Background:

The Centers for Diseases Control and Prevention (CDC) defines Environmental Public Health Network Tracking (EPHTN) as an ongoing collection, integration, analysis, interpretation, and dissemination of data from the environmental hazard monitoring, and from human exposure and health effects surveillance. Several studies have linked environmental hazard exposures to specific diseases. For example, exposure to lead has been linked to decreased mental function in children; asbestos to lung cancer, and chlorine from shower heads to bladder cancer. The need to gather, organize, integrate, analyze, and report data on chemical contaminants for the purpose of environmental public health surveillance is therefore necessary.

In the District of Columbia, before 2006, environmental health authority resided with the District of Columbia, Department of Health (DC DOH). The integration allowed for effective monitoring of the various dimensions of environmental health related problems in the District. Removal of the environmental health authority from DC DOH led to fragmented responsibility and lack of coordination of environmental public health surveillance. By 2010, it became evident that the environmental health system in the District was neither organized nor adequate thereby creating the need to join a nationwide environmental health network tracking system to monitor diseases and exposures in the District. Limited/no funding impeded the development of the DC EPHTN and the idea was stalled. The Principal Investigator (PI) of this grant applied for and was awarded the Association of State and Territorial Health Officers Phase I Fellowship to visit the Utah Department of Health to gain first-hand experience in tracking-related issues. The PI visited Utah in April 2009 and gained knowledge on Utah’s EPHT Program.

The planned next steps identified during Phase I of the State-to-State Peer Fellowship Program were to implement the DC DOH EPHT Network (DC EPHTN) and provide data for public health tracking. The Center for Policy, Planning & Evaluation (CPPE) was eligible to apply for Phase II funding, and in April 2012 was awarded $18,000 by ASTHO to design a demonstration project linking environmental exposures to health outcomes.

Phase II Project Activities

There were three major goals for this project:

1. Establish an EPHT Technical Advisory Group
2. Collaborate and Network with State Environmental Health Program
3. Develop a state tracking demonstration project and Perform data analysis that links health and environment data
1. Establish an EPHT Technical Advisory Group

CPPE established a Technical Advisory Group (TAG) which met quarterly since 2009, but in 2011 meetings were held when necessary, for example, if a new grant was being developed or if it needed to seek advice and support for ongoing activities. The TAG is composed of DC DOH program managers, DC Department of the Environment (DDOE) program managers, an attorney, epidemiologists, university professors, data owners, environmental health professionals, and laboratorians. It is currently composed of 12 active members. The DC EPHT Program planned to identify new members to include IT, public health informatics specialists and communication specialists who are not in the current membership. We were able to add a public health informatician and an IT specialist to the TAG. It has been difficult to get our communication officer involved in the group because of other competing priorities. The DC office of Communication will be consulted whenever necessary, especially when health messages must be communicated. Current DC DOH regulation requires that the Office of Communication is consulted to help prepare and approve all health messages.

2. Collaborate and Network with State Environmental Health Program

CPPE planned to adopt Maryland’s current EPHTN and build a DC EPHTN portal as part of a regional tracking system so DC and Maryland could share data. The PI had earlier discussed the possibility of adopting a customized Maryland Environmental Public Health Tracking Network. This had followed work group collaborative discussions between DC DOH and the State of Maryland, Department of Health and Mental Hygiene (MD DHMH) about developing an EPHTN for the District. The system was to be called “The District of Columbia Environmental Public Health Network Tracking Network (DC EPHTN)”. The goal was to develop a tracking system that would integrate data to help track exposures that might be linked to diseases in the District and to share data on environmental hazards, exposure to environmental hazards, and health effects potentially related to environmental hazards in the national capital region. The overall benefit would be improved health outcomes for all District residents and for all communities at large in the national capital region. Between July and September, three telephone conference calls were held with MD DHMH to discuss the partnership and consultation with the University of Maryland, the developer of the MD DHMH EPHTN. This was followed by email exchanges including a meeting between the partners at the Tracking Workshop in Denver, Colorado in April/May, 2012. The DC DOH Chief Information Officer and the PI also held two telephone conferences with the University of Maryland Contractor and several conference calls were held between the DC statistician and the Epidemiologist at MD DHMH, Dr. John Braggio. Dr. Braggio discussed the required standards and format for the data that matched the MD DHMH current data plan. Meetings were also held between the DC DOH statistician and the University of Maryland Contractor. Maryland organized a Regional Portal Discussion on August 25th 2013 to discuss the project and attract other interested states. ASTHO also organized several calls and webinars throughout 2012.
a. The Demonstration Project

The DC EPHTN and Mid Atlantic Regions Tracking System were built as a demonstration project to fulfill the requirements of the Phase II grant. It was the intent of the project to demonstrate a DC EPHTN by customizing the Maryland EPHTN to form the basis of a regional EPHTN. Hosting, operating middleware, and system software layers of the MD EPHTN are server-based opposed to the cloud, so that the District could customize operational functions of the MD EPHTN. Currently, the DC EPHTN is hosted by the Maryland Department of Health. For the District’s system to run independently of Maryland, it would require the District to host its own servers with oracle reporting database management systems as well as layering for the geographic information systems technologies. Ward attributes in the District are conjuncts to agile forms of segregated political decisions and require unique GIS services in a manner that can be centrally managed to support multiple users in the District. The current system contains data on DC asthma and myocardial infarction. See link to the DC EPHTN and Regional system.

DC Asthma Data:
http://dc.ephtracking.net/dc_staging_pub/maps_flex.aspx

DC Myocardial Infarction (MI) Data:
http://dmv.ephtracking.net/dmv_staging_secure/maps_flex.aspx

ID/Password for DC EPHTN MI Data
Log in ID: testuser
Password: test1Password

The Regional EPHTN:
http://dmv.ephtracking.net/dmv_staging_secure/maps_flex.aspx

ID/Password for Regional System:
Log in ID: testuser
Password: test1Password

b. Features of the DC EPHTN

User Interface:
The features of the DC EPHTN are the same as the MD EPHTN. The description below shows the capability of the MD EPHTN. The viewer can use queries to select objects to be displayed via selection, and can port data into an application that is of interest to them. Queries are activated as soon as the Queries tag on the EPHTN portal is clicked on. Here, the user can access the health or environmental variables and enter selection criteria. Figure 1-1 shows the different filters that can be combined interactively to select the desired results. A user can select one variable to view results in one-way table, or two variables to view results in two-way tables. The second level drop boxes may change based on the selection of row and column variables.
Single-selection of an item can be made using the drop down list. Users can control appearances of the drop down List control by setting the border Color, border Style, and border width properties. To specify the items that needed to appear in the drop down List control, place a list item object for each entry between the opening and closing tags of the drop down List control.

The query screen contains multiple drop boxes: The first row contains all health and environmental variables. The second row contains two drop boxes – one for row and one for column variable in order to produce two way tables. The rest of the drop boxes are filters.

Fig. 1.1
**Result screen:** This screen (Figure 1-2) displays the Online Analytical Processing (OLAP) report and graphs from which the request was submitted. The relevance is computed according to the relevance measure presented in Figure 1-1. The user can also swap the rows and columns by clicking the Transpose button as well as sorting the data in any columns (Figure 1-3).

Fig 1.2
Figure 1-3. Transposed table from Figure 1-2. The red circle indicates the sorting function.
**GIS Interface**

The GIS interface can be represented in the following screen shots (Figure 1-4 to Figure 1-6). Figure 1-4 displays one health outcome (asthma) with zip code layer. The graduated colors display the quintiles of age-adjusted rates as indicated by the legend. The Setting box provides the following:

- **Analyzing data** – currently three layers are included in the drop box (county, zip code, and census tract). Health outcome – listing of each health outcome variable such asthma and MI.
- **Data year** – listing of all years available in the database.
- **Find by zip** – allows the user to search any single zip code.

The Selection tool displays each polygon tool:

- Point
- Rectangle
- Line

Figure 1-4. Display of health outcome with zip code layer
Figure 1-5. Display of environmental hazard and health outcome overlay
2.0 Functions

To meet the goals of the National EPHTN, the Maryland EPHTN has developed a Web-based interactive health and environmental data access system. This network system integrated data from various sources to enable the systematic linking of health effects, exposures, and/or environmental hazard data. The system provides some simple and advanced tools for data analysis, GIS mapping, visualization, and reporting. The major functions will be to provide public and secured access to environmental, exposure, health and demographic data at the various geographical units. These are outlined below:

Public Portal

Query functions

- Providing public access to environmental, exposure, health and demographic data at the county level data
- Generating one-way and two-way tables with frequencies, age-adjusted rates, 95% confidence levels (CI), and graphs with the selected geographical unit and demographics.
- Providing filter option to select any particular geographic unit (i.e., county) and
demographic categories (age, gender, race, etc.)

- Providing transpose function to allow the swap of row and column variables.
- Providing sort function to allow the sort of values in each column according ascending or descending order.
- Providing printing PDF function.
- Providing dynamic risk messages associated with the selected health and environmental outcome.
- Providing suppression rule to prevent the identification of patients from being identified when the cell count is below 6.
- Protecting the dynamic risk messages associated with the selected health and environmental outcome.

**GIS functions**

- Providing display of health and environmental overlay at the county level including frequencies, age-adjusted rates, 95% confidence levels (CI), and graphs with the selected geographical boundaries.
- Allowing the selection of county census variables (such as household density, poverty, unemployment, etc) to be included in the display as 3-level overlay.
- Providing legend for each of the variables on the map.
- Providing polygon tools to allow the selection of individual county, areas with multiple counties, and counties not geographically connected.
- Providing help menus.
- Providing GIS glossaries.
- Providing printing PDF function.
- Providing dynamic risk messages associated with the selected health and environmental outcome.

**Secure Portal**

**Query functions**

- Providing role based access to the secure portal and the user can view the results based on the assigned role and the suppression rules.
- Providing access to environmental, exposure, health and demographic data at all geographical level data.
- Generating one-way and two-way tables with frequencies, age-adjusted rates, 95% confidence levels (CI), and graphs with the selected geographical unit and demographics.
- Providing filter option to select any particular geographic unit (i.e., county, zip codes) and demographic categories (age, gender, race, etc.)
- Providing transpose function to allow the swap of row and column variables.
- Providing sort function to allow the sort of values in each column according ascending or descending order.
Providing printing PDF function.
Providing dynamic risk messages associated with the selected health and environmental outcome.
Providing suppression rule based on the role of the user to prevent the identification of patients from being identified when the cell count is below 6.
Providing the dynamic risk messages associated with the selected health and environmental outcome.

**GIS functions**

- Providing display of role-based health, environmental, and census data at all geographical units.
- Allowing the selection of layers (i.e., county and zip code level).
- Output frequencies, age-adjusted rates, 95% confidence levels (CI), and graphs for health outcome, and means and CI for the environmental variable with the selected geographical boundaries.
- Allowing the selection of county census variables (such as household density, poverty, unemployment, etc) to be included in the display as 3-level overlay.
- Providing legend for each of the variables on the map.
- Providing polygon tools to allow the selection of individual zip code, individual county, areas with multiple counties, and counties not geographically connected.
- Providing help menus.
- Providing GIS glossaries.
- Providing printing PDF function.
- Providing dynamic risk messages associated with the selected health and environmental outcome.
- Applying suppression rules based on the user role assigned.

**Collaboration with Georgetown University**

The PI established a collaborative partnership with Georgetown University to conduct studies on environmental exposures and health outcomes. A Georgetown University Professor, Dr. Laura Anderko, who is also a member of the TAG worked with her students to conduct studies on exposure to particulate matter and ozone on asthma and exacerbations. See attached detailed report. None of the regression models found significant associations of particulate matter and ozone on asthma due at the .05 level. Some models resulted in changes in the opposite direction of what one would expect (e.g., that an increase in any air pollutant is associated with an increase in number of hospitalizations). There was a positive association between Ozone concentration and the number of AMI hospitalizations in the 60-69 age group, 80+ age group, as well as the population as a whole after controlling for month. However, none of these associations were statistically significant. CPPE will continue to partner with Georgetown to (a) assist with data collection and analysis and (b) development of metadata for the EPHTN. Student interns from the university will continue to work with DC DOH to ensure that all data needed are provided as required by CDC. The students will be involved in data
analysis that links health and environment data so that DC DOH will be able to demonstrate the need for continued tracking of specific environment and health indicators.