co-occurring psychiatric disorder, many addiction treatment facilities didn't even ask about mental health issues, let alone offer treatment for them. Furthermore, many drug

treatment programs, including some funded by the federal government, aren't staffed with licensed mental health clinicians.

Mauro would also like to see more harm reduction programs, such as the supervised injection facilities currently being discussed in New York City and Philadelphia or increasing access to naloxone, the drug that can reverse overdoses. Acknowledging that continued substance use—and relapse—is also part of substance use disorder, she says, will help reduce the stigma that can be a barrier to many seeking treatment. “One of the tricky parts,” she says, “is that stigma crosses . . . borders [of socio-economic status]. The need for treatment is also everywhere. I don't think we need to focus on one specific area. It's such a broad problem that every community needs support.”

That, says Silvia Martins, PhD, MD, associate professor of Epidemiology, is why a coordinated effort across states, agencies, and organizations is essential. “Let's say [you have] efforts to work on changes in prescribing practices,” she says, “but no efforts for overdose prevention or reducing stigma, then [you will] have problems on other levels.” Making it harder for people to get prescription opioids may send them in search of heroin, for example, or if the stigma isn't addressed, then people will continue to avoid seeking treatment.

What does coordination look like in practice? For starters, it's linking databases, so that authorities can track the epidemic from multiple angles: What patients are doctor shopping? Which doctors are overprescribing? Who is overdosing and dying? Getting treated with naloxone? Being sent to detox? “In an ideal world,” says Martins, “all of this would be linked.” Rhode Island and Kentucky have made significant strides, she says. New York City has several initiatives on the table. But it's often easier said than done, both for technical reasons—even in the age of big data, making databases talk to one another isn't always easy—and cultural ones—there's legitimate concern about privacy protections. Martins is currently in the process of building an interdisciplinary center that integrates faculty from the Columbia Mailman School with those



Nearly half of all people with a substance use disorder had a co-occurring psychiatric disorder.

In both 2015 and 2016, opioids accounted for well over half of all overdose deaths in the United States.

at Columbia’s medical school and the Morningside campus and is focused on analyzing the effects of a wide range of opioid policies implemented at the local level, including changes in prescribing practices to curb the development of opioid use disorders among medical users, harm reduction for those already using opioids and heroin, and the expansion of medication-assisted treatment.

Analysts have their work cut out for them, says Christine Mauro, PhD ’14, assistant professor of Biostatistics, a research partner with Martins and epidemiologist Pia Mauro (no relation). The annual National Survey on Drug Use and Health produced by the Substance Abuse and Mental Health Services Administration has frequent updates to its questions and definitions, she notes, which can significantly complicate work to uncover trends over time. Likewise, simultaneous revisions at the state level to medical and recreational marijuana policies and prescription opioid monitoring programs can complicate assessments of which programs are actually reducing opioid use and overdoses. “There are all these moving pieces,” says the biostatistician. “We’re trying to solve a really important problem and we want to make sure we’re rigorous in our analyses.”

Perhaps the most effective strategy for saving lives, says Martins, is primary prevention—averting opioid addiction in the first place—an effort still in its infancy. “In an ideal world,” she says, “primary prevention of any substance use and educating people on how to use substances in a way that is safe for them would begin as early as elementary school, with age-appropriate curriculum, classes, and messages.” “Just say no” campaigns won’t be enough. “People need clear information about risks and benefits, so they can make informed decisions as they grow and become exposed to substances.”

Investigative reporter ALISA ROTH is author of *Insane: America’s Criminal Treatment of Mental Illness, an exposé of the mental health crisis in U.S. courts, jails, and prisons.*

TRAUMA INFORMED

IN THE WAKE OF CHILDHOOD ADVERSITY

JASMINE BANKS & SHARON TREGASKIS



“WE LIVE IN A COMPLEX, MULTI-LEVEL UNIVERSE, AND THE CONDITIONS IN A WHOLE COMMUNITY CAN BE JUST AS IMPORTANT AS THE CONDITIONS IN A PERSON’S HOUSEHOLD.”

CONSIDER THE RATE AT WHICH AN INFANT LEARNS TO RECOGNIZE LOVED ONES, TO EXPLORE THE WORLD, TO COMMUNICATE. OR THE PACE OF A TODDLER PULLING HERSELF UPRIGHT, DECLARING HER PREFERENCES, FORMING ATTACHMENTS TO SIBLINGS, CAREGIVERS, THE FAMILY PET. OR A SCHOOL CHILD DISCOVERING THE JOY OF READING, A LOVE OF DINOSAURS, THE ABILITY TO MAKE MUSIC. THE MALLEABILITY OF THE HUMAN BRAIN EARLY IN THE LIFESPAN MAKES IT ALL POSSIBLE. THAT SAME PLASTICITY ALSO MAKES US UNIQUELY SENSITIVE TO INSULTS IN OUR FORMATIVE YEARS.

For the past 15 years, perinatal epidemiologist Virginia Rauh, MSW, ScD, has investigated the effect of pesticides on prenatal and early childhood development, documenting how exposure to environmental contaminants increases the risk for low birth weight, asthma, and attention deficit hyperactivity disorder. Frequently, those same families participating in her studies of exposure to pollutants were contending with socio-economic insults, as well. “These things are not randomly distributed,” says the professor of Population and Family Health, who is also deputy director of the Columbia Center for Children’s Environmental Health. “People who can least afford to address problems of pollution and toxic exposures are most likely to be exposed.”

As co-founder of CHILd, the Columbia Mailman School’s Child Health Initiative for Learning and Development, Rauh takes an expansive view of adversity. “I think of it as individual experiences that might happen within a family, stressors that have to do with substandard housing, instability, poverty, and a whole variety of things.” Like biochemical and physical insults, adverse childhood experiences—ACEs, in technical parlance—can have a synergistic effect. The higher a person’s ACE score—measured on a scale of one to ten, with points associated with experiences of physical and sexual abuse,

as well as domestic violence, substance use by a parent, and parental incarceration—the greater one’s risk for everything from skeletal fractures to heart disease, from academic troubles to incarceration.

At its worst, such toxic stress alters hormone signaling, immune function, even the fidelity with which DNA is transcribed and translated to orchestrate the structure and function of a person’s brain and body—some of the same outcomes affected by environmental pollutants. “Whether you have an adverse effects exposure from a social condition or a chemical, it damages the brain,” says Rauh, who previously served as a social worker in a neonatal intensive care nursery, grappling with the combined effects of environmental and psychosocial stressors in new families. “We live in a complex, multi-level universe, and the conditions in a whole community can be just as important as the conditions in a person’s household.”

In January 2018, Rauh signed on as co-director of Trauma-Free NYC, which aims to increase public awareness of ACEs; serve as a resource for the creation of a cross-sector coalition; promote research and demonstration activities; and design educational, training, and service learning programs in trauma-informed practices throughout the New York metro region. “People are just beginning to understand how early adversity affects brain development,” says Rauh. “Toxic childhood exposures have persistent biological effects that can lead to long-term difficulties.”

As a physician whose practice includes young adults who were diagnosed with HIV during incarceration, Alwyn Cohall, MD, a professor of Sociomedical Sciences and of Population and Family Health, and director of the Harlem Health Promotion Center, sees the clinical aftermath of early developmental insults, which themselves frequently extend from America’s legacy of racism. “When you look at social determinants of health—poverty, inadequate housing, and lack of resources for schools—you see a tremendous concentration of all these factors intersecting on

BEYOND ALLERGENS

Kids who live in low-income neighborhoods suffer higher than expected rates of asthma-related hospitalization and emergency care. Conventional wisdom blames the disparity on issues of healthcare access and utilization. Mounting evidence compiled by Matthew Perzanowski, MPH, PhD, supports an alternative hypothesis: "Asthma is not one disease."

"There are common symptoms and outcomes," he explains, "but different causes."

It turns out that kids who live in low-income neighborhoods are at higher risk for an asthmatic phenotype known as exercise-induced wheeze (EIW), which is also associated with increased rates of hospitalization. "It could be because their respiratory systems are more responsive to triggers," says Perzanowski, "and this leads them to get into trouble more quickly."

Perzanowski—an associate professor of Environmental Health Sciences—and his colleagues were analyzing exposure to dust mites, cockroaches, and the like for insights into the precursors to allergies and asthma when they found that EIW rates seemed to be independent of any of the allergens they were tracking. "We started thinking maybe this isn't an immunological pathway," he says. "Maybe there's a nervous system component."

To find out, Perzanowski has zeroed in on the parasympathetic nervous system, which regulates digestion and resting heart rate and has also been implicated in the airway tightening associated with EIW. With funding from the Columbia Mailman School's Dean's Pilot program, he teamed up with pediatric pulmonologists and developmental neuroscientists at Columbia's medical school, as well as Qixuan Chen, PhD, associate professor of Biostatistics, Julie Herbstman, PhD, associate professor of Environmental Health Sciences, and Virginia Rauh, ScD, professor of Population and Family Health. Already, they've begun collecting pilot data in partnership with the New York City Department of Health and Mental Hygiene and recruiting participants in a study to follow youngsters from infancy through school age. In June, the team included their preliminary analyses in an application for additional research support from the National Institutes of Health. "The goal," says Perzanowski, "is to understand the mechanisms of EIW and intervene early in life."

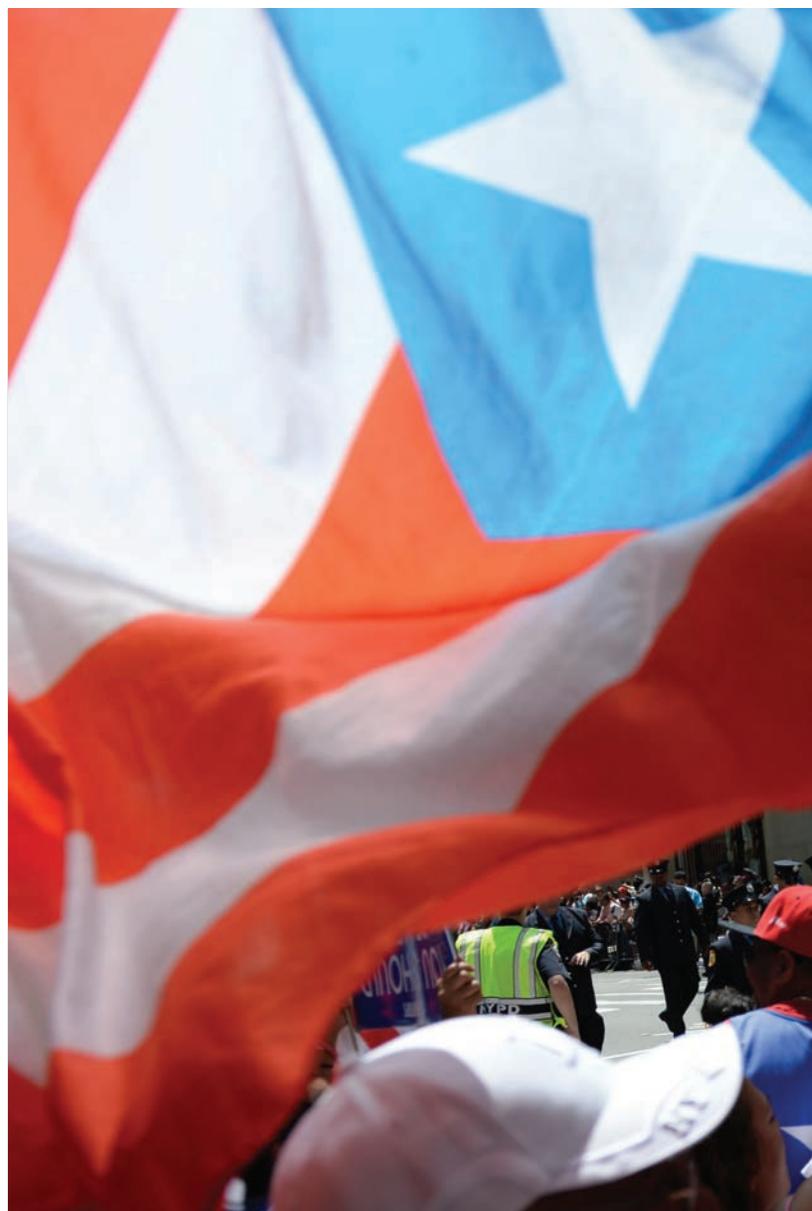
TIES THAT BIND

EMERGENCY RESPONSE IN THE WAKE OF STORMY WEATHER

BY NANCY AVERETT
& SHARON TREGASKIS

When Hurricane Maria made its way to Puerto Rico in September 2017, the Category 5 hurricane pummeled the island—uprooting trees, flattening buildings, dumping up to 30 inches of rain in just three days, and laying waste to island infrastructure.

In Washington Heights, the disaster brought together members of the Columbia Mailman School community intent on buffering the storm's effect on the health and well-being of the 3.3 million Americans who call the island home. The Dean's Office charged a network of concerned faculty, students, and staff—many with professional, familial, and social connections to Puerto Rico—with compiling an inventory of the public health skills that might be needed as soon as word arrived to inform their efforts.



Due to the storm's unprecedented destruction, that guidance was slow to come. "For almost a week, we didn't have any communication," says Professor of Sociomedical Sciences Marita Murrman, EdD, MS, the principal investigator of the Region 2 Public Health Training Center, a federally funded program responsible for educating public health workers in New York, New Jersey, Puerto Rico, and the U.S. Virgin Islands.

Finally, on Sept. 27, fully 10 days after the storm first made landfall, Murrman received an email from Maria Levis, CEO of Impactivo, a public health consulting firm on the island that serves as a liaison between the Region 2 Center and Puerto Rico's Department of Health. Levis's report was grim: The health department building in San Juan had been destroyed, and many public



health workers had lost their homes. The Impactivo office had intermittent power and Internet access, and that was only because of its proximity to a nearby hospital. Meanwhile, residents, devastated by the storm, were struggling to find clean water, food, and fuel to run generators.

The first order of business, said Levis, was educating the general public on topics such as how to disinfect water, administer mental health first aid, and safely dispose of dead animals. Picking the right conduit for dispersing such information was no small matter, given that cable service and cell phone towers had been knocked out by the storm and most people were relying on communication mediums like ham radio and Twitter. “The information we use for training healthcare workers was complicated and too jargon-y,”

Flag day: For 61 years, the National Puerto Rican Day Parade has celebrated the island and its culture. In June 2018—more than eight months after Hurricane Maria struck—the annual procession along Fifth Avenue furnished a national stage to grieve the more than 4,600 lives lost in the storm’s aftermath and highlight how federal economic policies had set the stage for an ongoing humanitarian crisis. Organizers included a special tribute to *el Pueblo de Puerto Rico* (the people of Puerto Rico) for their resilience and fortitude and honored the efforts of first responders and those whose relief work has been ongoing. *AP Photo / Bebetto Matthews*



Signal boost: In October, Tony-winning performer, songwriter, and lyricist Lin-Manuel Miranda retweeted post-hurricane safety tips for the general public developed by a Columbia Mailman School team. Meanwhile, students took the lead collecting signatures on petitions to the U.S. House of Representatives and Senate calling for the allocation of adequate relief funds, and at the end of the month organized a faculty panel discussion on disaster response that doubled as a fundraiser.

Murrman says. “We had to turn it into one-pagers, using conversational language translated into Puerto Rican Spanish.”

Within a day, a team at the School had created four fact sheets, had them translated by collaborators at the University of Miami, and emailed them to Levis, who printed the sheets in her office for her staff to distribute on the street, at pharmacies, and through local media.

When Levis wrangled a pro bono agreement with the Puerto Rican media to broadcast public health messages, School staff wrote radio copy and designed image-based messages for newspapers, social media, posters, and brochures. To sustain the distribution of those messages, faculty, staff, and student groups, including the Black and Latino Student Caucus, would ultimately raise more than \$11,000.

Puerto Rico’s plunge into darkness and widespread wreckage after Maria capped years of adverse economic poli-

cies imposed by federal and local legislators. Tax incentives coaxed industry to the island in the 1970s, but when they were revoked in the 2000s, companies left and unemployment skyrocketed. The Great Recession exacerbated the damage. By the time Maria hit, the Puerto Rican government was more than \$72 billion in debt, 45 percent of the island’s residents were living in poverty, and the infrastructure—power grid, water treatment plants, roads, bridges—had been crumbling for decades.

“The disruption that comes with a major hurricane makes a society as a whole vulnerable and certain components of the population more so,” says Associate Professor of Environmental Health Sciences Jeff Shaman, PhD, who heads Columbia’s Climate and Health Program. “People who don’t have the resources to buffer themselves—and those resources could be financial, infrastructure, familial—those are the people for whom

85 percent of research grant proposals submitted are rejected.

Seed Funds Spur Innovation

Lev

In 1973, Leonard Tow, PhD, launched Century Communications Corp with a \$22,000 investment. Twenty-five years later, he was chair, CEO, and CFO of the fifth largest cable company in the U.S., with a spin-off cellular phone company. “I’m a big believer in leverage,” says Tow, who joined the Columbia Mailman School Board of Overseers in 2012.

“It’s quite amazing what small commitments of confidence in an individual can do.”

That principle undergirds a series of awards made by Tow’s eponymous family foundation to propel research by early-career investigators at the Columbia Mailman School. “It gives us better returns for our investment,” says Tow, “and it gives our scholars an opportunity to demonstrate their capacity to achieve and develop their ideas.”

Consider, for example, the story of Yuanjia Wang, PhD, professor of Biostatistics, one of four professors at the School awarded a three-year, \$75,000 Tow Faculty Leadership Scholars grant in 2015. A budding expert in the identification of genomic, behavioral, clinical, and environmental features of neuropsychiatric conditions—depression, Parkinson’s disease, and the like—Wang was determined to redeploy her analytical expertise to use machine learning to mine prognostic insights from electronic health records.

The National Institutes of Health (NIH) has lost more than 20 percent of its purchasing power. Innovative ventures like Wang’s can be particularly risky, due to the increasingly heightened competition for those limited funds, says F. DuBois Bowman, the former chair and Cynthia and Robert Citrone-Roslyn and Leslie Goldstein Professor of Biostatistics. “I see a trend toward a more

Health services research receives only 1/20th of science funding.

erage

conservative, incremental science,” says Bowman, who regularly reviews grant proposals for the NIH. “People want to write the safe grant—the one they know will work and that they can convince reviewers will work—rather than the really ambitious one.”

Electronic health records are inherently messy—unlike the participants in clinical trials, real-world patients visit their clinicians on a random schedule determined by the emergence of new symptoms. Doctors, too, bring idiosyncracies to the equation. “That’s where we come in,” says Wang, “with the statistical thinking to account for those biases.”

To lay the groundwork for a successful R01 application to the National Institute of General Medical Sciences (NIGMS), Wang spent two years acquiring new skills and running pilot studies. This year, NIGMS awarded her team \$1.3 million to fully develop their vision, with Wang as primary investigator. She credits the Tow Foundation with the particularly competitive 9th percentile score her proposal received. “Without that funding,” she says, “I wouldn’t have had the time or resources to travel to conferences, hire students to work with our clinical data warehouse, or pay for the high-performance computing time required for our pilot studies.” 

The National Institutes of Health lost more than 20 percent of its purchasing power from 2003-2012.



1998

\$33 million naming pledge made in honor of Joseph L. Mailman

2000

Move to 722 West 168th Street

2008

Linda P. Fried, MD, MPH, named dean and DeLamar Professor

2013

Robert N. Butler Columbia Aging Center established

2014

Lerner Center for Public Health Promotion established

A FITTING TRIBUTE TWENTY YEARS AS THE MAILMAN SCHOOL OF PUBLIC HEALTH

“The Mailman family gave us a name, a brand. Phyllis, Jody, and Josh gave us a sense of community, a banner, the concept that we are a school. That has allowed us to do recruitment, build programs, and coalesce experts in the field of public health who represent a wide range of disciplines. Without a name, you don’t have the same kind of coherence.”

W. Ian Lipkin

Director, Center for Infection and Immunity
John Snow Professor of Epidemiology

2003

ICAP established to promote global health

2001

Center for Infection and Immunity joins the School



Joseph L. Mailman founded the Mailman Corporation, one of the earliest conglomerates in North America. A generous benefactor to organizations concerned with health and education, he also actively assisted families fleeing Nazi Germany.

2016

Columbia Population Health Partnership established

2012

MPH curriculum redesign launched

“Twenty-one years ago, we began a search for the best way to commemorate my father’s remarkable spirit of generosity. Happily, our search led to Columbia University’s venerable School of Public Health, then at the threshold of its 75th anniversary. We knew very little about public health at the time, but soon learned the basics—including the hard reality that public health was a desperately underfunded field. We also discovered that the myriad disciplines within public health resonated across our collective generations. It is a great pleasure to celebrate the first twenty years of the Joseph L. Mailman School of Public Health at Columbia University. We look forward to continuing the journey with this exceptional school that teaches how to save lives in the tens of thousands and improve the health of millions in populations around the world.”

Jody Wolfe

President, The Mailman Foundation

When Jody Wolfe, Josh Mailman, and their mother, Phyllis Mailman, pledged \$33 million to endow Columbia’s School of Public Health in 1998, it was the largest single gift ever made to a school of public health. For the school, renamed in honor of investor and philanthropist Joseph L. Mailman, and for the family foundation named in his honor, the gift was transformative. “We’d never given this kind of money on our own, for any cause,” says Mrs. Mailman. “It was a coming together of a wish to honor a man who had been beloved in our lives and an opportunity to do something that was truly needed.”

The effect of the Mailmans’ investment has been profound, says Dean Linda P. Fried, MD, MPH. “This tremendous gift enabled us to find a space that would become the School’s home, increase financial aid for students, recruit more of the most outstanding faculty, and invest more precious resources in innovative research programs that have yielded countless breakthroughs in public health and prevention.”

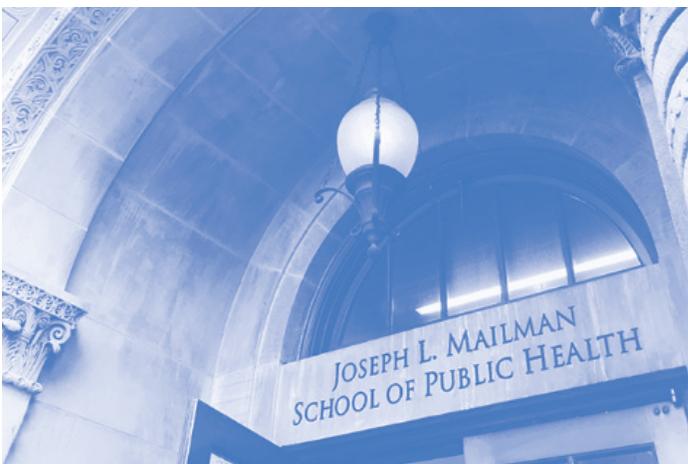
Joseph L. Mailman had a broad sense of equity and fairness, says his son, which made honoring him through support of public health education and research a particularly fitting tribute. “It’s not just about who can afford the best medical care,” says Josh

Mailman. “It’s about having a healthcare system that can cater to all. It speaks to his interest in promoting a fair society.”

Graduates share those values, says Mrs. Mailman, who has attended nearly every commencement celebration since 1998. “They really want to go back into their communities and help their constituencies,” she says. “They are thoughtful, earnest people who are looking to give back.”

As part of their pledge, and in close consultation with then-Dean Allan Rosenfield, MD, the Mailman family determined that the School—previously scattered across 10 city blocks in nooks and crannies of the Columbia University Medical Center—must have not only an endowment and a name, but a physical home.

By making their gift contingent on acquisition of a dedicated facility, the Mailman family paved the way for the move to 722 W. 168th St., a 200,000-square-foot facility with sweeping views of the Hudson River. “Small family foundations can do big things,” says Mrs. Mailman. “You don’t have to get in line behind the huge philanthropies. I think that’s really the lesson that should be learned and promulgated. That nice big sign that says ‘The Mailman School of Public Health’ came from a small foundation with a lot of nerve and a lot of will.” 



“The Mailmans’ generous gift has furnished a welcoming place for Columbia’s public health community to gather. The resulting relationships—among researchers, faculty, school administrators, and students—yield enormous synergies. There are the advantages of hallway and elevator conversations that potentially spark collaborations, which are more difficult when you’re in separate geographic spaces, and the economies of being able to engage in a greater number of events when you can just walk up or down a flight of stairs in the middle of the day.”

Michael Sparer

Chairman, Department of Health Policy and Management

Breaking the Silence

Support for Displaced Women

Since antiquity, women have endured stigma around menstruation. “I don’t know any culture in the world where you could walk around with blood on the back of your clothing and not have some embarrassment or shame,” says Marni Sommer, DrPH ’08, associate professor of Sociomedical Sciences.

For the 26 million displaced women and girls worldwide, the stakes are even higher. “If they don’t have the supplies to manage that blood flow, they remain indoors because it’s so incredibly taboo,” says Sommer. “It can be difficult for them to stand in line for distributions, collect water, or use the latrine where there’s little privacy.”

Sommer has advocated for menstrual hygiene management (MHM) for displaced women and girls for more than a decade, working with UNICEF, government health ministries, and nongovernmental organizations to ensure that women and girls have adequate supplies, education, and safe, sanitary spaces to change and wash, complete with disposal and waste management systems.

Shame and secrecy extend to many facets of sexual and reproductive health in displaced communities, including contraceptive services. “Countries affected by war are often characterized by breakdowns in health systems,” says Sara Casey, DrPH ’16. As director of the RAISE (Reproductive Health Access, Information, and Services in Emergencies) Initiative, a program of the Heilbrunn Department of Population and Family Health, Casey facilitates access to contraception and safe abortion care. “We tend to see an increased need for sexual and reproductive health services,” she says, “exactly at a time when those services are less likely to be available to women.”

Such services can serve as a fulcrum, says Terry McGovern, JD, Harriet and Robert H. Heilbrunn Professor and chair of Population and Family Health: “Access to health-care is absolutely critical to ensuring that women can fulfill their potential.”

—Kristin Bundy



Course Correct

Climate and Health Curriculum

The Global Consortium on Climate and Health Education (GCHE), an international collaboration to educate the global workforce on the health impacts of climate change, has announced a set of 16 core competencies for students of public health, nursing, and medicine.

With a roster of 162 health professions schools and programs (and growing), GCHE represents an estimated 130,000 students—and aims to expand the numbers of health professionals equipped to recognize and respond to the challenges

of climate volatility: deadly heat waves, flooding, air pollution, and wildfires; greater spread of disease vectors like ticks and mosquitos; and growing food and drinking water insecurity.

Among the 16 core competencies, GCHE recommends that students gain an understanding of complex environmental systems, learn to recognize and reduce climate-health effects in clinical and public health settings, and become adept at collaborating and communicating effectively with their peers, policymakers, and the private sector.

Jeffrey Shaman, an associate professor of Environmental Health Sciences and director of the Columbia Mailman School’s Climate and Health Program,

the first academic program of its kind in the U.S., directs the GCHE. “As the world faces monumental health challenges related to climate change,” he says, “there is a growing need for health professionals with the knowledge and skills to respond in a meaningful way.”

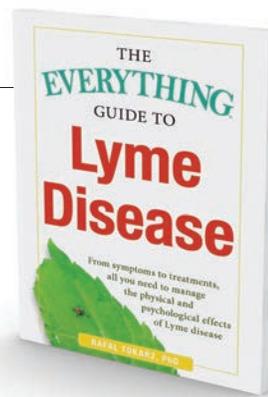


Lyme Light

Book on Tick-Borne Disease

In May, Simon and Schuster released *The Everything Guide To Lyme Disease* by Rafal Tokarz, PhD, associate research scientist at the Columbia Mailman School's Center for Infection and Immunity (CII). The 256-page text covers both psychological and physical symptoms, along with traditional and alternative treatments for one of the most rapidly emerging infectious diseases in North America and Europe. Spread to humans by the bite of an infected tick, the pathogen afflicts more than 300,000 people in the U.S. each year.

Tokarz is an expert on tick-borne diseases and a member of the CII team that developed the Tick-Borne Disease Serochip (TBD Serochip), the first multiplex blood test designed to detect *Borrelia burgdorferi*, the pathogen responsible for Lyme disease, and seven other pathogens. Currently, diagnosis of



Lyme disease, the most common TBD, requires two separate tests, which rely on subjective criteria for their interpretation. Such tests accurately identify fewer than 40 percent of patients with early disease and result in false positives 28 percent of the time. In a series of peer-reviewed publications, Tokarz has reported on the multiplicity of viruses with which ticks are often co-infected, further complicating accurate diagnosis in humans. While the TBD Serochip promises significant gains in diagnosis and early treatment, the test still has a long road ahead to FDA approval and clinical availability.



In the Air

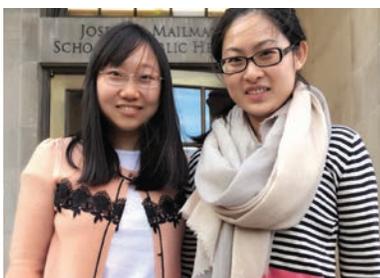
Fulbright Award

Unnati Mehta, MPH '18, will travel to New Delhi, India, as a Fulbright Scholar for the 2018-2019 academic year to conduct research at the Centre for Atmospheric Sciences at the Indian Institute of Technology-Delhi. Mehta's project will examine the impacts of ambient air pollution, specifically fine particulate matter, on respiratory health outcomes in New Delhi.

When she returns to the U.S., Mehta will begin her doctoral studies in Boston, focusing primarily on exposure assessment and environmental epidemiology. "New Delhi is one of the most polluted cities in India and in the world," says Mehta, who credits her research trajectory to the asthma-triggering pollution she experienced as a youngster visiting family in Gujarat. Access to information and healthcare made her symptoms manageable, but not everyone she met was so lucky. "So many people in India, especially those living at or below the poverty line, do not know about the dangers of air pollution exposure or even what asthma is, let alone know how to handle it."

A Numbers Game

Students Win Datathon



In September 2017, Wodan Ling and Shanghong Xie, both PhD students in Biostatistics, competed in a half-day datathon on the Morningside campus, sponsored by the financial services firm Citadel. From a pool of more than 1,000 applicants, the duo faced off against 180 entrants challenged to uncover insights from real-world data sets supplied by participating companies.

Joined by another Columbia student and a fourth from NYU, Ling and Xie had less than

six hours from the time they received their data set—from a company in the sharing economy—to formulate and answer a relevant question. They began by analyzing the structure of the data, scrubbing it (that is, removing false information), and organizing the figures—critical and time-consuming steps leading up to the analysis they chose to perform: The team proposed an algorithm that the company's providers could use to optimize their pricing in response to factors like geography and season.

Judges—a panel of three from Columbia's Department of Electrical Engineering, Yale University's Department of Statistics and Data Science, and AIG, the multinational insurance corporation—affirmed the approach, awarding the duo and their teammates a \$20,000 cash prize.



Centennial State Campaign

Donna Lynne, PhD '03

Donna Lynne, PhD '03, was group president of the Kaiser Foundation Health Plan and Kaiser Foundation Hospitals, overseeing a \$9 billion budget and 16,000 employees when John Hickenlooper tapped her to serve as Colorado's lieutenant governor and the Centennial State's chief operating officer in 2015. At the time, she had zero interest in pursuing the state's top office herself. Then she witnessed the 2016 presidential race, and everything changed.

In September 2017, just one month shy of her 64th birthday, Lynne launched her first campaign for elected office. "What we are seeing today is absolutely reminiscent of what we saw back in the 1960s—racism, sexism, disregard for the environment, and disregard for women's rights," Lynne declared at the launch of her bid to become Colorado's first female governor. "We have to stand together for the values we share and refuse to lose the progress we've made together."

When Lynne's campaign ended with the state primary in late June, she picked up where she'd never really left off—overseeing operations for Colorado's \$28 billion state budget and 30,000 employees. "She's like a Hoover vacuum cleaner of problems," Hickenlooper has said of his deputy. "They just disappear, and everyone's happy."

Lynne started solving government problems in 1976, as a White House intern in the post-Watergate years, helping to implement a new congressional budget process. Shortly thereafter, she landed a post directing analysis of New York City's \$2.5 billion education budget. Lynne continued in New York City government for more than 20 years. It was during her time as senior vice president of the New York City Health and Hospitals Corporation—a network of trauma centers, mental health facilities, neighborhood clinics, nursing homes, and home healthcare services, plus the Medicare payment system that connects them—that she was also a doctoral student in the Department of Health Policy and Management.

Since moving to Colorado in 2005, Lynne has climbed each of the state's 58 highest mountains—known collectively as the 14ers, for peaks above 14,000 feet in elevation—an achievement she touted on the campaign trail. "I've never been afraid of hard work," she declared in one TV ad. "I promise to keep Colorado climbing."

Fresh Take

Omkar Kulkarni, MPH '07



In healthcare, clinical innovation can save lives. To invite such transformative thinking—and realize the promise of digital health

and other disruptive technologies—Children's Hospital Los Angeles (CHLA) has tapped Omkar P. Kulkarni, MPH '07, to help drive clinical innovation as the hospital's first chief innovation officer.

As executive director of the Cedars-Sinai Accelerator, Kulkarni led a three-month residential program for healthcare start-ups on the Cedars-Sinai campus in Los Angeles providing a combination of entrepreneurial mentorship and consultation with experts from the hospital's clinical care and administrative teams to early-stage businesses. During his three years there, Kulkarni evaluated more than 3,000 ventures, with missions including enhancement of patient or family engagement in healthcare, development of connected devices, and healthcare Internet of Things, where the devices are a patient's smartphone or other forms of technology, and which are aimed at providing patients and providers with information to help in healthcare decision making.

At CHLA, Kulkarni's portfolio spans the clinical enterprise, where he's intent on finding successful new methods of care, incubating digital health tools, and rallying communities in and out of the hospital to solve problems in the field of pediatrics. He also works with the Consortium for Technology and Innovation in Pediatrics—which CHLA established in 2011 with the University of Southern California—to support and accelerate development and commercialization of medical devices and technology geared specifically at helping vulnerable children and their families.

“We’re taking the same talent, strategy, and playbook that drive demand for sneakers, breakfast cereal, and technology, and directing it toward ... the fight against HIV, malaria, and TB.” — BRIANA FERRIGNO



Pitch Perfect

Briana Ferrigno, MPH '13

Because I'm worth it. There are some things money can't buy; for everything else, there's Mastercard. Rice-A-Roni, the San Francisco treat. The Manhattan-based McCann advertising agency launched these and dozens of other iconic taglines over the last century. As president of McCann Global Health, Briana Ferrigno, MPH '13, harnesses the firm's creativity, global network, and influence to make the world a healthier place.

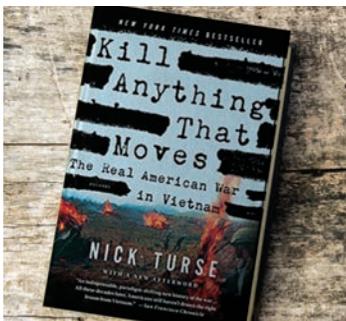
“We’re taking the same talent, strategy, and playbook that drive demand for sneakers, breakfast cereal, and technology, and directing it toward solving the most challenging public health issues like the fight against HIV, malaria, and TB,” says Ferrigno, whose clients include UNICEF and USAID.

The McCann approach starts by getting to know a target audience—adolescent girls in sub-Saharan Africa who are at risk for HIV, for example—from their dreams for the future to the kinds of music they prefer. “Rather than starting with health information,” says Ferrigno,

“we start with the human connection.”

As she pursued her MPH, Ferrigno also worked as a senior communications manager at ICAP, supporting the all-female leadership team during a rapid expansion to provide HIV care to more than 1 million people. “I got to work closely with these powerhouses who forged ambitious and impactful careers doing the work they are passionate about,” she says. “It was eye-opening and inspiring.”

Confident that other early-career women could benefit from such experiences, Ferrigno co-founded Changemaker Chats in 2013, soon after she started with McCann. Now in 12 cities around the world, the nonprofit invites highly accomplished female professionals to share their stories with women at earlier stages in their careers. The events, says Ferrigno, demonstrate that there is no one path to success. “I love the different perspectives of our speakers,” she says. “They really create a diverse portrait of what leadership looks like among women on their way to changing the world.”



Shine a Spotlight

Nick Turse, PhD '05

On a visit to the Columbia Mailman School in April, as part of the Rosner Seminar on History, Health, and Social Justice, war crimes reporter Nick Turse, PhD '05 recalled the combination of serendipity and grit that yielded his dissertation and culminated with his *New York Times* bestseller *Kill Anything That Moves: The Real American War in Vietnam*, which received a 2014 American Book Award.

Turse was midway through his doctoral studies when he visited the National Archives in Washington, DC, looking for materials to augment a Columbia Mailman School study of PTSD among Vietnam vets. Turse wasn't finding what he was after when an archivist offered up 30 boxes detailing the Pentagon's investigations into war crimes in Vietnam. Those boxes weren't what the PTSD team needed, either, but Turse knew they were of grave importance.

When the grad student couldn't interest more established historians in the materials, he decided to write a book on the records himself, while finishing his dissertation. To hammer out details of the plan, Turse met with his advisor, David Rosner, PhD, the Lauterstein Professor of Sociomedical Sciences and co-director of the School's Center for the History and Ethics of Public Health.

Rosner proposed an alternative: Turse would jettison the dissertation he'd already half-written, use the archived Pentagon files as raw material for a different dissertation, and then write the book. But first, the professor urged his grad student to record everything he'd seen in those boxes before it disappeared. Time was of the essence, Rosner said, and wrote his advisee a personal check to cover the cost. Twenty-four hours later, Turse was back in DC, digitally scanning some 20,000 pages of testimony.

Now managing editor of the Nation Institute's *TomDispatch* and co-founder of Dispatch Books, Turse has authored seven books on modern military operations and war crimes, including *Next Time They'll Come to Count the Dead: War and Survival in South Sudan*, an account of the aftermath of the U.S. government's first foray into nation-building in Africa.

Even more than the differences between war crimes in Vietnam and in South Sudan, says Turse, he saw common threads, especially among the people displaced by each conflict. “As an American, I had culpability. What I can do is report, so that's what I did. I tried to figure out what went wrong and, as best as I could, shine a spotlight on the injustice I saw.”

ICAP Celebrates 15 years

Improving the health of individuals, families, and communities around the world.

In 2003—out of the crisis of the global HIV epidemic—ICAP emerged. Propelled by the vision of founding director Wafaa El-Sadr, MD, MPH, MPA (pictured), a Columbia Mailman professor of Epidemiology, ICAP endeavors to strengthen the health systems of under-resourced communities around the world, demonstrating how innovative solutions can be implemented and scaled up to bring health and hope to those hardest hit by HIV/AIDS, as well as such devastating diseases as malaria and tuberculosis. Through a mix of research, implementation, and training, ICAP pursues its mission to make health and well-being a reality for populations around the world.



HIV In the 30 years since the pandemic began, nearly 30 million lives have been lost to HIV. Today, an estimated 35 million people worldwide are living with the virus. Each year, an additional 2.7 million people, including 390,000 children, are newly infected. Through service, research, education, training, and impact measurement, ICAP works with host countries and other partners to support efforts to confront HIV around the world.

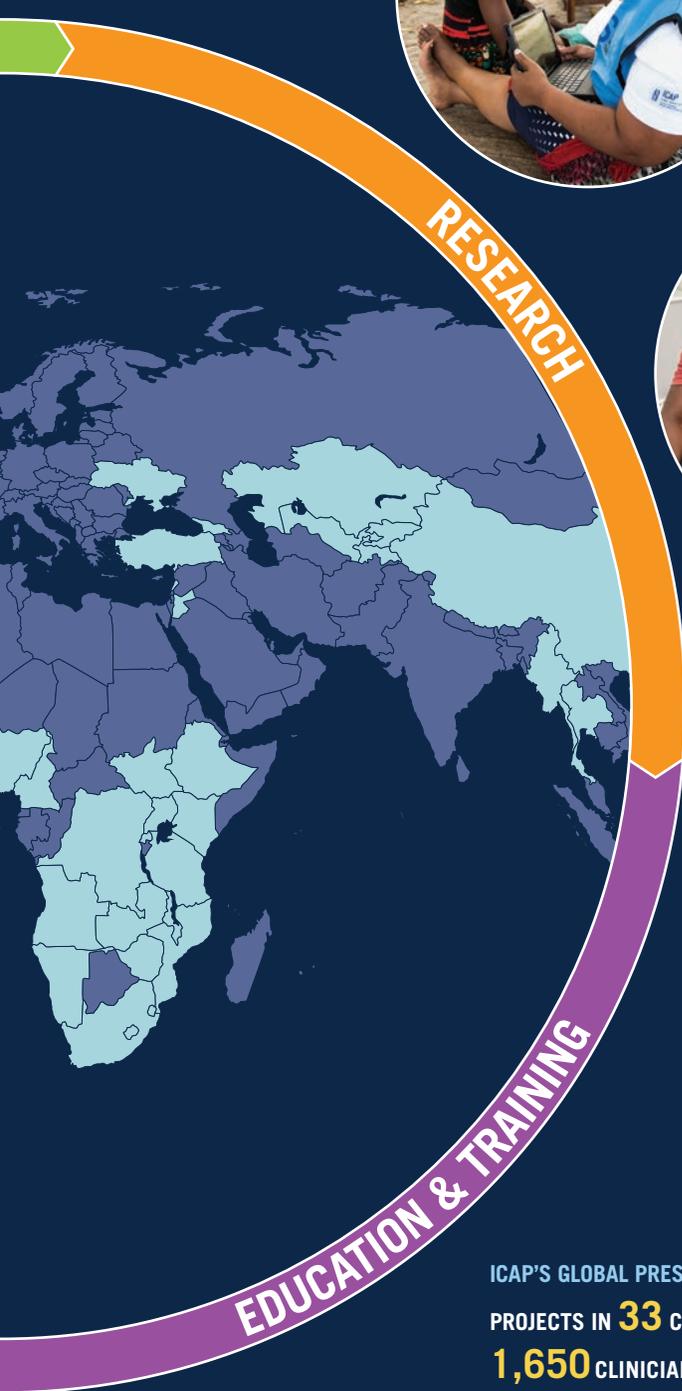


MALARIA Malaria remains a major health threat, particularly in sub-Saharan Africa and among children and pregnant women, worldwide. To promote accurate diagnosis and optimize treatment, ICAP has trained more than 2,500 laboratory professionals to conduct more accurate microscopy diagnoses and provided clinical training to more than 2,400 healthcare workers.



TUBERCULOSIS TB accounts for nearly one-quarter of HIV-related deaths; in some sub-Saharan countries, more than half of those with active TB are co-infected with HIV. ICAP promotes synergies between national TB and HIV control programs and supports the development of complementary clinical programs. ICAP also promotes clinician training, improved pediatric care and treatment, enhanced diagnosis, and development of best practices.





IMPACT MEASUREMENT Through the Population-based HIV Impact Assessment (PHIA) project, ICAP has partnered with the U.S. Centers for Disease Control and Prevention and ministries of health in 14 countries to collect critical information on the status of HIV epidemics at the national level since 2014. This information provides a report card on progress thus far in confronting the epidemic while informing strategic planning to guide future action.



PREVENTION In the United States, ICAP is evaluating new methods and approaches to HIV prevention. Currently ICAP is doing pioneering research in Harlem and the Bronx on long-acting pre-exposure prophylaxis (PrEP) to reduce HIV transmission.



EDUCATION & TRAINING Professional development of a global health workforce features prominently in ICAP's mission. The Global Nurse Capacity Building Program, for example, has helped to add more than 13,000 nurses and midwives throughout sub-Saharan Africa. More than 5,500 healthcare workers have participated in ICAP-supported training and networks, which include mentorship programs, as well as distance learning opportunities.

ICAP'S GLOBAL PRESENCE

PROJECTS IN **33** COUNTRIES
1,650 CLINICIANS, RESEARCHERS, DATA SCIENTISTS, AND OPERATIONS, FINANCIAL, TECHNICAL, AND COMMUNICATIONS ADVISERS SUPPORTING MORE THAN . . .
5,300 HEALTH FACILITIES AROUND THE WORLD

ICAP'S IMPACT

29M PEOPLE HAVE BEEN TESTED FOR HIV
2.3M PEOPLE HAVE BEEN ENROLLED IN HIV CARE
1.3M PEOPLE HAVE BEGUN HIV TREATMENT
616K WOMEN HAVE RECEIVED TREATMENT TO PREVENT HIV TRANSMISSION TO THEIR BABIES
4.2M PEOPLE HAVE BEEN SCREENED FOR TB

WWW.ICAP.COLUMBIA.EDU



The Hoboken University Medical Center Emergency Department closed for more than two weeks due to extensive flooding during 2012 Superstorm Sandy; the local fire department was also evacuated and thousands were trapped in their homes. AP Photo / Charles Sykes



While 4,000 nursing home residents in Texas were evacuated in August 2017, prior to Tropical Storm Harvey, 33,000 sheltered in place. In Orange, TX, the Louisiana Department of Wildlife and Fisheries assisted in emergency rescue. AP Photo / Gerald Herbert

Outbreak

Changing Disease Patterns Threaten to Strain Health Systems Worldwide

As climate change turns extreme weather into the new normal, learn to expect the unexpected, says infectious disease ecologist Micaela Martinez, PhD. Infectious disease patterns reflect the climate conditions under which hosts and vectors co-evolved, says the assistant professor of Environmental Health Sciences. “Now, since climate change is shaking things up, the ecology of organisms themselves and the climate are going to mismatch. We’re going to have this redistribution—it’s not necessarily better or worse, but it’s going to be very different and unpredictable, and that’s what makes things difficult. We’ve evolved our control strategies under very particular conditions under the last 100 years of disease distribution and climate; now things are changing. We’re going to have new diseases popping up in places never seen before.”

Simultaneously, expect a host of complications due to the chaos imposed by extreme weather events that shutter hospitals and disrupt daily life. Think, for example, of parents with young children, says Martinez, who also investigates how demographic, physiological, and environmental factors intersect to fuel epidemics of such diseases as measles and chickenpox. Inability to maintain a regular pediatric checkup schedule due to infrastructure problems after a climate catastrophe can lead to a breakdown in childhood vaccination rates and an increase in the resulting diseases. “That’s something we typically see in war-torn countries,” she says. “It only takes a small, susceptible pool to become the kindling for one of these outbreaks.”

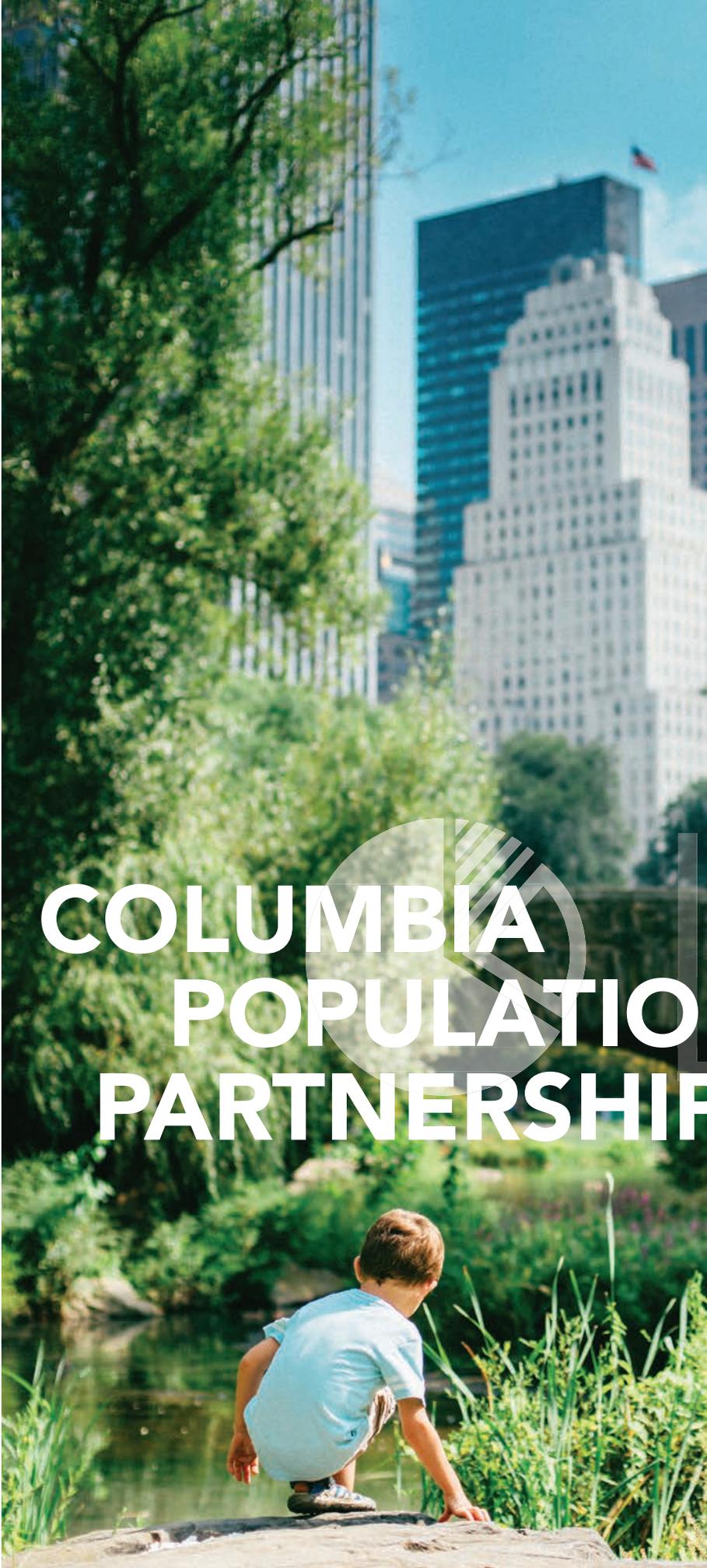
— Nancy Averett



In Somalia, drought has led to severe food and water shortages, precipitating cholera outbreaks, starvation, and mass displacement. Severe droughts also cause dust storms, leading to higher rates of cardiovascular and respiratory illness. Sipa USA via AP Images



From Maine to West Virginia, 2017 was the fourth-wettest spring on record, raising the spectre of a spike in mosquito-borne illnesses in the U.S. Worldwide, changing weather promises to transform disease distribution. Peter Hvizdak / New Haven Register via AP Images



COLUMBIA POPULATION HEALTH PARTNERSHIP

CASE STUDY:



Claritin®

How much time do people in the U.S. spend indoors? To find out, Bayer Consumer Healthcare's Claritin® team turned to researchers at Columbia.

Mailman School faculty mined a large public data set with responses from people across the U.S. and found that, on average, **we spend 95% of our time indoors—and the equivalent of just 18 days a year outdoors.** In response, Claritin® launched "Be an Outsider," a national campaign with Hollywood actor Josh Duhamel to boost awareness of the benefits of time spent outdoors and motivate behavior change. Make a change: Get outside!

CPHP connects businesses and government organizations with scientists at the Mailman School. Together, we develop mutually beneficial research collaborations that apply scientific insights in the quest for innovative solutions to address public health challenges, both in the U.S. and around the world.

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