Future and Emerging Strategies in Environmental Public Health Tracking

Technical Report

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Mary Fox
Sheriza Baksh
Juleen Lam
Beth Resnick

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EXECUTIVE SUMMARY

In collaboration with CDC's National Center for Environmental Health, Johns Hopkins University (JHU) investigators conducted a 12-month project including outreach to state and local Tracking grantees and an expert panel workshop to assess the performance and needs of the national Environmental Health Tracking Program (Tracking Program). Grantees and invited experts shared their views on the Tracking Program and provided advice for future directions to inform the Tracking Program's strategic planning efforts.

Outreach to State and Local Tracking Grantees

In outreach to state and local grantees, we inquired about both their anticipated (next 2 to 5 years) environmental public health needs and current challenges in order to inform planning for the national Tracking Program. The top five current challenges, in priority order, were:

1. Leadership/agency support
2. Personnel
3. Technical expertise
4. Data access
5. Data quality

The following emerging issues were prioritized by multiple grantees but were not ranked: climate change; vector-borne diseases; retirements of senior staff; health disparities; and real-time surveillance. To address both the emerging issues and challenges, state and local grantees recommended that communication particularly to policy-makers and agency leaders should be enhanced. Additionally, the establishment of long-term scientific objectives for tracking was recommended to help ensure continuing agency support through political changes. Furthermore, grantees recommended diversifying funding sources, perhaps from agencies such as the Environmental Protection Agency or National Institute of Environmental Health Sciences in addition to CDC, to enhance program infrastructure and personnel capacity to meet these challenges and emerging issues.

March 2015 Expert Panel Workshop

The expert panel of 15 participants included academics and other environmental health professionals familiar with the origins of the Tracking Program, current state and local grantee agency representatives, and potential partners not currently engaged with the Tracking Program. The expert panel (with CDC and JHU staff members) met for one and a half days in March 2015. The overarching aim of the workshop was to develop recommendations to guide the Tracking Program into the future. Specific workshop goals included an examination of Tracking Program activities from different perspectives and identification of new opportunities, data and methods, and communication strategies.

There was consensus among panel members that data from tracking programs at all levels can offer a wealth of information to inform public health decision-making on complex environmental issues. The national Tracking Program has enhanced and sustained critical environmental public health capacity, in particular the panel recognized the value of the network of people and organizations across the country sharing and using tracking data to guide public health actions. Challenges that were acknowledged included access to spatially and temporally refined data, as well as lack of general awareness of the utility of tracking data among policy makers and other stakeholders.

To guide the Tracking Program over the next five years, strategic opportunities were identified. Chief among these was the need for continued and expanded CDC leadership to develop a coordinated Tracking Program agenda identifying specific scientific goals, data needs, and initiatives. The expert panel recommended future growth to expand data and program scope/coverage; i.e., data available at a smaller scale (e.g., census tract), and expansion of tracking grants to all 50 states. Finally, the panel emphasized that communicating the successes, as well as the value of tracking programs at the state and national levels to decision-makers and the public will be integral to its utility and success.

Figure ES-1 adapts the Tracking Program logo to illustrate the key messages reflected in the expert panel's recommendations. From a strong leadership core, numerous opportunities can be developed to enhance the Tracking Program. Each opportunity, in turn, represents a chance to communicate public health information, actions and success stories with the ultimate goal of improving public health.

Figure ES-1. Illustration of workshop recommendations

The full list of recommendations appears below in priority order under the categories of leadership, opportunities, and communication. Although the project was designed to solicit advice for the national Tracking Program, many of the recommendations can be (and are currently being) implemented by state and local tracking programs. Building on these recommendations for strong leadership with a renewed vision, new opportunities and a scientific agenda, the Tracking Program is poised to advance environmental public health capacity and evidence-based practice.

Expert Panel Recommendations

Leadership

Engage program and agency leadership, build and maintain partnerships, create an agenda promoting science and practice

1) Develop and enhance strategic partnerships
   a) Health delivery system, e.g., Accountable Care Organizations
   b) Private sector, technology companies
   c) Federal agency partners: DOT, DOD, FEMA, USDA
   d) APHA, develop a policy/position statement on EPHT
2) Foster multi-level leadership buy-in
   a) Leverage current CDC, EPA, and other agency leadership
   b) Institutionalize collaboration
3) Build/promote a shared agenda
   a) Strengthen the environmental public health evidence base
   b) Inform environmental public health practice actions and measure outcomes

Opportunities

Build new data, linkages and funding sources, develop disaster response capacity, provide training, build toward 50-state network

1) Explore new health topics and data linkages
   a) Promote and develop EPHT for use in Health Impact Assessment, community health needs assessments, and other multi-disciplinary assessment approaches
   b) Enhance data to address environmental justice, climate change, food, built environment and community design
   c) Develop data linkage projects to include internal markers of exposure and health effects
2) Expand datasets to include other existing or emerging data, such as
   a) Health care-related data sources
      i) All payer claims data (APCD)
      ii) Health information exchanges (HIE)
   b) Other (at EPA, USDA, etc)
3) Develop tracking capacity to add value to disaster response and track sentinel events
4) Leverage resources: build internal efficiencies (e.g., economies of scale, data interoperability, etc.), secure external support
5) Provide tracking training/education for health professionals and the general public
   a) Conduct massive online open courses (MOOCs)
   b) Build EPHT into curriculum at public health schools/programs
   c) Establish research internships and fellowships
6) Expand to 50 state network

Communication

Enhance data availability, branding, and coordinated communications

1) Disseminate information to users (community, researchers, others) in user friendly formats: timely data that is scalable in time and space
2) Gain "Traction for Tracking"
   a) Build identity and brand. Key messages: EPHT is a national network; EPHT provides open data access advancing the right-to-know; EPHT builds capacity for timely information sharing
3) Conduct effective communication and outreach
   a) Engage partners for coordinated communication activities
   b) Highlight outcomes and impacts
   c) Promote success stories to acknowledge and build on EPHT progress

TECHNICAL REPORT

Project Origins

The Environmental Public Health Tracking Program (Tracking Program) at CDC's National Center for Environmental Health was developed in part, in response to recommendations made by the Johns Hopkins University Pew Environmental Health Commission in its report *America's Environmental Health Gap* (Burke et al. 2000). Since its inception the Tracking Program has provided vital support to state environmental public health efforts while simultaneously building a nationwide network of state, local, and academic partners to improve the nation's capacity to understand and respond to environmental threats to public health. Now, at the 15th anniversary of the Johns Hopkins University Pew Environmental Health Commission Report, it is time to take stock, examine the progress made, and develop a strategic approach for the future. As such, the Tracking Program contracted with Johns Hopkins Bloomberg School of Public Health to convene national thought leaders in environmental public health to assess progress, identify gaps and challenges, and provide recommendations for enhancing the utility and impact of the Tracking Program.

Background and Objectives

From the earliest days of organized public health, understanding environmental hazards and exposures has been critical to protecting the health of communities, and most importantly maintaining mechanisms to track population morbidity and mortality. As the national infrastructure for environmental protection has evolved since the creation of the U.S. Environmental Protection Agency (EPA) in1970, there has been an emphasis on controlling pollution sources and monitoring environmental quality. While these efforts have helped improve environmental quality the creation of environmental agencies has contributed to a "fragmentation" of environmental public health efforts among environmental and health agencies (IOM 1988). Research at Johns Hopkins in the mid 1990s validated the IOM report and revealed a lack of coordination between environmental protection and public health (Burke et al.1997). At the time the Pew Environmental Health Commission (the Commission) began its work in 1998,

environmental public health in the U.S. was an uncoordinated patchwork of local, state and federal environmental and public health agencies. The Commission reached out to the states and federal agencies to profile the Nation's capacity to track environmental hazards, exposures, and diseases. The findings, reported in *The Environmental Health Gap* (Burke et al. 2000), revealed a critical gap in our nation's capacity. The Commission found that as a result of decades of neglect, the nation's public health system was operating without basic information about chronic disease and related potential environmental factors (Burke et al. 2000; Litt et al. 2004). To address this gap the Commission, with the strong support of the environmental public health community, developed a blueprint for Environmental Public Health Tracking summarized in this overarching recommendation:

> *Create a federally supported Nationwide Health Tracking Network that informs consumers, communities, public health practitioners, researchers, and policymakers on chronic diseases and related environmental hazards and population exposures. This will provide the capacity to better understand, respond to and prevent chronic disease in this country.*

In response to the Commission recommendations, in 2002 The National Center for Environmental Health established the Environmental Public Health Tracking Program to bring this vision to a reality. As such, the CDC's Tracking Program since 2002 has supported and worked with agency, community, and academic partners to develop the necessary systems, training, expertise and capacity to address the vision of the Pew Commission for a program to develop, support and sustain:

1. National baseline tracking for diseases and exposures;
2. Nationwide early warning system for critical environmental health threats;
3. State pilot programs to test diseases, exposures and approaches for national tracking;
4. Federal investigative response capability; and
5. Links from tracking programs to communities and research.

The Tracking Program has spawned many successful projects from the first years of work including funding tracking programs in state and local agencies in 25 states, exposure prevention

and community environmental health assessments, and new policies and research (Litt et al. 2007; Kearney et al. 2014).

Environmental public health science has advanced with new understandings of population exposures and recognition of a broader range of health impacts. The increased recognition of the public health importance of climate change, the emergence of Health Impact Assessment (HIA) as a core tool for public health decision-making, and vast improvements in health information technology and availability all present great opportunities for the future of tracking. Recognition of and attention to the link between environment and health has never been greater. Public health policy decisions ranging from transportation to community development are increasingly dependent upon strong public health information (for example, see Madison, NY and Massachusetts success stories [NACDD 2015]). Despite these successes in the 12 years since its inception, the Program has been hampered by continued fragmentation in the field, scientific uncertainties, and limited resources. The goal of this project is to provide a blueprint for the future of Tracking, building upon the progress made and continuing to work toward the Pew Commission vision of a nationwide network and related public health capacity to better understand, respond to, and prevent environmental hazards, exposures and disease.

Objectives

JHU investigators in collaboration with CDC outlined the following project objectives to:

- Identify and engage experts in public and environmental health;
- Convene an expert panel workshop to assess the current state of the environmental public health tracking program and identify strategies to guide future activities;
- Gather input from key stakeholders; and
- Provide a written report summarizing the project proceedings, findings and recommendations to the Tracking Program.

Project results will help to inform strategic planning for the Tracking Program as it seeks to enhance the utility of efforts to develop, support and sustain program activities to build a nationwide network, as well as advance environmental public health capacity at all levels to better protect the nation's communities.

Approach

Planning and Outreach

During the planning phase of the project, JHU investigators contacted key stakeholders from state and federal health agencies, environmental public health agencies, and related organizations to gather input and suggestions for expert panelists. Contact was made primarily by way of email and conference call. Outreach efforts included the Association of Public Health Laboratories (APHL); the Association of State and Territorial Health Officials (ASTHO); JHU Center for Injury Control and the Office of Critical Event Preparedness and Response; US Environmental Protection Agency (EPA); US Geological Survey (USGS); and a number of current Tracking state health department grantees.

Expert panel workshop

Workshop Development and Planning

Building on information gathered during the outreach phase, JHU investigators in collaboration with CDC identified participants familiar with the origins of Tracking, current grantee agency representatives and partners, and potential partners not currently engaged with the Tracking Program. Invited participants (with CDC and JHU staff members) met for one and a half days in March 2015. Frances Phillips, RN, MHA, a professional facilitator with over 20 years of leadership experience in local and state health departments, facilitated the meeting. The participant list is attached as Appendix I.

The overarching aim of the workshop was to develop recommendations to guide the Tracking Program into the future. Specific workshop goals included an examination of Tracking from

different perspectives and identification of priority activities, data/methods, and communication strategies.

Workshop discussion prompts were developed to address the workshop objective and goals, presented in Appendix II. Prompts were developed under three broad categories: 1) unique or new opportunities; 2) data, tools, methods or partners needed to move the Tracking Program into the future; and 3) communication about tracking and its value. The workshop discussions and recommendations were documented and informed the preparation of this report.

Workshop Structure and Implementation

The workshop had three components: information sharing; breakout group discussion; and recommendation development. The information sharing sessions were designed to set the stage for the breakout group discussions, which, in turn informed the recommendations. The information sharing session began with an overview of the workshop charge by JHU investigators, followed by CDC staff presenting the key components of the Tracking Program and demonstrating the Tracking Public Portal capacities. These presentations were followed by two panel discussions to gather insights from the current grantees (Panel 1) and other agency and academic representatives (Panel 2).

Participants were assigned to three breakout groups to discuss each discussion prompt (see Appendix II). JHU investigators and note takers recorded each groups' responses. The group breakout sessions were followed by a report-out with the entire group where the key themes and important takeaways were identified and noted. Following the first day's activities with participants, the JHU team met to draft a listing of key themes and potential action items for day two discussions.

The third component of the workshop was the development of recommendations based on key themes and action items identified in day one. Recommendation development was done in a large group setting, including a ranking activity to capture the participants' priority recommendations. Following the workshop, a draft of the workshop proceedings was distributed to participants for review and comment to ensure that all important topics and recommendations were adequately captured.

Additional outreach

As a complement to the expert panel workshop, JHU investigators sought input from all of the funded EPHT Principal Investigators (PIs) and Project Managers (PMs) as well as to Environmental Health Directors of states currently not funded by Tracking. Funded Tracking PIs and PMs received were emailed a link to an online questionnaire. For Environmental Health Directors of states currently not funded by the Tracking Program, the questionnaire was made available in both hardcopy and online formats. Paper forms were available at the April 2015 State Environmental Health Directors meeting in Washington, D.C. The online survey link was sent electronically via email with the assistance of ASTHO.

The goal of the additional outreach was to solicit further input on the three main workshop questions (new opportunities or applications of Tracking; new data, tools, or methods needed; and strategies for communication, see Appendix II) as well as to identify current issues that Tracking could help to address, emerging issues where Tracking might be utilized, collaborative opportunities, and challenges in environmental public health. Copies of the questions are available in Appendix III.

Project Results

Additional outreach

The following summary reflects a total of 29 responses to the online questionnaire (Appendix III) including 25 grantee respondents, 2 respondents who had Tracking Fellows, and 2 non-funded respondents. Where additional details or explanation were requested, the number of respondents ranged from 4 to 14.

What are the unique opportunities or new areas of application for Tracking?

Tracking is at an opportune time in its development where the program can engage both citizen scientists and environmental advocates. This position allows for interaction between and collaboration with various stakeholders in order to better inform policy decisions. These

collaborations for the sake of Health Impact Assessments and Environmental Impact Assessments have the potential to streamline resources for singular objectives. Citizen scientists and environmental advocates can work together to develop indicators and data standards on social determinants of health as related to environmental exposures.

One respondent commented on the strength of the vector-borne disease portion of their portal. The data was timely and readily accessible for a multitude of data requests. This group is looking to expand its capacity in this area due to the high utility of the data. Some other possible areas for further data collection or incorporation into the Tracking program include: nationally collected radon statistics, USGS Coastal and Great Lakes beach quality data, city-level air pollution data, local food safety, local pest control, and local poison control data. Partnering with Offices of Emergency Management could also allow for the incorporation of maps depicting the transport of hazardous materials. One state has already begun this process. Additionally, many respondents commented on the potential value of incorporating electronic health records into the Tracking program in order to gain a better understanding of health outcomes from environmental exposures. Partnering with local syndromic surveillance in order to obtain real-time monitoring of acute health conditions is another opportunity for grantees to build partnerships to expand tracking data availability.

How do we move Tracking into the future?

Respondents consistently stated the need for local level data, as granular as legally permissible (e.g. zip code-level or neighborhood-level). One stated that he/she feels the need to choose battles wisely in this regard. Important issues cannot be addressed without granular data to back up claims and actions. For example, neighborhood level data is key for public engagement in cities. Given current tracking datasets, it is difficult-to-impossible to incorporate local projects. In this same vein, cross-geographical collaboration on topics such as air and/or water quality is one function the Tracking grantees can develop. Such regional collaborations could also reduce competition between grantees.

Responders also voiced the need for central CDC coordination of an agenda for data linkage projects, for the purpose of building and elucidating connections between environmental factors and health, and evaluating health impacts of environmental quality improvement or degradation.

This central leadership can help to better define the content for which there is a clear public health action anticipated, and for which tracking changes over time is needed and not available elsewhere.

In terms of data needs, responders also requested access to modeled exposure data (e.g., National Air Toxics Assessment) or those that have been converted to represent human exposures. They also requested reference rates (e.g., from the Behavioral Risk Factor Surveillance System [BRFSS]) in order to contextualize local measures with national levels. Real-time data on both exposures and health outcomes would be key for optimal utility of the Tracking system. With this real-time data comes an opportunity to build off of the work from the Tracking Program's Geospatial Workgroup. Tracking is primed for geospatial work similar to that performed at the Imperial College of London, where statistically viable and publishable data is produced after highly advanced mapping analyses.

Effective ways to communicate

Responders listed the following forms of communication with the public as being the most effective. They noted that a coordinated combination of direct and indirect communication methods was key to communicating health messages to the public, and the direct methods are very resource intensive. Success of these communication methods is issue and situation specific.

- *Direct: Public meetings, working with local PH, state and county fairs, school programs*
  This direct approach has two purposes: 1) deliver the message to the public where they are at in order to facilitate open discussion of what can or should be done, and 2) address questions regarding why any particular message is pertinent to the people of a particular community. Additionally, the responders note that promotional items have proven extremely effective, but have been used sparingly due to resources.
- *Indirect: Public Service Announcements, press releases, factsheets, etc.*
  The timing of the indirect messages should depend on when these messages can make the greatest impact.
- *Virtual: YouTube, Twitter, Facebook, etc.*
  Targeted social media campaigns would be helpful in reaching a broader demographic.
- *Google indexing to facilitate searches*

This would allow members of the public to readily access vetted data derived from Tracking as they conduct their Google searches.

Applying lessons learned

Respondents were concerned that as the Tracking Program moves forward, it must understand the needs of both advocates and supporters, and have the capacity to respond accordingly. Stakeholder assessment is important to understand the utility of data presented by tracking programs. Promoting the tracking program as a service to programs and local or state initiatives proved successful for some grantees, and allowed for better data collection efforts. Part of this notion of tracking as a service provided to local and state initiatives is that it must take a broad view of environmental public health, including indicators ranging from vector-borne disease to the built environment.

In order to be fully successful, granular, local-level data is needed. This can be accomplished by encouraging all jurisdictions to send their required health indicators and measures to the Tracking program and launch a national public awareness campaign for collecting such information. Additionally, national coverage of local-level data allows for the development of regional tracking networks. With both granular and aggregated data, decision-makers can better target programming. Communication about how partners are using tracking data is also key for promoting greater use appreciation of the rich data. These success stories, both on the local and national level can better improve policy decisions stemming from the use of tracking data.

While local-level data will be useful, without strong coordination between CDC and other states on linkage and evaluation projects, the value of having nationally representative data at that level will be lost. CDC must take the reins to better define an agenda and determine where the public health data needs reside. The Tracking Program does not have to build up expertise, but rather bolster critical environmental public health surveillance activities in participating jurisdictions. The Tracking Program should not try to develop subject matter expertise that already exists, but work with other CDC content-specific branches (e.g., asthma, air and respiratory health) to support accessibility and use of data that is meaningful to these branches. State and local tracking programs should integrate with environmental public health programs so that tracking

becomes essential to the optimal and efficient functioning of these programs. Such integration will also cultivate greater internal support of tracking programs.

On partnerships

Respondents were asked about their current partnerships as well as those that they would like to form in the future. These were broken down into five categories: local, state, national, academic, and other. Of the fourteen respondents, current use of partnerships was consistently high and concentrated at the local and state level. County level partnerships across the states were quite common. At the national level, EPA, the Food and Drug Administration (FDA), USGS, the National Aeronautics and Space Administration (NASA), and CDC provide strong partnerships. Respondents also mentioned partnerships with public schools of public health such as University of Maine, University of Kentucky, and University of Maryland. Across the respondents, partnership was limited with advocacy groups, but included such places as National Resources Defense Council, the Asthma Coalition, and March of Dimes.

Moving into the future, many respondents indicated possible satisfaction with the status quo by indicating "none" in response to future partnership needs. However, of those who identified other potential partnerships, they listed local level health departments and response teams, the Department of Transportation, USGS, patient advocacy groups, and other grantees. For academic partners, schools of public health were mentioned as well as Massachusetts Institute of Technology's School of Engineering. A summary of future partner responses is shown in the table below. Excluded from Table 1 are future academic partners as few specific examples were mentioned.

Local	State	National	Other
Local health, public works and fire departments	Department of environmental protection	FDA	Environment and health advocacy groups
Community-based public health organizations	Department of transportation	Departments of Energy and Labor	American Lung Association, American Heart Association
County health departments	Other tracking programs	Homeland Security	APHA
Local elected officials	Hospitals and health care organizations	USGS	Kentucky Population Health Institute
Community groups	Injury and poison control programs	ATSDR	Asthma Coalition
Local and regional planners	Registries: cancer and vital statistics	HUD	Chronic Disease Prevention Coalition
Tribal organizations	Political representatives, Congressional offices	NOAA	Robert Wood Johnson Foundation
		NASA	Society for Public Health Education

Table 1. Partnerships for the future

Abbreviations: APHA, American Public Health Association; ATSDR, Agency for Toxic Substances and Disease Registry; FDA, Food and Drug Administration; HUD, Department of Housing and Urban Development; NASA, National Aeronautics and Space Administration; NOAA, National Oceanic and Atmospheric Administration; USGS, United States Geological Survey.

Some responders reported a few barriers to these partnerships including confidentiality, difficulty communicating potential benefits to partners, turnover rates, political ideology, and lack of resources.

Current and emerging issues in environmental public health

Responders were asked to list current environmental public health issues that they are facing, as well as what they anticipate in the next 2-5 years. The responses are summarized in the table below. While the current issues are have somewhat tangible solutions, the emerging issues require greater creativity for formulating solutions, and can benefit from advanced planning.

Current	Emerging (next 2 – 5 years)

Implementing HIAs across networks	Climate change and preparedness
Child health, Lead, Lyme Disease	Vector-borne diseases
Private wells, indoor air (Rn, CO)	Retirements of senior staff
Data access/sharing difficulty with local and national data stewards	Health disparities
Lack of attention to indoor environment	Real-time surveillance
Chronic disease, healthy weight as relates to built environment	
Legalization of marijuana	

Table 2. Listing of current and emerging environmental health issues

What's needed to address emerging issues

Respondents were then asked what they needed in order to best address the emerging issues. To address both the emerging issues and challenges, state and local grantees recommended that communication, particularly to policy-makers and agency leaders, should be enhanced. Additionally, the establishment of long-term scientific objectives for tracking was recommended to help ensure continuing agency support through political changes.

Along with this, funding for staff to support the wide range of efforts and flexibility in hiring those staff is needed. Diversifying funding streams might be necessary to accomplish this. Responders noted the need to train and build technical expertise for using tracking data, especially in the areas of geographic information systems (GIS), urban planning, demography, and social marketing.

Challenges for environmental public health work

Finally, respondents were asked about the challenges in environmental health work and rated them as shown in Table 3 below. When asked about how they prioritized, the respondents stated that technical capabilities including IT support were often the primary hurdles to program work.

More Challenging	Less Challenging
Leadership/agency support	Collaboration
Personnel	Communication
Technical expertise	Health-based guidance
Data access	Health effect information
Data quality	Training

Table 3. Current challenges in environmental public health

Connections between the additional outreach and workshop discussions

The additional outreach was designed to allow all the current tracking grantees and environmental health directors from non-grantee states to provide input on the Tracking Program. Unfortunately, there was little participation from environmental health directors from non-grantee states. Since roughly two-thirds of the workshop participants were doing or had done tracking work, it was reassuring and perhaps not surprising that there was substantial overlap in topics raised by the respondents to the outreach questionnaire and those expressed at the workshop. The outreach questionnaire did touch on two topics not explicitly discussed at the workshop, current and emerging environmental health issues and the challenges to environmental public health work (summarized above). Issues highlighted by respondents to the outreach questionnaire such as data access, agency support, HIA, climate change, preparedness, and real-time tracking data, and remedies suggested including diversifying funding sources, communication and training are all captured in the workshop discussion and addressed by the expert panel recommendations as summarized below.

Information Sharing

Each participant on an information sharing panel had received a set of questions to consider in advance of the meeting focused on the three topics areas for information sharing discussion: the accomplishments and value of Tracking; ideas for next steps or future directions; and lessons learned (grantees only). After hearing the grantees (Panel I) and gaining a better understanding of Tracking Progam activities over the past decade, the academic and agency participants (Panel II) discussed next steps and exploring new opportunities.

Panel I: Grantees

Tracking Program Accomplishments/Value:

The general findings from the grantee panel were that the Tracking Program has enhanced and sustained environmental public health capacity, which was particularly critical during the recession years when, without the Tracking Program, such capacity would have been minimal or even non-existent. Additionally, the Tracking Program was lauded for enhancing technical expertise, creating access to data, facilitating the development of a "people" network of grantees and federal partners across the nation, as well as partnerships and data sharing across agencies and community organizations within their states. Collectively, these infrastructure supports, data sharing activities, and partnerships were identified as fundamental to achieving the vision of the Pew Commission and must be sustained and if possible expanded as the program moves forward.

Tracking programs inform actions by providing decision makers including regulators with needed data. The partnerships that the Tracking Program fosters allow for bridge building among environmental public health agencies and data stewards at the state and national levels. Tracking programs establish databases that inform and facilitate research and implementation activities, such as land use planning, needs assessment, and policy and program evaluation. As Oregon has now legalized marijuana, tracking data can prove beneficial in logging the implications for environmental public health in this regard.

Ongoing challenges:

The grantees outlined ongoing challenges many of which were centered on different aspects of data access, integration, and dissemination. Data access due to confidentiality and data use agreement issues has been an ongoing challenge and obtaining data at granular levels has been particularly difficult. Additionally, lack of standardized network architecture including data collection platforms, databases, and portals has created data integration challenges. These data limitations have hindered progress towards the aims outlined by the Pew Commission and finding solutions to such challenges should be a priority in moving the program forward. Additionally the sometimes differing missions and approaches across environmental and health agencies, such as enforcement and regulation compared to outreach and education, was cited as a barrier to developing common environmental public health tracking agendas and activities. Whereas environmental agencies typically work within single chemical risk/regulatory frameworks, public health agencies operate within multifaceted frameworks. This discrepancy often leads to difficulty in coordinating program initiatives.

Next steps:

In considering next steps the grantee panel addressed the Pew Commission aims for Tracking including response capabilities and community and research linkages. Tracking data will be instrumental in addressing the changing world, including climate change and understanding the health impacts of economic growth and globalization. A key to addressing such issues is sustaining and growing the tracking infrastructure and ensuring data availability to meet information needs of such emerging public health challenges. To do this, data enhancements must incorporate timely, accurate, community-level data (i.e., census tract level data, geocoded data, and potentially other data sources such as citizen science or crowd-sourcing). For example, in Vermont the tracking program in collaboration with CDC's Climate Change and Health Program developed a web-based portal used by trained volunteers to report harmful algal blooms (HAB) in near real-time for Lake Champlain and other lakes in the state. Prior to the web-based system, HAB reports were posted weekly and since HAB can appear or disappear quickly weekly reports were not timely for community or recreational use advisories (NACDD 2015).

Additionally, collaborating with various stakeholders will help the Tracking Program identify data expansion opportunities both upstream and downstream. Moving beyond the traditionally studied exposure/outcome relationships to the incorporation of emerging science such as epigenetics to these relationships would further increase the value of the data linkages. Capitalizing on crowd-sourced and other non-traditional forms of data collection will increase program access to timely data. Adopting new technologies for the user (data download utilities for portals) and enhancing connections to existing data streams can accelerate this process and help push the Tracking Network into the future.

Having more comprehensive data availability will enhance research and responsiveness. In particular, tracking can allow for collection of baseline data on hazards, exposures, and outcomes, which would be a beneficial resource for environmental public health research in evaluating changes over time, policy impacts, and identification of new issues. To ensure this, grantees see the need to build broader partnerships with academic entities to facilitate development of hypotheses and research implementation.

The expectation of flat or potentially reduced funding for tracking is a major concern, as it likely prohibits the addition of new capabilities without trimming others. Evaluation mechanisms are needed to determine if or when to stop a particular activity to allow for a new initiative. These funding concerns go beyond just whether a particular program can take on new activities; it affects the ultimate goal of the Pew Commission, of "institutionalizing" Tracking by developing and maintaining the necessary support and capacity for a nationwide network that includes all 50 states.

Panel II: Academic and Agency Representatives

Tracking Program Accomplishments/Value:

The academic and agency representatives highlighted many similar accomplishments/values of the tracking program as mentioned by the grantees, particularly highlighting the program's support of the environmental public health infrastructure. Additionally, the value of Tracking was highlighted in that it allows for multidisciplinary agencies and perspectives to collectively advance knowledge, capacity, and data to further our understanding of connections between

environment and health. These diverse perspectives and agencies should be leveraged to collectively advocate for and support future program advances.

Tracking has helped EPA to be "accountable" for both policy actions and inactions by highlighting the links between environmental exposures and health and then in turn the health protection afforded by improved environmental quality. The primary example for EPA has been related to air data, which is readily available. For example, the Wisconsin Tracking Program was able to use air data to develop the Regional Air Impact Modeling Initiative to link geographic estimates of toxic air pollutants and cancer risk. This Initiative allowed for the investigation factory emissions of trichloroethylene and adverse health effects (CDC 2006). EPA is looking to expand the datasets that can be available to tracking programs to allow for linkage of nationally collected, geographically focused exposure data and local level public health outcomes.

Similarly, Tracking has the potential to answer the 'so what' question of environmental contaminants for USGS. For substances such as endocrine disruptors in surface and ground waters, tracking data could be used to explore the subclinical effects of the exposure and in turn support actions to reduce exposures and any associated human health risks. At present, ecological health concerns, such as affects on fish are better characterized than the human health concerns. Tracking networks and capacity make them uniquely poised to address many environmental public health challenges, including water contaminants.

Challenges/Needs:

The academic and agency representatives cited lack of awareness about environmental public health tracking by agency decision makers as a challenge to assuring its continued use and sustained support and growth. Academics and agency representatives called for building "traction for tracking", essentially a means to make tracking more visible to and usable for decision makers. While the data might be useful, if policy-makers and key stakeholders are unaware of its potential, it will not be used to inform decision-making. Building "traction for tracking" may require an integrated training, communication, and outreach effort to establish tracking data and analytical tools as the preferred resource for the public health workforce to use in addressing complex environmental public health issues and in turn when assessment results

are communicated to decision makers they should be identified as products of 'tracking'. This will help develop "traction for tracking".

Panelists also commented on strategies for building resources for Tracking. Leveraging partnerships and cross-agency collaborations with regard to applied research is an arena for maximizing resources. For example, using tracking data across agencies, such as FDA, CDC, USDA, and EPA with regards to food safety practices and policies could help maximize resources, streamline efforts, and enhance outcomes evaluations. Furthermore, additional resources and opportunities for tracking may be available through partnerships related to the Affordable Care Act (ACA). As the majority of health funding goes to the health delivery system, there is a great need to collaborate with health care organizations and capitalize on the community health provisions in the Affordable Care Act.

Next Steps/Ideas:

The panel highlighted a number of ways that tracking can help address current and emerging environmental public health challenges such as developing baseline measures to assist with preparedness responses and climate change, as well as expanding into broader determinants of health including the built environment and socio-economic factors.

The panel discussed the potential of using tracking data to establish an understanding of baseline measurements for preparedness responses. Policy-makers can use tracking data to assess specific public health disasters, such as hurricanes or oil spills. These are situations where baseline data on the environmental and public health status can be critically useful to engage in disaster response and research. E.g., tracking data would allow for the analysis of spikes in adverse health effects related to disaster situations. Some of these capabilities were deployed by the New Jersey, New York State and New York City tracking programs after Hurricane Sandy to assist with response efforts including tracking emergency department visits to inform facility access, capacity and re-supply; and maps of high-rise apartments in flooded areas of NYC assisted responders with door-to-door outreach (NACDD 2015).

Additionally, tracking offers opportunity to build on new technologies and data collection approaches, such as crowd-sourcing data. This technique could be useful for food safety-related

work and has been used for HABs and tick surveillance in Vermont. Hand-held sensors for environmental sampling also represent an opportunity for crowd-sourcing data. Crowd-sourcing is one option for data linkages; however, there is also potential to link to a number of EPA data and mapping resources including Community Focused Exposure and Risk Screening Tool (C-FERST), EJScreen, and EnviroAtlas (EPA 2015a, b, c).

Tracking has emphasized "traditional" environmental health approaches focused on the ambient environment such as air quality, and the next steps are to expand beyond to broader issues such as the built environment; as well as understanding the social environment/socio-economic context within which the data resides to add further depth to exposure-adverse health effect relationships.

Breakout Group Discussions

A renewed scientific vision and approach to building the Tracking Program

While working on the discussion prompts in breakout groups, participants also provided input on approaches to strategic planning and program development. The planning and program development discussion is summarized here and the more specific ideas developed around the discussion prompts on new opportunities and applications, data and methods, and communication and value are presented below.

Tracking will benefit from a two-pronged strategy including both scientific and operational components. There should be a scientific foundation including an aim to build the environmental health evidence base. A priority activity will be to identify shared scientific goals within CDC and among partner agencies at the national level and among grantees at the state and local levels to develop environmental public health questions to address. The scientific goals must be clearly linked to practice to serve as the base for program operations.

Tracking will benefit from a high level leadership group to provide input and help the program articulate the scientific vision and achieve a higher profile. Tracking is the glue for the field, serving as the interconnection between health, environment and healthcare. Positive building of the program, agenda, and data needs to continue, and Tracking needs to determine the key

players in setting the long-term agenda for the future. As it stands, state tracking programs have good partnerships with each other, federal agencies, academia, and non-governmental organizations; however, to sustain and build on these existing partnerships ownership and support from a core group of CDC and other federal agency leaders is needed. High-level connections across agencies can enhance capacity building and long-term support.

The scientific agenda must be fleshed out and aligned with the practice-based mission and balanced with the capacity of the Tracking Program. Two priority scientific topic areas for tracking were suggested by workshop participants: 1) climate change; and 2) social determinants of health. The Tracking Program is primed to develop an approach to understanding the changing environment but will likely need additional exposure and outcome datasets. Additionally, the field of environmental public health is leaving the old paradigm of contaminant-by-contaminant prevention and entering a new paradigm with multifactorial exposures and determinants of health; this must be incorporated into the Tracking Program.

Other program development ideas included:

- Strengthening connections to the health care community and ACA-related data and assessment needs; and
- Developing an approach for sustainable growth of the Tracking Program such as metrics of success to determine the impact of various tracking activities. These measures of impact can then be used to inform decisions on what activities to continue/discontinue/develop when new opportunities arise.

The workshop did not include participants from the healthcare community or health economists. Reaching out to these partners will be needed to establish priority activities in linking to the health care community. Involving these groups will facilitate better development and monitoring of health indicators.

Discussion Prompt 1: What are the unique opportunities or new areas of application for Tracking?

Incorporating data from the Tracking Network into Health Impact Assessments (HIA) is one way to add value and build capacity into the Tracking program. HIAs allow policy-makers to bring

together expertise in all relevant sectors with necessary data and stakeholder opinion to propose and refine new programs, projects or laws. HIAs allow health departments to model the impact of a community's action and set priorities. Because HIAs address the multi-factorial nature of decision making, contributing to a HIA can showcase the breadth of data available through tracking programs and additionally could spur development of expanded tracking datasets, where needed. The increasing prevalence of HIA as a policy-development approach at local, state and national levels, makes it a priority opportunity for Tracking.

Another component that might be helpful in building connections to HIA and identifying other growth opportunities for tracking is a better understanding of how the data are used. Aggregate data on where, how and how often tracking data is used could prove beneficial to further developing the portal and articulating its value.

Strengthening tracking for community health was a core component of the Pew Commission vision for the Tracking Program and will be important in moving forward. Using tracking to support community needs assessments and related practice projects is one way to accomplish this aim. Tracking data can be used to assess concerns and create public health "priority lists" on a local level by understanding where the health concerns are, what populations are affected, and how they intersect. Of course, there needs to be adequate capacity to follow-up and conduct the necessary intervention and education activities in response to the community needs and interests identified by these assessment efforts.

Working with the Association of Schools and Programs of Public Health to improve the link between academia and Tracking allows for better support for research and training of students. Students can utilize data from the Tracking Network to develop manuscripts and research proposals, conditioning them to use this data in environmental public health research.

Figure 1: Concepts discussed in response to Discussion Prompt 1[1]

Discussion Prompt 2: How do we move Tracking into the future?

Data scale was identified as the biggest challenge in moving the Tracking Program into the future, both spatially and temporally. The first priority is to identify holes and fill in the surveillance map; all states need to be included, as this will better facilitate data completeness and linkages. Enhancing the granularity of tracking data will be key for future improved utility of the data to allow for a "drill down" effect of exposure and health effect data. Census tract data is the ideal option, but strategies to overcome obstacles to obtaining this granular level of data are needed. Additionally, data on chronic conditions and exposures over long-term periods as well as short-term periods allows for programmers and data users to drill down to specific time frames. This can prove useful for extreme events and disaster interventions. From an

[1] Word cloud created via Tagxedo at: http://www.tagxedo.com.

information technology perspective, Tracking needs to incorporate both aspects of scale into the continued development of the portal. End users should be able to define the scale of time and space. With expanded, more granular data comes increased complexity for the data steward and analytical complexity for the user. Data sharing rules need to be established and enforced and users must look at the right scale of data to answer their intended questions in order to best inform policy and program decisions.

Tracking can also benefit from non-traditional sources of data, such as healthcare utilization and crowd-sourced disease information via mobile technology. As seen with the Google's flu predictor, this source information might prove to be timelier than traditional surveillance methods. Pharmaceutical scripts reported to national databases can be combined with tracking data for a better understanding of health needs on a local level. This ad hoc approach to surveillance allows for flexibility to adapt to the ways information is tracked and collected for spontaneous problems that might arise. Public-private partnerships might be a feasible avenue in order to capitalize on these sources of data. This information has broad reaching applications from citizen scientists concerned about their communities to industries looking to develop a niche to real estate agents selling in environmentally healthy areas. As with any new source of information however, Tracking must make a vested interest in validating such data and communicating its limitations.

Tracking provides a baseline to characterizing multivariate exposures and health information. This can inform a research agenda to further develop surveillance priorities. Biomonitoring is one tool to connect with tracking data to better understand multivariate exposures. Applying socioeconomic factors then adds another layer to this data for the purpose of targeted interventions. A first step would be to assess what EPA and the Agency for Toxic Substances and Disease Registry (ATSDR) currently monitor in-house and build off of those ongoing regulatory tracking activities. Tracking should not be used to create new surveillance systems, but rather should leverage existing systems when feasible. Leveraging the low-hanging fruit already in existence at multiple agencies is a first step in breaking down silos.

Tracking needs to prioritize engagement, partnerships and education as it moves into the future. Medical and nursing curriculum communities can facilitate incorporation of environmental factors to the medical community. Partnerships do not stop at interagency collaborations, as they

need to include local health organizations and members of the public. With these connections, Tracking enhances its 'triple threat' potential for assessment, research and practice.

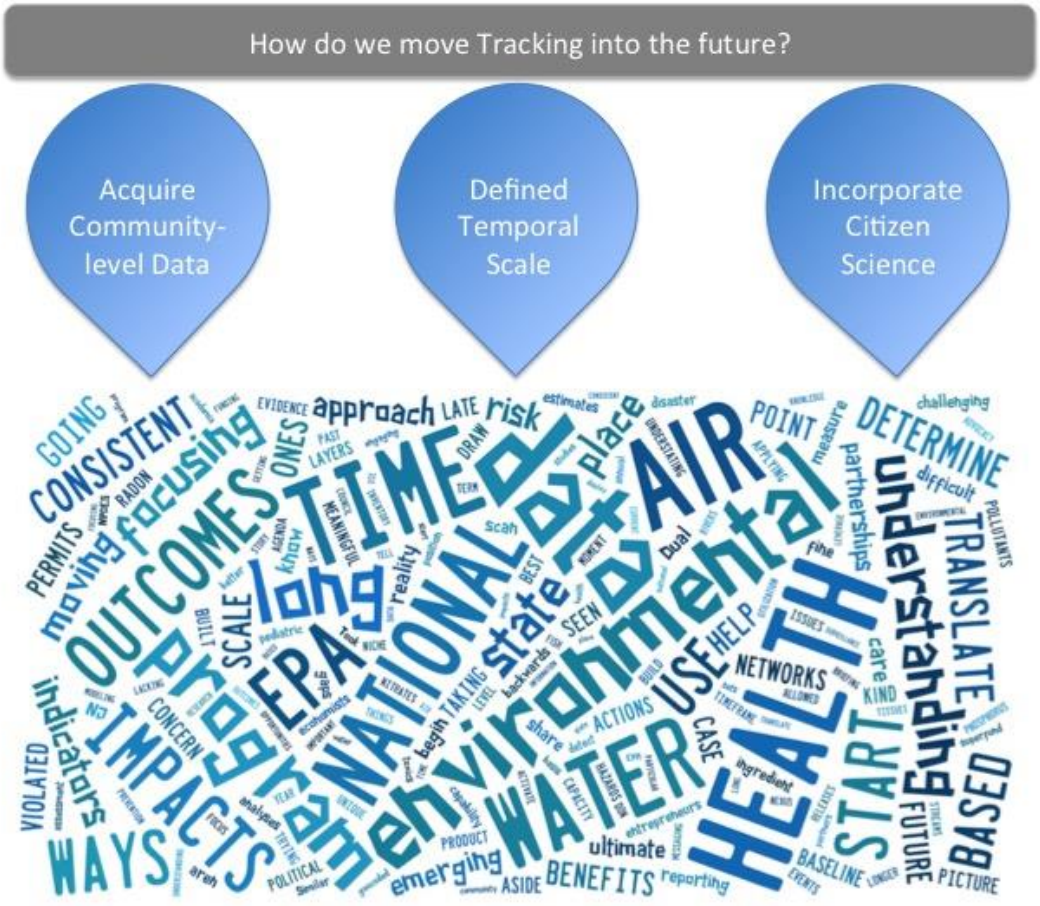

Figure 2: Concepts discussed in response to Discussion Prompt 2[2]

Discussion Prompt 3: What are new ways to articulate and communicate the value of Tracking?

HIAs were highlighted as an important instance of users outside of public health programs capitalizing on the potential of tracking programs. For example, the Massachusetts Department of Transportation incorporated tracking data into its HIA for a highway project and was able to demonstrate that the project alternatives offered improved health over the status quo (NACDD

[2] Word cloud created via Tagxedo at: http://www.tagxedo.com.

2015). From a political perspective, the incorporation of tracking data into HIA allows policy-makers to examine interventions and outcomes with direct relevance for their constituents. Reframing the story to analyze the return on investment for more strategic allocation of resources is another approach to exhibit its value to policy makers. For example, data from the tracking has been used to demonstrate that community cancer rates were no higher than expected, thus avoiding a disease cluster investigation that would likely be very costly and take years to complete. Having multiple sectors of a community, both governmental and non-governmental, use the tracking portal will inevitably create demand as well. Advocacy groups were the impetus for the Tracking Program, and it is essential that Tracking communicates with these stakeholders to assure that the program meets their needs, as well as communicating the value of tracking to them.

In terms of marketing the utility of tracking, the program needs to develop user statistics that are easily understood and shared to broad audiences, such as how the tracking data are/were used, i.e., individual or organization decision-making, informing a public policy, research, etc. Coupling this with success stories is integral to effective communication. One challenge in this regard is translating the value of the vast number of data inputs into value that can be easily understood by the public.

Concern about ecological fallacy with Tracking data leads to caution in communicating the results of a linkage project or investigation. Focusing on stories where the exposure and outcome plausibility is strong can help alleviate this concern. The data does not necessarily sell itself; however, the stories do. For areas where there is no direct connection between a health outcome and patterns of exposure exhibited in the Tracking data, it is important to state as such. For areas where there is no known connection, the value of the Tracking program lies in its ability to clarify the landscape, inform the debate and suggest necessary research. Essentially, messaging must fall into three categories: known associations, no association, unknown associations. Communicating some of these stories directly on the portal could prove beneficial as well. Tracking needs to determine a flagship issue to highlight in order to better advocate its utility and capability to researchers and policy-makers; one such flagship possibility is climate change.

In spite of the concern for ecological fallacy, it is imperative that research conducted through the use of tracking data be published as it is one of the strongest ways to demonstrate and communicate its value to the broader research community. Timing of publications and communication of the value of tracking through coordinated efforts between academia and government could prove powerful for translating the data into practice. Stakeholder involvement is key for successful reception of overarching messages; thus the data should be relevant for their needs. Information is key for maintaining a healthy environment, particularly when operating in a non-regulatory climate. In such situations, a Tracking program might be a more palatable and politically feasible option than additional regulation.

Tracking could benefit from an Institute of Medicine report to establish it in the field as a valuable tool for scientific use. Through such an IOM report, it could become a core component in environmental public health. In addition to this, partnering with educational institutions will help to facilitate uptake of Tracking data usage, as the workforce will increasingly be trained in its capabilities and applications. Futhermore, these suggestions are provide opportunities for the Tracking Program to solicit feedback from a wide range of environmental public health professionals on how best to strategically increase the scope of the program.

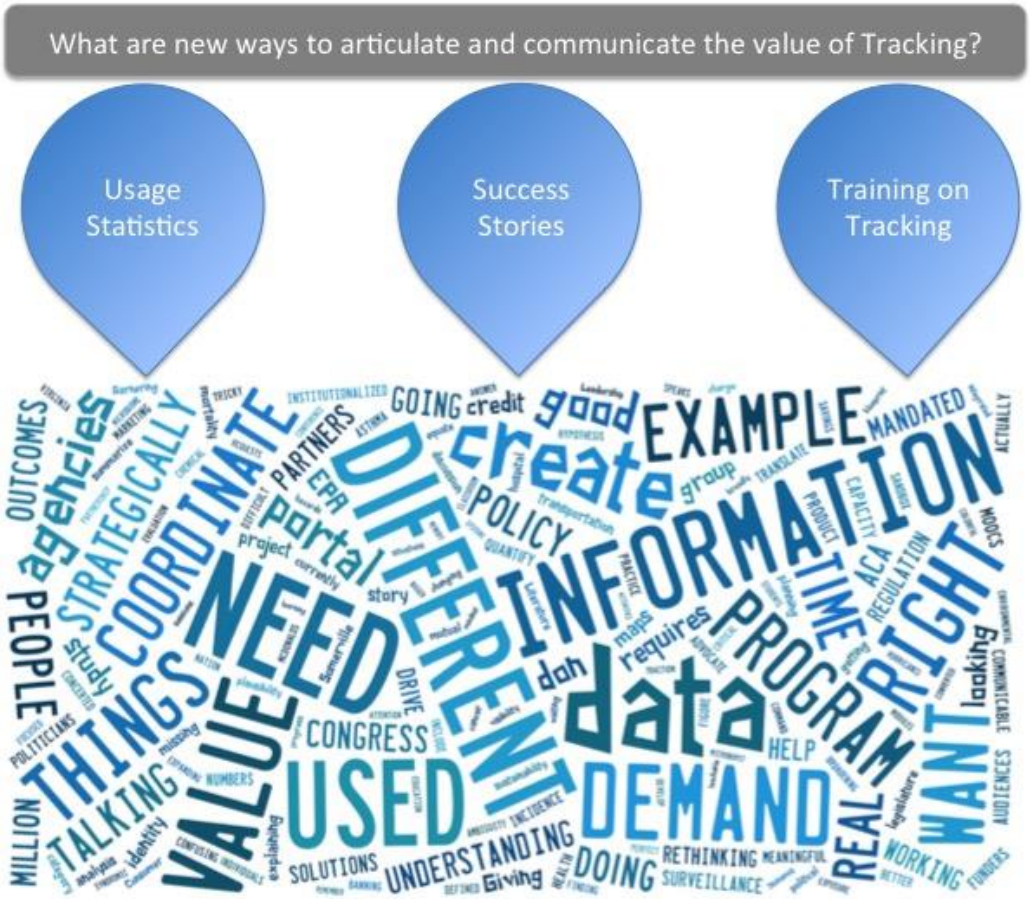

Figure 3: Concepts discussed in response to Discussion Prompt 3[3]

Recommendations

Following the first day of the workshop, JHU investigators met to identify main themes and organize recommendations by theme. The themes were reviewed and recommendations were prioritized by the full group on the second day of the workshop. Recommendations resulting from the discussion of Prompts 1 and 2 were re-organized under the theme of "Opportunities"; "Communication" was identified as a theme building on the discussion of Prompt 3; and a cross-cutting theme of "Leadership" was identified that was recognized as key to achieving the other recommendations.

[3] Word cloud created via Tagxedo at: http://www.tagxedo.com.

Key Points: Leadership

Development and renewal of partnerships need to be an ongoing priority at both the national and state levels. Workshop participants recommended that Tracking develop data and projects focusing on content where partnerships with USDA and FDA will be necessary. Additionally, CDC staff mentioned ongoing work to develop partnerships with health care organizations, which are critical to establishing high priority data linkage opportunities that workshop participants recommended. New partnership efforts should expand to the private sector including technology companies that may offer solutions to facilitate citizen science applications for Tracking.

Long-time academic colleagues familiar with tracking, Drs. Patrick Breysse and Thomas Burke are now in leadership positions at the CDC National Center for Environmental Health and at US EPA's Office of Research and Development, respectively. This presents a clear opportunity to strengthen the existing CDC and EPA partnership around Tracking and potentially foster new work such as linkage projects around biomonitoring, preparing new EPA datasets for distribution via the Tracking Network, and collaborations with EPA's HIA initiatives.

It is anticipated that CDC's current strategic planning work in partnership with grantees (of which this project is a part) will likely contribute to the outlines of a shared agenda for Tracking including activities to advance environmental public health science and practice. Public health actions and related outcome measures driven by the shared agenda should become new success stories for communication and outreach.

Key Points: Opportunities

Six priority opportunities were identified at the workshop falling into two categories: 1) data and projects; and 2) capacity and support. Participants encouraged Tracking to expand the available datasets to include more existing exposure-related data from EPA, US Department of Agriculture (USDA) and USGS, for example, and to develop new outcome datasets from health care systems or health information exchanges. Expanding the "reach" and value of Tracking by supporting different kinds of assessments including HIA, ACA-related community assessments, vulnerability and other types of community health assessments was also recommended. New

public health topic areas were also suggested including environmental justice, climate change, microbial and chemical food safety, and built environment and community design. Linkage projects incorporating biomonitoring were also recommended.

Under capacity and support, workshop participants prioritized building capacity for disaster response and tracking of sentinel events and diversifying sources of funding for tracking. In order to improve the reach and dissemination of tracking data, participants recommended that various types of training be provided to health professionals through curriculum via the Association of Schools and Programs of Public Health (ASPPH) and research internships or fellowships. Massive online open courses (MOOCs) may also be a venue to raise the profile of Tracking for the general public. Although recognized as a longer-term objective, getting 50 state involvement was recommended.

Participants spoke about redundancies within the Tracking program that could be eliminated in order to build internal efficiency and conserve resources. While there is no standard IT infrastructure, developing one that the current tracking states can transition into and new states can adopt as they enter the network would greatly improve efficiency. States would then save resources by not "reinventing the wheel". A strong caution was raised by participants about expanding too quickly or attempting many new activities without a careful consideration of starting new projects while managing those ongoing. One participant suggested that an evaluation scheme would be valuable to identify work that can be stopped to then allow for new projects to begin.

Key Points: Communication

Workshop participants recognized that providing accurate data to meet user needs is not only part of tracking's core mission but also should be a high-priority aspect of communication. A key to the tracking brand identity is a reputation as a respected data and information source supporting the "right-to-know" about the environment and building the capacity for data access and transfer of information. Workshop participants recommended development of effective communication strategies that acknowledge and build on program successes, and particularly focus on outcomes, impacts and positive return on the Tracking investment. To further enhance communication efforts of the Tracking Program and grantees, "champions" for tracking who can

articulate the value of tracking from different perspectives should be identified and engaged in coordinated communication campaigns.

Figure 4 adapts the sun imagery of the Tracking Program logo to illustrate key messages of the recommendations. From a central core of strong leadership numerous opportunities can be developed to enhance the Tracking Program. Implementation of each opportunity represents a chance to communicate information, actions and successes with the ultimate goal of improved public health.

Figure 4. Illustration of workshop recommendations.

Expert Panel Recommendations

Leadership

Engage program and agency leadership, build and maintain partnerships, create an agenda promoting science and practice

1. Develop and enhance strategic partnerships
    a. Health delivery system, e.g., Accountable Care Organizations
    b. Private sector, technology companies
    c. Federal agency partners: DOT, DOD, FEMA, USDA
    d. APHA, develop a policy/position statement on EPHT
2. Foster multi-level leadership buy-in
    a. Leverage current CDC, EPA, and other agency leadership
    b. Institutionalize collaboration
3. Build/promote a shared agenda
    a. Strengthen the environmental public health evidence base
    b. Inform environmental public health practice actions and measure outcomes

Opportunities

Build new data, linkages and funding sources, develop disaster response capacity, provide training, build toward 50-state network

1. Explore new health topics and data linkages
    a. Promote and develop EPHT for use in Health Impact Assessment, community health needs assessments, and other multi-disciplinary assessment approaches
    b. Enhance data to address environmental justice, climate change, food, built environment and community design
    c. Develop data linkage projects to include internal markers of exposure and health effects
2. Expand datasets to include other existing or emerging data, such as
    a. Health care-related data sources
        i. All payer claims data (APCD)
        ii. Health information exchanges (HIE)
    b. Other (at EPA, USDA, etc)
3. Develop tracking capacity to add value to disaster response and track sentinel events
4. Leverage resources: build internal efficiencies (e.g., economies of scale, data interoperability, etc.), secure external support
5. Provide tracking training/education for health professionals and the general public
    a. Conduct massive online open courses (MOOCs)
    b. Build EPHT into curriculum at public health schools/programs
    c. Establish research internships and fellowships
6. Expand to 50 state network

Communication

Enhance data availability, branding, and coordinated communications

1. Disseminate information to users (community, researchers, others) in user friendly formats: timely data that is scalable in time and space
2. Gain "Traction for Tracking"
    a. Build identity and brand. Key messages: EPHT is a national network; EPHT provides open data access advancing the right-to-know; EPHT builds capacity for timely information sharing
3. Conduct effective communication and outreach
    a. Engage partners for coordinated communication activities
    b. Highlight outcomes and impacts
    c. Promote success stories to acknowledge and build on EPHT progress

Discussion: Building the future of Tracking

Enhancements

As the Tracking Program currently stands, workshop participants and questionnaire respondents requested that CDC work towards providing small area community-level data to improve upon the breadth of existing datasets. The provision of this data would allow for better-informed policy decisions, and greater ability to compare statistics across different communities. This is especially important for informing activities such as Health Impact and community health assessments. Incorporating social determinants of health into the data collection process would add another layer of depth to these assessments as well, and allow policy developers to plan within the context of health disparities and environmental justice concerns. Additionally, community-level data will allow emergency responders to work within a framework that is built upon baseline data collected through tracking. In order to achieve this, both workshop attendees and questionnaire respondents acknowledge that IT improvements might be necessary to accommodate the expansion of data collection and to support additional data linkages in this regard.

As tracking moves into the future, workshop participants and questionnaire respondents note that communicating its utility to policy makers and other users is the only way to ensure continued, sustainable growth of the program. Success stories should be regularly solicited and distributed for this purpose.

A collaborative effort

With the current leadership in federal agencies looking favorably towards the efforts of the Tracking Program, it is critical that all parties are engaged in shaping future directions. Coordination efforts at this time will reduce duplication of effort and streamline resources. The end result will be integrated, useful data for environmental public health policy development. Cross-agency collaboration can also lead to diversified funding sources at the federal and state

level. In addition, outside sources of funding might recognize such coordinated efforts and be more inclined to support them.

Moving forward in the next 3-5 years, workshop participants and questionnaire respondents requested clear, coordinated, long-term scientific goals and practice objectives in order to better serve the needs of the public. Without a shared agenda for science and practice linking work from the national level to state and local programs, sustaining impactful accomplishments will be difficult. Three workshop participants provided additional comment on some of the short and long-term priorities they would recommend to the Tracking Program, see Appendix IV.

Conclusion

This work has affirmed that, since its inception in 2002, the Tracking Program has developed impressive networks of agency partnerships and environmental health professionals, created an IT infrastructure capable of sharing data and information for many important environmental public health topics, and built the corresponding analytical and response capacity for making informed public health actions through fellowships, trainings and the 26 grantee programs housed in 25 states. As the Tracking Program considers the emerging issues and challenges identified above, the workshop recommendations offer a way forward built on leadership and engagement of decision-makers, collaborations and new opportunities. From its current foundation and acting on these recommendations, the Tracking Program is poised to advance environmental public health capacity and evidence-based practice over the next five years.

References

Burke TA, Shalauta NM, Tran NL, and Stern BS. 1997. The environmental web: A national profile of the state infrastructure for environmental health and protection. Journal of Public Health Management and Practice 3(2): 1-12.

Burke TA, Tran NL, Litt JS, Apelberg BJ, and Chossek K. "America's Environmental Health Gap: Why the Country Needs a Nationwide Health Tracking Network." Final Report prepared for the Pew Environmental Health Commission, Baltimore, MD, September 2000.

Centers for Disease Control and Prevention (CDC). 2006. Keeping Track, Promoting Health. Available: http://www.cdc.gov/nceh/tracking/pdfs/healthtracks.pdf [accessed August 28, 2015].

Environmental Protection Agency (EPA). 2015a. Community Focused Exposure and Risk Screening Tool (C-FERST). Available: http://www2.epa.gov/healthresearch/community-focused-exposure-and-risk-screening-tool-c-ferst [accessed August 28, 2015].

EPA. 2015b. EJ Screen: Environmental Justice Screening and Mapping Tool. Available: http://www2.epa.gov/ejscreen [accessed August 28, 2015].

EPA. 2015c. EnviroAtlas. Available: http://enviroatlas.epa.gov/enviroatlas/atlas.html [accessed August 28, 2015].

Institute of Medicine (IOM) 1988. The Future of Public Health. Washington, D.C.: National Academy Press.

Kearney GD, Namulanda G, Qualters JR, Talbott EO. 2014. A decade of Environmental Public Health Tracking (2002-2012): Progress and challenges. Journal of Public Health Management and Practice 21(2 Suppl):S23-S35.

Litt J, Tran N, Malecki K, Neff R, Resnick B, and Burke T. 2004. Identifying priority health conditions, environmental data, and infrastructure needs: A synopsis of the Pew Environmental Health Tracking Project. Environmental Health Perspectives 112(14): 1414-8.

Litt JS, Wismann A, Resnick B, Dawson RS, Hano A, and Burke TA. 2007. Advancing health and environmental disease tracking: a 5-year follow-up study. American Journal of Public Health 97(3): 456-463.

National Association of Chronic Disease Directors (NACDD). Tracking in Action: Success Stories from CDC's Environmental Public Health Tracking Network. Available: http://c.ymcdn.com/sites/www.chronicdisease.org/resource/resmgr/Tracking_in_Action_Publication/Tracking_in_Action_Final_rev.pdf [accessed August 26, 2015].

Pew Environmental Health Commission. 2000. Technical Report. Available: http://www.jhsph.edu/research/centers-and-institutes/center-for-excellence-in-environmental-health-tracking/pew_technical_report.pdf [accessed July 2, 2015].

Pew Environmental Health Commission. 2000. Companion Report. Available: http://healthyamericans.org/reports/files/healthgap.pdf [accessed August 21, 2015].

Appendix I. Expert Panel Workshop Participant Roster

Scott Becker, Executive Director, Association of Public Health Laboratories

Thomas Burke, Deputy Assistant Administrator, US Environmental Protection Agency

Suzanne Condon, Associate Commissioner for Health, Director, Bureau of Environmental Health, Massachusetts Department of Public Health

Curtis Cude, Section Manager, Oregon Health Authority – Public Health Division

Jerry Fagliano, Program Manager, NJ Environmental & Occupational Health Surveillance Program

Michael Focazio, Program Manager, US Geological Survey, Toxic Substances Hydrology Program

Florence Fulk, National Exposure Research Laboratory, US EPA

Susan Klitzman, Professor and Senior Associate Dean, CUNY School of Public Health

Jill Litt, Associate Professor, Colorado School of Public Health

F. Javier Nieto, Professor and Chair, Population Health Sciences, University of Wisconsin-Madison

Glen Patrick, Epidemiologist, Washington State Dept. of Health EPHT Program

Martha Stanbury, Manager, Michigan Department of Community Health

Tener Veenema, Associate Professor, Johns Hopkins School of Nursing

Tim Watkins, Deputy National Program Director for the Air, Climate, and Energy, US EPA

with

Frances Phillips, Facilitator

Appendix II. Workshop discussion prompts

Prompt 1: What are the unique opportunities or new areas of application for Tracking?

What's working (successful projects) and what can we do more of (projects that should be replicated or "scaled up")?

Of the unique opportunities and new areas discussed, which do you recommend as top priorities?

Identify 6 - 12 month and 2 – 3 year action items to implement recommended opportunities and applications.

Prompt 2: How do we move Tracking into the future?

What indicators, tools, methods, or data are needed (and at what scale) to support these essential public health functions and research goals?

Who are the partners to leverage the Tracking data for future uses and opportunities?

What are the 'lessons learned' that are important to shape the program for the future?

Considering the tools/methods, partners, and lessons learned we discussed, which do you recommend as top priorities?

Identify 6 - 12 month and 2 – 3 year action items to implement recommended tools/data, partnerships, program directions.

Prompt 3: What are new ways to articulate and communicate the value of Tracking?

We have identified unique opportunities (Q1) and ways to meet those opportunities (Q2). How will these opportunities, methodologies, partnerships or program areas improve what you do?

What have you found to be effective to communicate the value of Tracking to organizations and EPHT partners you work with? What makes Tracking meaningful to your constituents and partners?

Considering the value of new initiatives and communication ideas discussed, which do you recommend as top priorities?

Identify 6 - 12 month and 2 – 3 year action items to develop recommended approaches to reach various EPHT stakeholders and partners.

Appendix III. Additional outreach questions

1. What are the current issues in your state that an environmental health surveillance system (such as Tracking) could help you address?
2. Are there emerging issues you anticipate in the next 2 – 5 years that would likely benefit from an environmental health surveillance system (such as Tracking)?
3. Based on your knowledge of the Tracking Program, what datasets, tools, methods, or applications you would like see developed and included?
4. From your perspective, what is the value of the Tracking Program?
5. Capacity building is an important component of the Tracking Program. How would you rate your agency's current environmental public health capacity in the following areas?
    a. Communication with the public
    b. Data collection
    c. Data analysis
    d. Equipment/infrastructure
    e. Health effects information
    f. Knowledge/training
    g. Personnel
    h. Other, please specify
6. What agencies/organizations do you **currently collaborate with** in any of your environmental public health work? Please reply to all categories with the names of organizations/agencies you currently work with or respond "none." You may write the names of multiple organizations/agencies in each box.
    a. Local
    b. State
    c. National
    d. Universities/Academic institutions
    e. Other organizations/agencies
7. What agencies/organizations are you currently not working with that you would **like to collaborate with in the future** on your environmental public health efforts? Please reply to all categories with names of organizations/agencies you would like to collaborate with or respond "none." You may write the names of multiple organizations/agencies in each box
    a. Local
    b. State
    c. National
    d. Universities/Academic institutions
    e. Other organizations/agencies
8. Are there barriers to collaboration? If so, please describe.
9. What do you consider to be the most effective way(s) to communicate with the public about issues related to environmental health? (Please be as specific as possible with regards to communication messages/tools/venues, etc.).
10. What are some of key barriers you face in communicating with the public about issues related to environmental health?
11. Please rate the items listed below as to the level of challenge they present in addressing environmental public health issues.

a. Collaboration/Partnerships
b. Data access
c. Data quality/Usability
d. Health effects information
e. Health based guidance/standards
f. Laboratory capacity
g. Outreach and communication
h. Personnel
i. Support/Interest from your agency leadership
j. Technical expertise
k. Training
l. Other, please specify

12. For the issues you ranked above as "extremely challenging" please rank your top three challenges (#1 being the most challenging)
13. Please comment, as necessary, to explain your ranking of the challenges above.
14. Please provide any additional comments you would like to share with the CDC Environmental Public Health Tracking program regarding current and future environmental public health protection.

Appendix IV: Priority Agenda Items

NOTE: The following additional advice on short vs. long term priorities was provided by three workshop participants.

Short Term Priorities (1-2 years)

Opportunities

1. Explore new health topics and data linkages
    a. Promote EPHT for Health Impact Assessments, community health needs assessments, etc.
    b. Develop data to address environmental justice, climate change, food, built environment and community design
    c. Add high value topics given the resource constraints
    d. Provide better understanding of multivariable exposures
2. Develop capacity to add value to disaster response, track sentinel events
    a. Add a retrospective analysis in these situations
3. Provide training opportunities for health professionals and others
    a. Research internships and fellowships
    b. Incorporate training into schools of public health

Communication

1. Conduct effective communication and outreach
    a. Engage partners for coordinated communication activities
    b. Focus on outcomes and impacts
    c. Acknowledge and build on progress by promoting the success stories
2. Build "Traction for Tracking"
    a. Build identity and brand. Key points: EPHT is a national network; EPHT provides open data access advancing the right-to-know; EPHT builds capacity for timely information sharing

Leadership

1. Continue developing strategic partnerships
    a. Federal agency partners: DOT, DOD, FEMA, USDA
    b. APHA, develop a policy/position statement on EPHT
2. Foster multi-level leadership buy-in
    a. Leverage current CDC and EPA leadership
    b. Institutionalize collaboration
3. Build/promote a shared agenda
    a. Building the environmental health evidence base
    b. Taking public health actions and measuring outcomes
4. Extend and expand resources: improve internal efficiency and secure external support
    a. Evaluate current programming to determine whether datasets are optimal
    b. Should some datasets be modified, reduced, or eliminated?

Long Term Priorities (3-5 Years):

Opportunities

1. Explore new health topics and data linkages
    a. Develop linkage projects featuring biomonitoring of exposure and effects
2. Expand datasets to include other existing or emerging data
    a. Health care-related data sources
        i. All payer claims data (APCD)
        ii. Health information exchanges (HIE)
    b. Other (at EPA, USDA, etc)
    c. This should be done in conjunction with state and federal data stewards
3. Extend and expand resources: Improve internal efficiency, secure external support
4. Provide training opportunities for health professionals and others
    a. Build EPHT into curriculum at public health schools/programs
    b. Develop massive online open courses (MOOCs)
5. Expand to 50 state network
    a. This would require doubling of resources

Communication

1. Get information to users (community, researchers, others) in user-friendly formats: timely data scalable in time and space

Leadership

1. Continue developing strategic partnerships
    a. Health delivery system, e.g., Accountable Care Organizations
    b. Private sector, technology companies