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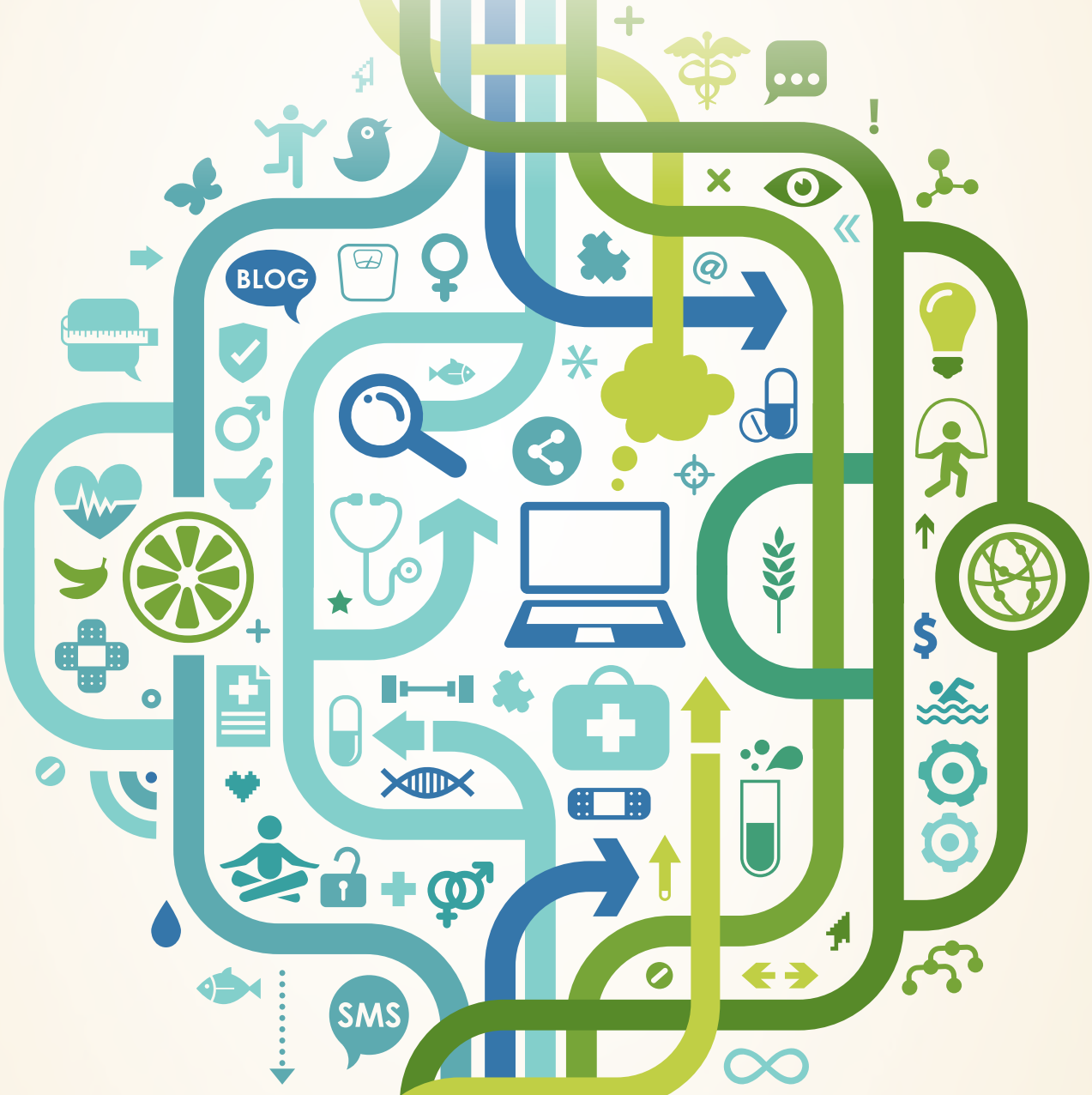
THE MAGAZINE OF THE UNIVERSITY OF WASHINGTON SCHOOL OF PUBLIC HEALTH



BIG DATA:
THE PATH TO HEALTHIER COMMUNITIES?

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FROM THE EDITOR

SEPARATING THE HOPE FROM THE HYPE

Big Data is a big buzzword. Some tech industry pundits go so far as to describe Big Data as "the new oil." For this issue of *Northwest Public Health*, we explored the question, "How will Big Data transform public health in our region?" To answer this, we sought to separate the hope from the hype.

The hope is that Big Data will provide insights that inform public health action. In these pages you'll find promising examples of those insights: how social determinants influence obesity, whether fitness tracking can increase physical activity, the role of data in health reform, and how the interplay between genetics and the environment shapes health.

The hype is the mistaken belief that Big Data—or any technology for that matter—will by itself lead to better health. It will take more than dazzling graphs and maps created with Big Data to improve the health of our communities.

Nearly 100 years ago, microbiologist C.-E.A. Winslow articulated a definition of public health that still resonates today: "Public health is the science and the art of preventing disease, prolonging life, and promoting physical health and efficiency through organized community efforts . . ." The public health hopes for Big Data will be realized only if we as a society invest in organized community efforts—and use data (big and small) to make those investments wisely.

Please enjoy this issue of *Northwest Public Health*. We welcome your feedback via our reader survey at www.nwpublichealth.org/survey.

Tao Sheng Kwan-Gett, Editor-in-Chief
Northwest Public Health

FROM THE DEAN

BIG DATA'S POTENTIAL TO ADVANCE PUBLIC HEALTH

Big Data is on everybody's lips these days. It has enormous potential to advance public health—and enormous potential to confuse since it means so many things.

For geneticists, Big Data refers to such efforts as genome-wide association studies, which interrogate genomes across populations to identify single nucleotide polymorphisms disproportionately present in particular diseases. For health services researchers, Big Data evokes the promise of huge patient data sets, ranging from clinical records (which are becoming more available thanks to consolidation in the health care sector), to such sources as the Behavioral Risk Factor Surveillance System.

But Big Data extends well beyond the health sector. A quick check of your pockets will reveal ways in which you contribute to Big Data every day. Your credit cards and customer loyalty cards create records of what you buy, and your smartphone can create records of your travel patterns, your interests, and even—if you post on Facebook or tweet—your very emotions. If you wear a Fitbit or similar device, you contribute data on your physiology. These data streams have the potential to revolutionize public health research and impact, not to mention our notions of privacy, and much more.

As this issue of *Northwest Public Health* shows, the University of Washington School of Public Health is actively engaged in Big Data research and collaboration.

You will learn about Daniela Witten and her groundbreaking work on genomics, and what a youth physical activity project called *Gear Up & Go!* is teaching us about data's social side—a project in collaboration with Allen Cheadle at Group Health Research Institute (GHRI) and evaluated by the Northwest Center for Public Health Practice (NWCPHP). You will also learn of the School's engagement in the Healthier Washington health transformation initiative and what's ahead for data management and analytics, including the innovative work at the Institute for Health Metrics and Evaluation. Program evaluation for the health initiative will be housed at NWCPHP and led by Douglas Conrad, in collaboration with GHRI. You will also see some student perspectives on various Big Data projects.

From sensors to apps, from data analytics to data visualization, we are privy to technologies and techniques that we could not have imagined only a decade ago. The opportunities for public health are boundless. Enjoy this issue of *Northwest Public Health*, as it gives you some glimpses into how Big Data's potential is becoming reality.

Howard Frumkin, Dean
UW School of Public Health

PHOTO: AMOS MORGAN

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ABOUT

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WHAT IS BIG DATA? THE HOPE & THE HYPE

BY TAO SHENG KWAN-GETT

BIG DATA: IT'S ALL RELATIVE

Big Data has been one of the hottest buzzwords in the tech world for the past few years. But what exactly is Big Data?

In the mid-90s, NASA scientists first used the term to describe computer graphics data that overwhelmed the memory and hard disk storage space of their then state-of-the-art computers. Fourteen years ago, tech guru Doug Laney, Vice President for Research at the IT research firm Gartner, Inc. coined "the three Vs" that distinguish Big Data from ordinary data: Volume, Variety, and Velocity.

Volume refers to the sheer amount of data that exceeds the storage capacity of most computers. Velocity is the rate at which data is generated and transmitted, exceeding the bandwidth of ordinary information systems. And variety relates to the myriad of data formats and structures that are often incompatible and inconsistent.

One problem with this definition is that it makes Big Data a relative term. Technology has advanced so quickly that what was considered Big Data 20 years ago might now be handled by your smartphone, and what we call Big Data today might easily be processed by your tablet tomorrow.

THE HOPE AND HYPE OF BIG DATA

Whatever the level of technology, the hope for Big Data is that analyzing large amounts of complex data will yield insights that will result in better decisions. Most of the advances have been in e-commerce. Google for example analyzes how you search for information on the web, tries to predict what goods and services you might be interested in buying, and puts ads for those goods and services on your computer. Amazon looks at your buying patterns, and recommends products that it thinks you are likely to buy.

The problem is that the expectations for Big Data—or any new technology—often exceed its capabilities, resulting in hype. Gartner has gone so far as to generalize a progression of expectations that he calls the hype cycle, starting with a "technology trigger," growing to a "peak of inflated expectations," sinking to a "trough of disillusionment," rising on a "slope of enlightenment," then arriving at a "plateau of productivity."

HEALTH BIG DATA SOURCES

The sources of hope for health Big Data span the spectrum from "micro" to "macro."

On the micro end of the spectrum is genomic data—DNA sequence information that helps us understand the structure and function of genes. The hope is that Big Data analytics will enable researchers to design more effective drugs and develop more accurate screening for diseases that have a genetic component. (For more on genomics and Big Data, read *Genomics & Latino Health* on page 20.)

On the macro end are data about populations. This can include electronic medical records—the data that is generated about us every time we visit a clinic, fill a prescription, have a laboratory test done, or are admitted to the hospital. The hopes here are that Big Data techniques will identify inefficiencies in the health care system, reduce medical errors, and improve health outcomes. (The *Regional Roundup* on pages 14–15 has some nice examples of how states are building their capability to use health data for population health.)

Other sources of health Big Data include the web itself. Google researchers have studied whether influenza trends during flu season can be predicted by analyzing how often we use certain search terms to self-diagnose or treat ourselves. The answer: not very accurately according to a 2014 article in *Science* magazine.

Twitter feeds and other social media are also studied as sources of surveillance data on obesity and chronic diseases. Fitness and health data that we store on our smartphones are yet another potential source of health Big Data. (To learn how some schools and startups in the Puget Sound area are exploring physical activity data to gain health insights, see page 8.)

USING BIG DATA FOR POPULATION HEALTH VS. PUBLIC HEALTH

Will these sources of health Big Data yield useful information for the purposes of improving population health? The term population health is another buzzword recently making the rounds in health sciences circles. David Kindig, Emeritus Professor of Population Health Sciences at the University of Wisconsin–Madison, developed this commonly accepted definition: "the health outcomes of a group of individuals, including the distribution of such outcomes within the group."

The interesting thing about population health is that the concept of population is a fluid one: a business's population is its employees; a health insurer's population is its subscribers; a health care system's population is its patients. (Page 10 of this issue explores the converging interests of the public health community and health care industry on population health.)

The difference between population health and public health has important implications for Big Data. A 2013 policy brief published by the Robert Wood Johnson Foundation contained the startling statistic that for every dollar spent on health in the United States, only four cents goes to public health and prevention. If investments in health Big Data mirror this pattern, the health care system could see its population health Big Data hopes realized while public health is left behind. Disparities in the availability of health data could lead to further disparities in health outcomes.

HEALTH BIG DATA BOTTLENECKS

What factors are slowing widespread use of Big Data for public health? One is access to data and the ability to share it. Another is the availability of analytic tools that make it possible for people to use Big Data without having a PhD in data science. However, the most important factor might be not technological but human: To use Big Data effectively, organizations need to adapt their processes and train their people on how and why to use Big Data.

Other concerns for health Big Data include privacy issues such as the use of individual genetic data and electronic health records. Data sources that aren't maintained using the most advanced security technology could be vulnerable to hacking, and the information they store could be sold on the black market. Earlier this year, Premera Blue Cross notified 11 million subscribers that their personal information was compromised by hackers in 2014.

Even if privacy issues are adequately addressed, we need to use health Big Data cautiously. Using huge amounts of data can give us a false sense of scientific validity. But in the end, Big Data is just that—data. All of the same errors we sometimes make analyzing ordinary data sets can also be made with Big Data.

Confusing correlation with causation is a good example. Just because two indicators are trending the same way doesn't mean they have anything to do with one another. Do an image search for "correlation vs. causation" online, and you can find some graphs illustrating humorous examples, such as a chart that shows the Greek debt crisis rising at the same rate as the number of active Facebook users, or the US murder rate declining with the usage rates of a popular web browser.

Bias is another source of error. For population health data to be accurate, it has to be from a representative sample of the population. If the health data you analyze about a community come only from a health system that serves a white middle class population, you won't be aware of the health issues facing ethnic communities and those who don't have access to care. And as a result, you will be dangerously unaware of the health disparities that exist across racial and socioeconomic lines.

In the end, public health is not going to be improved by health Big Data. Public health will be improved by people—people in health care, government, non-profits, and academia who rigorously analyze Big Data and use the results to make better policies and improve practice. ◆

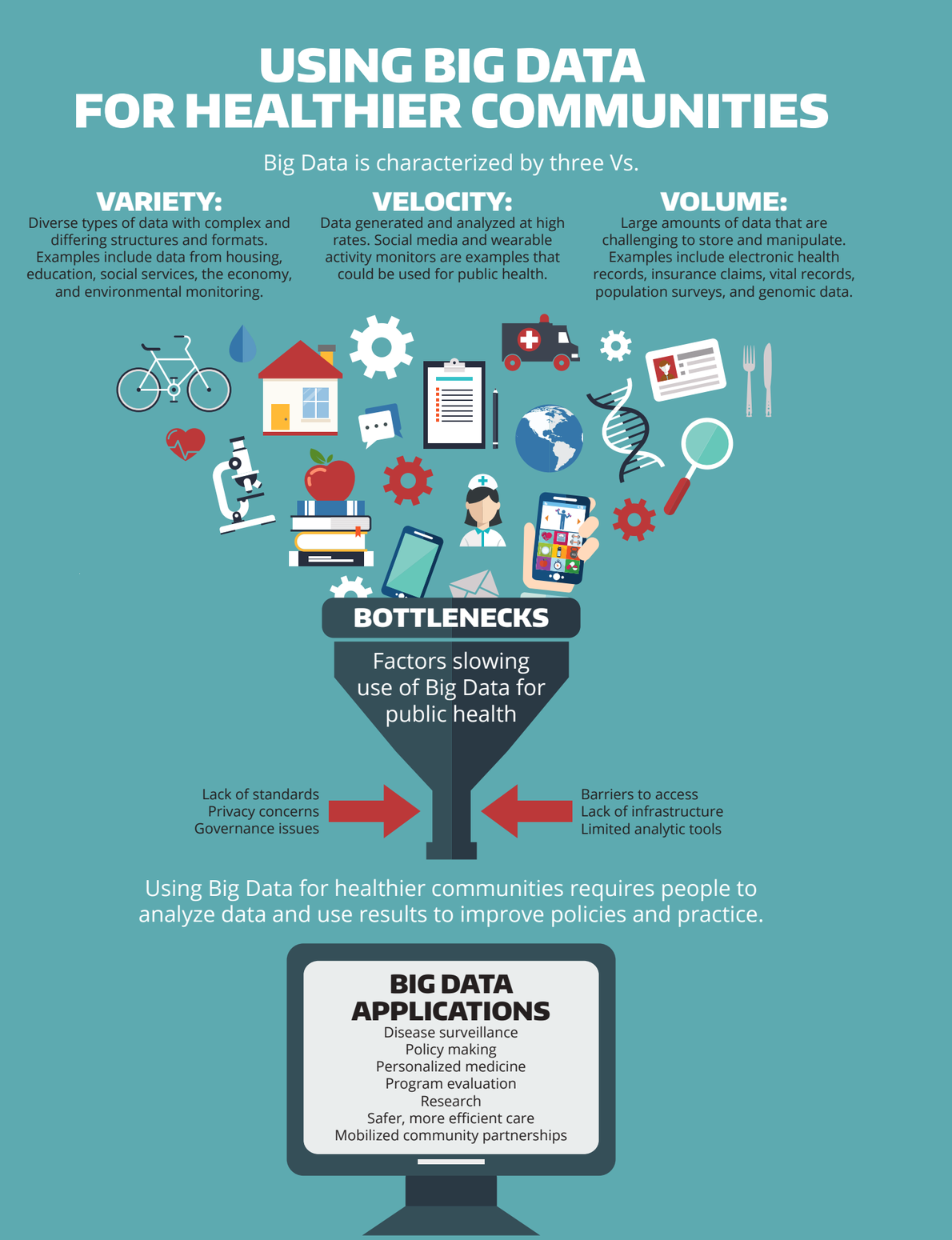


PHOTO: SNOHOMISH COUNTY HEALTH LEADERSHIP COALITION

INDIVIDUAL FITNESS TRACKING TURNS SOCIAL

Activity-tracking technology is drawing users and designers together. What does this mean for data analysis and population health?

BY DEBORAH GARDNER

"I like to play basketball with the governor," says a Silver Lake Elementary student on camera. In the same video on the Snohomish County Health Leadership Coalition website, Governor Jay Inslee sinks a layup. Inslee has a major height advantage over the fifth-grade players, but the kids have what may be a different advantage—they're each wearing a sleek activity-measuring wrist device called the Sqord PowerPod.

Through the Coalition's *Gear Up & Go!* initiative, the device is available to every fifth-grader in Snohomish County schools to encourage movement, play, and a lifelong love of being active. Thousands of fifth-graders in over 100 schools participate. Students upload data to laptops and tablets at schools, libraries, and community organizations, accumulating virtual currency to adorn an avatar with Seahawks garb or other fashions. If the devices are trendy among the fifth-grade set, they're inclusively so; the program is free and optional, with parent or guardian permission.

The goals of *Gear Up & Go!* align nicely with Inslee's Healthiest Next Generation Initiative, but interest in individual activity monitoring raises questions about access, data, and privacy. Will data-generating tools advance population health or increase disparities? What are the implications of targeting technology to children?

At school, something unexpected happened. Silver Lake PE teachers had assumed athletic kids would be the most active, but a teacher told *Gear Up & Go!* Program Manager Carly Kaufman about a student who unexpectedly scored high points. The girl proudly told Kaufman she'd found creative ways to be active: running in place, walking the dog, doing laundry—anything to keep moving. This was no anomaly. The same story unfolded around the county. The kids teachers expected would be less active became top scorers.

Could technology reverse childhood's activity decline? "There is a greater long-term potential if you can build habits at a young age," said Dr. Allen Cheadle, Director of the Center for Community Health and Evaluation at Group Health Research Institute. "Targeting fifth-grade was strategic because activity starts to decline when kids enter middle school."

As one of the program's evaluators, along with the Northwest Center for Public Health Practice, Cheadle's team is analyzing the PowerPod data. It's pretty Big Data—a row for every 15 minutes for every child. The device is not research-grade and is worn on the wrist, so the team plans to study its accuracy.

Even with limitations, activity-monitoring data are more accurate than self-reported data. "Measuring outcomes requires having good metrics, and activity self-reports from kids are particularly inaccurate," Cheadle explained. With accelerometers offering greater precision, he foresees a steep increase in use of activity-monitoring data. Researchers are studying the best ways to wear monitoring devices and interpret the data. Cheadle hopes to understand the association between device-wearing and higher activity levels. The researchers found kids were more active with PowerPods than without them.

The PowerPod doesn't collect sensitive data such as location—a particular privacy concern for children—and data is used for research only. Reassured by this, all Snohomish school districts joined the public-private collaboration.

Teacher and student enthusiasm for the program is infectious. "School climate and the social aspect have an enormous impact, which builds camaraderie and community engagement," said Kaufman. For example, after Snohomish County's Oso landslide, students and the Coalition, along with United Way of Snohomish County, turned students' virtual points into real dollars to aid the relief effort.

Kids are not the only ones using individual activity monitoring together. Adult fitness data monitoring is turning social too, explains Russell Benaroya, CEO and co-founder of EveryMove, a Seattle-based network encouraging users of various activity-monitoring devices and apps to inspire one another and to use and share their own data.

Similarly, California-based Quantified Self Labs connects technology creators and users for tracking health metrics and developing improvements. In 50 cities on five continents, enthusiasts use another social network—Meetup.com—to gather in Quantified Self Meetup groups for show-and-tell, presentations, and hands-on work. A 2014 Quantified Self Public Health Symposium brought together policy makers, technology users, tech companies, and public health researchers.

PHOTO: SQORD INC.

It makes sense that individual monitoring has become collaborative, said Quantified Self co-founder Gary Wolf. "People are interested in themselves and always have been, but there's also a cultural piece." He sees Quantified Self as a cultural movement for data and health literacy.

The cultural shift is not universal. For kids or adults, technology—even with a social or cultural component—won't change population health without concurrent environmental changes. "Behavior change alone won't get people to adopt an active lifestyle and eat more nutritious food if the environment doesn't support those behaviors. It's difficult for people to thrive in an unhealthy environment, no matter what tools they have," said Glen Duncan, Associate Professor of Epidemiology at the University of Washington.

A device won't help someone who has nowhere to walk or play, Duncan warns, stressing that technology can't compensate for inequitable environments or socioeconomic disparities. Large-scale, personalized activity data may help reveal whom the technology does not help, and why.

Growing privacy concerns—even for adults—leave some people hesitant about fitness monitoring. A January 2015 Federal Trade Commission report warned that "unauthorized access to data collected by fitness and other devices that track consumers' location over time could endanger consumers' physical safety."

However, technology use is thriving. With *Gear Up & Go!*, Coleman Greene, CEO of Sqord Inc., sees an opportunity; instead of blaming technology for sedentary behavior, why not embrace it to help kids move? Russell Benaroya envisions a future that integrates personal technology with health care and rewards people for tracking activity. "The future self is quantified—but humanized." ◆

converging interests

AN INDUSTRY PERSPECTIVE BY RICK RUBIN

As the interests of public health and health care industries converge, rapid changes are occurring in business models, roles and responsibilities, and partnership strategies. Industry's ongoing reinvention and expanding interest in public health offers the public health community an opportunity to create new partnerships with industry. However, convergence is about meeting in the middle and that will require new thinking on both sides.

The following three health information concepts stand out and are reflected in larger markets:

CONVERGING PERSPECTIVES ON POPULATION HEALTH

Public health has long focused on the health of populations at the national, state, and local level, while the health care system has generally focused on treating individuals. With new payment models emerging, those at risk for results in financing and delivering care are thinking more in terms of population health management. While governmental public health is ultimately responsible for the population in a state or local jurisdiction, the term as used in the health care context usually refers to a given population of patients or members for which the enterprise is responsible.

Traditionally, one of the barriers to greater focus on population health by industry stemmed from concerns about return on investment (ROI). The January 19, 2015 *Health Data Management* newsletter reported that "more than half of health care managers surveyed expected to recoup their investments in population health management programs within three to four years, according to KPMG." It is worth noting that the overlapping interest is not complete—the populations served by health care systems don't obey county or state lines.

This convergence offers exciting opportunities for partnership between public health and industry. I envision both parties sharing work to more efficiently achieve complementary population health objectives in these three areas: targeting health problems, either through the concentration of forces to achieve greater depth, or to divide and conquer for greater breadth; collecting data collaboratively to reduce cost and burden; and planning interventions together to increase scope and impact.

DATA CONNECTIVITY CONVERGING WITH POPULATION HEALTH ANALYTICS

In order to join forces on population health efforts, both parties have to be able to share data effectively. For the past 25 years, much of the shared effort around health information has been targeted at connectivity. From community health information networks, to regional health information organizations, to health information exchanges, many labored and few succeeded in connecting all the dots in any given community. One result of this overall failure has been the need for individual enterprises in health care and individual programs in public health to build their own means of connecting or sharing data.

As the term "analytics" becomes ubiquitous, we are realizing two things: that business intelligence is valuable, and that our long-standing connectivity challenges are going to be solved. Plenty of challenges remain, but the prognosis for widespread, low-cost health information exchange has never been better. The emergence of standards, the proliferation of applications and databases, the presence of new solution providers, and the strengthening of the underlying business case for health information sharing all offer cause for optimism.

This convergence has two important implications for public health. First, public health professionals should aggressively seek opportunities with industry to apply their significant expertise in analyzing population health data. Second, public health programs that have invested in narrowly focused custom information systems should embrace broader-based connectivity solutions. As connectivity becomes more of a commodity, public health can use funds wisely by avoiding one-off connections.

STORYTELLING CONVERGING WITH DATA SCIENCE

We usually think of population health analytics as the exclusive domain of "quants"—number crunchers and tech geeks. But a list of analytics predictions for 2015 from the International Institute for Analytics (IIA) cited storytelling as the hot new job in analytics, a job described as "analytics journalists."

This is another area of convergence between public health and health care. We all tend to do a much better job of compiling data than explaining it in compelling ways. For the public to get behind what we do, they need to understand it—for them to understand it, we need to tell the story of why it's important and how it will make a difference in people's lives.

As the population health opportunity grows and access to data becomes easier, we shouldn't lose sight of that final step; where the interpretation, communication, and a call to action take place. "Analytics journalism" has the ring to it. Wouldn't it be great to blend the talents of the quants and the storytellers to better serve the public and the industry?

So, here is my final takeaway: leaving the comfort zone for the convergence zone won't be easy or painless for public health, but the benefits can be significant, and the first movers will gain advantage. ◆

Rick Rubin is the CEO of OneHealthPort, a collaborative health information services company. With 35-plus years in the health care industry, Rubin has an in-depth understanding of multiple market perspectives, shared health information needs, and policy level concerns.

MAPPING BIG DATA ON A SMALL BUDGET

Oregon public health researchers use drivers license data to map obesity to social determinants of health.

BY MICHAEL MCCARTHY

In 2009, Daniel Morris was working on health promotion and chronic disease prevention for the Oregon Health Authority's Public Health Division. At the time, the division wanted to do more to address the rising rate of obesity in the state, but there was little funding available.

"One approach to take when funding becomes an issue is to collect data, make do with the data that are available, and use those data to make your case for funding," said Morris.

The data that were readily available to Morris were collected by the Behavioral Risk Factor Surveillance System (BRFSS), an ongoing telephone survey conducted by the US Centers for Disease Control and Prevention that tracks the prevalence of smoking, alcohol use, physical inactivity, diet, and other behaviors that increase the risk of disease. While BRFSS provides useful statewide data, it was not designed to provide effective data at the county level, let alone at the neighborhood level.

"Unfortunately, the BRFSS data can't tell you where in your community you should target your efforts," said Morris.

Since the division lacked funding, it could not collect such data on its own. But when Morris heard about two researchers at the University of Utah, Ken Smith and Cathleen Zick, who had used data from drivers' licenses to look at obesity rates in Salt Lake County, he thought it was a brilliant idea.

Both state and federal law allow government agencies to use Department of Motor Vehicle (DMV) records for government purposes. For less than $1,000, Morris obtained nearly four million anonymized DMV records for licenses and identification cards issued or renewed by the DMV between 2003 and 2010.

The anonymized data fields included home address with zip code, date of birth, sex, height, weight, and the date of card issue. "Drivers license data are an inch deep, but a mile wide," said Morris. "DMV does not provide demographic data about race and ethnicity, but it's enough to get started."

Initially, some were skeptical about the quality of the data since people often lie about their weight on their drivers licenses. "However, people fudge their weight on the telephone surveys, too," said Morris. In fact, Morris found that men underreport their weight by about two percent, and women by about five percent. "When you average these hundreds of thousands of people together, the geographic patterns hold true, so the data are very good for guiding local decision making."

Morris and his colleagues at the Environmental Public Health Tracking Program geocoded the addresses and then determined the average body mass index (BMI) for individual counties, census tracts, and census block groups. They also aggregated the data so that it could be displayed in 0.25 square mile blocks, which created a high-resolution grid that covered the entire state.

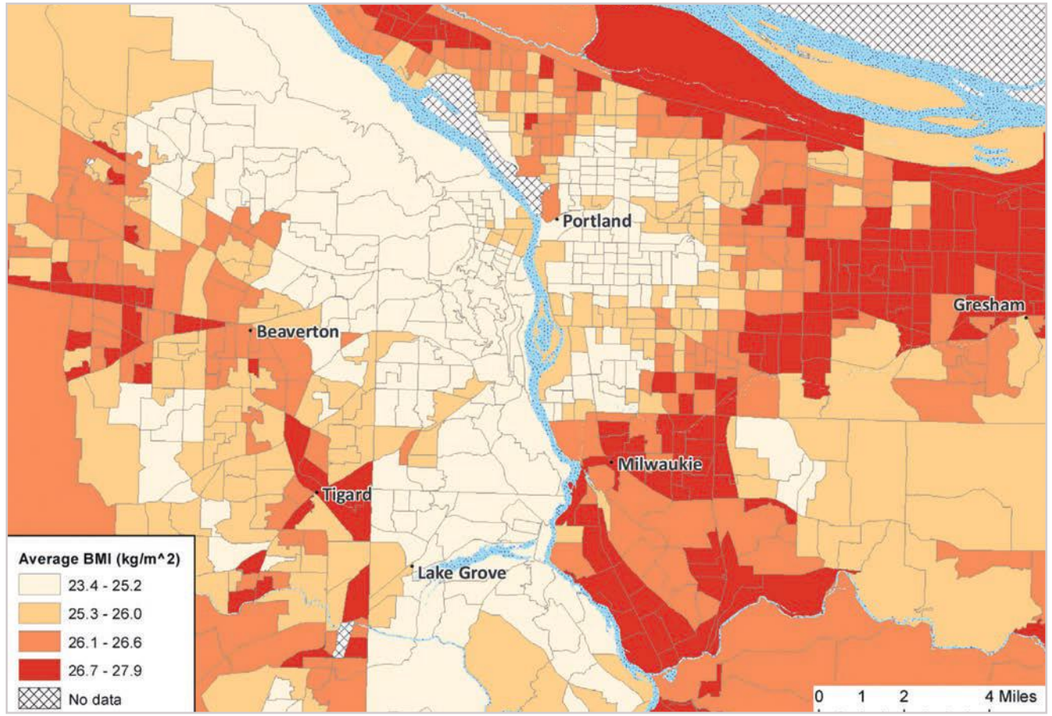
"With a relatively modest investment, we increased the resolution of our maps by about 10,000 times," said Morris. "Before, we only had resolution at the county level, and because Oregon has 36 counties, we only had a 36 pixel map. With the DMV data, we jumped to maps with hundreds of thousands of pixels."

This was the level of resolution needed to tell the story of two Oregon communities: the neighborhood of Rockwood and the city of Corvallis.

Rockwood is a racially and ethnically diverse, low-income neighborhood east of downtown Portland, Oregon. After a preliminary survey found high levels of food insecurity in the neighborhood, the Ecumenical Ministries of Oregon—a statewide association of religious groups that engages in public policy issues—conducted a Community Food Security Assessment to define the barriers to healthy foods. Monica Cuneo, who worked at the Oregon Public Health Institute at the time, helped the Ministries synthesize their findings and go one step further.

Cuneo combined data from the assessment with geocoded data available through an online tool created by the Coalition for a Livable Future—known as the Regional Equity Atlas.

"The combination of these two sources really amplified each other," said Cuneo. While the assessment told a very compelling story, the Atlas allowed people to see Rockwood in context with Portland, the county, and even the Portland-Vancouver metro region.



MAP DISPLAYING THE AGE-ADJUSTED MEAN BMI BY CENSUS BLOCK GROUP OF THE PORTLAND METROPOLITAN AREA CREATED FROM DMV RECORDS.

Among the Atlas's resources were geocoded BMI data drawn from the DMV data prepared by Morris and his colleagues. "The BMI maps made it possible to ask questions about the relationships between high BMI and access to grocery stores, parks, and other resources," said Cuneo. "We could then identify the communities, neighborhoods, and even the blocks where the needs are the greatest."

Just a few hours down the road in the city of Corvallis, Kathleen Johnson was working with Benton County Health Services to determine the community impact of different highway speed limits. A four-lane highway cut down the middle of South Corvallis, separating many residents from schools, stores, and other community resources. The highway also made walking and biking difficult. Part of the assessment identified where low-income, Latino, elderly, and other vulnerable members of the community lived in relation to the highway and community resources, and their overall health status.

"People working on the project had a strong hunch from studies that the neighborhoods in town with lower socioeconomic status and more diversity would have higher average BMI," said Johnson. However, they needed more concrete data to go with the anecdotal information. "The DMV BMI data proved what we had suspected," said Johnson.

The stories of Corvallis and Rockwood are just a few among many. According to Morris, the DMV BMI data have correlated so well with other studies linking BMI to the social determinants of health—such as poverty, low educational attainment, and minority status—that DMV BMI maps may prove to be better indicators of the socioeconomic status of communities and neighborhoods than other measures commonly used.

"One of the challenges of obesity prevention efforts is that people have a mistaken belief that it's all about personal agency and choice; if people worked harder, ate healthier, and made better decisions, they wouldn't have this problem. But I think it's hard to look at these maps and not think obesity has a lot to do with the places that poor people live."

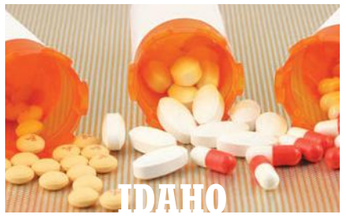
The Oregon researchers hope to use the DMV data to track trends in obesity over time by looking for associations between household location and distance to food, alcohol, tobacco retailers, and access to parks and recreational facilities. ◆

Regional Roundup

Informing Alaskans Through Data Visualizations

State, regional, and community health data are more readily accessible to Alaskan health organizations, health providers, and policy makers thanks to a state-wide data visualization initiative known as Informed Alaskans. The initiative includes a web-based data dissemination system called the Alaska Indicator-Based Information System for Public Health (AK-IBIS), and a geographic information system using InstantAtlas™.

Users have access to health information in both graphic and text formats. By combining descriptive profiles matched by a suite of maps, tables, and charts, users can access health data through an intuitive, informative, and interactive interface. Visual indicators of color, size, location, and direction augment numerical and categorical data to help understand health risks, disparities, and disease prevalence in Alaska.



Health Data Exchange Helps Reduce Prescription Drug Fraud

Prescription drug overdose is a huge public health issue; many who become addicted to prescription opioids later become addicted to heroin.

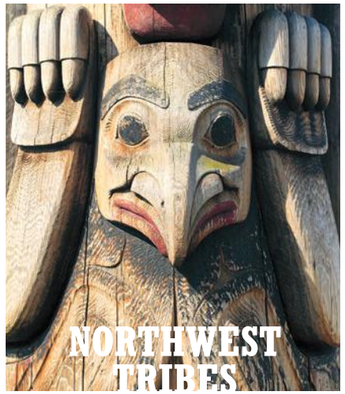
The Idaho Health Data Exchange (IHDE) is helping combat this epidemic by providing licensed providers and other medical staff who treat patients access to patient electronic health records. By accessing clinical data through the IHDE, health care providers now have a more comprehensive view of a patient's records and prescription history, making it less likely for a patient to be given an inappropriate prescription, and reducing a patient's ability to go "doctor shopping."

The IHDE is a key part of Idaho's state innovation model testing grant, a $39.6 million award from the federal Center for Medicare & Medicaid Innovation.

Standardizing Indicator Benchmarks for Cardiac Rehab Programs

Since 2006, the Montana Cardiovascular Health Program has collected data for more than 120 cardiac rehabilitation programs in 20 different states. With data for more than 12,000 patients, the program has standardized indicator benchmarks so that individual programs can compare their data to that of the entire group. As the only agency conducting cardiac rehabilitation surveillance, the program aims to use the data to drive quality improvement projects that result in improved patient care.

The program is having a direct impact on the Million Heart's "ABCS of Heart Health." In fact, 95% of patients take aspirin as directed, 92% have their blood pressure in control, 73% have their LDL at goal (LDL <100). Smoking rates decreased from 12% upon entry to 4% post cardiac rehab. Additionally, 69% of the smokers were referred to smoking cessation programs.



Correcting Race Data for American Indians and Alaska Natives

American Indians and Alaska Natives (AI/AN) in the Pacific Northwest have a life expectancy that is 6.9 years shorter than non-Hispanic whites. This sobering statistic would have been underestimated by about two years if AI/AN racial misclassification had not been corrected in death certificates from Idaho, Oregon, and Washington. In the Northwest, AI/AN racial misclassification can range from 30-60% in vital statistics and other public health datasets.

Through the Improving Data and Enhancing Access (IDEA-NW) Project, the Northwest Tribal Epidemiology Center corrects inaccurate race data for AI/AN through record linkages with state-level public health surveillance data systems, including cancer registries, hospital discharge systems, trauma registries, vital statistics and STD/HIV systems. The goal is to increase availability of accurate health status data for Northwest tribal communities to support decision-making and efforts to eliminate health disparities. This project serves the 43 federally recognized tribes in the states of Idaho, Oregon, and Washington.

Projecting the Health Benefits of Active Transportation

The Oregon Health Authority in collaboration with Metro, the regional government, used the Integrated Transport and Health Impact Model (ITHIM) tool to project significant reductions in chronic diseases through increased physical activity, better air quality, and fewer injuries and fatalities from traffic crashes. The tool synthesized data from sources such as vital statistics records, regional household travel surveys, regional air quality monitoring and modeling, and Oregon traffic fatality and severe injury crashes.

By considering ITHIM's output data alongside data about economic and demographic impacts, the agencies developed a transportation and land use strategy. The Metro Council adopted this strategy in December, 2014, which could save the region $100–$125 million annually from reduced illnesses, and prevent 126 premature deaths annually by 2035.

Evaluating Healthier Washington

Washington State received a four-year, $65 million grant from the federal Center for Medicare & Medicaid Innovation to support the Healthier Washington project.

Developed through a collaboration of state leaders, community members, legislators, and health care systems, Healthier Washington aims to emphasize health care value over volume, save the state a billion dollars in health care costs, and accelerate the state's culture of innovation.

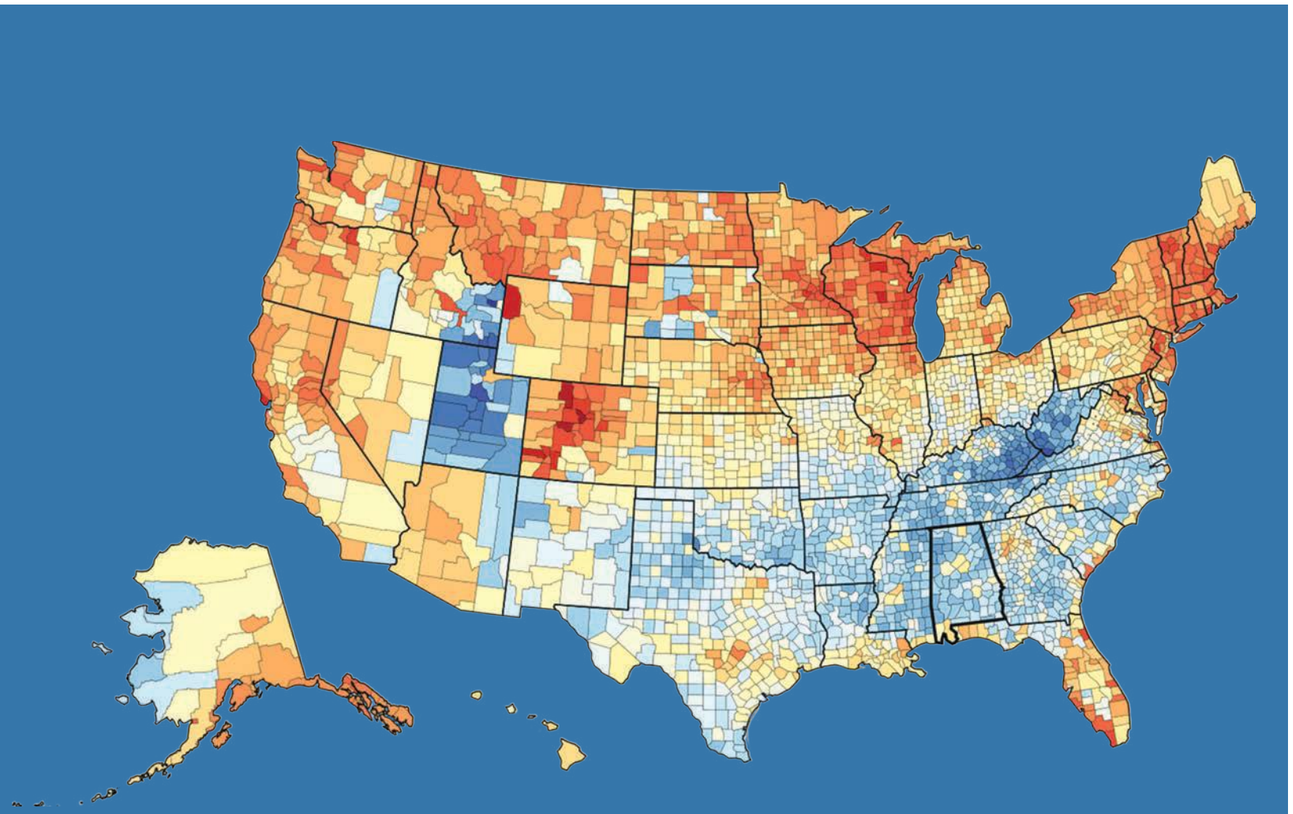
The University of Washington (UW) School of Public Health will play a key role in evaluating its success. The team, led by Douglas Conrad and co-principal investigator Tao Sheng Kwan-Gett, will use qualitative and quantitative methods to assess impact. Group Health Research Institute, the Institute for Health Metrics and Evaluation, state agency experts, and UW graduate students will also collaborate with the team.

App Connects Medicaid Clients to Health Services

In Wyoming, more than 40% of pregnancy-related health care costs are paid by Medicaid. WYhealth Due Date Plus, a phone application launched by Wyoming Medicaid and Wildflower Health, provides vital health advice and access to health care services. Users can track pregnancy milestones, use a weight gain calculator, get information on risk factors for pregnancy complications, and be referred to a free 24/7 call center staffed by nurses. Medicaid clients can also get in touch with local public health offices, which offer home visits and other key health services for pregnant women.

"The Due Date Plus app will allow us to support pregnant women, while also helping reduce pregnancy complications such as early delivery, low birth weight and C-sections, and hospital re-admissions," said James Bush, Medicaid Medical Director at Wyoming Department of Health.

PHOTOS: ANDREA HAMBERG AND THE MONTANA CARDIOVASCULAR HEALTH PROGRAM.



THE IHME WEBSITE CAN GENERATE MAPS WITH COUNTY-LEVEL HEALTH DATA COLOR CODED BY INDICATORS SUCH AS LIFE EXPECTANCY, HYPERTENSION, OBESITY, PHYSICAL ACTIVITY, POVERTY, SMOKING, AND ALCOHOL USE (VIZHUB.HEALTHDATA.ORG/US-HEALTH-MAP).

TRANSFORMING DATA INTO ACTION

How can a $65 million partnership and a research center known for visual data and global metrics change how we use health data?

BY DEBORAH GARDNER

The Institute for Health Metrics and Evaluation (IHME), an independent research center at the University of Washington (UW), is no stranger to the global health spotlight. The center is renowned for leading the Global Burden of Disease Study (GBD). However, some people are surprised to learn of the institute's domestic focus. To Ali Mokdad, UW Professor of Global Health and leader of IHME's survey and surveillance work, such surprise is baffling.

"The US is part of the globe, and IHME works in every country, including the United States," he said. And with an extensive statewide project on the health reform horizon, IHME and its partners have an interest in analyzing local health metrics in Washington State.

In December 2014, the Center for Medicare & Medicaid Innovation awarded Washington State a $65 million four-year grant to implement Healthier Washington, a collaborative project to achieve what's often called the Triple Aim: better health, better care, and lower costs. Healthier Washington uses three strategies: changing how payment for health services works, focusing health care on the "whole person," and using regional collaboration to improve local health care.

"The Washington Health Care Authority (HCA) is the lead agency, but the project is a partnership," said Laura Zaichkin, Administrator of the Office of Health Innovation and Reform at HCA. Partners include the Department of Social and Health Services (DSHS), Washington State Department of Health (DOH), Office of Governor Jay Inslee, a leadership network of more than 50 stakeholders, and groups focused on investment areas.

DOH and HCA will lead a group developing the Plan for Improving Population Health. There will be a Practice Transformation Support Hub offering technical assistance for providers. Partners such as IHME will be instrumental for data analytics. The Northwest Center for Public Health Practice and faculty in the UW Department of Health Services will collaborate with Group Health Research Institute (GHRI) to evaluate Healthier Washington.

"There's a lot of potential here; I love this collaboration," said Mokdad about the broad coalition of partners, each with different expertise.

Healthier Washington will amplify successful approaches already being used by organizations recognized for innovation, such as IHME, GHRI, and the Research and Data Analysis Division of DSHS. Doing this involves recognizing that "health is more than health care," said Zaichkin. "In practice this means taking a systemic approach with Healthier Washington and investing in multiple interdependent areas to improve population health."

During 2015, stakeholders will gather to shape the work of the subsequent three years. That planning year is an "opportunity for stakeholders to design something that's going to work for Washington," said Sue Grinnell, Special Assistant, Health Transformation and Innovation at DOH. One investment area includes developing regional Accountable Communities of Health (ACH) to encourage local collaboration between entities working on health and social services. Another is data mapping and analysis to yield accessible and usable data.

Will Big Data transform health in Washington State? Mokdad has a different view. "Big Data is a big buzzword right now," said Mokdad. "Everyone says Big Data is going to make a big difference. But the data per se never make a difference in life. It's how you analyze that data and how you get the message out."

Clear data communication has helped IHME highlight health disparities. IHME Director Chris Murray has long been interested in US disparities, especially at the county level. In 2006, he published a report in PLOS Medicine called "Eight Americas: Investigating Mortality Disparities across Races, Counties, and Race-Counties in the United States." The researchers found life expectancy disparities across the US that were staggering by international standards.

The ability to assess county-level health puts IHME in a unique place to measure health metrics. With a grant from the Robert Wood Johnson Foundation, IHME is piloting an effort to apply its GBD methods to the county level and—in large, dense cities such as Seattle—at the neighborhood level. As it did with the GBD project, IHME will create data visualizations about the results.

Data visualization is an IHME specialty. IHME shares visualizations and methods publically to present data usably for scientists, the general public, and policy makers. IHME's experience doing this is a boon to Healthier Washington, given IHME's ability to create powerful visualizations from combined statewide data.

For Healthier Washington, linking separate data systems begins with inventorying and connecting existing data sources from DOH, DSHS, HCA, the Department of Early Learning, and other entities across the state. Combining these sources creates "a lot of possibility to look at health in a different way," said Grinnell. According to Zaichkin, "The partnership also hopes to integrate with other data sources in areas such as housing, education, poverty, employment, and other areas of life that affect health." Linking existing data will give a fuller picture of health in Washington.

Data mapping and integration will improve accuracy and yield population health information advocates can use. The public may find access to local data empowering. Since meaningful change often starts at the community level, regionally specific data can inspire communities to address health outcomes where they live.

Reaching audiences is part of what Mokdad sees as data's real purpose: action. "Simplified data can influence policy and build political will. At its best, such data can enable decision makers, practitioners, and the public to understand what each needs to do in order to achieve better health and to reduce the burden of disease," he said. Data integration and visualization can yield population health projections useful for public health and medical professionals.

"Big Data is a means to do something, but not really the solution," said Mokdad. "It's not Big Data that's so special, it's the analysis of Big Data." Turning analysis into action is something Healthier Washington hopes to sustain in the years to come. ◆

Close Up
with Daniela Witten

Daniela Witten is an Associate Professor in the Department of Biostatistics at the UW School of Public Health. Featured three times on Forbes' 30 Under 30 list, she develops statistical machine learning methods for analyzing large-scale data from biology and other fields.

Q. Tell us about your research. What excites you most about your work?

In the last 15 years, the field of biology has been transformed by new technologies that make it possible to get a detailed molecular snapshot of what's happening within a tissue sample or even a single cell. Now so-called "omic" data (genomic, proteomic, transcriptomic, metabolomic) can be collected relatively inexpensively, and research labs all over the US and the world are generating huge data sets.

Unfortunately, the statistical methods needed to analyze these large-scale data sets have lagged behind the experimental techniques used to generate the data. Basically, the problem is that modern biological data are very high-dimensional; the number of measurements is typically orders of magnitudes larger than the number of observations.

For instance, one might measure three billion DNA nucleotides in each of 300 patients. High-dimensional data leads to a "needle in the haystack" problem—or in statistical terms, a tendency toward overfitting and false positives. In contrast, "classical statistics" deals with the much simpler low-dimensional setting, in which there are many more observations than measurements.

My research involves developing methods to make sense of high-dimensional data. I use ideas from classical statistics, convex optimization, and machine learning in order to develop computationally efficient and statistically rigorous techniques for biological data analysis.

My work is very interdisciplinary, which means I get to collaborate with a lot of researchers in other fields and often get to think about new and interesting problems.

Q. What impacts do you foresee your research having in public health and other fields?

The promise of modern biomedical research is to translate new technologies, such as inexpensive DNA sequencing, "from bench to bedside." So far, this promise has not been fully realized, in part due to statistical challenges associated with this type of data. I hope that my research will contribute to the development of clinical applications for omics data, and to a better understanding of human disease.

Q. Some people don't fully understand what Big Data is and are skeptical of its potential. Why do you think that is?

There's been a lot of hype in the media about Big Data, and of course that engenders some skepticism. Some of this skepticism is warranted—Big Data has been around in biology for more than 10 years, and the results so far (in terms of translation to the clinic) have been somewhat limited. But a lot of this is due to the fact that the scientific community is still grappling with fundamental issues, such as best practices for experimental design and analysis of Big Data. I'm confident that we will start to see more positive results as the dust settles.

Q. Diversity in the high tech industry and public health are at opposite ends of the spectrum. For example, enrollment at the UW School of Public Health is 72% women, while men make up the majority of the high tech workforce. What are your thoughts on how diversity shapes the outcomes and developments in areas such as the high tech industry and fields such as public health?

It is wonderful to see so many women in public health. I hope that in the future, we will begin to see more women in statistics as well, and in related fields such as math and computer science. These fields are of growing importance given the ubiquity of large-scale data across a number of fields, and there is a lot of potential to make an impact in public health (and in other areas too).

Q. What advice would you give to students and those who are beginning their careers? What kinds of data-related issues would you encourage them to explore and improve upon?

I got into statistics because I wanted to develop a broad skill set that can be applied to a lot of different problems over the course of my career. I encourage students and those beginning their careers to take some courses in math, statistics, and computer science. Even if you decide not to pursue a PhD in one of those areas, I am confident that those skills will serve you well in your future endeavors!

GENOMICS & LATINO HEALTH

A University of Washington project seeks to understand the role of genetics in the health of Latino communities.

BY MICHAEL MCCARTHY

Researchers at the University of Washington (UW) are participating in an ambitious effort to find out what role genes play in Latino health. The program, called the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), is part of a national effort to determine how culture, environment, and genetics affect the health of Latino Americans.

Launched in 2006 by the National Heart, Lung, and Blood Institute, the study has enrolled 16,000 Latinos selected from a random sample of residents of communities in the Bronx, Chicago, Miami, and San Diego.

The sample selection process was designed to include at least 2,000 people who identified their origins as coming from one of six geographic areas: Mexico, Puerto Rico, the Dominican Republic, Cuba, Central America, and South America.

The goal of the study is to assess the current health status of Latinos, track the health effects of immigration and the adoption of mainstream US lifestyles, and identify the genetic, environmental, and socioeconomic factors affecting their health.

Upon enrollment, participants went through in-depth health assessments including a detailed medical and family health history, a physical exam, and testing to evaluate heart, lung, endocrine, and neurocognitive function. Laboratory tests included the collection of each participant's DNA.

Participants also filled out questionnaires about their education, occupation, income, diet and level of physical activity, as well as a number of questions designed to determine the degree to which they had adopted a mainstream American lifestyle. The participants continue to be followed with a yearly interview to track their development and health.

The UW is home to the HCHS/SOL Genetics Analysis Center (GAC), which is helping to identify variations in the participants' DNA that might help explain their susceptibility to diabetes, high blood pressure, heart disease, and other conditions. The HCHS/SOL researchers are examining approximately 2.5 million sites in the participant's DNA sequences to try and identify genetic variants that may be associated with different conditions, diseases, and traits.

The UW team, led by Bruce Weir, a Professor in the Department of Biostatistics, and Cathy Laurie, a Senior Principal Research Scientist also in Biostatistics, are using these 2.5 million genetic variants along with publicly available genomic datasets to look for additional variants that may also be associated with diseases and traits of interest.

"It's called 'in silico' genotyping because it is done using computers," said Sarah Nelson, a Research Scientist working on the UW project who is also a doctoral student at the UW Institute for Public Health Genetics. "It is quicker and far less expensive than genotyping in the laboratory."

Using this approach, the UW team was able to expand the number of variants by ten-fold—to 25 million variants that researchers can use to study whether they are associated with certain diseases and conditions. These potential associations could provide insight on why some diseases are more or less common among Latinos and ideally help identify effective strategies to prevent and treat disease.

Part of the UW GAC's mission is to facilitate more than 15 working groups, each of which is looking for genetic variants associated with different conditions, such as high blood pressure, high cholesterol, and dental disease. This work is still in progress, but early results suggest that the same genetic variants associated with disease in Western European populations are often the same as those seen in the Latino samples. However, they are also finding new variants that have not been identified before, whose importance will be the focus of future research.

Researchers hope that the data collected as part of the HCHS/SOL study will answer a number of questions. Why, for example, compared to non-Hispanic whites, are stomach and liver cancer more common among Latinos but prostate and breast cancer less common? Is there a "thrifty gene" that makes some Latinos more likely to develop diabetes when they adopt the high-calorie, high-fat "American" diet? And why do low-income Latinos tend to be healthier than higher-income non-Hispanic whites who typically enjoy better living conditions and easier access to medical care—a phenomenon known as the "Hispanic paradox?"

Sorting out the role genetics plays in Latino health is important, according to Stephanie Malia Fullerton, an Associate Professor in the UW Department of Bioethics and Humanities who studies the ethical and social implications of genomics research in racial and ethnic minority communities. "Genomics is going to play an increasing role in the practice of medicine and until very recently, most genomics research has focused on populations of Western European origins," said Fullerton. "But we should recognize that compared to the effect that personal behavior, lifestyle, and socioeconomic factors have on health, the effects of most of the genetic factors identified by this kind of research are likely to be modest."

India J. Ornelas, an Assistant Professor in the UW School of Public Health with a special interest in health disparities in Latino and immigrant populations, agrees. "It is always important to understand the biological determinants of health, such as genetics, but these biological factors always interact with environmental factors such as diet, economics, and in the case of many Hispanics, the stress of immigration. The great strength of this project is the collection of cultural and socioeconomic data in addition to this genetic information," said Ornelas. "This will allow us to better understand how these biological and environmental factors interact." ◆

School of Public Health: Making a Difference

Creating healthier communities is the aim of the research, teaching, and service at the University of Washington School of Public Health. Here is a sampling of the School's local, national, and global impact. For a comprehensive list of stories, visit: http://sph.washington.edu/news/archive.asp.

FOOD SAFETY SPENDING LINKED TO RATE OF ILLNESS

Higher spending on food safety measures was linked to lower rates of foodborne illness, according to recent study led by Betty Bekemeier, Associate Professor of Nursing and Adjunct Associate Professor of Health Services.

The study, published in the American Journal of Public Health, measured and analyzed incidence rates of intestinal disease in all 35 local health districts in Washington State and in 36 local health districts in New York State. By comparing the health districts' spending on food safety and sanitation, researchers found those with higher spending had fewer cases of certain food-related illnesses in their populations.

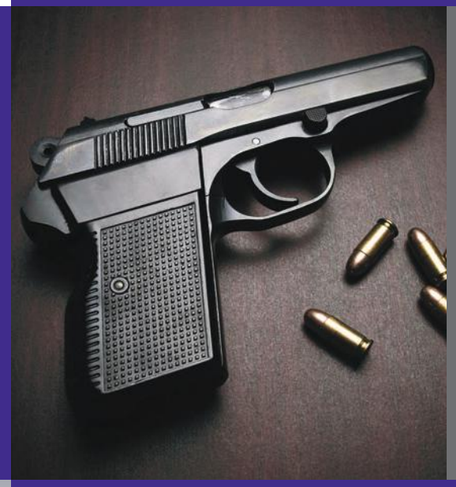
"This study shows how important it is to collect good data that link public health expenditures and outcomes," said NWCPHP Director Tao Sheng Kwan-Gett. "One of our main goals is to show policy makers that investing in public health yields a good ROI (return on investment)."

A NOVEL METHOD TO SCREEN CHEMICALS' TOXICITY

Tens of thousands of chemicals are currently in use, with more being introduced every year. However, because traditional testing methods are time-and cost-prohibitive, scientists have discerned toxicity to human health for only a fraction.

A new Predictive Toxicology Center at UW will allow researchers to develop more accurate in vitro models—organ-mimicking cell cultures. These will allow testing of chemicals for their potential risk to humans and help accelerate the evaluation of large numbers of chemicals. Professors Elaine Faustman and Terrance Kavanagh in the Department of Environmental and Occupational Health Sciences will co-direct the new center, which is part of the Institute for Risk Analysis and Risk Communication.

"We are proud to invest in building a new, three-dimensional way of looking at how toxic chemicals affect people and all living things," said Michelle Pirzadeh, Deputy Regional Administrator for the Environmental Protection Agency, Region 10.



GUNSHOT VICTIMS AT RISK FOR FUTURE HARM

People injured by gunshot wounds in Washington State are at far greater risk of returning to the hospital with ensuing firearm-related injuries, according to a study led by Ali Rowhani-Rahbar, Assistant Professor of Epidemiology.

Rowhani-Rahbar and colleagues from the School of Public Health and Harborview Injury Prevention and Research Center identified nearly 700 trauma patients with gunshot injuries and tracked them over six years using hospital and arrest records. They also followed 70,000 patients hospitalized for non-firearm injuries.

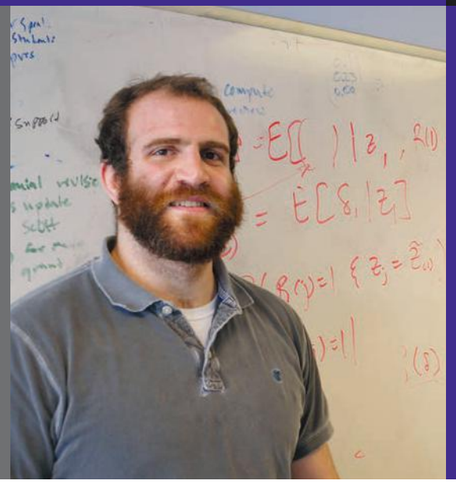
The findings show that gunshot survivors were four times more likely than other patients to die from firearms, and 21 times more likely to be hospitalized for a subsequent gun injury. Researchers will evaluate interventions next to see what is most effective in reducing repeat violence and crime affecting those hospitalized for gun injuries.

USING OPEN-SOURCE SOFTWARE TO STUDY DISEASES

Noah Simon, an Assistant Professor of Biostatistics, is developing open-source software that could help other scientists better understand diseases. He was recently named to Forbes' 30 Under 30 List of top young scientists for 2015, and his work could ultimately lead to more targeted therapies and better personalized medicine.

"Personalized medicine means assaying lots of genetic and genomic features and trying to use (that information) in treatment decisions," said Simon. "We've come to realize that diseases we previously thought were very uniform are actually very diverse collections."

According to Forbes, Simon's algorithms are being used to "characterize the biology behind Crohn's disease, rheumatoid arthritis, and various cancers." The potential patterns found in genetic mutations and gene expression could help explain what causes the disease.

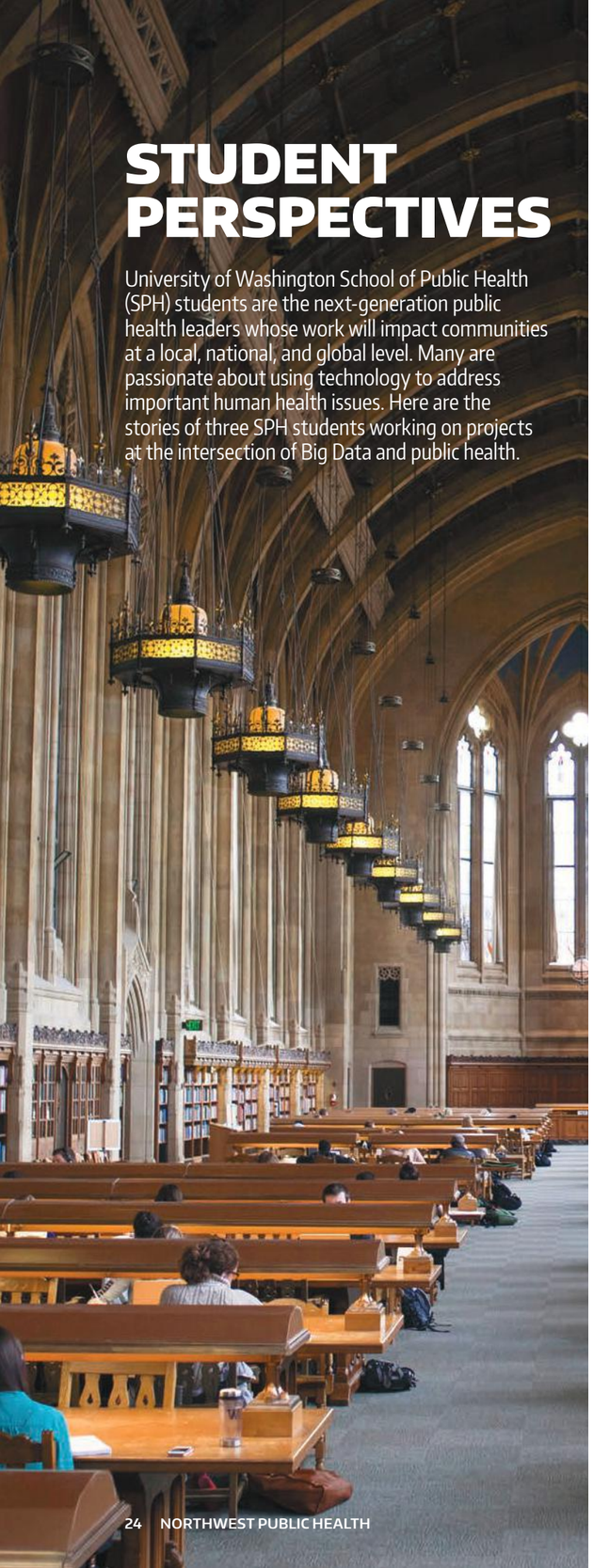


BRINGING E-LEARNING TO LOW-RESOURCE SETTINGS

The UW Global Health Department E-learning Program (eDGH) is paving the way to use distance-learning technologies to deliver much-needed training and classes to low-resource settings. These e-learning activities are being conducted in more than 30 countries, and include online offerings of Global Health courses along with a variety of e-learning training products developed for international health training programs. Its largest course, Leadership and Management in Health, reached nearly 1,000 students globally in 2015. eDGH is co-led by Associate Professors Ann Downer and Michael Chung.

Downer, also the founding Director for Global Health's International Training and Education Center for Health (I-TECH), was recently named winner of the UW's 2015 Distinguished Contributions to Lifelong Learning Award. "I believe in the power of education to change the world, and I consider teaching and learning to be acts of personal and social transformation," Downer said. "In some parts of the world, promoting the right to education is even a revolutionary act."

PHOTO: LAUREN DUNNINGTON



STUDENT PERSPECTIVES

University of Washington School of Public Health (SPH) students are the next-generation public health leaders whose work will impact communities at a local, national, and global level. Many are passionate about using technology to address important human health issues. Here are the stories of three SPH students working on projects at the intersection of Big Data and public health.

SALONI PARIKH

UNDERGRADUATE STUDENT, PUBLIC HEALTH AND COMPUTER SCIENCE

Throughout Saloni Parikh's public health coursework, professors have presented countless statistics on the prevalence, incidence, mortality, and morbidity of specific diseases. While these statistics are often surprising, Parikh finds the process of collecting, organizing, and analyzing these numbers even more intriguing. "I am fascinated how technology can be used to improve the lives of underserved populations and prevent disease," said Parikh.

As an Undergraduate Research Assistant in the UW Information and Communication Technologies Development (ICTD) Lab, she works on open-source mobile data collection tools to collect clinical information, and communicate public health messages to patients. Parikh designed and implemented a custom Open Data Kit (ODK) Android application for the HOPE Study, a randomized control trial of home-based HIV testing and counseling for partners of pregnant women in western Kenya. The app allows community health workers to screen patients for eligibility, follow up with the study participants, and collect GPS data for home visits.

"Working on open-source mobile data collection tools to collect and visualize data in real-time has compelled me to see data as a powerful tool for prediction, and an opportunity for innovation," said Parikh.

Parikh's undergraduate research experiences have driven her to find further applications of technology in global health. She hopes to have more opportunities to travel and deploy tools to improve health services in low resource areas. "Understanding the impact of technological interventions on specific communities can perhaps lead to more solutions for public health issues," said Parikh. Her goal is to continue designing and developing technologies that make data collection, aggregation, and analysis easier in clinical settings. She plans to pursue graduate studies in Computer Science with a focus on ICTD.

DR. COURTNEY D. CORLEY

MASTER'S STUDENT, GLOBAL HEALTH

As a Senior Data Scientist for the Pacific Northwest National Laboratory (PNNL), Courtney D. Corley develops methods to use Big Data analytics to improve how communities detect and respond to health threats. His interests include using mathematical modeling and social media data to enhance public health systems for early warning and situational awareness.

During graduate school, Corley investigated the interplay between social media, vaccine hesitancy, and disease with regards to the human papilloma virus vaccine that was in trials back then.

"It was fascinating to build models that could inform various vaccine policies, and then link that with public sentiment regarding vaccination towards the virus that causes a vast majority of cervical cancers," said Corley.

Since then, Corley has tried to obtain as much data as possible to understand the dynamics of disease, and to pursue new methods for disease surveillance, including proteomics to blogs and health surveillance data (ICD-9 codes). At PNNL, Corley works with datasets that are hundreds of terabytes and contain tens of billions of records.

"Ultimately, what drives my research is answering the question of what insights can be gained by looking at data in a different way," said Corley.

A tremendous amount of work investigating ways to use novel data sources for public health is already underway, and Corley hopes this trend continues. His goal is to pursue the question of how to impact public health outcomes and outbreak management using novel data sources. "This is a much harder problem to solve and I believe it will take a lot of bright people to help," said Corley.

NATASHA CLOSE

PHD STUDENT, EPIDEMIOLOGY

As a Surveillance Epidemiologist in the Office of Communicable Disease Epidemiology at the Washington State Department of Health, Natasha Close coordinates efforts to collect real-time electronic health record data from hospitals and clinics for the purposes of syndromic surveillance. As part of her job, Close has a variety of responsibilities that include data analysis and strategic planning.

"I have used syndromic surveillance to monitor influenza and emerging diseases, identify health effects related to poor air quality during wildfire season, and to conduct all-hazards surveillance during large events (e.g., the Super Bowl, 2010 Vancouver Olympics)," said Close.

While traditional notifiable disease reports provide public health with important information for disease control, they provide information on a very limited number of conditions. With the increasing use of personal electronics, there is a wealth of information available in near real-time that could allow for surveillance of a wide variety of infectious and non-infectious conditions.

"Since these sources of information often involve large amounts of 'messy' data, new tools and approaches are needed to take advantage of this information," said Close. "These typically include development of novel analytics and visualizations." Close enjoys this intersection of technology and public health, and believes that advancement in this area is crucial to conduct modern day disease surveillance.

Close hopes to continue to expand public health's use of Big Data by developing, refining, and validating appropriate methods for analysis. "I also hope to demonstrate the value of Big Data in public health by applying such methodology to provide timely and otherwise unavailable surveillance information during real-world events," said Close.

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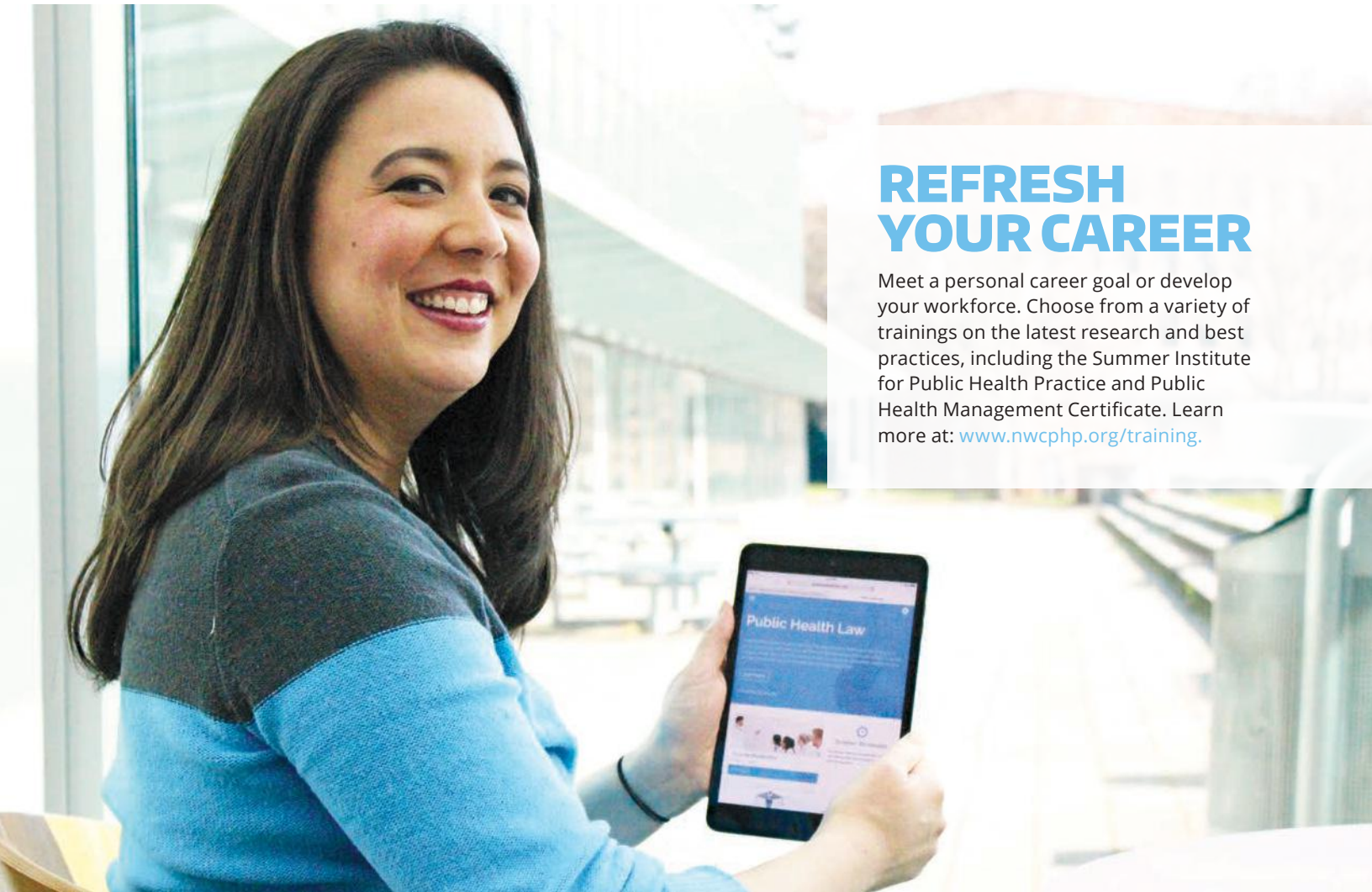

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