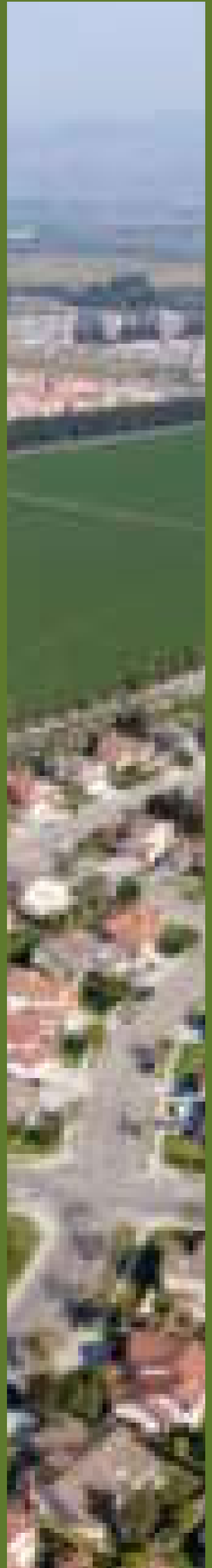

Keeping Track, Promoting Health…

Connecting the Dots

In 2000, the Pew Environmental Health Commission detailed an "environmental health gap," a lack of basic information needed to document links between environmental hazards and chronic disease. The most common environmental health hazards are air and water pollution; asthma, cancer, and lead poisoning are the most frequent adverse health effects that concern Americans.

Without a tracking program, environmental causes of chronic diseases are hard to identify. Systematically measuring amounts of hazardous substances in our environment, tracing their geographic spread, seeing how they show up in human tissues, and understanding how they may cause illness would seem a wise precaution.

The National Environmental Public Health Tracking Program, developed by the Centers for Disease Control and Prevention (CDC), is the start of that system.

Over the last four years, CDC has laid the foundation of a national system to track environmental hazards and the diseases they cause, updating traditional medical detective work with computers, satellites, and geographic information systems.

The building blocks of that foundation included grants to state and local health departments. Health departments are often best placed to monitor hazards because they understand special local conditions that modify general environmental health risks. In addition to its pilot grants, CDC has collaborated with a number of other federal agencies, professional organizations, and civic groups to mobilize support for the Tracking Program.

The pilot programs and collaborations are not mere exercises, though. They have already begun to pay off in faster responses to environmental health questions and in action to prevent disease.

However, a full-fledged tracking program must do more than simply gather facts. It must connect data sources, provide the tools to make sense of them, and make that crucial information available to those who need it. To do just that, the CDC has been working intensely for the past several years to develop the National Environmental Public Health Tracking Network.

The Network, which will promote information system standards to integrate local, state, and national databases of environmental hazards, environmental exposures, and health effects, will be a crucial component of the National Environmental Public Health Tracking Program.

With the help of the National Environmental Public Health Tracking Network, scientists, communities, policymakers, and the public soon will have access to the information they need to make good decisions about preventing disease, keeping the American public healthy, and saving lives.

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Daniel Kass was thinking about bug spray, not only what it does to the bugs, but how too much of it can make people sick—affecting their nervous systems, poisoning children, harming fetuses, and causing other long-term effects.

Kass and his colleagues at the New York City Department of Health and Mental Hygiene wanted to know where and how pesticides were used in the city. What risks did they represent to city dwellers if wrongly used?

Fortunately, the health department had a new resource to help them find the answers—a pilot grant from the U.S. Centers for Disease Control and Prevention (CDC) to develop a pesticide tracking system for the city.

"Poison control center calls and hospital admissions can tell you about acute poisoning episodes, but there was no way to evaluate how widespread use and exposure to pesticides were," says Kass.

The grant was part of CDC's national effort to build an environmental public health tracking program, one that would eventually help public health and environmental health practitioners connect existing information and collect new data on numerous environmental hazards, their presence in humans, and their effects on health.

Using the CDC grant, Kass's team pulled together 15 sources of hazard and health outcome data from city and state health, finance, planning, housing, and environmental protection agencies. The sources ranged from pesticide sales and housing reports to birth records and hospital emergency room charts. They also drew from a city health survey that measured pesticide levels in residents' urine samples.

"We had to look at many different data, otherwise we wouldn't get a complete picture of the health impact of pesticides," Kass explained. "For instance, poison control data came mostly from residents calling about children exposed to rodenticide, while emergency room visits involved more serious exposures, and hospitalizations were overwhelmingly due to improperly used insecticides. Pesticide use data helped us make a connection with illness. Together, they gave us a better sense of what and where the problems were."

By adding questions to an existing telephone survey, the tracking program helped the health department warn vulnerable neighborhoods about illegal use of certain pesticides, set up a hotline for residents to report illegal sales, and learn more about safer pest control. The results also provided the science to back a city pesticide reduction ordinance.

"We wanted to rapidly apply our data to public health needs, so we aimed for something practical," says Kass. "We were phenomenally successful in making a difference at the local level, increasing awareness, reducing hazards, and improving health."

PROLOGUE

part one

On the Trail of Hazards to Health

Daniel Kass's high-tech approach to pesticide poisoning illustrates how connecting health and hazard information works to keep people healthy.

For the last four years, CDC has used similar programs to lay the foundations of a nationwide Environmental Public Health Tracking Program. When complete, the Tracking Program will pursue environmental hazards and the diseases they cause, complementing traditional medical detective work with computers, satellites, and geographic information systems. Even now, with only pilot projects completed, CDC's environmental public health tracking strategy has already proved its worth in preventing illness and addressing community concerns.

Public health workers have long been charged with looking for patterns of infectious diseases—who got sick, when, where, and how. When epidemics broke out, they traced diseases from infected patients back to where bacteria or viruses lurked. They identified the insects, the polluted water, or other sources of infection that caused or carried such infectious diseases as cholera, yellow fever, tuberculosis, and polio.

These dedicated public health workers also pushed for water purification, food inspection, and immunization to prevent illness. Antibiotics and other drugs kept people alive and reduced the risk of

epidemics. This combined attack was one of the great health triumphs of the last century, saving lives by the millions.

While that success has allowed us to live longer, healthier lives, it also brings new challenges to those who protect the health of our communities. Today, chronic illnesses—like birth defects, developmental disabilities, asthma, cancers, heart disease, and neurological diseases—are responsible for 70 percent of deaths in the United States and affect over 100 million men, women, and children, says Shelley Hearne, Dr.P.H., founding executive director of Trust for America's Health. These diseases cost our country more than $325 billion a year in health care and lost productivity and account for 60 percent of personal health care costs.

Harvard researchers estimate that 50,000 to 100,000 people die prematurely each year as a result of air pollution alone. Illnesses stemming from air pollution cost about $100 billion annually in the United States, according to the American Lung Association. The Environmental Protection Agency (EPA) estimates that reducing air pollution to levels required by the 1990 Clean Air Act Amendments will prevent more than 1.7 million asthma attacks.

Research shows a connection between our envi-

ronment and our health, but we still have a long way to go in understanding what links the two. We need better information and more sophisticated tools to understand the causes of these diseases if we are to prevent them.

NEW TIMES, NEW HAZARDS

The World Health Organization estimates that poor environmental quality may be responsible for one fourth of all preventable illness in the world. Every day we encounter chemicals, physical agents, and other substances in the air, water, and soil around us, as well as in the food we eat.

However, making the connection between environmental threats and chronic diseases is not easy. Environmental hazards have subtle effects on human health. They rarely cause immediate illness the way epidemic disease germs do. Their effect on the human body can go unnoticed, and years or decades may pass before symptoms appear. A single exposure or a single chemical may not trigger an illness, but an accumulation of exposures over time can take its toll. Effects are complicated. Many hazards may influence the appearance of one disease, while a single hazard may influ-

ence many outcomes. Genes and behavior may also affect how environmental pollutants cause disease in individuals.

A tracking program can provide information to help us understand how the environment influences the development of disease. Only by systematically measuring environmental insults, tracing their geographic distribution, documenting their residues in human tissues, and understanding their connection with illness can that information help prevent suffering and disease. Integrating all of these elements sets environmental public health tracking apart from traditional disease surveillance.

Tracking programs serve another function, too. Sometimes long-term data actually shows that disease rates are not exceptional in communities worried about clusters of illness. Tracking improves access to that information and permits faster analysis. Lack of ready access to usable data delays a health department's ability to serve the public and address its concerns. Without a swift, accurate response, the public may misinterpret delays as "foot dragging" or a "government cover-up."

Unfortunately, tracking programs are still in their infancy.

"We can track flu, West Nile virus, and mad cow

"We can track flu, West Nile virus, and mad cow disease but not enough of the chronic illnesses that are the biggest killers of Americans, because we just don't have enough of that basic information."

TOM BURKE, Ph.D., PROFESSOR, CO-DIRECTOR, RISK SERVICES AND PUBLIC POLICY INSTITUTE, JOHNS HOPKINS UNIVERSITY

disease but not enough of the chronic illnesses that are the biggest killers of Americans, because we just don't have enough of that basic information," says Johns Hopkins University's Tom Burke, Ph.D.

FROM AIR TO BLOOD TO BRAIN

Exceptions exist, of course. Decades ago, scientists documented concentrations of toxic lead from auto exhaust and measured lead residues in the blood of children who breathed polluted air or inhaled paint dust. Doctors knew lead poisoning caused developmental problems, convulsions, coma, and even death. Integrating that information persuaded Congress to

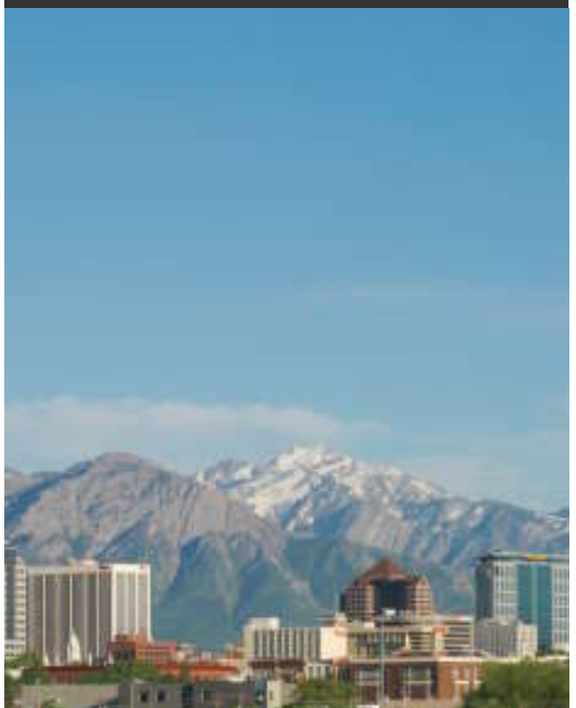
CASE STUDY:

Utah

Sam LeFevre of the Utah Department of Health received a call from a citizen in west Salt Lake City who was concerned about cases of cancer in his neighborhood. In the past, a similar call would have prompted a study that would have taken a year to complete, with most of that time spent waiting for data.

On a flight to Atlanta for a meeting, LeFevre pulled out his laptop computer and began analyzing the cancer data. Using the systems he'd helped develop with a CDC grant, LeFevre mapped the location of the caller's house, tied in cancer data, and compared the percentage of cancer cases in the neighborhood to the percentage in the entire state of Utah.

Before the flight landed, LeFevre knew he could assure the resident that there was no greater likelihood of cancer in his vicinity than in the state as a whole. Most important, with the support of Utah's pilot tracking program, he was able to complete his analysis in a few hours instead of the year it would have ordinarily taken.



"We need to get tracking results in front of people in a very usable way, not only on a national level, but by state and locality as well."

HOWARD FRUMKIN, M.D., Dr.P.H., DIRECTOR, NATIONAL CENTER FOR ENVIRONMENTAL HEALTH AND THE AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, CDC

ban lead compounds from gasoline and paints. In time, lead levels in the atmosphere and in children's blood declined, and today lead poisoning rates in children have declined and deaths are rare.

At its best, that is how environmental public health tracking works: helping connect the dots between environmental hazards and illness. Parts of that system are already in place. Many federal and state agencies collect data on chemicals introduced into the air or water. The EPA routinely monitors air quality. The U.S. Geological Survey (USGS) tests water in rivers and in wells. National Aeronautics and Space Administration (NASA) satellites record information on vegetation cover, forests and forest fires, flooding, ultraviolet radiation, and surface temperatures. CDC regularly measures levels of 148 chemicals found in our blood. States or localities may record particular substances depending on local geology, industry, or weather patterns. Hospitals, doctors, and health departments report cases of disease and injury.

A nationwide environmental public health tracking program can rise from that foundation of existing local, state, and federal systems. But such a program will need more than a patchwork assortment of data. A workable system will not only collect information from disparate sources, but also analyze it and make it

available to those who can act to prevent or control disease.

"We need to get tracking results in front of people in a very usable way, not only on a national level, but by state and locality as well," says Howard Frumkin, M.D., Dr.P.H., director of CDC's National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry, which oversees the Tracking Program. "People care deeply about local health issues."

A LITTLE HISTORY

Connecting hazardous substances in the air or water

CASE STUDY:

Wisconsin

Wisconsin's tracking program collaborated with the state's Department of Natural Resources to implement a new environmental public health tool, the Regional Air Impact Modeling Initiative. Developed by the Environmental Protection Agency, the Initiative provides geographically focused estimates of toxic air pollutant concentrations and then estimates community cancer risk.

Public health officials soon provided the system with a real-world test. A community in southeastern Wisconsin asked about factory emissions of the solvent trichloroethylene. Drinking or breathing high levels of trichloroethylene may harm the nervous system and cause liver and lung damage, abnormal heartbeat, coma, and even death. Regional Air Impact Modeling and other monitoring techniques confirmed high levels of the chemical.

With that information in hand, the Wisconsin Department of Health and Family Services recommended that the industrial plant reduce its emissions. Presented with modeling, monitoring, and consultation results, the factory owner—who was in compliance with all applicable permit requirements—agreed to change the manufacturing process in the plant to eliminate trichloroethylene emissions.

This intervention resulted in reduced community trichloroethylene exposure, and showed how use of air pollutant modeling to identify high-risk communities can prompt action to decrease toxic air pollutants.

to illness might seem an obvious step, but its application has been spotty. Environmental and public health units at all levels of governments were once united. After creation of the EPA in the 1970s, however, health and the environment often became separate realms with separate administrative structures, separate funding, and separate legal authorities for action.

Doubts about that division emerged in 1988, when the Institute of Medicine reported on the generally poor state of the public health infrastructure in the United States. The Institute specifically said that separating environmental health and public health had fragmented responsibility for environmental health.

Over the years, health and environmental data systems functioned without broader integration. Data collected by environmental agencies for regulatory purposes was often unusable for environmental public health tracking. Information covered large geographic areas, like states, regions, or the entire nation, but rarely zip codes, census tracts, or city blocks, which might have been more helpful in targeting prevention efforts. On the health side, surveys of individual health took too long to compile, and reports from doctors or hospitals were delayed or lacked crucial details.

The idea of a nationwide tracking program moved into the public policy arena with a 2000 report from the Pew Environmental Health Commission, backed by research from the Johns Hopkins School of Hygiene and Public Health. The report detailed an "environmental health gap," a lack of basic information needed to document links between environmental hazards and chronic disease—even though surveys found most people thought that tracking environmental health was a good idea.

"When the Pew Commission report came out, everyone—the press, the public, Congress—couldn't believe that a tracking program didn't already exist," says Hearne.

"While overt poisoning from environmental toxins has long been recognized, the environmental links to a broad array of chronic diseases of uncertain cause are unknown," concluded the report. To forge those links, the Pew report called for integrating tracking systems for environmental hazards, bodily exposures, and diseases; linking data to allow swift analysis; and using the results to prevent disease and save lives.

FIRST STEPS TOWARD TRACKING

The Pew report stimulated new thinking and specific proposals to overcome the split between environment

"When the Pew Commission report came out, everyone—the press, the public, Congress—couldn't believe that a tracking program didn't already exist."

SHELLEY HEARNE, Dr.P.H, FOUNDING EXECUTIVE DIRECTOR, TRUST FOR AMERICA'S HEALTH

and health. In response, Congress provided CDC with funds in 2002 to develop the National Environmental Public Health Tracking Program.

CDC in turn asked scientists, managers, and policy specialists from two dozen state health and environmental departments, medical societies, nongovernmental organizations, universities, and federal agencies to serve on workgroups addressing tracking issues. The four workgroups covered organization issues, information technology and tracking methods, tracking systems needs assessment, and how to provide tracking data to health agencies, elected officials, and the public to prevent disease.

CDC then selected pilot programs around the country to build tracking capacity and demonstrate just what a tracking program could do. The knowledge gained would open new avenues of discovery, new paths of prevention, and new hope for long-term health for all Americans.

A quick look at those pilot projects gives clear insight into the benefits of environmental public health tracking.

Environmental Public Health Tracking

ONGOING EVALUATION

DATA

Collection
↓
Integration
↓
TRACKING NETWORK
↓
Analysis
↓
Interpretation

DISSEMINATION

Assessment
↓
Research
↓
STAKEHOLDERS
↓
Intervention
↓
Policy

Stakeholders Include:

- Federal Agencies
- State & Local Governments
- Academia
- Health Care System
- Business & Industry
- Nongovernmental Organizations
- Policymakers
- Media
- Public

PREVENTION

ONGOING EVALUATION

The Beginning of Tracking

1970

EPA is created—environmental health responsibility moves from public health authorities to EPA

1988

Institute of Medicine reveals a fragmented public health system with no link to environmental health

2000

Pew Environmental Health Commission issues *America's Environmental Health Gap: Why the Country Needs a Nationwide Tracking Network*

2001

CDC and Agency for Toxic Substances and Disease Registry develop a proposed plan for environmental public health tracking network

2002

Congress funds $17.5 million to CDC to develop a tracking program and network and CDC convenes planning workgroups

2003

Congress funds CDC's Tracking Program at $27.5 million

2004

Congress funds CDC's Tracking Program at $27.4 million

2005

Congress funds CDC's Tracking Program at $24.4 million

2006

Congress funds CDC's Tracking Program at $24.2 million

part two

Pilot Projects Lead the Way

LIKE POLITICS, ALL HEALTH IS LOCAL

People can be exposed to the hazards that cause chronic illness at home, at school, at work, or at play, so state and local health departments are often best placed to monitor these hazards. They are aware of any special local conditions that modify general environmental health risks, and they can take action to improve conditions. Mercury levels in fish are a priority for Washington State, for example, while Louisiana focuses on known hazardous waste sites, and Maine is concerned about high arsenic levels in well water. For that reason, individual states made excellent testing grounds for the Tracking Program.

PHASE ONE

To put ideas into action, CDC issued three sets of pilot grants. The first phase began in 2002 with about $7 million a year allocated for three years to health departments in 10 states and three cities to build up their ability to track hazards and diseases. Montana linked hospital data on respiratory and cardiovascular disease with air quality monitoring data and found an association between asthma and increases in fine air particle levels. New York State tackled a pilot project that enabled the state's environmental software to talk to and exchange data with the health department. The results led CDC and EPA to explore how similar sys-

CASE STUDY:

New Hampshire

Tracking programs often help focus the search for the roots of illness by ruling out a suspected environmental cause. In January 2006, a retired physician told the local newspaper that he suspected a cancer cluster in Claremont, a former mill town in the Upper Connecticut River Valley. His comments came amidst an ongoing controversy over air pollution from a large solid waste incinerator operating nearby and sparked a call to look into the health and environmental status of the town.

New Hampshire Governor John Lynch asked the state health and environmental services departments to investigate. Thanks to a CDC-funded pilot tracking program, the investigators had access to 14 years of health and environmental data showing that cancer incidence in Claremont was actually less than expected for similar communities and for the entire state. The tracking program team explained the study's results to community members in town meetings and answered their questions about health and the environment.

tems might exchange data between the two federal agencies and among states.

Another seven states divided $5 million a year for three years, beginning in 2002, for data linkage demonstration projects. Illinois, for instance, used a geographic information system and sophisticated software to track chemical contamination in private wells in two communities and their effects on rates of cancer.

"Capacity building may not sound exciting, but it has been one of the most rewarding aspects of this program," says Judith R. Qualters, Ph.D., chief of CDC's Tracking Branch. "When we started, capacity

varied widely in the health departments. But in just three short years, people were doing projects above and beyond what we originally envisioned."

PHASE TWO

In 2003, with additional funds from Congress, CDC funded nine states and New York City with about $4 million each year for three years to explore how disparate sets of data already being collected could be linked together. Along with some states from the original group of grantees, funding went to four new states. Oklahoma's health department tied data on childhood lead poisoning, asthma, birth defects, and

CASE STUDY:

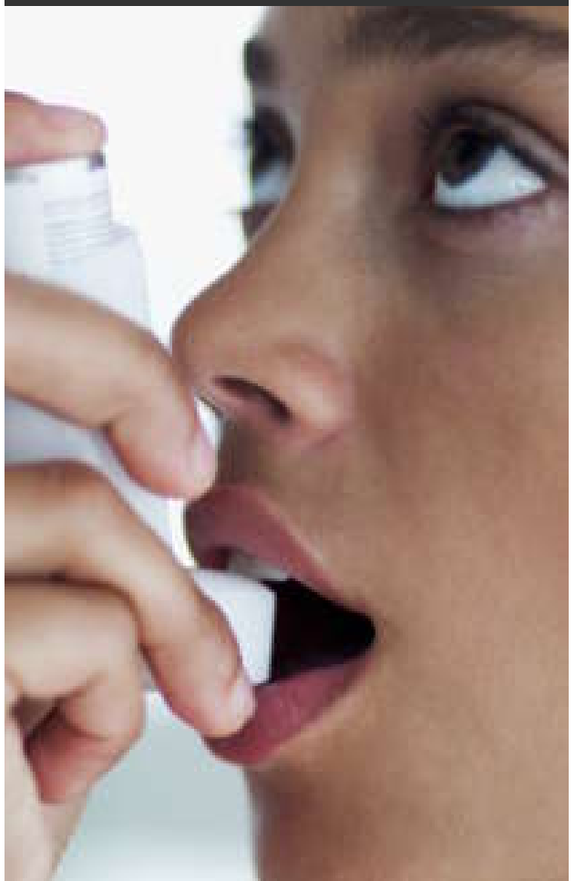
California

California's agricultural industry applies 20 percent of all the pesticides used in the United States. Pesticides contain chemicals toxic to humans and can cause acute poisoning, cancer, birth defects, and nervous system damage. These pesticides are often applied where people live or work—schools, homes, roadsides, and farms. With CDC funding, California increased its tracking program capacity to provide reliable information to residents on pesticide use and potential for exposure. The public now has free access to that information through an online tool—AirPIC (http://www.pesticideinfo.org/airpic)—developed by the Pesticide Action Network. AirPIC shows that the technical ins and outs of tracking programs often prove less important to communities than access to easily understood information.

CASE STUDY:

Pennsylvania

At present, the Allegheny County Health Department learns of a chronic disease in an individual only when it is listed on a death certificate. The department can't relate asthma cases to places of residence to see if they are near known sources of air pollution. Now, under a CDC grant, Allegheny County has begun working with the Pennsylvania Department of Health, the University of Pittsburgh, and Drexel University of Philadelphia to develop a standardized asthma reporting system for schools. The two universities will use their combined expertise in managing and linking large databases to synchronize the flow of information. This collaboration will enhance the surveillance of asthma, clarify the role of environmental hazards and exposures, and eventually reduce the burden of asthma among Pennsylvania school children.



cancer to environmental hazard data from the Department of Environmental Quality. Louisiana demonstrated ways to link existing state tumor registry data and human exposures to 32 creosote hazardous waste sites, groundwater contaminants, and drinking water data.

RESEARCH HELP FROM ACADEMIA

CDC also funded three schools of public health for $2.1 million in 2002—Johns Hopkins University, Tulane University, and the University of California-Berkeley—to explore how knowledge from the research community can provide technical assistance

and training to state tracking programs and further the science of environmental public health.

A new round of funding was awarded in 2005 to academic partners including the University of California-Berkeley, Tulane University, the University of Pittsburgh, and the University of Medicine and Dentistry of New Jersey. These university partners continue to research the relation between health and the environment. They also provide technical advice on the best ways to conduct the complex data analyses needed to describe and monitor the impact of environmental exposures on human health.

CASE STUDY:

New Mexico

New Mexico compared levels of arsenic in wells with urine biomonitoring samples and cancer incidence, evaluating all the data by census tract. Arsenic in drinking water was linked to bladder cancer, especially among white residents. However, bladder cancer rates among Hispanics and Native Americans were found to be lower, possibly as a result of differences in how they metabolize arsenic. This pilot project answered some questions but also revealed new areas for research.

CASE STUDY:

Florida

The Florida tracking program sought to explore how three developmental disabilities—mental retardation, autism, and behavioral disorders—might be connected to elevated blood lead levels. Working with the University of Miami's Department of Psychology and Florida's Department of Education, the tracking program linked 2003–2004 school records of 294,806 children with blood lead screening tests taken over the previous decade. Results showed that children with lead levels above 10 µg/dL had a 30 percent higher risk of developmental disabilities than children below that cutoff point. The program found that several socioeconomic factors were associated with higher levels of these disabilities. The tracking program also mapped results to the county level with a geographic information system so that the health department could inform parents, health providers, and others about taking steps to eliminate lead poisoning by 2010.

FINDING COMMON GROUND

At CDC's request, each state tracking program convened advisory groups to help identify leading environmental health problems. Most states said air and water pollution were their prime concerns, while asthma and cancer topped the list of adverse health effects. State and city health personnel also wanted more training opportunities to study tracking, increased standardization of electronic data elements, and better methods for disseminating information. Priorities varied, but there were also common issues that could be tackled collectively.

By September 2006, state and local tracking

grantees had completed projects linking health and environmental data. These projects looked at asthma, cancer, birth defects, pesticide poisoning, and autoimmune and neurodegenerative diseases among other health outcomes. About half of the state and local tracking programs examined children's blood lead levels, a well-known biological marker indicating how much lead actually gets into the body.

WORKING TOGETHER

These grants prompted discussions about tracking between environmental monitoring agencies and traditional health organizations—both in and out of government.

Those discussions proved to be at least as important as the grant programs.

"The primary value of the pilot programs has been that they've brought various disciplines together—especially at the state level—to talk and exchange information and ideas," says Henry Anderson, M.D., chief medical officer at Wisconsin's Division of Public Health.

In addition to its state, city, and academic grants, CDC has collaborated with a number of other federal agencies, professional associations, and nongovernmental organizations, including the EPA, USGS,

"The primary value of the pilot programs has been that they've brought various disciplines together—especially at the state level—to talk and exchange information and ideas."

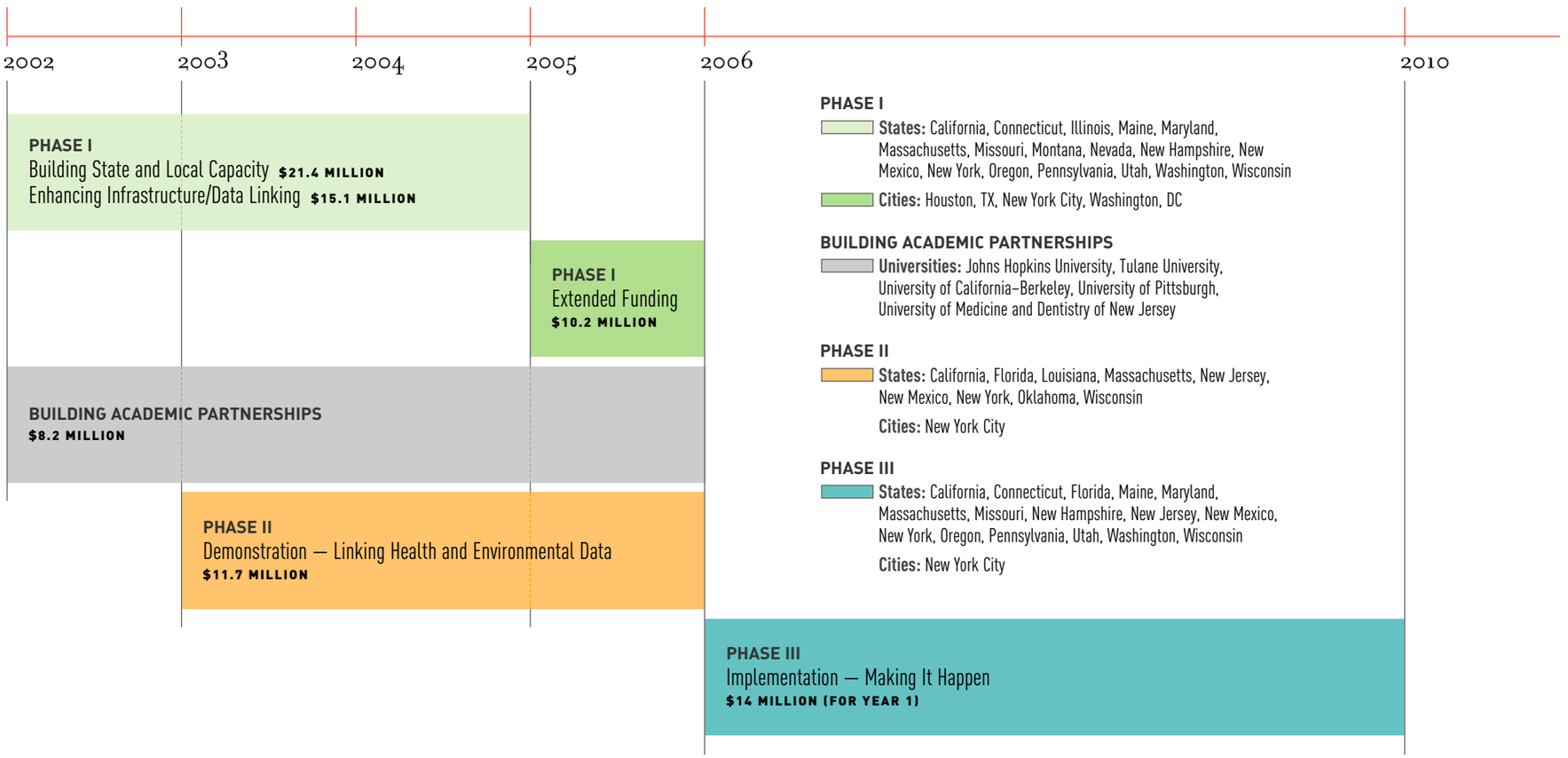
HENRY ANDERSON, M.D., CHIEF MEDICAL OFFICER, WISCONSIN DIVISION OF PUBLIC HEALTH

NASA, the Census Bureau, the Council of State Governments, the National Council of State Legislators, the American Public Health Association, Physicians for Social Responsibility, the National Environmental Health Association, and the Council of State and Territorial Epidemiologists.

Professional organizations like the Association of State and Territorial Health Officials share successful models, best practices, lessons learned, and resources developed by funded states with other states to help them develop tracking capabilities. The National Association of County and City Health Officials works to ensure that the Tracking Network meets the needs of local health professionals.

The pilot projects have now established a proof of concept and can serve as models for the next round of the nationwide effort. The challenges they have overcome are providing guidance for the implementation phase of the Tracking Program.

The Tracking Program and Network Development Through Grants



part three

A Proven Concept, A New Reality

CDC, the states, and cities all learned important lessons from the pilot programs. Flexibility, collaboration, and integration replaced the isolated approach to data and its uses. Furthermore, the pilot programs and collaborations are not mere exercises. They have already begun to pay off, says CDC's Frumkin. "This is real information that lets us know we're on the right track and helps alert us to problems we need to turn to."

Today, because of CDC's Tracking Program, Washington State can not only think about mercury levels in fish, but also take action. Using tracking resources, it has automated the process of compiling information from many sources to warn citizens faster and more accurately about fish hazards. Tracking funds allowed Maine to examine high arsenic levels in well water and their effects on reproductive outcomes so that state public health officials can warn well users about the hazards of exposure to arsenic during pregnancy.

Massachusetts's Center for Environmental Health monitored the air in schools to measure temperature, humidity, carbon dioxide, carbon monoxide, and fine particulates. It linked these data to school records and student health data and found higher rates of asthma in schools with moisture or

> "The Tracking Program showed us the value of having advance data on the environment and health for making decisions."
>
> SUZANNE CONDON, M.S.M., ASSOCIATE HEALTH COMMISSIONER, MASSACHUSETTS

mold problems.

"The Tracking Program showed us the value of having advance data on the environment and health for making decisions," explains Suzanne Condon, Massachusetts associate health commissioner. "In this case, if you have to make a decision with limited resources, fixing the school with the leaky roof first makes the best public health and economic sense."

Since 2002, 21 states and three cities have used CDC grants to expand tracking capacity and demonstrate to the public what tracking can do.

CDC has not been sitting on the sidelines. The agency now has greater expertise and capacity to provide technical support to state and local programs. Meetings and conferences allow people from around the country to share experiences and lessons learned, as well as to build collaborations.

"So much has changed since the Pew Commission report," says Hearne. "It's phenomenal to see the rapid evolution from concept to implementation, from gap to engagement."

CHALLENGES

Yet with all the success of the pilot projects, challenges still remain.

"Initially we thought we could quickly link envi-

ronmental and health data to investigate community concerns," says LuAnn E. White, Ph.D., professor and director of the Tulane School of Public Health and Tropical Medicine's Center for Applied Environmental Public Health. "However, we found tracking is like peeling an onion—each layer reveals more issues that require extensive work to find the answers we seek."

Among those layers rest questions of how data is organized, how it can be linked for analysis, how privacy is protected, and how to ensure a broader understanding of the entire program.

The environmental and health communities have traditionally looked at data in very different ways, says Richard Jackson, M.D., M.P.H., of the University of California-Berkeley. The two use different vocabularies and have different standards of accountability. Environmental agencies accumulate immense amounts of data, most of it publicly available. Health data is subdivided, hard to access, stored in aging databases, and constricted by a legal priority on privacy, all of which lead to its underutilization, says Jackson.

A workable system must bridge the gaps between sources, but not by creating a single massive system, says CDC computer scientist Patrick Wall. Hundreds

of data sources from an array of city, county, state, and federal agencies must be made compatible and tied together seamlessly to make a tracking network useful in practice.

Creating computer systems to exchange data easily requires experts knowledgeable in both computer science and health. Those experts must unite many types of environmental and health information, in diverse data systems, and then devise systems for complex analyses.

But even simple issues can cause complications. One state adopts zip codes as its geographic unit, while another uses street addresses. Men and women are coded in one database as M or F and in another by numerals. Information is still often confined by organizational boundaries, although barriers are coming down, especially where pilot projects have led the way.

Keeping the health data of individuals private takes careful planning, too. Laws governing health information vary from state to state and within each state. Public health agencies may be authorized or required to collect some data, yet they are barred from access to other information. Still other laws regulate who may use the data and for what purpose.

"The current legal structure is not conducive to the development and implementation of a compre-

"The current legal structure is not conducive to the development and implementation of a comprehensive environmental tracking system."

LANCE GABLE, J.D., M.P.H., PROFESSOR OF LAW, WAYNE STATE UNIVERSITY

> "Infrastructure is rarely at the top of the public's agenda, yet it is essential to improve health care in the United States."
>
> TOM BURKE, Ph.D., PROFESSOR, CO-DIRECTOR, RISK SERVICES AND PUBLIC POLICY INSTITUTE, JOHNS HOPKINS UNIVERSITY

hensive environmental tracking system," says Wayne State University law professor Lance Gable, J.D., M.P.H., "We don't practice public health or medicine with outdated science. We shouldn't practice it with antiquated legal authorities."

Finally, the Tracking Program can also benefit from broader knowledge among the public and policymakers about its purposes and value. The more they know about this part of the health infrastructure, the better they will understand how tracking can help them and their families.

"Infrastructure is rarely at the top of the public's agenda, yet it is essential to improve health care in the United States," says Hopkins's Tom Burke. "Unless you can pull together environmental data and measures of population health, fundamental questions won't be asked and can't be answered."

THE FUTURE

Yet these are challenges, not obstacles. Today, CDC is building on its existing partnerships and lessons learned to implement the next big step: creation of the National Environmental Public Health Tracking Network.

Secure and Web-based, the Network will unite smaller networks, using standardized data systems to

bring together local, state, and national data sources for environmental hazards, environmental exposures, and health effects.

The vision is simple—but making it a reality is not. Creating the Network will require developing and using standards to protect sensitive information, improving states' computer capacity to exchange information, and developing tools to consistently analyze and report data.

The Network will allow cities and states to easily and quickly access information needed to protect the health of their citizens. It will help people to learn about the health status of their communities, about potential hazards, and about what they can do to keep healthy. Researchers will access data through the Network to further our understanding of the environment and health.

In 2006, CDC moved from the planning and capacity building phase to the implementation phase of the Network. In August 2006, CDC awarded $14 million to California, Connecticut, Florida, Maine, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, New Mexico, New York, New York City, Oregon, Pennsylvania, Utah, Washington, and Wisconsin to continue work on the Network. These grants will improve information technology but will

also expand laboratory capacity, continue training public health workers, and develop better ways to communicate information on the Network to those who need it to take action.

In 2007, with the continued support of Congress, CDC will expand local and state health department networks and contacts with other state, local, and federal partners.

In 2008, the Tracking Network will be ready for launch. Once launched, development will continue as more people use the Program and CDC expands its capacity, updates research on the system, and evaluates its progress.

CASE STUDY:

Maine

After a killer winter storm hit Maine in 1998, knocking out power around the state, Maine's health department began receiving reports about carbon monoxide poisonings as people turned to gasoline-powered generators. Two people died from the deadly gas and 285 fell ill. Without a tracking system, the department's most powerful tool for recording these incidents proved to be the telephone. The state toxicologist called each of Maine's hospital emergency departments every day to find out how many people had been poisoned by carbon monoxide.

The state's CDC grant helped Maine begin to track carbon monoxide poisoning. Maine and other states developing carbon monoxide surveillance shared their knowledge with a CDC response team after Hurricane Katrina in 2005. They helped the New York State Department of Health launch an emergency carbon monoxide surveillance system after Buffalo lost power in an early winter storm in 2006. Tracking provided the resources to collect the information needed to protect people.

The story won't end there.

"Longer term, tracking will be able to provide a real service to the American people," says Michael McGeehin, Ph.D., director of the Division of Environmental Hazards and Health Effects, National Center for Environmental Health at the CDC. "I can envision a day when people will be able to go to the Tracking Web site and instantly find a wealth of easily understood information about their community—on the environment, possible human exposures, and the overall health status of their neighborhood. They will be able to make informed decisions on not only where but also how they live. We still have plenty to do before we get to that point, but that's the tracking goal, and we're heading in the right direction."

CONCLUSION

Since the Tracking Program's inception in 2002, the environmental health information gap has begun to close. CDC and its partners have made great strides in laying the foundation for an information network that can guide health protection decisions.

"Up until now, we have attempted to address environmental threats to the health of our communities without the benefit of an integrated system of health and environmental data," says McGeehin. "A

> "A successful tracking system will provide our citizens with critical information on the threats to their health posed by the environment and how well we, as a nation, a state, or a community, are dealing with those threats."
>
> MICHAEL MCGEEHIN, Ph.D., DIRECTOR, DIVISION OF ENVIRONMENTAL HAZARDS AND HEALTH EFFECTS, NATIONAL CENTER FOR ENVIRONMENTAL HEALTH, CDC

successful tracking system will provide our citizens with critical information on the threats to their health posed by the environment and how well we, as a nation, a state, or a community, are dealing with those threats."

Indeed, as this scientific dream becomes an everyday reality, the National Environmental Public Health Tracking Program will give state and local public health officials the ability to spot long-term trends as hazards or diseases increase or decline. The Tracking Program will help them warn the public and elected officials of impending health dangers and plan for changes in health services or infrastructure. When citizens call with complaints or fears of disease outbreaks, the Tracking Program will provide the data necessary for officials to respond with scientifically valid information. The Tracking Program will help governments at all levels better target scarce prevention dollars.

With the help of the National Environmental Public Health Tracking Network, scientists, communities, policymakers, and the public will have access to the information they need to make wise decisions to prevent disease, keep the American public healthy, and save lives.

The Future of Tracking

"Longer term, tracking will be able to provide a real service to the American people. I can envision a day when people will be able to go to the Tracking Web site and instantly find a wealth of easily understood information about their community—on the environment, possible human exposures, and the overall health status of their neighborhood. They will be able to make informed decisions on not only where but also how they live. We still have plenty to do before we get to that point, but that's the tracking goal, and we're heading in the right direction."

Michael McGeehin, Ph.D.
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2006

- Disseminate lessons learned from tracking program projects
- Disseminate Tracking Network Implementation Plan
- Fund state/local health departments to construct tracking networks
- Begin construction of CDC national Tracking Network
- Complete state/local pilot projects
- Identify nationally consistent data and measures

2007

- Disseminate standards for Tracking Network structure and content
- Publish report on first four years of Tracking Program

2008

- Deploy national Tracking Network
- Deploy state and local networks
- Publish first CDC biennial report on health and environment

2009

- Develope strategic plan for 2010–2015
- Expand and enhance the content and usability of the Tracking Network

2010

- Develop additional Tracking Network tools and services
- Publish second CDC biennial report on health and environment

Before and After Tracking

Before tracking, even simple questions about health and the environment would take months to answer.

With a tracking system in place, health officials can respond quickly, often within hours, to locate hazard sources or allay citizen concerns.

Before tracking, collections of data were created and held by many different government departments in individual "silos."

Tracking creates standards and tools to link these disparate sources of information and then help ask important questions about the public's health.

Before tracking, the environmental and health realms were often separated administratively and philosophically.

The CDC tracking initiative brings these two worlds together for the benefit of all.

Before tracking, health and environmental officials concentrated mainly on acute incidents like hazardous chemical releases or point-source pollution.

With tracking in place, they can follow amounts and geographic spread of compounds over time, allowing them to monitor long-term trends and place those acute incidents in context.

Before tracking, CDC and state and local health departments concentrated on infectious disease surveillance, their traditional area of concern.

With tracking, they can apply the same "disease detective" skills to finding environmental causes of illness and then taking preventive measures to protect the public's health.

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Useful Resources

Association of State and Territorial Health Officials (ASTHO). 2004. *Environmental Public Health Tracking Fact Sheet.* ASTHO [Internet]. Available at: http://www.astho.org/pubs/EPHTfactsheet.pdf. Accessed November 2006.

ASTHO. Tracking Program. ASTHO [Internet]. Available at: http://www.astho.org/?template=1events.html. Accessed November 2006.

Bell ML, McDermott A, Zeger SL, Samet JM, Dominici F. Ozone and short-term mortality in 95 US urban communities, 1987-2000. *Journal of the American Medical Association.* 2004 Nov 17;292(19):2372-8.

Centers for Disease Control and Prevention (CDC). National Environmental Public Health Tracking Program [Internet]. Available at: http://www.cdc.gov/nceh/tracking. Accessed November 2006.

CDC. Mini-Monographs in Environmental Health Perspectives. CDC [Internet]. Available at: http://www.cdc.gov/nceh/tracking/monographs.htm. Accessed November 2006.

CDC, Science Applications International Corporation. *Environmental Public Health Tracking Network Vision.* Atlanta, GA: CDC; October 20, 2004. CDC [Internet]. Available at: http://www.cdc.gov/NCEH/Tracking/network.htm#doc.

CDC. *National Report on Human Exposure to Environmental Chemicals.* 2005. CDC [Internet]. Available at: http://www.cdc.gov/exposurereport/. Accessed November 2006.

CDC. TRACKS 2006: Presentation files for each session of Implementing the Tracking Network Conference, Atlanta, GA, August 9-11, 2006. CDC [Internet]. Available at: http://www.cdc.gov/nceh/tracking/tracks06/presentations.htm. Accessed November 2006.

CDC. Adult blood lead epidemiology and surveillance—United States, 2003-2004. *Morbidity & Mortality Weekly Report.* 2006; Aug 18;55(32):876-9.

Glad JA, Kotchian SB, Barron GM. Developing a local comprehensive environment and health tracking system: using what we know to improve health and the environment. *Journal of Environmental Health.* 2004 Jun;66(10):9-14, 28.

Institute of Medicine (IOM). *The Future of Public Health.* Washington, DC: National Academy Press; 1988.

IOM. *The Future of the Public's Health in the 21st Century.* Washington, DC: National Academy Press; 2002.

Kyle AD, Balmes JR, Buffler PA, Lee PR. Integrating research, surveillance, and practice in environmental public health tracking. *Environmental Health Perspectives.* 2006 Jul;114(7):980-4.

National Association of County and City Health Officials (NACCHO).
Local Public Health Perspectives on Environmental Public Health Tracking. Final Report. May 2005. NACCHO [Internet]. Available at: http://www.naccho.org/topics/environmental/documents/FinalReportonEPHT505_000.pdf. Accessed November 2006.

Pew Environmental Health Commission. America's Environmental Health Gap: Why the Country Needs a Nationwide Health Tracking Network. 2000. TFAH [Internet]. Available at: http://healthyamericans.org/reports/pew/. Accessed November 2006.

Pew Environmental Health Commission. Attack Asthma: Why America Needs a Public Health Defense System to Battle Environmental Threats. 2000. TFAH [Internet]. Available at: http://healthyamericans.org/reports/pew/. Accessed November 2006.

Pew Environmental Health Commission. 1999. Healthy from the Start: Why America Needs a Better System to Track and Understand Birth Defects and the Environment. 1999. TFAH [Internet]. Available at: http://healthyamericans.org/reports/pew/. Accessed November 2006.

Thacker SB, Stroup DF, Parrish RG, Anderson HA. Surveillance in environmental public health: issues, systems, and sources. *American Journal of Public Health.* 1996;86:633-8.

Thun MJ, Sinks T. Understanding cancer clusters. *A Cancer Journal for Clinicians.* 2004 Sep-Oct;54(5):273-80.

Trust for America's Health (TFAH). *Nationwide Health Tracking: Investigating Life-Saving Discoveries.* TFAH [Internet]. Available at: http://healthyamericans.org/docs/index.php?DocID=88. Accessed November 2006.

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For more information about the National Environmental Public Health Tracking Program please visit: www.cdc.gov/nceh/tracking.