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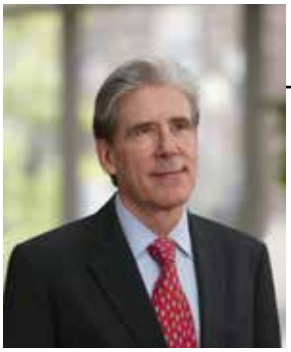
HARVARD PUBLIC HEALTH

Spring 2015

THE MAGAZINE OF THE HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH

the e-cig quandary



DEAN'S MESSAGE

Inflection Points

At the end of August I will be leaving the Harvard T.H. Chan School of Public Health, where I have been honored to serve as dean since 2009, to assume the presidency of the University of Miami. My experience at Harvard has been extraordinary, and the decision to step down came only after deep reflection. (See related story, page 4.)

As I move on, the kind of amazing work that has inspired me these past six years is vividly reflected in the Spring 2015 issue of *Harvard Public Health*. The cover article on e-cigarettes—which today are one of the most conspicuous moving targets in our field, with sophisticated consumer marketing outpacing scientific certainty—examines the need for clarity across a range of questions. Will these stylish, battery-operated nicotine-delivery devices help longtime smokers who want to quit—or will they serve as a gateway to tobacco cigarettes for young people trying these novel products on a lark?

In a similar vein, the Q&A with biostatistician Melody Goodman, SM '03, PhD '06, thoughtfully explores how public health can bring clarity to our national discussion on police-associated violence. The Off the Cuff feature with Vish Viswanath, professor of health communication at the School, describes how public health can convey clarity to concerned parents about the overwhelming benefits of childhood vaccinations.

The student profile of Rose Filoramo, PhD '17, shows a young biologist pursuing clarity on sepsis, one of the most vexing disorders in health care today. The story on JP Onnela, assistant professor of biostatistics, describes a quest to build clarity about mood disorders by drawing on unobtrusive cellphone technology. And the portrait of clinician and filmmaker Deborah Van Dyke, MPH '93, reveals how a passion for improving health inspired a line of clear and simple instructional videos targeted to the world's most impoverished places.

Going forward, public health will continue to be a central passion. As I embark on a new stage of my life, I feel immeasurable gratitude to the department chairs and center directors, members of the faculty, academic appointees, alumni, students, staff, and my leadership team at the School. I am also grateful for the transformative $350 million gift by the Chan family's Morningside Foundation and for the ongoing generosity of all our benefactors and volunteers.

At the start of its second century, the Harvard T.H. Chan School of Public Health is in an exceptionally strong position to meet the challenges of the 21st century.

Happily, at the start of its second century, the Harvard T.H. Chan School of Public Health is in an exceptionally strong position to meet the challenges of the 21st century. I have no doubt that this School is poised to soar to new heights.

Julio Frenk
Dean of the Faculty and
T & G Angelopoulos Professor of Public Health and International Development,
Harvard T.H. Chan School of Public Health

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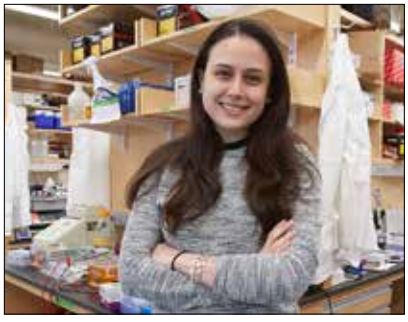
COVER STORY

14

The E-Cigarette Quandary: Are electronic cigarettes one of the biggest health hazards since tobacco cigarettes—or the best chance to get smokers to quit?

FEATURES



DEPARTMENTS

Top center column, Mark Binder for the Global Health Media Project; All others, Kent Dayton / Harvard Chan

COVER, Dennis Toohey / Makeready

DEAN JULIO FRENK TO LEAVE SCHOOL

Julio Frenk, dean of the Harvard T.H. Chan School of Public Health, will become the next president of the University of Miami, it was announced April 13. Frenk, the T & G Angelopoulos Professor of Public Health and International Development (a joint appointment with the Harvard Kennedy School), will step down at the end of August and assume his new role on Sept. 1.

"My time as dean of the Harvard Chan School has been among the best experiences of my career, and the decision to step down was only made after deep reflection," said Frenk. "I am extremely proud of all that has been accomplished during my time at this school, and am excited at the opportunity to lead a university with great upward momentum and thereby continue to create and deploy knowledge for the greater good.

Kris Snibbe / Harvard Staff Photographer

"My excitement about taking the helm of the University of Miami owes much to Harvard President Drew Faust, whose expansive vision of universities has greatly influenced my own thinking," said Frenk. "Under her tutelage, I have come to believe that universities have an essential role to play if humanity is to meet the many challenges of the 21st century."

MAJOR CHANGES AND CHALLENGES

Frenk assumed the role of dean in January 2009. He has presided over a dramatic expansion of the School's international reach, the reimagining of its mission to focus on four global public health challenges, a major revamping of its curricula, and the renaming of the School to honor T.H. Chan after a historic $350 million endowment gift by The Morningside Foundation.

"Julio has energized the Harvard Chan School with his extraordinary devotion to how universities can enhance the health of populations around the world," said President Drew Faust. "He has combined high ideals with clear-eyed pragmatism, scientific rigor with humane compassion, all in the service of improving the understanding and practice of global health in the 21st century.

"It's clear from their choice that the University of Miami's trustees share Julio's own qualities of wisdom and foresight, and that they have discovered in him the remarkable leadership capacity and vision with which he has graced Harvard these past six years," said Faust. "We thank him for his service to Harvard, to higher education, and to human health."

Faust indicated that she will name an interim dean in the coming months as the University launches a comprehensive search for Frenk's successor.

"Today, the University of Miami selected a world-renowned scholar and leader as its next president," said Stuart A. Miller, chair of the University of Miami Board

of Trustees. "Dr. Frenk has been called 'a visionary, an insightful analyst, an institutional innovator, and a pragmatic problem solver' and, speaking for the entire board, we could not agree more."

In his first address as dean in 2009, Frenk declared that he wanted the Harvard School of Public Health, as it was then known, "to be the first school of public health of the 21st century."

FOCUSED ON FOUR GLOBAL THREATS

Frenk arrived at the School at the height of the global financial crisis and during a period when government funding for scientific research—which constitutes more than 60 percent of the School's revenue—was shrinking. He successfully guided the School through those financially turbulent waters while simultaneously encouraging faculty and students to ambitiously address on a global scale what he believes are the four most important health threats facing our world today: old and new pandemics, including AIDS and Ebola, obesity, and cancer; social and environmental threats to health, ranging from violence and racial disparities to pollution and occupational hazards; poverty and humanitarian crises; and failing health systems in the U.S. and internationally.

RESHAPED EDUCATIONAL STRATEGY

During his tenure, Frenk and the faculty also significantly reshaped the School's educational strategy, reimagining how to develop future public health leaders and placing a greater emphasis on case-based learning, interactive activities, and other pedagogical innovations.

The results of those efforts included creation of a new Doctor of Public Health (DrPH) degree program as the flagship professional doctoral degree for public health leaders, and establishment of Harvard's first "blended" master's degree program offered by one of its graduate Schools, enabling students to pursue a degree in epidemiology through a combination of online and in-classroom learning experiences. During Frenk's deanship, the School's faculty also created a new Population Health Sciences PhD program to transform its existing five Doctor of Science (SD) programs into a single integrated degree for students pursuing careers in environmental health, epidemiology, global health and population, nutrition, or the social and behavioral sciences. Its master of public health (MPH) degree was redesigned and beginning in the fall of 2016 will be the single master's degree program offered at the School for students planning professional careers in government, civil-society organizations, and private businesses.

RENAMING GIFT HIGHLIGHTED TENURE

Frenk was honored to serve as dean during the School's centennial in 2013 and kicked off an ambitious capital fundraising campaign that same year. The School quickly exceeded initial expectations with the announcement of a generous $350 million gift—the largest in Harvard's history—from The Morningside Foundation in September 2014. The School was renamed the Harvard T.H. Chan School of Public Health in recognition of that gift.

"We thank him for his service to Harvard, to higher education, and to human health."

—Drew Gilpin Faust, President, Harvard University

Before his appointment as dean, Frenk had served in a series of important leadership positions in the field. From 2000 to 2006, he was Mexico's minister of health, a role in which he instituted a comprehensive health insurance program known as Seguro Popular, which expanded access to health care to millions of previously uninsured Mexicans. He was the founding director-general of Mexico's National Institute of Public Health. From 1998 to 2000, he served as executive director of Evidence and Information for Policy at the World Health Organization (WHO).

Frenk earned his medical degree from the National University of Mexico, as well as a master of public health and a joint doctorate in medical care organization and in sociology from the University of Michigan. He is a member of the U.S. Institute of Medicine, American Academy of Arts and Sciences, and National Academy of Medicine of Mexico.

In addition to his scholarly works, which include more than 140 articles in academic journals, as well as many books and book chapters, he has written two best-selling novels for youngsters explaining the functions of the human body.

In September of 2008, Frenk received the Clinton Global Citizen Award for changing "the way practitioners and policy makers across the world think about health." ■

Reprinted from the Harvard Gazette.

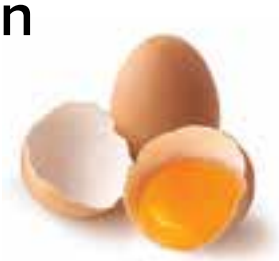
TRAUMA'S TOLL ON WOMEN'S HEALTH

Women are more likely than men to develop post-traumatic stress disorder (PTSD), and new evidence suggests PTSD not only devastates women's mental health, it also raises their risk for cardiovascular disease, diabetes, and obesity. Survey data from nearly 50,000 women gathered over 22 years found that those suffering PTSD are nearly twice as likely to develop type 2 diabetes, compared with women who don't have PTSD. Antidepressant use and elevated body mass index accounted for nearly half the increased risk. Results were published online January 7, 2015, in *JAMA Psychiatry*. First author Andrea Roberts, research associate in the Department of Social and Behavioral Sciences, notes that with fewer than half of Americans with PTSD receiving treatment, "Our study adds urgency to the effort to improve access to mental health care to address factors that contribute to diabetes and other chronic diseases."

The Heat Is On

Extreme heat is the most common cause of weather-related deaths in the U.S., and older Americans are particularly at risk. In the largest and most comprehensive study of heat-related illness to date, senior author Francesca Dominici, professor of biostatistics, and colleagues have identified the conditions most likely to land seniors in the hospital during a heat wave—including fluid and electrolyte disorders, renal failure, urinary tract infections, sepsis, and heat stroke. Risks rose when the heat wave periods were longer and more extreme, and remained elevated for up to five days after the hottest day. The study appeared online December 23, 2014, in the *Journal of the American Medical Association*.

Eggs Are OK—in Moderation



A new report from the federal 2015 Dietary Guidelines Advisory Committee recommends easing previous restrictions on dietary cholesterol, concluding that for most healthy people, cholesterol-rich foods such as eggs do not raise blood cholesterol or harm the heart. The panel, which includes the School's Frank Hu, professor of nutrition and epidemiology, also called for Americans to focus on healthy fats rather than restricting overall fat consumption, and to limit added sugar to 10 percent of daily calories—all of which Harvard Chan researchers have been saying for years.

VERMONT CALLS IT QUITS ON SINGLE-PAYER

Vermont Gov. Peter Shumlin announced in December that the state would not pursue a single-payer financing scheme for health insurance because of high projected costs. The widely publicized program was designed by William Hsiao, K.T. Li Research Professor of Economics, the subject of the Spring/Summer 2012 cover story of *Harvard Public Health*.

Top, © Christina Kennedy / Alamy; all others, iStock

SWAT! Mosquito Sex Linked to Malaria Transmission

Sexual biology may be the key to uncovering why *Anopheles* mosquitoes are unique in their ability to transmit malaria to humans, and why species within this genus vary widely in their power to do so. Through analysis of 16 *Anopheles* genomes, researchers found that mosquito reproductive traits evolved along with their capacity to transmit the *Plasmodium* parasite that causes malaria. Four species that exchange the highest quantity of a steroid hormone known as 20E are all major carriers of malaria and are found in regions of Africa and India hit hard by the disease. Senior author Flaminia Catteruccia, associate professor of immunology and infectious diseases at the Harvard Chan School and the University of Perugia, Italy, believes that these findings may provide a new target for malaria control efforts. The study was published online February 26, 2015, in *Science*.

Rethinking the Role of DNA

Twins have long been the go-to population for scientists hoping to measure how genes shape individual differences, from height to cancer risk. But a new Harvard Chan–led study argues that other factors such as environment can bias the results of these studies. Senior author Alkes Price, associate professor of statistical genetics, and colleagues, studied the genomes of unrelated people with ancestry from two different continents, Africa and Europe. They found that only 55 percent of the variance in height and other traits could be attributed to genetics—far lower heritability than that found by most twin studies. According to Price, the finding is in line with research that has narrowed down the source of our significant differences to just 1 million DNA sequence variations known as single nucleotide polymorphisms (SNPs), out of more than 30 million. Price believes that researchers should focus on these SNPs to identify "which genes or pathways are biologically important so that drugs can be designed that can help cure or control disease."

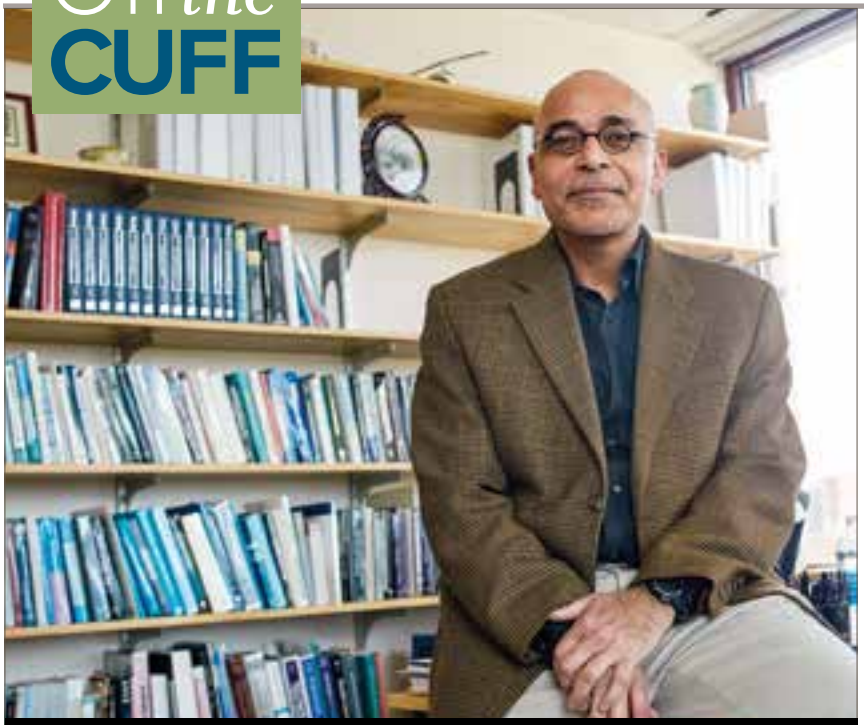
Using Drug Coverage to Discriminate

Some insurers offering health plans through the new federal marketplace may be tailoring drug coverage to deter people with HIV from selecting their plans. Harvard Chan researchers found that these insurers are placing all HIV drugs in the highest cost-sharing category in their formularies—which list the plans' covered drugs and costs. As a result, patients with HIV must spend thousands more dollars per year than if they had enrolled in other plans. If left unchecked, the practice could partially undermine a central feature of the Affordable Care Act: protecting people with preexisting conditions against discrimination. It could also lead to sicker people clustering in plans that offer more generous prescription drug benefits—in turn creating a "race to the bottom" with insurers hiking their drug co-pays to avoid a large influx of sick and expensive enrollees.

LEARN MORE ONLINE Visit *Harvard Public Health* online at http://hsph.me/frontlines for links to press releases, news reports, videos, and the original research studies behind Frontlines stories.

Top left, CDC / James Gathany; all others, iStock

Off the CUFF



"Vish" Viswanath is chair of the Vaccine Confidence Working Group of the National Vaccine Advisory Committee, which reports to the U.S. Department of Health and Human Services. In June 2015, the working group will vote on national recommendations for improving acceptance of, and confidence in, childhood vaccines.

MAKING THE CASE FOR CHILDHOOD IMMUNIZATION

KASISOMAYAJULA "VISH" VISWANATH
PROFESSOR OF HEALTH COMMUNICATION, DEPARTMENT OF SOCIAL AND BEHAVIORAL SCIENCES

Q: There has been an uptick of measles, whooping cough, and other infections in the United States. Many of these infections, which are routinely prevented by childhood immunizations, have been traced to pockets of communities where parents either refuse or delay childhood vaccination. A study published in March in *Pediatrics* found that more than 70 percent of children's physicians have agreed to parents' requests to delay vaccination—even though the doctors believe it puts children at risk. How can public health best make its case for childhood vaccination?

A: Two messages seem to be getting lost in the current discussion. One is that most parents in the United States—well over 90 percent—get their children vaccinated. Vaccination is the norm. The media imply that there are two sides to this story when there aren't. Rather, a tiny group that opposes vaccination is receiving a disproportionate share of media attention, sowing doubt where there is none. There is only one, dominant scientific side and most everyone believes it.

Second, some parents do have concerns about vaccines and their possible adverse impacts—but they still get their children vaccinated. These parents are not anti-vaccine. Parents should ask questions about *any* medical procedure that affects their children.

Just providing facts and numbers is not the most effective way to communicate. So why don't we in public health tell more stories? First, because we have taken the success of childhood immunization for granted. Second, because of that success, there are very few emotional stories to draw on. In the early 1960s, I could have easily recited a sad story about an unvaccinated child contracting polio in the U.S., but today I can't. Yet an anti-vaccine group can take a compelling story about an autistic child and make specious causal attributions to vaccines, based on fraudulent research. We must not let that kind of flawed science go uncontested—and the media, frankly, have a responsibility to stop reporting it.

Kent Dayton / Harvard Chan

CAMPAIGN UPDATE

GIFT FUNDS LEADERSHIP TRAINING TO ADDRESS GLOBAL HEALTH

Jeff Walker, MBA '81

"What can we do to minimize suffering?" This question drives the work of Jeff Walker, MBA '81, and his colleagues to address global public health issues. A former full-time venture capitalist and private equity investor, Walker now spends some 95 percent of his time on global health efforts and the study of philanthropic and collaborative leadership. He is currently vice chair in the Office of the U.N. Secretary-General's Special Envoy for Health Finance and Malaria, focusing primarily on community health workers, and his book *The Generosity Network* is the basis for a Harvard Kennedy School course he helped establish.

The same question provided the impetus for Walker's $500,000 gift to the Harvard Chan School, part of his Campaign gift to his alma mater, Harvard Business School. The gift created the Jeffrey C. Walker Fund for Public Health Leadership Development and is designed to promote collaboration between the Harvard Chan School and Harvard Kennedy School, especially in support of the work of Howard Koh, professor of the practice of public health leadership and director of the Leading Change Studio at the Harvard Chan School.

Walker believes that investing in leadership training programs is the most effective way to address big global health problems. Employing the skills of collaboration and networking honed throughout his business career, he has become a catalyst for bringing together people with a passion for public health and advancing serious programs to tackle the issues.

Michael Voligny

Voligny Named Vice Dean at Harvard Chan

Michael Voligny was named vice dean for external relations at the Harvard T.H. Chan School of Public Health. Harvard Chan Dean Julio Frenk made the announcement on March 20.

Voligny, who had been interim dean since August 2014, has served the University in a variety of roles for the past two decades. He began working as a major gift officer at the Harvard Chan School in 1994. In 1996, Voligny served as a key leader in the University's fundraising efforts in Asia. He left the University in 1999 to become vice president for development with Hope Worldwide, in Philadelphia, before returning to the School in 2002. Voligny began his University career in 1989, serving in a leadership fundraising role at the Graduate School of Design.

According to Dean Frenk, "Michael has a wealth of fundraising experience, a strong dedication to the mission of the School, and a deep respect for faculty and their research. We are extremely fortunate to have him assume the position of vice dean."

Top, courtesy of Jeffrey Walker; top left, © Baz Ratner / Reuters left; Emily Cuccarese / Harvard Chan

Ellen Feldberg Gordon, AB '76

CHALLENGE GIFT TO PREVENT EATING DISORDERS

"As with anything," says Ellen Feldberg Gordon, AB '76, "if you can start with prevention, then you're ahead of the game." Gordon, a psychotherapist, specializes in working with clients who are struggling with an eating disorder.

She points out that much of the current research in the field of eating disorders focuses on treatment rather than on prevention. But the STRIPED program—of which Gordon was a founder in 2009, with a significant gift—is different. That's why STRIPED (Strategic Training Initiative for the Prevention of Eating Disorders) is the focus of her philanthropy at the Harvard Chan School.

Led by Bryn Austin, SM '96, SD '99, associate professor of social and behavioral sciences, STRIPED is a graduate-level multidisciplinary training program for public health professionals who will work on eating-disorder prevention. The program is based at the Harvard Chan School and Boston Children's Hospital. At the heart of Gordon's passion for this field is her own personal experience. "I had an eating disorder myself," she says, "as did my mother and my daughter. I've seen how it can affect not only the individual but also the entire family."

Gordon recently pledged $500,000 to STRIPED in the form of a challenge, to encourage others to contribute to this important research. She will match contributions to STRIPED dollar for dollar, up to $500,000, over the next five years.

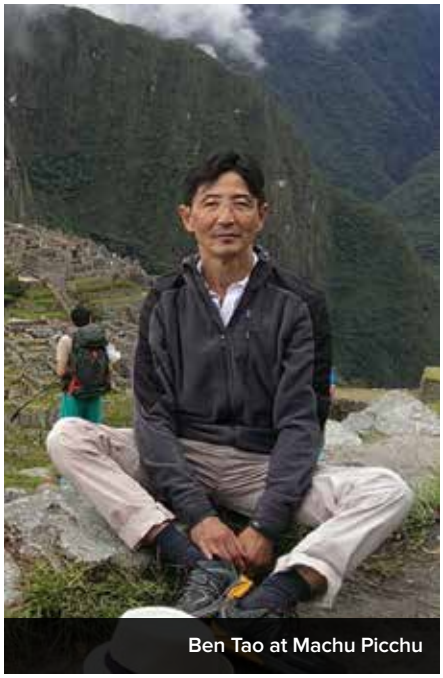
For information about contributing to the Eating Disorder Prevention (STRIPED) Fund, please contact Jennifer Sabatini at sabatini@hsph.harvard.edu or 617-432-2800.

Top, Figge Photography; left, Veer.com

Gifts Support Human Rights Research

"We just clicked." That is how Ben Tao, an entrepreneur, described his fall 2014 meeting with the Harvard Chan School's Jennifer Leaning.

Born in Burma (also called Myanmar), Tao retains a keen interest in events there. When he met Leaning, the François-Xavier Bagnoud Professor of the Practice of Health and Human Rights and director of the FXB Center for Health and Human Rights, they discussed, among other topics, the plight of the Rohingya refugees. The Rohingya, a minority Muslim group in Burma, are facing persecution there; many have fled to Bangladesh, where they live in refugee camps. As a result of that meeting, Tao contributed $50,000 toward the implementation of Leaning's Rohingya Rapid Assessment Project. She traveled to Bangladesh in March 2015 to begin the first phase of the study.



Ben Tao at Machu Picchu

Tao is a strong supporter of many of the School's other human rights efforts as well. After meeting Theresa Betancourt, associate professor of child health and human rights and director of the Research Program on Children and Global Adversity, he contributed $50,000 to support her Mental Health Disparities in Refugee Children research project. And he contributed $500,000 to establish the endowed Tao Fund for Human Rights Research. Tao describes this gift as a vote of confidence in Leaning, Betancourt, Dean Julio Frenk, and other faculty he has encountered. "Everyone I've met at the School has been deeply inspiring and impressive," says Tao. "Their dedication to their jobs is really priceless."

Jennifer Leaning, François-Xavier Bagnoud Professor of the Practice of Health and Human Rights; Director, FXB Center for Health and Human Rights

Gifts fund:

Rohingya Rapid Assessment Project

Mental Health Disparities in Refugee Children Research Project

Tao Fund for Human Rights Research

Top, © Lai Seng Sin, Associated Press; far right, Emily Cuccarese / Harvard Chan; right, courtesy of Ben Tao

Q&A

A Public Health Lens on Police-Associated Violence

In 2014, the police killings of three unarmed African-American males—Eric Garner in Staten Island, New York; Michael Brown in Ferguson, Missouri; and Tamir Rice in Cleveland, Ohio—sparked a national conversation on police brutality and on endemic racism in U.S. society. Biostatistician Melody Goodman, SM '03, PhD '06, assistant professor in the division of public health sciences at Washington University School of Medicine in St. Louis, focuses her work on the social risk factors behind health disparities. She spoke recently with Madeline Drexler, editor of *Harvard Public Health*.

Melody Goodman, SM '03, PhD '06

Q: If you could design a public health study that illuminated the causes and effects of police-associated violence, what would you do?

A: I would do two studies. First, we don't have consistently collected data across police departments and across states about exactly what's happening. So I would collect surveillance data that we could monitor over time. Whenever there is an interaction between a police officer and a community member and someone gets hurt, we would ask each party and all witnesses—using a standardized data collection instrument—what happened and whether any weapons were involved. It should be mandatory that police departments collect and report these data at the local, state, and national levels.

We also don't know how aggressive policing affects the health of African-Americans, especially men—both physical health and social well-being. So the other study would be a mixed-method, qualitative-quantitative study that compares the health effects of community policing—the model where police officers focus on building partnerships and working closely with community members to address conditions that lead to public safety issues—with the militarized police model used in many urban centers.

African-American men, and especially youths, often assume that at some point they will land in jail, even if it's just overnight to pay a fine. To be in an environment where you don't trust the institutions that are designed to protect and serve—police, criminal justice, medical—makes you go through life in a different way.

Q: When you saw videotapes of the deaths of Eric Garner, Michael Brown, and Tamir Rice, what was your response?

A: As an African-American woman who grew up on the south side of Jamaica, Queens, in a New York City housing project, seeing aggressive police tactics is not surprising to me. It happened all the time when I was a kid, which was at the height of the crack epidemic and the resulting "war on drugs." This is what drove me into public health: being from a community where it's clear how social determinants impact health outcomes.

I felt the national debate was polarizing. On the one hand, it was good that there were more discussions about what it is like to be a black youth in this country. But no one talked about the privileges that come with being a white police officer. For example, most people wanted to believe the police officers and discredit the witnesses. No one talked about the officers' inherent biases. Even the idea that black men are perceived as threats is a bias. The killing of Tamir Rice—who was 12 years old—is a perfect example of bias.

Q: Why are we more comfortable discussing black victimization than white privilege?

A: The people who are now benefiting from white privilege didn't set up this system, and they don't want to be penal-

Left, courtesy of Melody Goodman; opposite, © Lucas Jackson / Reuters

Demonstrators protest outside of Greater St. Marks Family Church in Ferguson, Missouri on August 14, 2014.

ized for how it was set up before. It's not that I think that they should be, but we don't even talk about it.

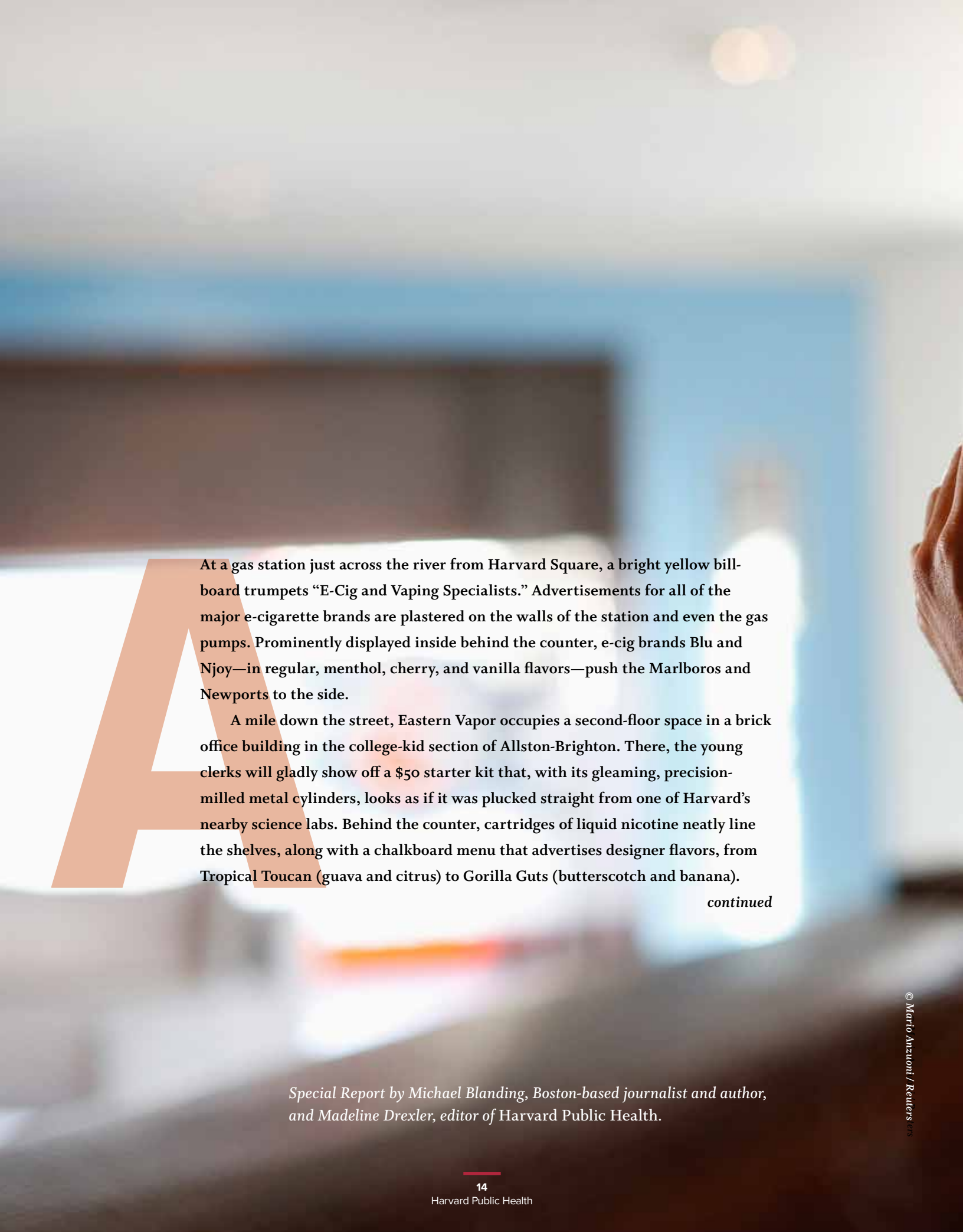
I remember the first time I saw a white person curse at a police officer. I was shocked. I thought, "Here it goes, something terrible is going to happen." But nothing happened. My mom didn't call it "white privilege"—we didn't have that language—but she made me aware that I could not behave like that, because of my skin color.

Or take the hashtag "#blacklivesmatter." It's about priorities. When I write proposals to do my disparities work, stating that blacks are underserved is not enough to pull in funding. I have to show how my work will benefit the whole community and often make an economic argument to do so.

Q: What does it say about our society that there are so few public health studies of police violence?

A: It says that we're not allowed to question or criticize police departments. As scholars, we get criticized on a daily basis—it's part of what we do. In the culture of policing, you are seen as either pro-police or anti-police.

I've told my colleagues that I wish police officers could live in an academic environment for just one year, where everything they did got critiqued. It changes your mentality about what criticism really means. I would love to be able to say, "This study of mine is not open for criticism!" But when I get feedback on a paper, it's not that people are criticizing me as a person—they're just trying to help me build a stronger scientific case. I've learned to use criticism to make my work better. I wish police departments would open themselves up for constructive criticism. I am not saying they will enjoy it, but they will be better for it. ❂

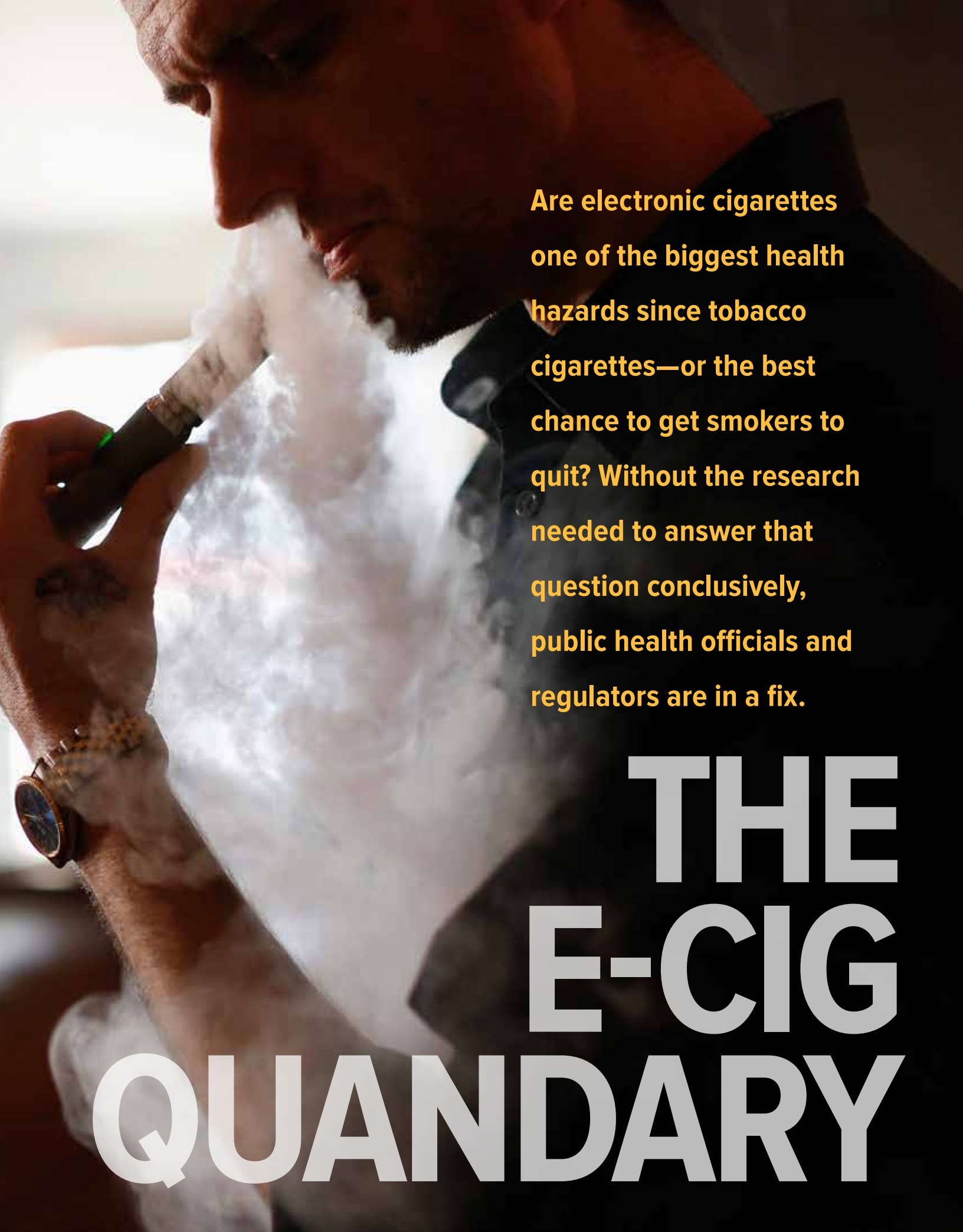


At a gas station just across the river from Harvard Square, a bright yellow billboard trumpets "E-Cig and Vaping Specialists." Advertisements for all of the major e-cigarette brands are plastered on the walls of the station and even the gas pumps. Prominently displayed inside behind the counter, e-cig brands Blu and Njoy—in regular, menthol, cherry, and vanilla flavors—push the Marlboros and Newports to the side.

A mile down the street, Eastern Vapor occupies a second-floor space in a brick office building in the college-kid section of Allston-Brighton. There, the young clerks will gladly show off a $50 starter kit that, with its gleaming, precision-milled metal cylinders, looks as if it was plucked straight from one of Harvard's nearby science labs. Behind the counter, cartridges of liquid nicotine neatly line the shelves, along with a chalkboard menu that advertises designer flavors, from Tropical Toucan (guava and citrus) to Gorilla Guts (butterscotch and banana).

continued

Special Report by Michael Blanding, Boston-based journalist and author, and Madeline Drexler, editor of Harvard Public Health.



Are electronic cigarettes one of the biggest health hazards since tobacco cigarettes—or the best chance to get smokers to quit? Without the research needed to answer that question conclusively, public health officials and regulators are in a fix.

THE E-CIG QUANDARY

It was only eight years ago that electronic cigarettes—battery-powered devices that heat up a liquid nicotine solution into an inhalable vapor—hit the United States market. Today, annual global sales total upwards of $2 billion (though reliable sales figures are hard to come by, in part because online sales are not recorded in retail surveys). E-cigarettes command a devoted following among ex-smokers, who rely on them to get their nicotine fix while avoiding the harmful side effects of tobacco smoke. Online message boards are full of testimonials by hardcore smokers who have sucked on Marlboros or Camels for decades, only to finally quit with the help of e-cigs. "Vaper" conventions draw converts from around the country to compare the newest nicotine delivery systems and compete to see who can blow the biggest cloud of steam. And e-cigarettes have gone mainstream, starring in Super Bowl ads and dangling from the lips of celebrities, from Katherine Heigl to Leonardo DiCaprio.

At the same time, teens and young adults—many of whom have never taken a drag on a combustible cigarette—are "vaping" just for kicks. Youth are a key target market for e-cig companies, which lean heavily on social media advertising. One company, Blu eCigs, has created an e-cig with a carrying case that glows blue when another vaper using the same brand is nearby.

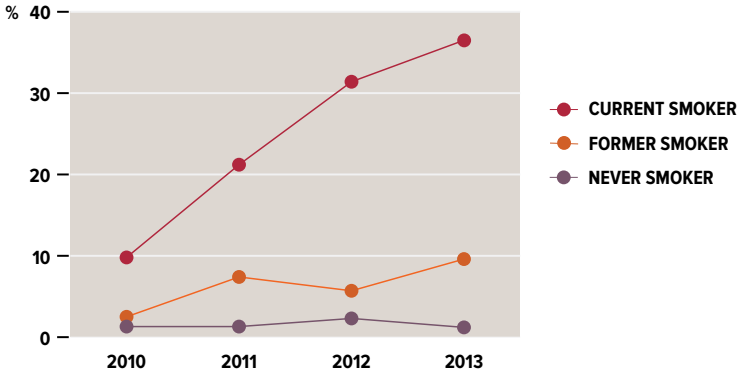
Side by side, these trends present a big dilemma for public health.

Surprising Trends Behind the Numbers

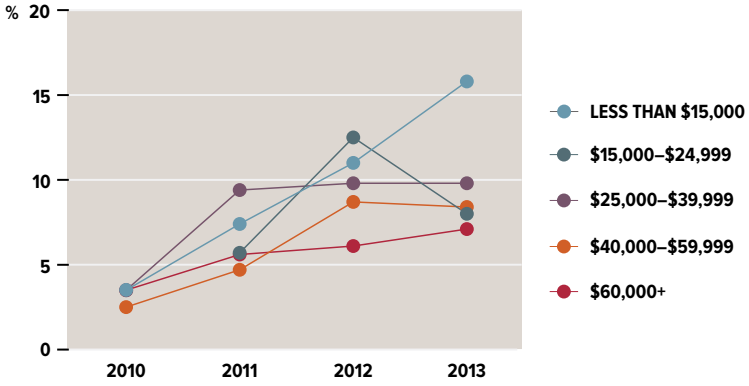
Overall, e-cigarette use more than doubled among adults in the United States from 2010 to 2013. But a breakdown of the data by smoking status, household income, and education level reveals surprising trends: Current smokers are the top e-cigarette consumers, and the steepest rise in e-cig use is among individuals with the least income and education.

E-CIG USERS*:

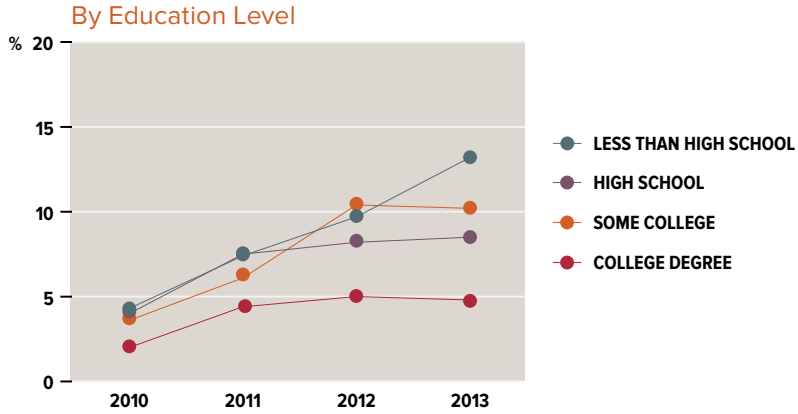
By Smoking Status



By Household Income



By Education Level



* Individuals who have used e-cigs at least once.

Source: King et al. *Nicotine and Tobacco Research*, 2015, 219–227, using HealthStyles survey.

DOUBT IS A POWERFUL PRODUCT

For decades, tobacco companies did everything they could to convince smokers that cigarettes weren't killing them—insisting the jury was still out on the science despite dozens of studies that linked smoking with lung disease and cancer. As one tobacco executive famously wrote in 1969, "Doubt is our product…the best means of competing with the 'body of fact' that exists in the minds of the general public."

In the case of e-cigarettes, however, the jury really is still out, with scant scientific studies about whether they are a salvation for hard-core smokers, a potential scourge for young novelty seekers—or something in between.

Surgeon General Vivek Murthy says health officials are **"in desperate need of clarity"** to help guide policies on electronic cigarettes.

Which is why, for public health, the sudden explosion of e-cigarettes into mainstream culture has created a quandary. On the one hand, they represent a potential game changer for smoking-cessation efforts—giving new hope to long-time puffers who have tried unsuccessfully for years to quit. On the other, they introduce an untested, potentially dangerous product that could not only spawn a whole new generation of nicotine addicts, but also serve as a gateway to regular cigarettes—just as U.S. smoking rates have hit an all-time low.

A SCIENTIFIC HAZE

In February 2015, the new U.S. Surgeon General, Vivek Murthy, said health officials are "in desperate need of clarity" on electronic cigarettes to help guide policies.

We know what substances in cigarettes do the most harm. According to the American Cancer Society, the smoke produced by burning dried tobacco leaves and other additives contains a complex mixture of more than 7,000 chemicals, including more than 70 known to cause cancer and, in some cases, heart and lung disease. Among these deadly substances are cyanide, benzene, formaldehyde, methanol, tar, and poisonous gases such as carbon monoxide. Smoking accounts for at least 30 percent of all cancer deaths in the United States.

We know less about exactly how dangerous nicotine—the addictive and psychoactive substance in cigarettes and e-cigs—is. Surprisingly, few large-scale studies have examined nicotine addiction separate from cigarette smoking. Some studies on nicotine replacement therapy (such as patches and gum) during pregnancy have found adverse effects on fetal development and an increase in preterm labor, though at rates lower than those linked to cigarettes.

According to the U.S. Centers for Disease Control and Prevention (CDC), nicotine, which stimulates the pleasure and reward pathways in the brain, is as addictive as heroin, cocaine, and alcohol. It causes blood vessels to constrict, raises blood pressure, and can trigger abnormal heart rhythms. One of the biggest questions in the current e-cig debate is whether nicotine harms neurological development during adolescence, a critical period for brain growth. And according to a CDC study, the number of calls to poison centers nationwide involving e-cigarette liquids containing nicotine rose from one per month in September 2010 to 215 per month in February 2014.

IS E-CIG VAPOR BENIGN?

While e-cigarette vapor has far fewer hazardous components than cigarette smoke, it is not benign, according to a small but growing body of scientific literature. A January 2015 health advisory from the California Department

continued

of Public Health noted that, "Chemicals in the aerosol are absorbed through the bloodstream and delivered directly to the brain and all body organs." It added that, "E-cigarette emissions also contain volatile organic compounds and fine/ultrafine particles. These ultrafine particles can travel deep into the lungs, where they get trapped and may lead to tissue inflammation." Among the ingredients in e-liquids, the advisory said, are "flavoring agents, propylene glycol, and toxic chemicals known to cause cancer, birth defects, and other reproductive harm."

According to a 2014 review published by the U.S. Food and Drug Administration (FDA), e-cigarettes contain varying levels not only of nicotine, but also of potentially harmful nitrosamines, aldehydes, metals, volatile organic compounds, phenolic compounds, and other substances. "Various chemical substances and ultrafine particles known to be toxic, carcinogenic and/or to cause respiratory and heart distress have been identified in e-cigarette aerosols, cartridges, refill liquids and environmental emissions," the researchers noted. Other studies have found that e-cigarettes produce high levels of nanoparticles, which can trigger inflammation and have been linked to asthma, stroke, and heart disease.

This past January, a report in the *New England Journal of Medicine* found that exposure to the carcinogen formaldehyde—produced when the propylene glycol and glycerol in e-cig solutions are heated, sometimes at upward of 1,000 degrees Fahrenheit—could reach levels five to 15 times higher than formaldehyde levels in cigarette smoke. In February, a study published in *PLOS One* found that mice exposed to e-cig vapor suffered impaired immune defenses against bacteria and viruses in the lungs, and

"There has been a genuine and perceptible disagreement among people who are very committed to tobacco-control research … You cannot question anyone's motives here."

—Kasisomayajula "Vish" Viswanath, professor of health communication

Kent Dayton / Harvard Chan

Weighing the Pluses and PLUSES

1. Smoking is the leading cause of preventable premature death worldwide, killing nearly 6 million people each year. Building on a "harm reduction" approach—which aims to minimize the deleterious effects of an addictive substance rather than encourage total abstinence—substituting e-cigarettes for tobacco cigarettes could save lives.
2. E-cigarettes generally contain fewer toxic chemicals and lower concentrations of carcinogens than tobacco cigarettes.
3. E-cigarettes may deliver less nicotine than regular cigarettes and thus may be less addictive.
4. E-cigarettes do not produce the sidestream smoke in combustible cigarettes that causes dangerous secondhand exposure.
5. E-cigarettes match smoking's gestures, behavior patterns, and "throat hit," making them a more appealing alternative to traditional forms of nicotine.

"E-cigarettes are a double-edged sword. While they could potentially advance smoking cessation, currently they are a disruptive product of unknown safety and efficacy."

—Howard Koh, professor of the practice of public health leadership

that the animals were more susceptible to influenza. The immune-system effects of e-cigarette exposure, the authors concluded, "are similar to those observed after exposure to cigarette smoke."

Other studies have found that the nicotine in e-cig vapor penetrates the bodies of bystanders at levels comparable to those of people exposed to secondhand cigarette smoke. And propylene glycol, one of the main base ingredients in e-liquid, is known to cause eye and respiratory irritation.

Yet scientists don't know how this worrisome laundry list of potential problems plays out across populations over years or decades of use. "E-cigarette products are so new, the long-term effects are unclear," says Kasisomayajula "Vish" Viswanath, professor of health communication at the Harvard Chan School, who has been involved in crafting a policy statement on e-cigs for the American Association for Cancer Research, released jointly with the American Society for Clinical Oncology. "For example, we don't know what happens when people ingest nicotine combined with propylene glycol," which carries both the nicotine and the flavor solutions.

"They are by design definitely less dangerous than cigarettes, but they are not a healthy alternative to smoking—quitting is the healthiest alternative," notes Constantine Vardavas, a former research scientist in the School's Center for Global Tobacco Control, now at the University of Crete. He was lead author of a 2012 study in the journal *Chest* that found that inhaling e-cig vapor damages lung function—though the long-term or clinical health impact is unclear.

continued

Emily Cuccarese / Harvard Chan

Minuses of E-Cigarettes

1. E-cigarettes could serve as a gateway to conventional cigarettes—"renormalizing" nicotine use in public places and creating a net increase of people hooked on tobacco cigarettes.
2. E-cigarette vapor contains toxins and carcinogens suspected of being harmful to humans.
3. E-cigarettes are no more effective in helping people quit smoking than over-the-counter nicotine patches, nicotine gum and lozenges, or smoking-cessation drugs—and most smokers who use e-cigarettes to stop smoking appear to fail.
4. If e-cigarettes are redesigned to deliver the same levels of nicotine as regular cigarettes, they may foster addiction in young users who have not smoked before and lead to relapse in former smokers.
5. The longer that e-cigarettes are sold without regulatory constraints and are targeted to youth, the more likely they are to gain a foothold in the market before all the scientific data are in.

MINUSES

So what kind of research would clear the air? Public health investigators would like to see studies that clarify how and under what circumstances people are using e-cigarettes; long-term studies of health effects; clinical trials that show how effective e-cigarettes are compared with conventional cessation approaches in helping people quit smoking; and targeted laboratory studies that analyze the harmful constituents of e-cigarettes.

PUBLIC HEALTH RIFTS

With so much not known, the ambiguity about health risks and health benefits has created a rift within the tobacco-control community. "There has been a genuine and perceptible disagreement among people who are very committed to tobacco-control research," says Viswanath. "You cannot question anyone's motives here."

Conflicts within public health aren't new, of course—consider the lingering controversies over saturated fat or mammograms. But it is surprising to see this dispute play out in a community where previously the only disagreement about cigarettes had been over which regulations were needed and how quickly. "It has split tobacco researchers into two groups: those for and against," notes Vardavas. "It's horrific to watch—it's almost like a civil war."

Viswanath agrees, adding: "There are clearly two sides, or three sides if you include those like me in the middle trying to figure out what the heck we are talking about."

Yet other Harvard Chan researchers sense that over the past year, the public health community may be moving toward a tentative agreement on the potential benefits of e-cigarettes. According to Vaughan Rees, interim director of the School's Center for Global Tobacco Control and an expert on substance abuse and dependence, the field is coalescing around the idea that, if regulated properly, e-cigs could bolster overall harm reduction by helping smokers quit tobacco cigarettes or helping them smoke less. The trick will be regulation, he adds. "Harm reduction can only work in a regulatory environment that encourages complete switching among current smokers or tobacco users, and discourages use among adolescents."

Rees' suggestion for achieving this net harm reduction may sound counterintuitive and even risky: Make

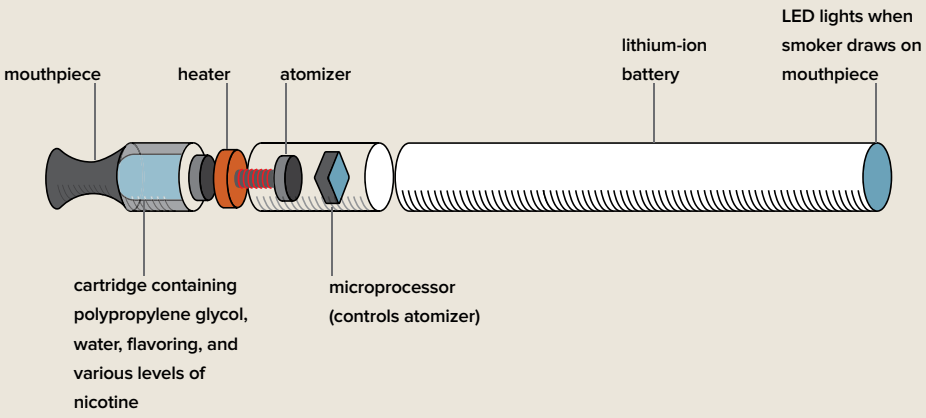
"I would like to see current smokers switching to e-cigarettes at a high rate—and use that is as low as possible among adolescents."

—Vaughan Rees, interim director of the Harvard Chan School's Center for Global Tobacco Control

Emily Cuccarese / Harvard Chan

HOW A COMMON E-CIGARETTE WORKS

1. User inhales from the mouthpiece, turning on the device and activating the LED light.
2. Battery sends charge to the atomizer and heater, which vaporize liquid from replaceable cartridge, producing flavored, nicotine-containing vapor, which is consumed and exhaled by the user.



e-cigs *more* addictive, by raising their nicotine levels. His rationale is that low-nicotine e-cigs are both less likely to deliver the kick that will enable smokers to completely switch and, because of their mild flavor, are more likely to hook young people on nicotine. "We're eager to find the sweet spot," says Rees, "where we support switching away from tobacco cigarettes without unintentionally increasing an individual's nicotine dependence."

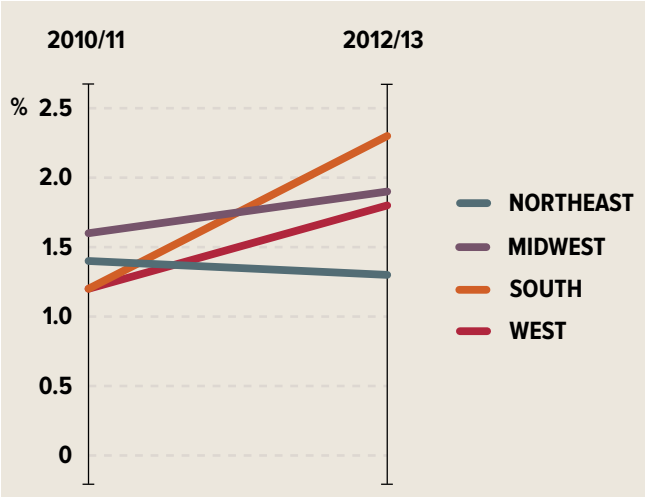
REGULATING E-CIGARETTES WILL TAKE TIME

How shall officials regulate e-cigarettes? "The key issue is: What is the public health cost of a nicotine addict compared to that of a smoking addict?" says John Quelch, professor in the Department of Health Policy and Management at the Harvard Chan School and the Charles Edward Wilson Professor of Business Administration at Harvard Business School.

"Obviously, the goal is to get e-cigarettes regulated as quickly as possible, so we can advance the possible benefits of e-cigarettes while minimizing any harm," says Howard Koh, professor of the practice of public health leadership at the Harvard Chan School and former U.S. assistant secretary of health.

VAPING HOT SPOTS

Percentage of U.S. adults who used e-cigarettes in the previous 30 days, by region.



Source: King et al. *Nicotine and Tobacco Research*, 2015, 219–227, using HealthStyles survey.

Research Questions That Need Answers

- Will e-cigarettes lead more smokers to quit their habit or lure more nonsmokers to start smoking?
- How effective are e-cigarettes in helping smokers quit, compared with conventional methods such as patches or behavioral therapy?
- What substances and chemical by-products are found in e-cigarettes, and how harmful are they through direct or secondary exposure?
- What is the best way to gauge e-cigarette sales—a large fraction of which take place on the Internet and are not included in retail sales tracking—and what is the fastest-growing segment of the market?
- In the absence of strong scientific data about the health effects of e-cigarettes, how should government regulate these novel products?

But Koh adds that federal rulemaking is highly deliberative and notoriously time consuming. "There is going to be a period of uncertainty until all of the regulatory policies are put in place," he says.

FEDS NEED DATA TO ACT

Without being able to cite robust studies, the FDA and the European Union's Tobacco Control Directive have been caught flat-footed, unsure of how to regulate e-cigarette use. A 2014 FDA proposal recommended restricting sales to minors, mandating disclosure of ingredients, and requiring warning labels that state nicotine is an addictive substance. But these measures fall short of curtailing advertising, banning flavors, or reducing vaping in public. According to Vaughan Rees, with e-cigarettes quickly evolving to deliver more nicotine, there is a desperate need for regulations that both require product standards

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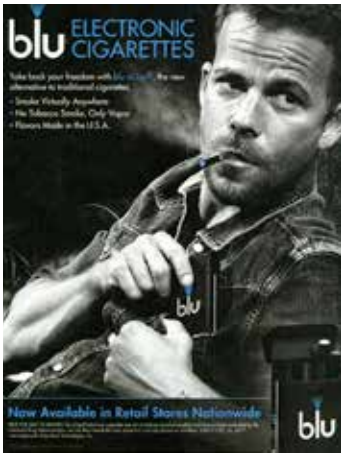


E-cigarette ads, including those that appear in social media platforms, clearly target a youth audience.

Images courtesy of the collection of Stanford University (tobacco.stanford.edu<http://tobacco.stanford.edu>)

about nicotine content (so that smokers get enough nicotine to quit) and eliminate exposure to potentially toxic chemicals.

One hurdle is that the FDA is required by law to base regulations on scientific studies—with the possibility of legal challenges by e-cigarette companies if regulators overreach. "The emphasis on data is very strong," says Koh. "With attempts at regulation there is always the threat of litigation, so the FDA is moving with all deliberate speed to make sure the decisions they are making will withstand scrutiny."

The agency has called for long-term prospective studies on the effects of e-cigarettes, supported by a call for proposals by the National Institutes of Health to support such research. But given the slow pace of regulatory action, it may be one or two years before the research is launched, and at least three years before public health conclusions can be drawn from the first longitudinal studies. That lag may give the new products more than enough time to establish a foothold in the market.

That's too long, e-cigarette opponents say. The government already has enough evidence to move on e-cigs and should err on the side of caution, they claim, in case the hot new products turn out to be a health menace. "E-cigarettes are a double-edged sword," notes Koh. "While they could potentially advance smoking cessation, currently they are a disruptive product of unknown safety and efficacy."

Critics are convinced that e-cigarette companies prefer to do business in what has often been characterized as a "regulatory Wild West." "They're operating in a completely unregulated environment right now, and it's enabled the e-cigarette industry to go from virtually zero to billions of dollars a year over the past five or six years," says Rees. "Who wouldn't want to operate in a completely unregulated environment where profit is concerned?"

STATE AND LOCAL REGULATIONS QUICKER

In the absence of federal action, states and localities—which are empowered by law to move more quickly to regulate public smoking—have begun clamping down. Today, four states—Arkansas, New Jersey, North Dakota, and Utah, as

well as the District of Columbia—have placed e-cigarettes under the purview of existing laws that prohibit smoking in public, and more states have passed narrower laws forbidding vaping in schools and other specific locales. And nearly 300 cities and counties—including Boston, Chicago, Los Angeles, New Orleans, New York, Philadelphia, and San Francisco—have banned e-cigs in restaurants, bars, workplaces, and casinos.

Both Harvard University and the Harvard Longwood Campus include e-cigarettes in their smoke-free policies.

DISTRACTING FROM THE TOBACCO THREAT

Constantine Vardavas worries that evolving trends in public smoking could lead to a new acceptance of both electronic and tobacco cigarettes, particularly among dual users. "We've spent millions of research dollars and all the tobacco-control efforts of the past decades to denormalize smoking in public places, and a nod of approval to e-cigarettes passes along a message to youth that it's OK," he says. "Whatever smoking rules exist for conventional cigarettes should exist for e-cigarettes, so you are reducing smoking and not renormalizing it."

"The key issue is: What is the public health cost of a nicotine addict compared to that of a smoking addict?"

—John Quelch, Professor of Health Policy and Management

That renormalization applies to marketing as well. Conventional cigarette advertising is prohibited on television and radio, on billboards and public transportation, and in magazines targeted to youth—but no such bans apply to e-cigarettes, which seem specifically targeted to teens. "When you see a magazine ad with a sexy girl in a bikini with the slogan, 'Slim. Charged. Ready to Go.'—that is not aimed at a 55-year-old who is quitting smoking," notes Vardavas. "That is made to appeal to adolescents."

While it's important to get e-cigarette regulation right, Vardavas adds, it's not worth advocates' fighting among themselves only to lose sight of the continued threat of tobacco smoking, especially in countries outside the United States. "If we focus too much on the trees of the e-cigarettes, we risk missing the forest of conventional tobacco use. That risk is still magnitudes more important, and is still going to be a major public health issue around the globe."

"There is tremendous concern we could reverse our success in denormalizing the addiction of cigarettes," says Koh. "We could introduce another potentially addictive agent to young people and undermine the progress we've made on tobacco control in general."

If there is a silver lining in the vaping cloud, it may be that the debate on e-cigarettes has pointed the spotlight on the harmful effects of all cigarettes. "Too often the public thinks that the tobacco problem has been solved," says Koh, "but in the U.S., we still have over 1,000 people dying a day from tobacco addiction. E-cigarettes use can be a means to bring urgent new attention to the ongoing complexity of this tremendous addiction."

And despite the potential dangers that increased e-cigarette use poses, the public health community is better positioned to deal with the issue than it was decades ago, when tobacco companies intentionally obscured the dangers of conventional cigarettes. Decades passed between the 1964 surgeon general's report on smoking and health and strong government policies regulating cigarettes, such as higher taxes on the product, laws against smoking in public places, and health warning labels. "The tobacco-control community is much better organized than we used to be," says Viswanath. "We now know that conventional cigarettes produce very harmful effects over time. We learned our lesson."

Next page: The Business Perspective

Kent Dayton / Harvard Chan

E-cigs: The Business

No matter what happens with e-cigs in the coming years, it may be a while before they seriously challenge the conventional cigarette market. While some conventional smokers and nonsmokers alike are trying them, today they are still a minor presence compared with conventional cigarettes, accounting for only 1 percent of the American cigarette market, according to a 2014 article in *The Economist*.

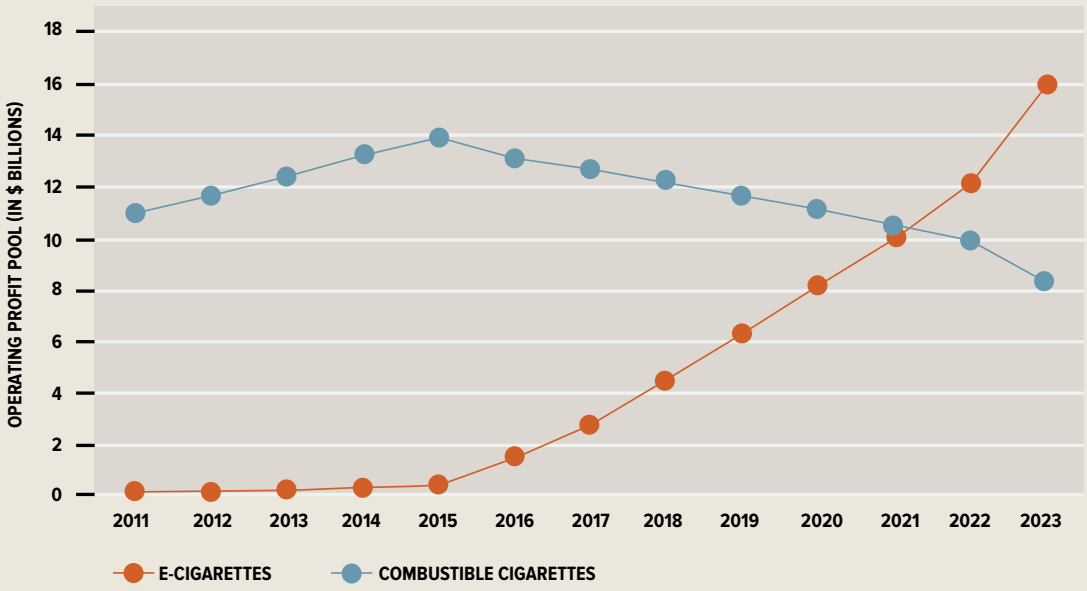
But Wall Street is still bullish on e-cigs, with a 2014 report from analysts at Wells Fargo Securities speculating that "we think E-cigs are to Tobacco what Energy Drinks are to Beverages—profitable and quickly growing in volume and shelf space at retail, and increasingly gaining consumer acceptance." Market research firm Euromonitor International Ltd. projects that e-cigarette sales could reach $51 billion worldwide by 2030.

More than 460 brands and some 7,700 flavors of e-cigs have flooded the market, according to a 2014 market study published in *Tobacco Control*. The marketing war has heated up since the number three tobacco company, Lorillard Inc., acquired Blu eCigs in April 2012 and began pouring money into television and display advertising. Number two tobacco company Altria/Philip Morris acquired its own e-cig brand, MarkTen, in 2013. Meanwhile, the top cigarette company, R.J. Reynolds, launched its own e-cig brand, Vuse. Last summer, Reynolds bought Lorillard, spun off Blu, and began national distribution of Vuse.

"WE THINK E-CIGS ARE TO TOBACCO WHAT ENERGY DRINKS ARE TO BEVERAGES—PROFITABLE AND QUICKLY GROWING IN VOLUME AND SHELF SPACE AT RETAIL, AND INCREASINGLY GAINING CONSUMER ACCEPTANCE."

—Wells Fargo Securities LLC
Tobacco Talk 4Q13 Survey

E-CIGARETTE PROFITS COULD SURPASS THOSE OF COMBUSTIBLE CIGARETTES WITHIN 10 YEARS



Source: Company data and Wells Fargo Securities LLC estimates. Data for 2011–2013 are actual. Data for 2014–2023 are estimated.

Perspective

Throughout all the mergers and acquisitions, retail sales of e-cigs have risen steadily, from $500 million in 2012 to nearly $2 billion in 2013, according to a 2014 report from Wells Fargo Securities LLC (though some estimates range up to $2.5 billion). Early e-cig ads boasted that their products could help hardcore smokers ditch their habit. But a 2014 study of e-cigarette websites in the *American Journal of Preventive Medicine* concluded that much e-cigarette advertising was based on vastly inflated or misleading claims—including 64 percent of ads claiming that their products helped in stopping smoking and 76 percent claiming they produced no secondhand smoke.

Indeed, an April 2015 analysis published in the *American Journal of Public Health* found that smokers who used e-cigarettes were 59 percent less likely to quit smoking than smokers who never used e-cigarettes. And a 2014 study in the *Journal of the American Medical Association* showed that smokers who used e-cigarettes were not more likely to have cut their cigarette consumption one year later. According to Vaughan Rees, interim director of the Center for Global Tobacco Control at the Harvard Chan School, there is no compelling scientific evidence so far that e-cigarettes are better than nicotine patches, lozenges, prescription drugs, or cognitive-behavioral therapy in helping smokers quit.

Yet emphasizing the health benefits of their products may be part of a strategic attempt on the part of e-cigarette companies to stave off more advertising regulations. "If you are an e-cigarette manufacturer, it's important to be able to establish that consumers can quit smoking by using e-cigarettes," says John Quelch, professor in the Department of Health Policy and Management at the Harvard Chan School and the Charles Edward Wilson Professor of Business Administration at Harvard Business School. "As long as you can do that, you are going to be allowed to market it."

From a business perspective, the lax regulation of e-cigarettes probably hurts the "Big Three" tobacco companies more than it helps them, says Quelch. That's because lack of regulation favors new entrepreneurial companies, allowing them to establish their brands and cut into the big companies' market share with unique flavors and innovative marketing campaigns outside of Big Tobacco's regular playbook.

"That's very important for new e-cigarette brands that are trying to build their businesses and reputations right now," says Quelch. Ironically, with tighter regulations that make it harder for e-cigarettes to compete, the major tobacco companies may be better able to control the spread of e-cigs to focus on their main product of tobacco cigarettes. Not taking any chances, big tobacco companies are at the same time working to acquire e-cigarette brands—and Quelch fears that once e-cigs are established in the market, companies may underpromote them or jack up prices to be on par with tobacco cigarettes in an effort to drive consumers back to combustible cigarettes.

Next page: The Youth Market

TOBACCO COMPANIES PLAY BOTH SIDES

Combustible Cigarettes and E-Cigs

Today's leading tobacco companies still reap the vast majority of their profits from combustible cigarettes. But they are hedging their bets by moving aggressively into the e-cig market. Lorillard Inc., for example—the third-largest American manufacturer of cigarettes at the time of its acquisition by Reynolds American in 2014—also produced the popular line of Blu eCigs. In a move aimed at easing regulatory concerns over the merger, Reynolds, which has its own e-cigarette brand called VUSE, sold Blu to a British tobacco company for $7.1 billion. Blu had been purchased by Lorillard for $125 million in 2012.

According to Lorillard's 2013 annual report, "Electronic cigarettes occupy a unique position in the market. They not only have the ability to add sales and profit to the tobacco industry, but they also have the very real potential to reduce the harm from traditional combustible tobacco products."

So far, however, the vast majority of Lorillard's profits come from combustible cigarettes:

$7 billion
OVERALL ANNUAL SALES

$1.2 billion
OVERALL PROFIT

$6 million
(0.5 percent of total profit)
PROFIT FROM E-CIGARETTES

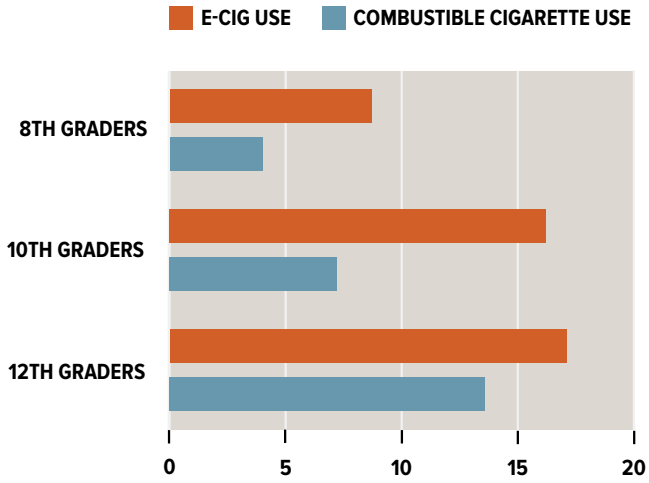
Sources: New York Times, June 17, 2014, *Wall Street Journal*, July 15, 2014

TEENS PERCEIVE SCANT RISK IN E-CIGARETTES

Trends in youth e-cig use are especially worrisome, since they presage behaviors that may be difficult to alter once young e-cig consumers become adults. Are teenagers experimenting with e-cigs on the way to becoming smokers, as a way to transition away from smoking, or both at once—for example, smoking while at home and vaping at the bar? Researchers won't know for sure until they are able to conduct longitudinal studies that follow the same subjects over years to determine their patterns of use.

"We need to follow a group of adolescents over the next few years to figure out who has experimented with e-cigarettes and why," says Constantine Vardavas, a former research scientist at the School's Center for Global Tobacco Control. The implications of such studies will be crucial in settling the debate about whether e-cigs should be tightly regulated as a dangerous hazard or embraced as a therapy for smoking cessation.

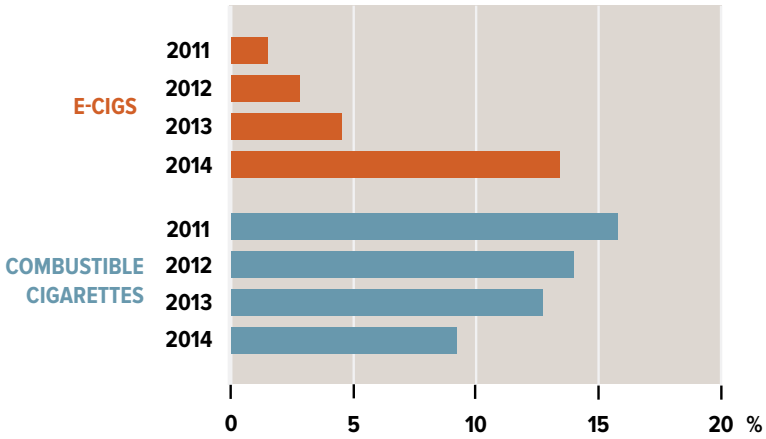
E-CIGARETTES OUTPACE COMBUSTIBLE CIGARETTES AMONG TEENS



Estimated percentage of students in 2014 who used e-cigarettes and combustible cigarettes in the preceding 30 days, by grade.

E-CIG USE IS SKYROCKETING AMONG HIGH SCHOOL STUDENTS

While teen e-cigarette use has soared over the past few years, teen smoking has plummeted to 9.2 percent—the first time that teen smoking rates in the U.S. have ever hit single digits. Many researchers believe that e-cigarettes may be diverting teens away from combustible cigarettes.



Estimated percentage of high school students who used e-cigarettes and combustible cigarettes in the preceding 30 days, 2011–2014.

Source for both charts: Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E. & Miech, R. A. (2014). *Monitoring the Future national survey results on drug use, 1975–2013: Volume I, Secondary school students*. Ann Arbor: Institute for Social Research, The University of Michigan.

VAPING
One Man's Experience

The first time Ted Read saw an electronic cigarette, four or five years ago, he was volunteering at a film festival. His boss, whom he describes as "sort of a hipster," pulled out a cigarette that looked just like a tobacco cigarette—only no smoke came out when she puffed on it. "She whipped out one of these 'cigalikes' and was kind of smugly smoking it indoors," he recalls.

Read, a smoker, wasn't impressed.

Fast-forward to February 2014. Read had flown from Boston to Portland, Oregon, for a wedding and knew that during a long layover he wouldn't be able to light up. He picked up a pack of Blu electronic cigarettes—known for the blue LED at the tip that illuminates when a person takes a drag. "In Portland, I was in a rental car driving through a strange city. I needed to smoke," he explains, sitting in a park near Harvard Square, looking like something of a hipster himself in a fedora, plaid shirt, and Converse sneakers. "But my wife doesn't let me smoke in the car. So I tried this e-cigarette." For the rest of the trip, he thought about buying tobacco for the pipe he usually smoked. "But I didn't," he says, with some wonderment. "I kept sucking on the e-cigarette with that blue light."

Read had been a smoker for more than 30 years, starting at boarding school at 14 and continuing through last year as a "beard-stroking pipe smoker" at 46, despite the fact that his wife, a communications professional at the Harvard T.H. Chan School of Public Health, deplored the habit and asked him to quit every few months. An electronic musician, Read had tried repeatedly to quit, but inevitably some new source of stress would send him back to smoking. "Something would happen," he says, "and I'd find myself almost subconsciously at the convenience store."

After the Portland trip, he began researching e-cigarettes, going online to order a thin metal tube known as a "clearomizer." He pulls it apart to show the hole where he pours in a solution of nicotine and chemicals, mostly propylene glycol (PG)—available in a range of flavors (Read prefers the fruity ones). The other half of the tube holds a battery. When a small button is pressed, it activates a heating coil inside that vaporizes the solution, which Read inhales and then breathes out as clear vapor.

Today, Read has quit smoking a pipe and only occasionally smokes a cigarette, when hanging out with friends in the music scene. And he's gone from "vaping" a solution of 24 milligrams of nicotine per milliliter of PG to one of 6 mg/mL, and hopes to get that down to 3. "I was breathing better almost immediately," he says. "My teeth are whiter, and I don't always smell like smoke." The biggest benefit, however, has to do with his wife. "She is always looking at me and smiling."

Kent Dayton / Harvard Chan

Scientists are using cellphone data to track everything from depression and mood disorders to crowd behavior.

Your Phone Knows How You Feel

On a difficult day, the patient's data stream includes very few pings. Her GPS sensor shows her going slowly from the bedroom to the bathroom and back again. She does not check email, but does watch four hours of Netflix. No phone calls out, except for Chinese food. Seven phone calls in, from her sister. She answers none of them.

On a high day, her data stream shows jerky movements all over the house, plus 12 trips outside, including two to the liquor store. Twenty-five calls to people very low on her contact list—some of whom she hasn't spoken to since high school. Three hours of sleep. And $3,000 spent via PayPal on Etsy.

Back at her doctor's office, where the data are sent, a quick number crunch triggers a suspected diagnosis: bipolar disorder, in manic mode, with a crash coming any day.

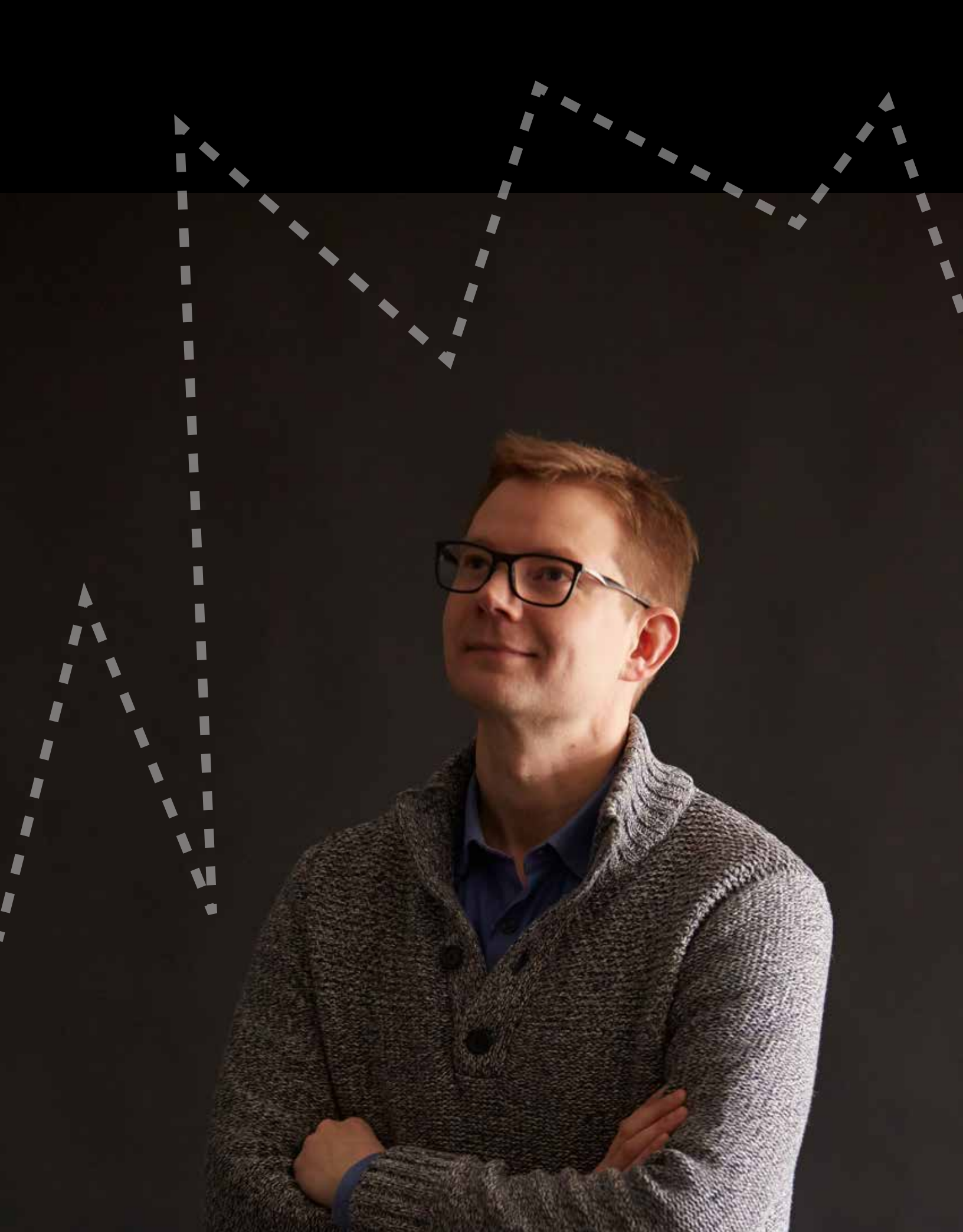
A lifesaving diagnosis made possible by a practically invisible technology: a smartphone.

At least, that's the brave new hope for mental health care, as envisioned by Jukka-Pekka "JP" Onnela, assistant professor in the Department of Biostatistics at Harvard T.H. Chan School of Public Health. Onnela won a National Institutes of Health 2013 Director's New Innovator Award for his proposal to combine mental health research with big data—one of today's cutting-edge approaches to psychiatric research.

"I've always been interested in the big picture," Onnela says. "The structure of connections between individuals is the essence of public health. People are connected—and therefore our health is connected."

continued

Kent Dayton / Harvard Chan



WALKING DATA POINTS

In the past decade, the mobile phone has turned people into walking data points that can be measured on a vast scale. Onnela has been widely lauded for recognizing the research potential of such a tool. He is an emerging figure in the field of network science—which studies the connections among thousands of individuals, or among biological substances such as proteins and metabolites—whose findings are informing a wide range of public health questions, from psychiatric diagnosis to HIV/AIDS treatment to disaster relief.

For psychiatry in particular, the goal is to make diagnostic judgments based not on what the person says about his or her mood or state of mind—some of which may be misrepresented or misremembered—but rather on what can be objectively observed and measured. This aspect of mental illness has dogged experts for years: its deep subjectivity. Clinical depression to one practitioner may be just a rough spell to another.

For psychiatry, the goal is to make diagnostic judgments based not on what a person says about his or her mood or state of mind—some of which may be misrepresented or misremembered—but rather on what can be objectively observed and measured.

Onnela is now collaborating on a project sparked by the NIH award and its $1.5 million in funding over five years. His team has hired software developers to create a smartphone app that can collect both passive data (for example, how many steps someone takes a day) and active data (such as voice samples) about mental health. The results could produce the most fine-grained scientific picture yet of the ever-changing dynamics of emotion. And if Onnela is right, using digital devices to quantify human behavior in everyday settings—an approach he calls "digital phenotyping"—could go well beyond mental health.

PHYSICS AND PUBLIC HEALTH

The short-haired, boyish-looking Onnela, 37, was born and raised in Finland, where communications technology is more advanced than in the United States. (They've been banking by text there for more than a decade.) His father was a high school physics teacher, his mother a health sciences professional who ran a college for nurse training—twin specialties that have played out in Onnela's career as well.

Trained in the physics of networks, he first deployed mathematical algorithms to understand complex theoretical networks. Slowly, he started looking outside the theoretical and more at how human beings function in social webs, using statistical analysis to glean how those endless interconnections play a role in health.

While on a fellowship in Oxford, England, Onnela spent a semester as a Fulbright scholar at Harvard, where he teamed up with Harvard Kennedy School political scientist David Lazer, one of the pioneers of computational social science. Then, at an international conference, he recognized Nicholas Christakis—at the time a Harvard University professor of medical sociology—in an elevator, and shyly introduced himself. Christakis was well known for his own brand of network social science, including research on obesity that linked one's weight to that of one's friends.

Onnela became a postdoc in Christakis' lab, studying the ways people form social connections and how that affects their health. In 2011, he moved to Harvard T.H. Chan School of Public Health. "It's primarily because of Nicholas' influence that I ended up choosing a career in health," Onnela says.

Christakis, now at Yale University, returns the compliment, noting that Onnela's work has emerged at an important juncture in social science—just as big data meets a resurgent interest in social connectivity. "His innovative work in understanding the structure of human interaction has put him on the scientific frontier," says Christakis.

And though it may sound counterintuitive, Christakis adds, using advanced technology helps scientists understand human beings in their natural state—the Holy Grail for social science research. "It's very challenging to observe the natural world—it's messy, it's difficult, and it's been that way since scientists first began practicing their craft," he says. "JP is able to quantify but simultaneously simplify complex patterns in the natural world."

CLUES TO MOOD

When Onnela's name started percolating through the scientific community, his discoveries attracted researchers from outside network science. One of those was Harvard psychiatric resident John Torous, who found new technology intriguing. He was struck by how Onnela—with no training in psychiatry—could immediately intuit key questions dogging the mental health world.

"He has a whiteboard in his office and began to sketch out diagrams of what we could do," Torous says. "He understood what kind of data would be useful to mental health care—applying voice data such as pauses and pitch, location data, social data—as markers to pick up on different diseases."

"For a long time, people have wanted to explore the social side of mental illness, but you can't follow your patient all day," explains Torous, who now collaborates with Onnela on mental health data collection. "A lot of mental health diagnosis is done retrospectively, which is unlike anything else in health care."

SKEPTICAL ABOUT SELF-REPORTS

Onnela considers cellphone technology a vast improvement over many traditional methods of data collection, especially the self-reported questionnaire filled out after the fact. Most people just can't remember what they ate or how much they slept even a day or two later, he says. "Our memories, our recollections of what we've done, and what others have done tend to be very biased," he says.

Currently, Onnela, Torous, and others are piloting a daily on-screen questionnaire, in which people are prompted to record the quality of their sleep shortly after they get up. Two or three times a day, patients are pinged to answer three simple questions from a list of about a dozen traditionally used by mental health professionals as part of regular check-in office appointments. These questions can serve as bellwethers of mental well-being or illness, such as "How well can you concentrate?" and "Do you feel active and energetic?" More gravely, the pop quizzes that surface on the cellphone may ask if the patient feels he or she would be "better off dead or hurting myself."

The team discovered that people were more likely to report suicidal feelings on the smartphone than on a printed questionnaire at a doctor's office, though they can't say for sure which answer is more accurate.

The smartphone questionnaire has another advantage, Onnela says. It can mimic a human interviewer by adapting to previous answers as it goes along. So if the answer to "How well did you sleep?" is always "Fine," it will stop asking that question so often, but if the answer to "How well can you concentrate?" varies widely, it will home in on that behavior, asking more and more detailed follow-up questions.

Eventually, Onnela says, the tool could evaluate how well treatments are working. In the past, it could take months to assess the efficacy of a psychiatric drug. Today, he says, smartphone sensors can pick up more quickly whether a person reacts to a new drug, for example, with jitteriness or sleeplessness or other unpleasant side effects. "Now that we can more accurately quantify behavior, it might take us just weeks instead of months to fine-tune medications and dosages."

"Now that we can more accurately quantify behavior, it might take us just weeks instead of months to fine-tune medications and dosages."

PRIVACY AND THE PERSONAL TOUCH

Onnela's brand of network science is not without controversy. For one thing, he will need to navigate sticky ethical issues of privacy. In studies using data from operators, all cellphone data are anonymized—meaning no one's specific movements can be traced back to his or her identity, so what Onnela is learning is attributed to the community at large. But for scientists to create an app that would work on the individual level, patients will need to agree to having their activities tracked by researchers.

"If we look at the past five or 10 years, our notion of privacy has evolved and continues to evolve. The boundaries between what's public and private are getting blurred," Onnela says. "And today, what's private for somebody in their 30s is probably different from somebody in their 60s."

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Deborah Van Dyke, MPH ’93 (left), examines a sick baby in Kano, Nigeria, in 2011, where the Global Health Media Project—the organization she founded—filmed a video on newborn care.

A PICTURE OF HEALTH

Alumna's instructional videos transform frontline health care globally

In rural South Sudan, the population barely tops four people per square mile. Vehicles are a rarity. And when night falls, a limitless silence descends.

Despite this isolation, Deborah Van Dyke, MPH '93, was rattled awake late one evening by a woman pounding urgently on her door. It was 2008. Van Dyke—a family practice clinician—was working as medical coordinator for Médecins Sans Frontières, the international aid organization, at a makeshift rural clinic. Her visitor, a local nurse, breathlessly explained that a birth in a nearby medical tent had gone wrong. The pair grabbed a flashlight and raced through the dark to intervene.

"The baby was blue, floppy. He wasn't breathing," Van Dyke recalls. "The doctor and midwife trying to resuscitate him were doing chest compressions and suctioning the infant's mouth and nose." What they forgot to try in the heat of the moment was the one simple intervention that could actually save the child. Van Dyke stepped in with a bag and mask—a device used to squeeze air into a patient's lungs—and positioned it securely on the infant's face. After a few seconds, he was breathing. "That's all it took," she says.

As the newborn gained consciousness, Van Dyke had an epiphany: "All over the world, so many lives could be saved if health workers could learn critical skills through the teaching power of video."

That idea formed the seeds for Van Dyke's future mission. After her return from South Sudan, she founded the Global Health Media Project (GHMP), a nonprofit devoted to creating educational videos for caregivers in the developing world. With the help of professional filmmakers and a dedicated group of volunteers, she has spent the past four years producing dozens of short pieces that demonstrate simple but critical medical practices for health workers in the developing world—from inserting an IV to examining a placenta to recognizing sepsis in a newborn.

"The list of topics we could address is nearly endless," says Van Dyke. "Right now, we are looking at preterm care, midwifery skills, emergency obstetric care, infection prevention, family planning, and management of chronic disease. In the future, we want to cover major diseases with our series of animations that 'make invisible germs visible,' including TB, malaria, HIV—even the common cold."

UNICEF, Save the Children, the World Health Organization, and other aid groups all use the videos as educational tools, and they've been shown on national television in places like Ghana and Namibia. To date, the videos have been viewed in 225 countries and territories and downloaded by more than 2,000 organizations around the world.

Sending video into areas without running water and electricity—let alone Internet access—can be a challenge. While these films are now often taken to the field by NGOs and shown on tablets, laptops, and even mobile projectors, Van Dyke is planning for a future in which technology and economics will make it more and more possible to deliver video lessons directly to practitioners via mobile phones.

continued

Mark Binder for the Global Health Media Project

KNOWING THEIR AUDIENCE

No matter what topic they're covering, all of GHMP's videos follow a similar structure: they're short, simple, and clear. Van Dyke says this pared-down style is critical for communication.

A video explaining how to spot infant breathing problems opens on a baby swaddled in a white cloth in her worried mother's lap. The child's chest sucks in and belly moves out with each breath, a symptom of possible pneumonia. Over the next few minutes, a male caregiver in fresh blue scrubs counts off the baby's breathing rate with a wristwatch, then gently probes the infant's chest and abdomen. As the caregiver works, a narrator calmly explains the procedure and possible treatment, pausing for long stretches of silence as the action unfolds on screen.

"We make videos because the teaching power is exceptional, and even more so for these caregivers, because many don't come from a 'reading culture,'" says Van Dyke. "Instead, we show everything visually and translate narration into their language, so there is no barrier to comprehension."

Left to right: Deborah Van Dyke (center) demonstrates "kangaroo mother care" to a young mother (left) in Nagpur, India, in 2012. Van Dyke watches monitors during a video shoot in Itahari, Nepal, in 2014. The crew was filming a segment on correct techniques for breast-feeding. Van Dyke (right, on monitor) talks with a breast-feeding mother in Itahari, Nepal.

AN UNLIKELY FILMMAKER

Van Dyke is quick to admit that she's an unlikely filmmaker. "When I started, I had no film experience at all. I've just learned by doing. These are uncontrolled environments, so we need to be prepared to shoot anything, and to turn on a dime when something changes—when the mother gets tired, the baby has fallen asleep, or a health worker doesn't know a particular procedure."

Assembling field shoots is no simple task. Each video represents months of painstaking work, including preshoot preparations, videotaping, and editing. First, Van Dyke says, she chooses compelling topics: "They need to both address a pressing global health need and be effectively conveyed visually." Finding the right location is a big piece of the puzzle as well. To capture a wide variety of procedures, the team must visit clinical sites that have a high daily turnover, health workers willing to take time out of their schedules, and patients who are open to being on camera.

Perhaps most important is identifying health care workers who might appear in the videos. Ideal candidates, Van Dyke says, are seasoned workers who already have excellent skills, a certain confidence that comes with years of practice, and a good bedside manner. Many practitioners aren't used to being on camera, however, so she arranges a separate scouting trip ahead of the shoot to brief them and strengthen their support for the project. Fortunately, she hasn't had to work very hard to persuade caregivers to share skills and experience. "They know they'll be playing an important role in helping other health workers like themselves learn, all over the world," she says.

> ***"We try to model compassionate care in our videos by showing—not telling—how to treat a patient with kindness and respect," says Van Dyke.***

LIVE ACTION, NOT STAGED

Workers who view the videos seem to universally agree. "The videos meet a pressing need for better care of newborns," says Subarna Mukherjee, community health adviser for Last Mile Health, a small medical nonprofit operating in Liberia. "They are the next best alternative to actually witnessing a case firsthand, and they give workers here much more confidence in diagnosing problems."

Left, Amita Sreenivas; center and right, Tony Bacon

Van Dyke thinks that GHMP's collaborative approach is one of the reasons the group is so successful. Its videos show practitioners interacting with actual patients, not actors. Nothing is staged; the ailments, procedures, and treatments are all real. And, Van Dyke adds, so is something more intangible: the benevolent spirit of the caregivers she recruits.

"It's not just a matter of getting the medical aspects right," she says, insistently. "It's also about bedside manner and compassion. Providers are often overworked, so caring behavior isn't always the norm." This shortcoming can make people reluctant to access health care, she adds—including laboring women, who sometimes won't make the trip to a clinic because they're worried they'll be treated disrespectfully. "That's why we try to model compassionate care in our videos by showing—not telling—how to treat a patient with kindness and respect."

STILL IMAGES FROM *THE STORY OF CHOLERA*:
1. At the health center, a boy tells a nurse that his father is sick. 2. He brings the nurse to his house. 3. The nurse recognizes that the father is sick with cholera.

EMPOWERING COMMUNITY HEALTH WORKERS

Van Dyke has cultivated this sort of professional warmth throughout her career. After graduating college with a forestry degree in the mid-1970s, she felt a sudden urge to change fields entirely and become a midwife. "I realized if I could do anything, I wanted to help give women a more humanized birth experience," she says.

After delivering babies on the Texas-Mexico border, she entered an accelerated nursing program and eventually spent two years at Yale, where she became a family nurse practitioner. Completing a stint at a clinic in Kathmandu, Nepal, she returned to the States to attend the Harvard T.H. Chan School of Public Health, where she studied international health. Today, she splits her time between GHMP and her family practice in rural Waitsfield, Vermont.

"I was so inspired by the people I met at Harvard, like Iain Aitken," who taught international maternal and child health at the Harvard Chan School for more than 17 years. "I remember the tremendous value he placed on community health workers. He helped me see that that cadre of workers, with their reach into the remote villages, can make a tremendous difference in the quality of public health for the country as a whole."

A PERVASIVE HUMANISM

GHMP made its first foray into animation with a film on cholera. In collaboration with Yoni Goodman—the animator behind the critically acclaimed film *Waltz with Bashir*—Van Dyke's team produced a gracefully rendered short film (*The Story of Cholera*) explaining how cholera is spread and how it can be prevented by sterilizing drinking water and improving sanitation. Since its completion in 2012, the film has received dozens of accolades and awards, and has been translated into nearly 30 languages. The team is now working on *The Story of Ebola*.

Filmmaking is expensive, however, and at the moment, GHMP relies on individual donations, grants, and volunteer work to operate. With more reliable funding, Van Dyke says she could expand her team's efforts and even set up satellite offices in several developing nations, creating easier access to patients and film sites.

She doesn't let scant resources discourage her, though. Van Dyke still spends hours in the editing room each week, squeezing as much as she can out of her existing footage to create new videos that serve as "accurate, simple teaching tools, with a pervasive humanism," as she puts it. "That's our signature."

David Levin is a Boston-based science journalist. He can be reached through his website at www.therealdavidlevin.com.

Kent Dayton / Harvard Chan

UNRAVELING A MEDICAL MYSTERY

SEPSIS KILLS MORE THAN HALF A MILLION PEOPLE IN THE U.S. EVERY YEAR. A HARVARD CHAN STUDENT IS UNTANGLING ITS SECRETS.

Katie McQuestion, a radiology technician in Kenosha, Wisconsin, was feeling perfectly healthy a week before she died from sepsis. She'd had her annual influenza vaccination but still came down with a nasty flu at the end of last December. The flu likely progressed to bacterial pneumonia. By New Year's Day, her symptoms had catapulted from aches and chills to a dangerously low temperature and rapid heart rate. She was rushed to the emergency room. Twelve hours later, her parents received a phone call from the hospital: Their daughter had suffered a heart attack, her organs were failing, and there was nothing more that doctors could do. McQuestion, a newlywed, died at age 26.

Sepsis causes more than 500,000 deaths in the U.S. each year—more than prostate cancer, breast cancer, and AIDS combined. It develops when the immune system's response to an infection cascades out of control. Cases are on the rise, and researchers are working to address the disorder's many unanswered questions.

Rose Filoramo, PhD '17, never expected to be one of those scientists. She entered the Harvard T.H. Chan School of Public Health three years ago with a Joseph D. Brain Fellowship in Environmental Health. A warm and articulate biologist with a big smile—who once considered a career in acting—Filoramo quickly developed a passion for studying the immune system. In her first two years of graduate study, she shifted her research focus from the immunological effects of environmental endocrine-disrupting compounds to those of naturally occurring hormones like estrogen and testosterone.

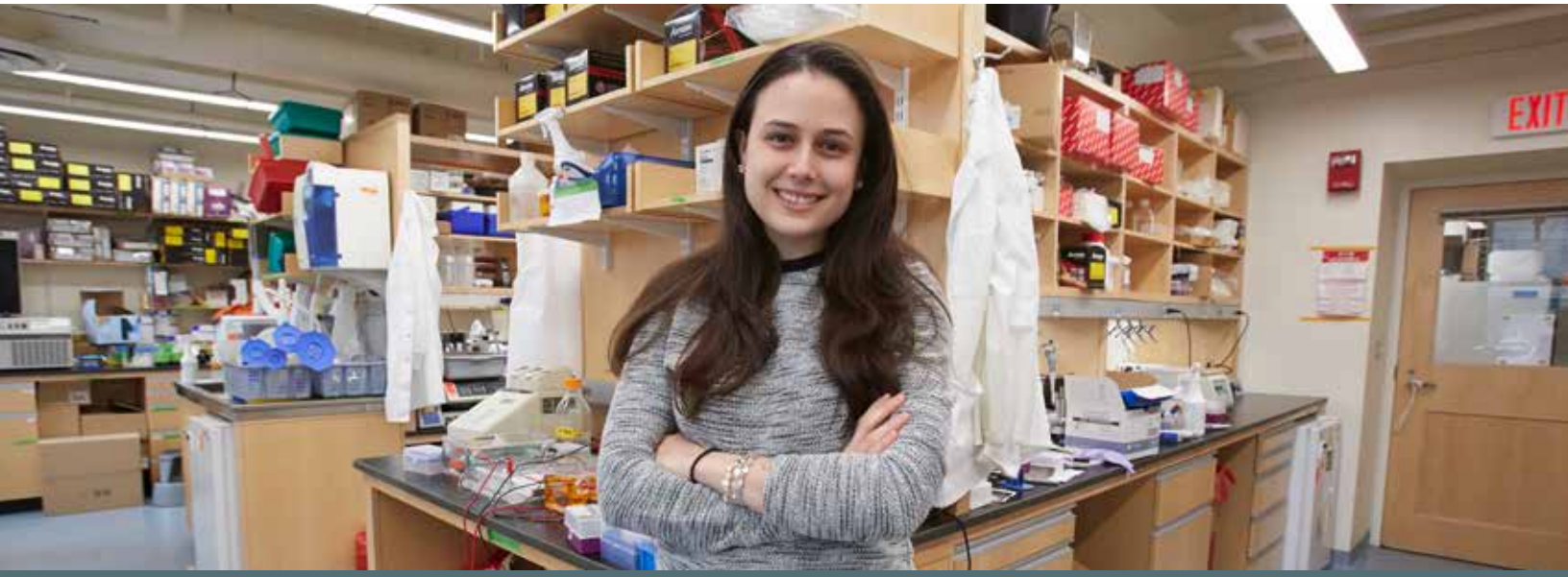
continued

Now, working with adviser Lester Kobzik, professor in the Department of Environmental Health, she's delving into an intriguing new question: Why do young, prepubertal children seem to have a natural resistance to dying from serious infections? This phenomenon was well documented during the deadly 1918 flu pandemic, during which children ages 5 to 14 were much less likely to die than the rest of the population, despite being infected at similar rates. The pattern also appears to apply to sepsis.

IMMUNE SYSTEM "FREAKOUT"

Filoramo describes sepsis as an immune system "freakout." During an infection, chemicals released by the immune system flood the bloodstream to ward off invaders. Normally, this process is very tightly controlled, producing only enough inflammation to kill the pathogens. The body then swiftly returns to normal. During sepsis, however, the infection causes a systemic inflammatory response far beyond what is "needed" to defend the body. This overly exuberant inflammation can lead to impaired blood flow and tissue damage.

If caught early, sepsis can be treated with antibiotics and intravenous fluids. But the disorder can be difficult to diagnose because its symptoms—such as fever and breathing difficulties—mimic other conditions like heart attack or acute pancreatitis. While antibiotic treatment can eliminate the offending pathogen, once the intense inflammatory response is set in motion, it can continue to wreak havoc on the body—lowering blood pressure and weakening the heart. No treatment currently exists for septic shock, the syndrome's final stage, which can trigger multiple organ failure and death.



Rose Filoramo, PhD '17, describes sepsis as an immune system "freakout" that kills half of its victims. "If we can figure out what is different in the regulation of children's immune responses during sepsis," she says, "it could lead to the discovery of novel drug targets that could help adults better survive these lethal infections." No treatment currently exists for septic shock, the syndrome's final stage, which can trigger multiple organ failure and death.

"Nearly 50 percent of people who develop sepsis die," Filoramo says. "If we can figure out what is different in the regulation of children's immune responses during sepsis, it could lead to the discovery of novel drug targets that could help adults better survive these lethal infections."

According to Kobzik, "Any new treatment, even if it reduced mortality by only 10 percent, would save millions of lives a year worldwide."

While it's known that people who are older, or have compromised immune systems, are more at risk of developing and dying from sepsis, researchers don't understand why common events like a playground scrape, appendicitis, or the insertion of an intravenous line cause some people's immune systems to revolt.

"With sepsis—as with a lot of other diseases—the body goes into a state of chronic inflammation and can't seem to return to a healthy homeostatic point," Filoramo explains. "Even after people survive sepsis, their immune system can flip-flop from hyper-responsive to sluggish, making them vulnerable to secondary infections." Sepsis cases have spiked in recent years, perhaps due in part to an aging population, the rise of antibiotic-resistant bacteria, and an increase in invasive medical procedures such as vascular catheters.

Kobzik, Filoramo's adviser, praises her contributions to this vitally important area of research. "Rose brings in different perspectives and angles of biology to the project in a very coherent and well-informed way," he says. "While I had already been looking at the central question of why children are less likely to die from infection, she initiated the work's current focus, and it is proceeding very well."

AN "AHA" MOMENT

To observe the prepubertal protective effect in the lab, Filoramo injected mice with endotoxin, a substance found in the cell walls of certain bacteria. This creates a sterile model of sepsis—the body responds with the same overwhelming immune response, but without the added complexity of bacteria replicating in the body. After months of trial and error, experimenting with different dosages of endotoxin and observing their effects on the mice, she had a quietly satisfying "aha" moment last year. The postpubertal mice were dying at higher rates and their blood showed elevated levels of inflammatory proteins, compared with prepubertal mice. Filoramo describes these young mice as "looking a bit bedraggled, like you or me when we get the flu. But you could tell that they were going to get better."

Filoramo believes it to be a novel finding. "No one is really looking at this question with sepsis and exploring it in the depth that our lab has," she says. Now that she's proven that the endotoxin model works, she will be conducting analyses to probe deeper into the differences in gene regulation between pre- and postpubertal mice. She will also be moving on to more complex models of sepsis using live bacteria. She is about a year away from publishing the findings, which she'll continue to refine for her thesis.

COMBINING THEATER AND SCIENCE

Filoramo's career course was set during a high school human physiology class. The inner workings of the body were so fascinating to her that she soon found she was asking more questions than her teacher could answer. He encouraged her to start looking things up on her own, which she did. Although she was active in theater in high school and college, and mulled becoming a professional actor, she ultimately decided that her future lay in biological research.

Her public speaking talents are coming in handy, however, as Filoramo embarks on a new passion: teaching. She recently served as a teaching assistant during a human physiology course for Harvard Chan graduate students and loved it—particularly when students came to her with their own challenging questions. She sees herself someday running a research lab at an undergraduate institution, teaching and mentoring students in their first research experiences.

Meanwhile, Filoramo will continue to explore perplexing questions about the immune system, focusing on sepsis, infectious disease, and chronic inflammation.

"The fact that we're not sick all the time is kind of amazing," Filoramo says. "The way that the body initiates and then shuts off the inflammatory response is really interesting to me. If we better understood the way inflammation is resolved, we could improve therapies for a lot of different diseases."

But while these research questions intrigue her, she seems most inspired by the way that her research could provide a teaching opportunity for others.

"When I'm retired, I hope to have established a lot of good relationships with my former students. My goal is to have inspired them to go into research as well," she says. "I believe that by making students feel confident that they can do this type of work, good teachers can recruit more young scientists to the field. There is always a need for new perspectives."

—Amy Roeder is assistant editor of Harvard Public Heath.

Kent Dayton / Harvard Chan

THE STORY OF T.H. CHAN

Soon after the largest gift in Harvard's history was made to the Harvard T.H. Chan School of Public Health in the fall of 2014, many people began wondering: Who is T.H. Chan for whom the School has been renamed?

Born in the 1920s, T.H. Chan grew up during turbulent times in China and did not have the opportunity to pursue higher levels of education. He settled in Hong Kong in 1948. Starting from an entry-level job in a bank, he eventually built a successful real estate business.

According to his son Gerald, SM '75, SD '79, his father was a man "unfailingly committed to enabling others to become educated."

"Growing up, I remember seeing friends coming to my father to borrow money for their children's school fees," Gerald recalled. "My father never turned down such requests including requests for support to pursue tertiary education abroad which was at that time an expensive proposition relative to what people in Hong Kong were making. His actions spoke powerfully to my brother Ronnie and me about enabling others to have an education."

It is easy to see how Gerald Chan and his brother Ronnie developed a deep commitment to education and public health growing up in their household.

Mrs. T.H. Chan was trained as a nurse in a British hospital in Northern China in the 1940s. It was a time when infectious diseases were the leading cause of death in the world. In the 1950s, government vaccination programs in Hong Kong had not yet achieved universal coverage. Gerald remembers his mother giving cholera vaccinations to the neighborhood children in the kitchen of their home.

"She would boil her hypodermic needle on the kitchen stove," Gerald reminisced of that era before injection needles were disposable. "The syringe was made of glass and the needle made of stainless steel. The needle would be reused time after time with sterilization in boiling water in between. The needle got blunted with repeated use, which meant the injection was extraordinarily painful. No wonder kids screamed and wailed in our kitchen."

By the mid-1970s, Gerald was studying at Harvard School of Public Health. Inspired by his mentor, Professor Jack Little, he switched his studies from physics to radiation biology. "My father came to visit me. The Kresge Building was brand-new and I brought my father to see it. He was awed by Harvard and quite proud that his son was studying there," Gerald said. "I count it a great privilege to have studied at Harvard. If I were a young man applying to Harvard today, I don't think I could get in. The students now are so brilliant."

Photographs courtesy of the Chan Family

Mr. and Mrs. T.H. Chan, in the 1960s. Trained as a nurse, Mrs. Chan administered cholera vaccinations to neighborhood children in Hong Kong in the 1950s.

Right, Mr. T.H. Chan with his grand nieces and grand nephews in the 1980s. Mr. Chan was unfailingly committed to helping others gain an education.

Opposite, Mr. T.H. Chan, in the 1950s.

After the $350 million gift to the School was announced, Gerald heard from a family friend what happened after his father's visit to the School, a story he had not known before.

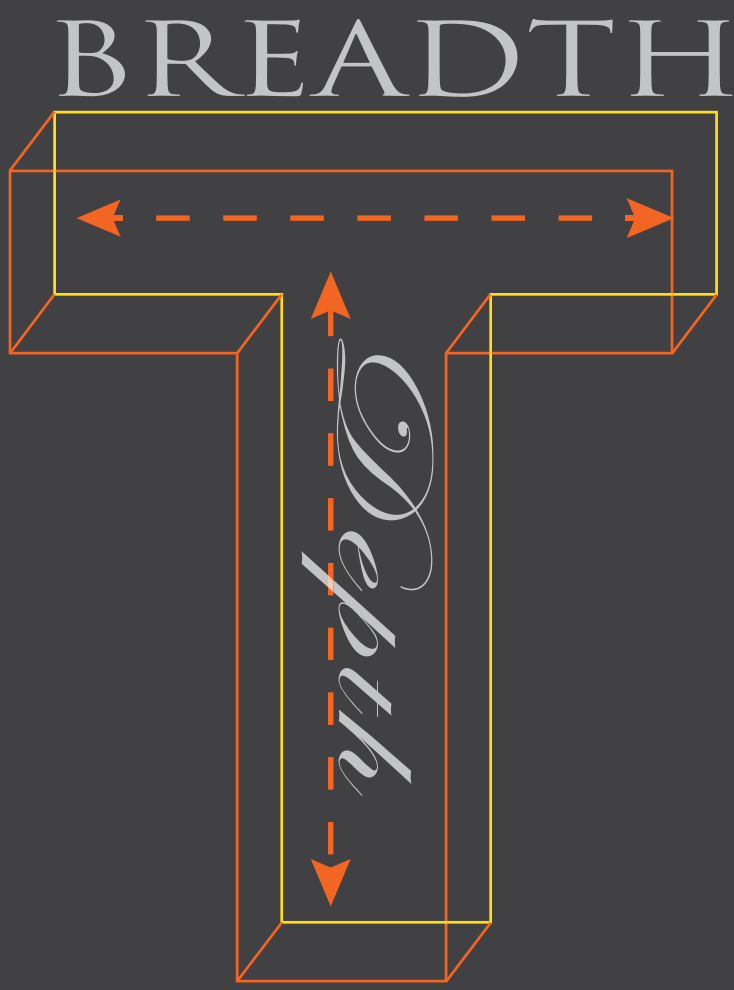
"I had received a fellowship for my doctoral studies at the School of Public Health," Gerald said. "On his way back to Hong Kong from Boston, my father stopped in San Francisco to visit his old friend Mr. S.P. Wong. For the few days that he stayed with Mr. Wong, he could not stop talking about my fellowship. On the one hand, he was proud that I had received a fellowship, which in his mind was an honorific scholarship. On the other hand, he was profoundly disturbed that my taking the fellowship meant that I had displaced someone who, without the support of the fellowship, would not have the means to attend this School. He kept saying to his friend, 'We have the means to pay tuition. Why is Gerald taking the scholarship away from someone else?' That inner struggle between feeling proud of his son on the one hand and on the other hand feeling disturbed that social justice had been abrogated is a poignant portrait of my father."

Mr. T.H. Chan died nearly 30 years ago. His sons are pleased that the gift through the family's Morningside Foundation will enable his legacy to continue in a meaningful way.

"In keeping with my mother's work to improve people's health and my father's commitment to supporting education, my brothers and I thought it most appropriate to celebrate their legacy by making a gift to the Harvard School of Public Health," said Gerald.

"My father would be very pleased with this gift and all the good works that this gift will enable."

Looking to Public Health's Future:



Newly redesigned master of public health (MPH) degrees and a new PhD in Population Health Sciences are coming soon to Harvard T.H. Chan School of Public Health. Along with the new, professionally oriented Doctor of Public Health program, launched in summer 2014, the degrees bolster and streamline the School's offerings, encourage greater integration among academic disciplines, open clearer paths toward either academic or professional careers, and provide innovative educational experiences—both in and out of the classroom. The changes are part of a broad-based effort to update the School's educational programs and ensure that Harvard Chan students graduate with both great breadth of understanding in the field of public health and great depth in their particular area of concentration.

Harvard Chan Redesigns Degree Programs

RETHINKING THE MPH

The new MPH offerings at the Harvard Chan School are part of a larger trend in public health education toward focusing on competencies rather than disciplines, according to Nancy Turnbull, associate dean for professional education. To that end, a new public health core is a key feature of the new program. Rather than taking separate courses in biostatistics, epidemiology, health administration, social and behavioral sciences, and ethics, MPH students will take part in new educational experiences, starting even before they get to campus. These experiences will integrate those traditional domains with new ones, including public health life sciences, the history of ideas in public health, leadership, and communication. The new MPH programs will also focus more on problem-solving skills and on how to apply public health training to real-world situations, will use more cases and simulations to boost active learning, and will provide more opportunities for field experiences.

Degree designations will likewise change as part of the new MPH offerings. Currently, the School grants two master's degrees in its professional track: a nine-month MPH for students with a prior doctorate—typically either an MD or JD—and a two-year "SM2" for those without doctoral degrees. As of fall 2016, everyone in the professional track will earn an MPH, either in nine or 16 months, depending on prior academic achievement and professional experience. Shortening the current two-year program to 16 months will make it more affordable and enable graduates more freedom to pursue the types of public health jobs that are most exciting to them, says Turnbull.

The School will continue to grant an SM (master of science) degree in its academic/research track.

"BLENDED" LEARNING

Beginning in June 2015, the Harvard Chan School will also offer a third type of MPH—a professional master's degree in epidemiology that blends online, on-campus, and in-the-field learning. It's the first such degree to be offered at a Harvard professional school. The pilot program will include three-week-long intensive sessions at the beginning, middle, and end of the program; 10 to 12 hours per week of online learning, including live classroom discussion, interactive exercises, modular video sessions, and case-based studies; and a yearlong practicum culminating with a capstone project and presentation.

School administrators hope that reducing the required time on campus and offering online courses will extend the reach of a Harvard education and draw a new crop of students from around the globe, says Ian Lapp, associate dean for strategic educational initiatives. "Offering short, intensive, on-campus experiences with engaging digital learning experiences will allow students to remain employed in their home countries and to participate in field experiences while also taking classes," he says. Adds Michelle Bell, assistant dean for educational programs, "We want people to continue working in their countries. There's such a need for public health professionals worldwide."

A POPULATION HEALTH SCIENCES "UMBRELLA"

A new PhD in population health sciences will launch in fall 2016. Five departments that have traditionally granted SD (doctor of science) degrees—environmental health, epidemiology, global health and population, nutrition, and social and behavioral sciences—will instead offer PhDs under the population health sciences umbrella. As a result, all future students in the School's doctoral research track will earn one degree—the PhD. Students in the professional track will continue to earn the DrPH.

Students in the new PhD program will share a common core curriculum offering breadth in population health sciences as well as depth in a specific field of study. They'll also receive formal training in how to become successful educators and instructors.

The goal is to produce experts who are cross-disciplinary in their orientation and knowledge. Program Director S V Subramanian, professor of population health and geography, says the emphasis on an explicitly cross-disciplinary approach—spanning social, quantitative, and life sciences, among others—represents a fundamental shift in research-focused doctoral training in public health.

"Increasingly, scientists in the field of public health are working at the intersection of several disciplines, and this is only natural because the etiology and patterning of health rarely lends itself to be understood from a single disciplinary lens," says Subramanian. "At the Harvard Chan School, with our current faculty breadth and expertise as well as our proven record in producing eminent academicians and scientists, we are uniquely positioned to offer a forward-looking vision of where public health is headed."

LEFT: At the Harvard T.H. Chan School of Public Health, the evolving educational strategy aims to instill "T-shaped" competencies: deep knowledge in an area of specialty (vertical bar of the "T") coupled with the breadth of knowledge (top horizontal bar) to work effectively across disciplines and fields of inquiry.

IN MEMORIAM

ROSE EPSTEIN FRISCH

Rose Epstein Frisch, an associate professor emerita of population sciences and a pioneer in explaining the biological mechanisms of fertility and cancer in women, died on January 30 at age 96.

Frisch's discovery that the energy stored in body fat governs when a woman becomes fertile led to the discovery of leptin, the hormone that implements this biological pathway. The effect is that a woman who is too lean, whether from malnutrition or intense exercise, experiences decreased fertility or even infertility. In related work, Frisch demonstrated the relationship between early athletic activity and later-life cancer risk.

"Dr. Frisch's studies were visionary and set in motion a chain of discoveries that led to a much better understanding of women's health," said Lisa Berkman, director of the Harvard Center for Population and Development Studies, where Frisch worked for decades. "What also was remarkable was that this was accomplished during a period when most women scientists struggled to have their work recognized."

In 1974, Frisch co-authored a paper showing that a woman's menstrual cycles can stop if she loses weight, often as little as 15 pounds. She estimated that those wishing to become pregnant should aim for at least 17 percent body fat. There are babies named Rose in her honor by mothers who were runners and took her advice.

Frisch also found, in a 1985 study, that female athletes were less likely to develop breast cancer, apparently because of reduced estrogen exposure.

Frisch earned a PhD in genetics from the University of Wisconsin in 1943. She was a fellow of the American Academy of Arts and Sciences, the John Simon Guggenheim Memorial Foundation, and the Radcliffe Bunting Institute.

DIMITRIOS TRICHOPOULOS

Dimitrios Trichopoulos died on December 1 at age 75. He was Vincent L. Gregory Professor of Cancer Prevention and professor of epidemiology, and a past chair of the Department of Epidemiology. Over four decades in the field of cancer epidemiology and prevention, Trichopoulos published more than 1,000 scientific papers, continually staking out scientific frontiers. His seminal research linked secondhand cigarette smoke to lung cancer; tied hepatitis B virus and tobacco smoking to an increased risk of primary liver cancer; and documented that surgically induced and early natural menopause reduced breast cancer risk. Outside the cancer field, his paper linking psychological stress after an earthquake in Athens to increased risk of cardiac death was one of 27 papers cited by *The Lancet* as part of the core canon of medical literature.

Trichopoulos' research career included several significant "firsts": He was first to propose that in utero exposures play a major role in breast cancer causation.

Far left, courtesy of Harvard Medical Library, Francis A. Countway Library of Medicine; left, Kent Dayton / Harvard Chan

In 1981, he also was first (along with an independent paper published a few days later) to report that secondhand smoke raises the risk of lung cancer.

A native of Greece, Trichopoulos earned an SM at the School in 1968 and was appointed a full professor in the Department of Epidemiology in 1989. He took on the role of chair that same year, serving until 1996.

"Dimitrios was indeed a giant among giants in the field of epidemiology," said Michelle Williams, chair of the Department of Epidemiology and Stephen B. Kay Family Professor of Public Health. "He will be remembered most for his generosity, sincerity, and enduring commitment to teaching and mentoring legions of students and junior faculty from across the globe."

WILLY PIESSENS

Willy Piessens, professor of tropical public health emeritus, died on October 4, 2014, at age 71. Piessens joined the Harvard Chan faculty in 1981 and retired in 1995. Initially focused on immunology, Piessens spent the latter half of his career concentrating on *Wuchereria bancrofti*, a parasitic roundworm that is the major cause of lymphatic filariasis. He published more than 100 articles and reviews on the topic and collaborated with the World Health Organization and other institutions. ✪

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1959

Roger Meyer, MPH, was elected vice president of the Rotary International Fellowship of Physicians for North America in 2014. He is currently professor emeritus of public health and pediatrics at the University of Washington and hopes to bring more public health endeavors to Rotary's global programs.

1968

Elizabeth Whelan, SM, died on September 11 at age 70 from sepsis complications. She was an epidemiologist and founder of the American Council on Science and Health.

1977

L.D. Britt, MPH, was awarded an honorary fellowship in the Royal College of Surgeons of Glasgow, in the United Kingdom. He also has been recognized with the highest honors bestowed by the French Academy of Surgeons, the West African College of Surgery, and the College of Surgeons of South Africa.

1978

Michael J. Rosenberg, MPH, died on December 8 in an accident at age 66. A physician and entrepreneur, he founded Health Decisions, a company that helps pharmaceutical and biotechnology companies conduct and analyze clinical trials of experimental drugs. Rosenberg previously served as chief, reproductive health activity, at the U.S. Centers for Disease Control and Prevention.

1987

Robert Lee Mittendorf, MPH, DrPh '91, died in December at age 71 from the expression of a genetic disorder, alpha-1 anti-trypsin. He was a physician, clinician, and medical researcher. Most recently, Mittendorf served as professor emeritus at Loyola University Medical School in Chicago.

1992

Jasjit Ahluwalia, SM, was named dean of Rutgers School of Public Health in January. He previously served as professor of internal medicine and epidemiology at the University of Minnesota Academic Health Center, where he was founding executive director of the clinical research office.

Tony Coles, MPH, was named chairman and chief executive officer for Cambridge-based Yumanity Therapeutics. Before his new appointment, he was chairman and CEO of the San Francisco–based cancer drug maker Onyx Pharmaceuticals.

1994

Cheryl Whitaker, MPH, a physician and entrepreneur, announced the launch of a new health care firm in September. NextLevel Health Illinois works with the state to provide care to black and Latino men and to others under the poverty line who are now eligible for Medicaid. Whitaker remains a partner in Whitaker Kinne Group LLC, a company she helped found that advises businesses on health care and Medicaid issues.

1999

Juan Celedón, MPH, DrPH '01, received the Claude Lenfant Award at the World Congress of Asthma in Mexico City in March 2014, as well as the Recognition Award for Scientific Accomplishments from the American Thoracic Society in San Diego in May 2014. Both awards honored "outstanding research contributions on asthma and asthma disparities."

2000

Sandro Galea, MPH, was appointed dean of the Boston University School of Public Health in September. He previously served as the Gelman Professor and chair in the Department of Epidemiology at Columbia University Mailman School of Public Health.

2002

Alan Guerci, SM, president and chief executive officer of Catholic Health Services of Long Island, was named chairman of the board of directors of the Nassau-Suffolk Hospital Council in May 2014.

2003

John Bonamo, SM, was named executive vice president and chief medical officer of Barnabas Health in New Jersey in December. Bonamo, a physician executive with a distinguished clinical background in obstetrics and gynecology, has since 2001 served as president and chief executive officer of Saint Barnabas Medical Center.

2009

Edward Sheen, MPH, was appointed in September as a White House Fellow. He is an internist and was a clinical fellow in liver and digestive diseases at Stanford University. White House Fellows serve as full-time assistants to senior White House staff, cabinet secretaries, and other top-ranking government officials.

2011

Eke Ahizechukwu, MPH, received an American Medical Association Foundation 2014 Leadership Award in

May. This national award recognizes medical students, residents and fellows, and early career physicians for achievements in community service, medical education, and public health.

2012

Mosoka Fallah, MPH, was among the Ebola fighters named *Time* magazine's 2014 "Person of the Year." He was profiled in the Winter 2015 *Harvard Public Health*.

Yanick Vibert, MPH, received the Roosevelt Award for Service to Humanity from the March of Dimes, Southeast Pennsylvania Division, in November. She was recognized for her work as an attending neonatologist at St. Christopher's Hospital for Children in Philadelphia, and as a medical volunteer in Haiti and Uganda. Among her efforts: helping rebuild a local hospital in Haiti after the 2010 earthquake, treating babies stricken with cholera and tetanus, and assisting with establishing free pediatric clinics. She also is a trainer with the neonatal resuscitative program Helping Babies Breathe and has traveled to Africa many times to volunteer in clinics and give lectures.

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AWARDS AND HONORS

Dean Julio Frenk was elected to the Robert Wood Johnson Foundation board of trustees in January. Frenk has led the faculty at the School since 2009 and is also the T & G Angelopoulos Professor of Public Health and International Development, a joint appointment with Harvard Kennedy School.

Gökhan S. Hotamisligil, J.S. Simmons Professor of Genetics and Metabolism, and chair of the Department of Genetics and Complex Diseases, received a 2015 Roy O. Greep Award for Outstanding Research from the Endocrine Society at its 97th annual meeting in March in San Diego.

Howard Koh, professor of the practice of public health leadership, received the 2014 Sedgwick Memorial Medal for Distinguished Service in Public Health in November at the American Public Health Association's annual meeting in New Orleans. He also received the National Leadership Award from the Community Anti-Drug Coalitions of America in February.

Meredith Rosenthal, professor of health economics and associate dean for diversity; and **Paula Johnson**, professor in the Department of Epidemiology, were elected to the Institute of Medicine in October, in recognition of outstanding professional achievement.

Pardis Sabeti, associate professor in the Department of Immunology and Infectious Diseases, was among the Ebola fighters named *Time* magazine's 2014 "Person of the Year." Sabeti's work analyzing Ebola's genetic code and tracking its mutations was covered in the Winter 2015 *Harvard Public Health*.

APPOINTMENTS AND PROMOTIONS

Yonatan Grad
Assistant professor of immunology and infectious diseases

Margaret Kruk
Associate professor of global health

Francine Laden
Professor of environmental epidemiology

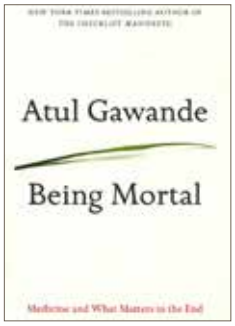
Ankur Pandya
Assistant professor of decision science

Stéphane Verguet
Assistant professor of global health

continued

Kent Dayton / Harvard Chan

BOOKSHELF



BEING MORTAL: MEDICINE AND WHAT MATTERS IN THE END

Atul Gawande
Metropolitan Books, 2014
304 pages

Medicine has triumphed in modern times, transforming the dangers of childbirth, injury, and disease from harrowing to manageable. But when it comes to the inescapable realities of aging and death, what medicine can do often runs counter to what it should. Through eye-opening research and gripping stories of his own patients and family, Atul Gawande—who is professor in the Department of Health Policy and Management, a practicing surgeon, and director of Ariadne Labs, a joint center for health systems innovation—reveals the suffering this dynamic has produced. Gawande details how nursing homes, devoted above all to safety, battle with residents over the food they are allowed to eat and the choices they are allowed to make; how doctors, uncomfortable discussing patients' anxieties about death, fall back on false hopes and treatments that are actually shortening lives instead of improving them; and how families go along with it all. And he finds people who show us how to have the hard conversations and how to ensure we never sacrifice what people really care about.

HUMAN RIGHTS AND ADOLESCENCE

Jacqueline Bhabha, editor
University of Pennsylvania Press, 2014
376 pages

This book presents a multifaceted inquiry into the global circumstances of adolescents, focusing on the human rights challenges and socioeconomic obstacles young adults face. Contributors use new research to advance feasible solutions and timely recommendations for a wide range of issues spanning all continents, from relevant international legal norms to neuropsychological adolescent brain development, gender discrimination in Indian education to Colombian child soldier recruitment, stigmatization of Roma youth in Europe to economic disempowerment of Middle Eastern and South African adolescents. Editor Jacqueline Bhabha is professor of the practice of health and human rights at the Harvard Chan School. Other School contributors include Theresa Betancourt, Elizabeth Gibbons, Orla Kelly, Margareta Matache, and Elizabeth Newnham.

"TO SAVE HUMANITY": WHAT MATTERS MOST FOR A HEALTHY FUTURE

Julio Frenk and Steven J. Hoffman, editors
Oxford University Press, 2015
376 pages

The turn of the 21st century was an objective low point in the history of human health: AIDS was raging across Africa, millions of women died each year in childbirth, and billions suffered malnourishment. In response, the United Nations launched its Millennium Development Goals (MDGs), an ambitious charter that since 2000 has measurably reduced the worldwide burdens of poverty, hunger, and disease. With the MDGs set to expire in 2015, continued progress on these fronts is anything but certain. "*To Save Humanity*" is a collection of short, honest essays on what single issue matters most for the future of global health. Co-edited by Dean Julio Frenk and authored by the world's leading voices from science, politics, and social advocacy, the collection is both a primer on the major issues of our time and a potential blueprint for post-2015 health and development.

Critics also suggest that warm human interaction can't be replaced by cool high-tech probing devices—however accurate they may be. Onnela agrees that cellphones could never supplant caring conversation or a pat on the shoulder or, more broadly, the rich therapeutic relationship. Rather, the new technology would complement it. "Nobody would argue that because you have a thermometer or can take your blood pressure at home that it negates the need for doctors," he says.

Torous agrees. "Just as cardiologists use echocardiograms, psychiatrists want to bring in more objective data," he notes. "That means they will spend less time asking about symptoms and spend more time on treatment."

MAPPING SOCIAL NETWORKS

As technology improves and sensors get smaller, collecting behavioral data will only get easier and less intrusive. Given this, Onnela would like to see classic long-term public health studies—such as the Framingham Heart Study or the Nurses' Health Study, which follow individual habits and health outcomes over long periods—updated in the future to include social connectivity.

"People have of course considered social networks and the role of social support in the past, but because it's been traditionally very difficult to collect data—social network data at the large scale—these studies have mostly been limited to much smaller groups of people," he says. "We'd like to understand the structure of the social network at the societal level. That's what's going to determine how information and misinformation flow, or how pathogens spread, among a large group of people."

To that end, Onnela is mapping broad social networks in markedly different settings. In 2013, he studied the Kumbh Mela festival in India, a three-month Hindu religious event that draws millions of people. Most of these festivalgoers carry cellphones. Drawing on their electronic exchanges, Onnela's team was able to follow the ebb and flow of attendance. Over time, Onnela says, similar research techniques could be deployed to predict the dynamics of refugees during natural disasters, or to help governments predict crowd and traffic patterns to avoid major jams or even stampedes.

Onnela has also applied social mapping techniques to infectious-disease control. His ideas helped guide scientists in the Botswana Combination Prevention Project, part of the Harvard T.H. Chan School of Public Health AIDS Initiative, as they conducted trials for HIV treatments. Typically in such studies, researchers choose one village to receive treatment and another nearby village as a control group, receiving standard care but no additional treatment. If lots of people have relationships across the villages, however, the effect of the interventions is diluted and harder to measure.

With Botswana's unusually high rate of cellphone coverage, Onnela aims to assess data to estimate how much social mixing occurs between villages. "If we can understand the extent of mixing, we can learn how effective different treatments really are," he says.

THE NEXT BIG THING?

Onnela is sensitive to the potential pitfalls of any "next big thing" in health care or mental health treatment. "Data alone won't do it," he says. The flood of information must be collected efficiently, analyzed thoughtfully, and validated clinically.

Moving forward, Onnela wants to use his math, physics, and statistical skills to manipulate bigger and bigger data sets, and to refine methods to analyze them, to improve population health. "I love being able to combine my passion for quantitative sciences with the desire to change the world, the lives of people, even in a very small way."

And while he is devoting his career to complex theories and ever-more-advanced technology, his inspiration tends to come in notably low-tech moments. "I get my best ideas when I'm not actively trying to think, such as when taking my dog for a walk."

So what would a researcher learn from studying Onnela's cellphone records? "They would probably learn that I get to the office early and I leave the office late," he says with a laugh. "But everyone who knows me already knows that."

Karen Brown is a freelance writer and public radio reporter in Western Massachusetts who specializes in health and mental health issues.

For information about making a gift to the Harvard T.H. Chan School of Public Health, please contact:

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GIVING & RECEIVING

Many years ago, when I was dean, I decided to support the School through a financial planning vehicle called a "deferred gift annuity," in which I made a gift to the School and in turn would receive fixed annuity payments for life. This is certainly a win-win: I am supporting the School that has meant so much to me for so many years while I am supplementing my income for the rest of my life. And my return on this investment with Harvard is greater than I could have received if I had invested on my own. With this deferred gift annuity, I both give and receive. How often does that happen?

—Barry R. Bloom
Professor, Departments of Immunology and Infectious Diseases and Global Health and Population

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PASSING THE TORCH Chelsea Clinton, Vice Chair of the Clinton Foundation and inaugural recipient of the School's Next Generation Award, presented this year's Next Generation Award to Blake Mycoskie, founder and "chief shoe giver" of TOMS on April 9, 2015. They are pictured with Dean Julio Frenk (right). The award, established in 2013 to mark the school's centennial, honors an individual age 40 or younger for leadership and commitment to health as a human right. Mycoskie was recognized for his "one-for-one" business model, in which every product purchased helps a person in need. View a recording of the event at hsph.me/chelsea.