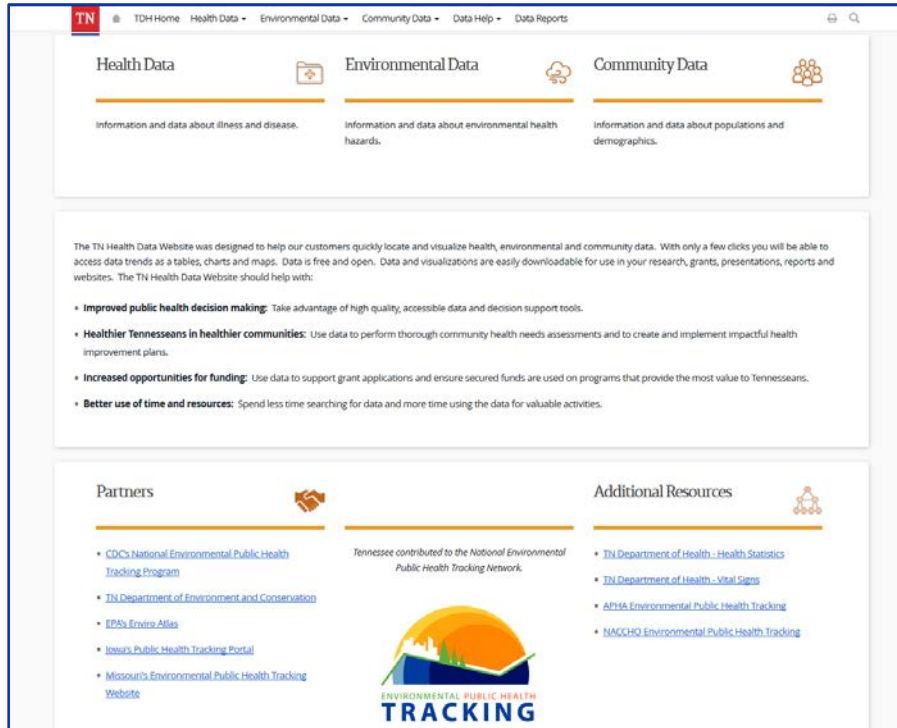


# ASTHO 2018-2019 Environmental Public Health Tracking: Peer-to-Peer Fellowship Program Project Report

## *Programming a Health Data Website for Tennessee*



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## **Introduction**

### *Background on Public Health Tracking in Tennessee*

The Tennessee Department of Health participated in ASTHO's EPHT Fellowship Program in 2013-2014. TDH was mentored by the Missouri Department of Public Health and Senior Services. Tennessee submitted 12 years of data for 4 different health outcomes to CDC's EPHT network. The ASTHO fellowship allowed staff in the Environmental Epidemiology Program (EEP) to build several webpages to share and visualize data about asthma, cardiovascular disease, chronic obstructive pulmonary disease, radon, heat-related illness, cold weather-related illness, toxic substance incidents, site specific investigations, and demographics/socioeconomic status. These EPHT webpages were viewed by other government agencies, academic researchers, and the general public.

### *Problem Statement*

EEP was able to maintain what was created during the last fellowship, but struggled to advance from a series of webpages to a true online portal. The datasets behind the prior visualizations were in various files and formats, and were difficult to update. The individual who created the previous visualizations left the position, and the expertise was lacking to update the cumbersome datasets. Finally, the software driving the previous webpages was outdated and was no longer going to be supported by TDH starting in 2019. EEP concluded that a new streamlined process was needed that would enable staff to more easily update datasets as more years of data became available, and that new visualizations were needed to transition our webpages into an interactive, user-friendly portal.

### *Pilot Project Plans*

This pilot project aimed to extend the work from the 2013-2014 fellowship to improve our data structures and program an online data portal to facilitate Tennessee's entry into CDC's EPHT Network. First, the health data that EEP has received from other programs needed to be restructured in a way that would integrate with the state's new data visualization software and would facilitate continuous and efficient updating in the future.

Next, the data visualizations needed to be recreated. TDH has new software on contract for programming webpages and data visualization. This software, called Tableau, is currently used by a variety of states funded by the EPHT grant. Updating our data visualizations and webpages into interactive Tableau dashboards will lead to an improved Tennessee Health Data Website that will

enhance communication and data-sharing with partners and the public. Our tracking content areas for the project focused on updating the EPHT data EEP already has access to, including asthma, heart attacks, chronic obstructive pulmonary disease, heat-related illness, and cold-related illness.

Finally, a new website was created to include a library of Tennessee's health, environmental, and demographic data as well as visual representations of the data as tables, charts, and maps.

## **Site Visit**

On April 29-30, 2019, Tennessee's fellowship recipient Kelly Squires visited the Iowa Department of Public Health offices in Des Moines, Iowa. Staff from Iowa's Bureau of Environmental Health Services, including Rob Walker, Heather Lloyd, and Tim Wickam, welcomed Ms. Squires and oriented her to Iowa's tracking program. The opportunity to be matched with an enthusiastic EPHT mentor was critical to the success of this project and a most worthwhile experience.

Iowa detailed the many aspects of their tracking program that would be integral to the development of a tracking program in Tennessee, including data management, processing, governance, visualization, and communication. In order to learn more about data management and processing, Ms. Squires was able to meet with the IT staff member that is partly funded by the tracking program. He explained how he is able to use the data that other programs provide in SQL databases, implement the calculations and suppressions needed to produce the measures relevant for the tracking program, and create the data views and connections necessary for the tracking program to access via Tableau. The process by which Iowa receives and manages data from their partners was a vital lesson learned.

Iowa also introduced the lead of their data management program. This is a separate group that oversees data governance and tackles issues around suppression rules and data sharing. They also maintain a list of every dataset in the health department. This allows the tracking program to focus on processing, organizing, and visualizing data.

As planned between the two states on calls prior to the site visit, a great deal of time was focused on how to create data visualizations in Tableau. The staff explained how they effectively suppressed data in their charts and tables. They explained when and why they chose to display subsets of data, such as by race or age group. They also explained that the last visualization in each Tableau dashboard is a table with counts and rates for each county, allowing users to easily export the data if they would like.

Finally, the tracking staff in Iowa gave advice on communication with partners and with the public. They offered tips on how to have conversations with other programs that might want their data visualized on a portal, such as how to address data gaps and how to make decisions on what indicators should be used. They offered invaluable points to include in discussions with leadership on the utility of a tracking portal, including the importance of NCDMs and standardization, and the benefits of collating health data in one place. They described their partnerships with outside organizations, such as universities, to create videos to include on the tracking portal in order to better engage with the public.

## Methods

As part of the first ASTHO EPHT fellowship, Tennessee submitted 12 years of data for 4 different health outcomes. At that time, iDashboards was used to visualize data online. The State of Tennessee now uses Tableau to visualize data in dashboards, and Adobe Experience Manager to program and publish webpages. These software products were used together, along with graphics and ESRI ArcGIS maps, to build Tennessee's Health Data Website.

Data was reorganized from the multiple data files and formats into a single, standardized Excel file for each condition. These data files were cleaned and suppression rules were implemented, eliminating data privacy issues. This allowed a single Tableau template to be used for every data indicator, significantly increasing efficiency. Although there are benefits from automated data systems, and we aim to transition to a SQL database in the future, we chose to use flat Excel files behind Tableau for this pilot project because of the immense time and resources that will be required to create a SQL system with our IT staff.

For this project, webpages and data visualizations were updated for the following conditions at the state and county levels:

- Asthma Emergency Department visits, 2000-2016 (annual)
- Asthma Hospitalizations, 2000-2016 (annual)
- Heart Attack Hospitalizations, 2000-2014 (annual)
- Chronic Obstructive Pulmonary Disease Hospitalizations, 2000-2014 (annual)
- Heat-Related Illness Emergency Department visits, 2000-2014 (15-year aggregation at the county level)
- Heat-Related Illness Hospitalizations, 2000-2014 (15-year aggregation at the county level)

- Cold-Related Illness Emergency Department visits, 2000-2014 (15-year aggregation at the county level)
- Cold-Related Illness Hospitalizations, 2000-2014 (15-year aggregation at the county level)

These data were pulled from the Tennessee Department of Health's Hospital Data Discharge System (HDDS). HDDS data result from an agreement with the Tennessee Hospital Association. Data was pulled using the ICD-9 and 10 codes from the Nationally Consistent Data and Measures (NCDM).

All data visualizations were created using Tableau; because of a software upgrade during the fellowship, the asthma dashboards were created in Tableau 2018.1, while the others were created in Tableau 2019.2. Each condition included five tabs of dashboards depicting state and county level ED visit or hospitalization counts and crude rates (per 10,000), presented as maps, charts, and tables.

The new health data website was also updated and had webpages added about Carbon Monoxide Poisoning, Radon, the Social Vulnerability Index, and Frequently Asked Questions. Placeholders were created for Air Quality, Population, Death, and other data sets in anticipation of the site expanding in the near future.

## Results

### *Goals and Outcomes*

The *Programming a Health Data Website for Tennessee* project had three proposed outcomes toward building a new public-facing Health Data Website. Our proposed outcomes were to:

1. Add more years to the four 2000-2012 datasets submitted to CDC in 2014
2. Create an online data library to share our EPHT data and metadata records
3. Program [www.TN.gov/HealthData](http://www.TN.gov/HealthData) using Tableau to display tables, charts, and maps

While we were able to add data through 2014 to most of our indicators (data through 2016 for asthma indicators), at the site visit we learned that the data EEP has received from partners in the past was not in an ideal format. While the Iowa tracking program receives its data in line lists, and then is able to aggregate data as needed, the data that EEP has received is already aggregated into race, gender, and age group categories that make it difficult or unfeasible to create customizations. For instance, the data that EEP has access to has already been aggregated into

certain age groups that differ from those in the NCDMs. We learned that it would be beneficial to the long-term sustainability of the tracking portal to request line-listed data in the future, and that new data pulls would be necessary. Therefore, the decision was made to avoid redundancies now and only add more data when we could receive it in a more efficient format.

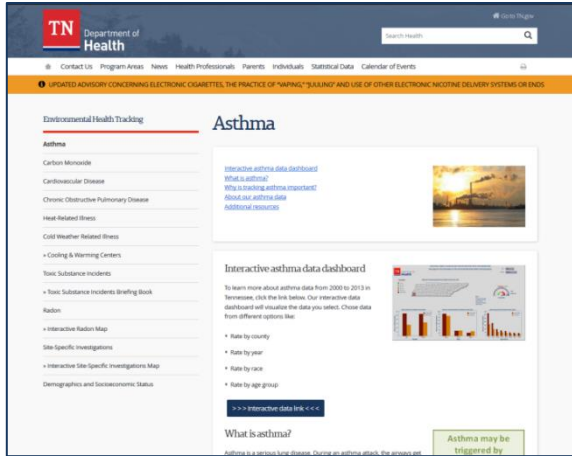
We successfully created an online data library to share our EPHT data and metadata records. All dashboards have been published internally, and they are becoming publically-available on a rolling basis as they are approved. We successfully used Tableau to display tables, charts, and maps. Currently the health data webpages and data dashboards are housed on EEP's website, though the sites may migrate to their own data portal site as more programs contribute data.

Additional goals and objectives that were met throughout the course of the pilot project include:

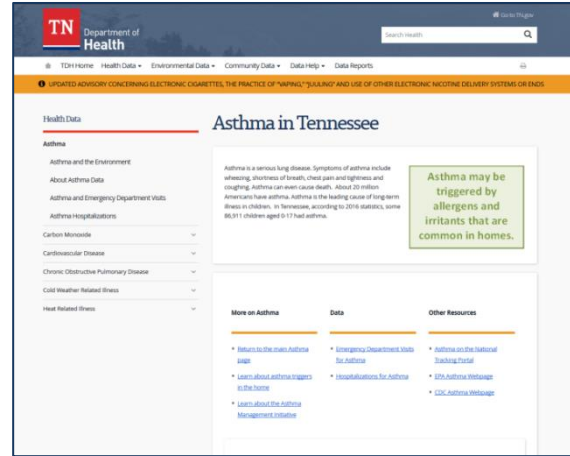
- Building collaboration with internal stakeholders by distributing the project proposal throughout the department, meeting with data stewards and webmasters, and sharing project outcomes with partners and supporters
- Determining gaps and needs in our current datasets
- Cleaning datasets
- Building webpages in Adobe AEM
- Gaining knowledge on how to successfully implement a health tracking portal through a site visit
- Building an online data library by creating webpages for each of our focus areas and adding elements of ArcGIS and Tableau to these webpages to show data as a table, chart, and map

### *Improved Health Data Website*

Although it may not be easy to appreciate through the screenshot images below, the updated format of our EPHT webpages is better and leads to a highly improved user experience. Previously, the web content consisted of one scrolling page of health topics, with each data visualization opening in a separate browser window outside of our website template. Now, however, each health topic is displayed with basic information, easily digestible to the public, with links to health education, metadata, and data visualizations.



asthma page before

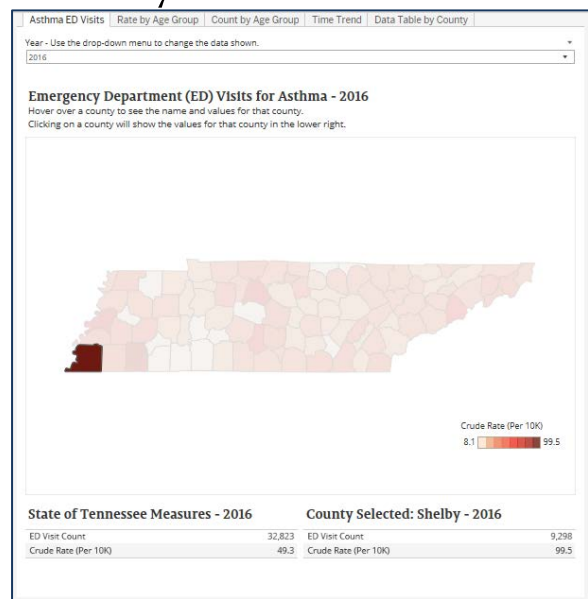
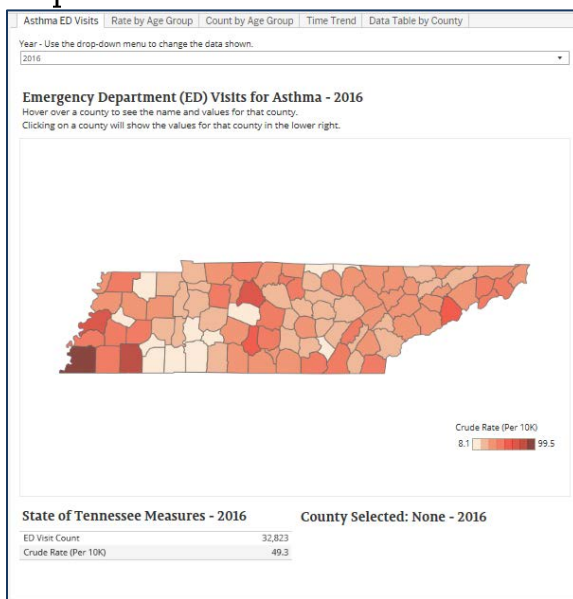


asthma page after

### Data Visualizations and Dashboards

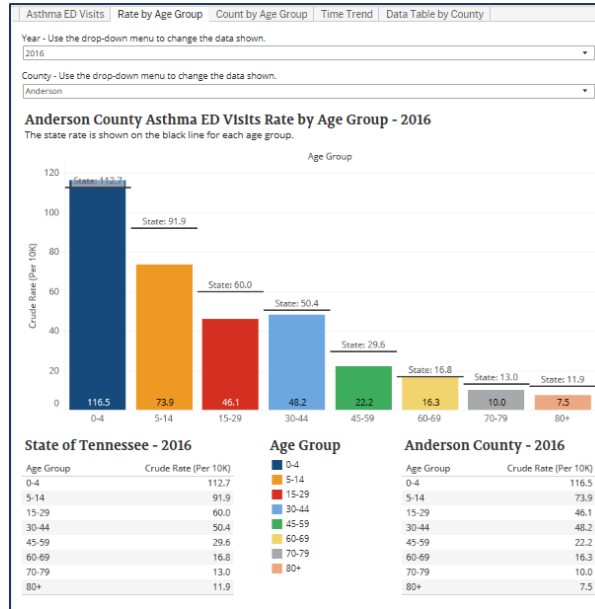
The data visualizations now are embedded within our webpages. Our Health Tracking Website follows the established EPHT format of providing data as a map, table, and chart. Five tabs span across the top of each data visualization to provide users these different dashboard views. Dropdown tabs also provide our users more options when visualizing our data. The five dashboards for each condition are:

- A choropleth map showing the count and rate of each condition at the county level and a table showing the count and rate for the state of Tennessee. For conditions shown annually, the map and table can be filtered by year. Hovering over a county reveals a tool-tip that displays the county name and data measures. Clicking on a county on the map filters a table that presents the count and rate values at the county level.

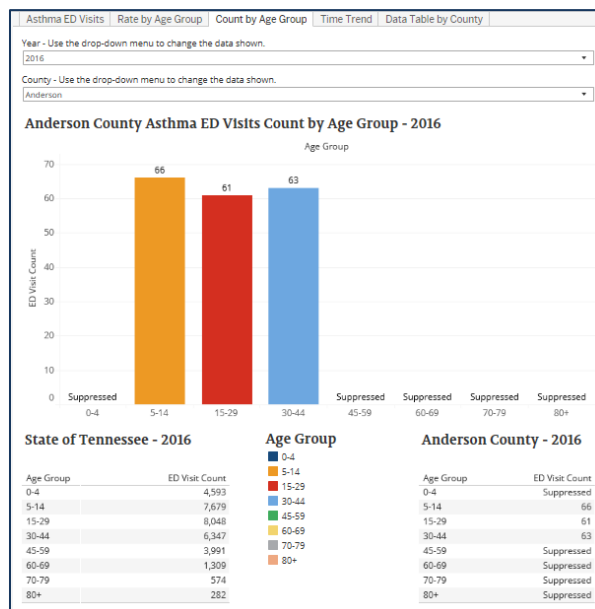




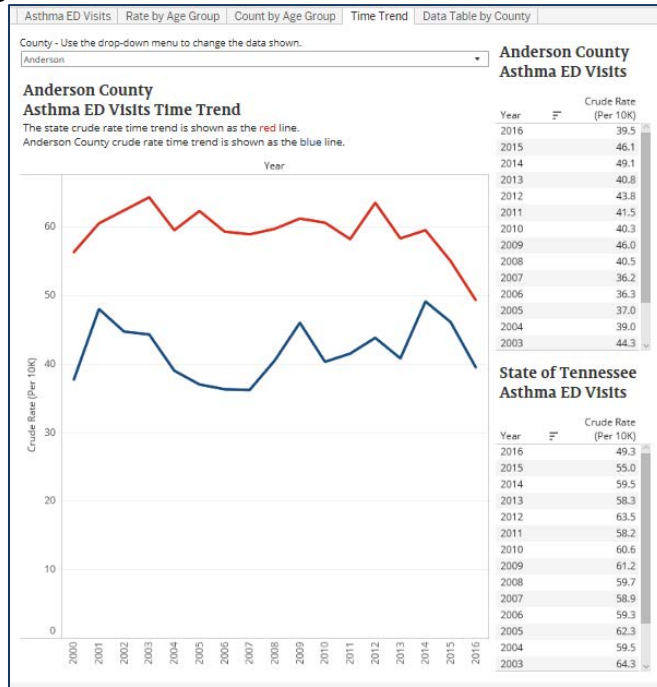
- A bar chart showing the rate of each condition by age group at the county level; the bar chart includes reference bands with the state rate for each age group for comparison. The dashboard also presents the state and county rates by age group in tabular format. Year and county filters are at the top of the dashboard.



- A bar chart showing the count of each condition by age group at the county level; the bar chart includes reference bands with the state count for each age group for comparison. The dashboard also presents the state and county rates by age group in tabular format. Year and county filters are at the top of the dashboard.



- Annual rates for the state are presented in a table and as a time trend line chart. For conditions that are not aggregated at the county level, the chart also includes a county filter, a line depicting the county time trend, and a corresponding table.



- A data table showing the count and rate for every county. For conditions that are not aggregated at the county level, the dashboard can be filtered by year.

**Asthma ED Visits by County - 2016**

County	ED Visit Count	Crude Rate (Per 10K)
Anderson	300	39.5
Bedford	221	46.5
Benton	36	22.5
Bledsoe	30	20.4
Blount	399	31.0
Bradley	301	28.8
Campbell	155	39.0
Cannon	39	27.8
Carrroll	97	34.5
Carter	285	50.5
Cheatham	158	39.6
Chester	28	16.0
Claiborne	82	25.8
Clay	13	16.8
Cooke	209	59.4
Coffee	164	30.0
Crockett	26	18.1
Cumberland	181	30.9
Davidson	4,980	72.8
Decatur	29	24.6
DeKalb	55	28.4
Dickson	228	43.7
Dyer	132	35.0
Fayette	172	43.4
Fentress	69	38.3
Franklin	131	31.4
Gibson	194	39.3
Giles	111	37.9
Grainger	70	30.3
Greene	259	37.7
Grundy	32	23.9
Hamblen	269	42.2

The data dashboards were created to maximize the user experience and encourage interaction. The maps with Tennessee's 95 counties are interactive and display more data when a county is hovered over or selected. The data tables start in alphabetical order by county showing counts and rates. The tables are sortable as well as downloadable. Charts show annual state and county rates, as well as state and county data trends over time. Additional helpful features have been added as well, such as reference lines to indicate how a metric compares to the state. In many of our visualizations small data tables accompany the charts.

## **Conclusions**

Without dedicated federal EPHT funding, Tennessee was partially successful maintaining and promoting a health tracking portal on its own. This ASTHO EPHT fellowship opportunity was timely for us. We were able to update old webpages into a health tracking site that is more visually interesting, easier to update as needed, and seems helpful to not just our program, but our entire department. We were able to move data from inoperable data visualizations to standardized software. The overall look and feel of our Health Data Website has received immediate praise.

### *Lessons Learned*

One of the most important lessons learned from Iowa was that the aggregated Excel data files we had received in the past were not conducive to a systematic, easily-updatable, efficient tracking portal. We learned that it will be much better in the future to re-request our data files as line-list data, which may require MOUs moving forward. While this altered our perspective on how much we would be able to accomplish in the short-term for this pilot project, it gave us confidence that the extra time we will need now will be highly beneficial moving forward.

Learning how Iowa has structured its tracking portal was vital, and we used that template to create our own website. We believe this format will not only work now but also be expandable later. This will encourage other data stewards in TDH to share their data on the same public-facing website that we hope will encompass health, environmental, and community data.

### *Looking Forward*

Our Health Data Website is currently serving as a pilot project for our upper management to experience. We believe their viewing, understanding, and interacting with the Health Data Website can lead to department-wide changes in the way we organize, visualize, share, and promote health data.

We have shared this project with both internal data teams and a new Data Governance Program at TDH. After more discussion with these teammates, TDH will decide whether to make our Health Data Website a unique URL or a main menu option on all departmental webpages. Both options are appealing and would formalize our portal.

We have a steep obstacle to redo our data files with line item data more compatible with an efficient data portal. We believe this obstacle can be overcome by providing data stewards clear directions for how to pull, clean, organize, and share their data. We will use the data visualizations programmed from this project as examples for them to duplicate. We know that once this obstacle is overcome, adding a new set of data each year will be much easier.

After this rebuilding process, we will invite our partners to contribute more data such as childhood lead poisoning, particulate matter, ozone, housing quality, pedestrian injuries, and water quality. We will pull in complimentary data from the US Census and Data.gov. Over time, we hope to include some small-scale data about cities and towns to support Community Health Assessments.

We believe with our updated Health Data Website, mentoring by Missouri and Iowa, and completed ASTHO fellowships, Tennessee will be more competitive when applying for CDC EPHT funding in the future.

## Appendices

### Partner Agencies and Collaborations:

<b>Agency</b>	<b>Collaborations</b>
TN Health Family Health and Wellness	Childhood lead poisoning data steward
TN Health Division of Population Health	Hospitalization and Emergency Department data steward
Tennessee Department of Environment and Conservation	Air quality, water quality, and hazardous site data steward(s)
TN Health Environmental Epidemiology Program	Healthy Homes and site-specific health investigations data steward
TN Health Office of Informatics and Analytics	Department's team for data, standards, and HL7