ASTHO 2017–2018 Environmental Public Health Tracking: Peer-to-Peer Fellowship
Outdoor Air Quality and Asthma
Final Report

Submitted by:
Jess Rinsky, PhD, MPH
Epidemiologist
Occupational and Environmental Epidemiology Branch
North Carolina Division of Public Health
5505 Six Forks Road
Raleigh, NC 27609

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Association of State and Territorial Health Officials
Environmental Public Health Tracking: Peer-to-Peer Fellowship Program
2231 Crystal Drive, Suite 450
Arlington, VA 22202

Introduction

Environmental Public Health Tracking (EPHT) provides a useful structure for tracking and displaying environmental and health data. Currently, the Centers for Disease Control and Prevention (CDC) funds health departments in 25 states and 1 city to develop and run EPHT programs. While not funded, building a robust EPHT program is a priority for North Carolina.

In 2017, I was accepted into the Association of State and Territorial Health Official's 2017–2018 EPHT: Peer-to-Peer Fellowship Program and paired with Colorado, an EPHT-funded state for mentorship. During the fellowship year, I visited and received training from Colorado EPHT staff, completed a pilot project, and developed a list of priority next steps for building North Carolina's EPHT program.

Site Visit

In April 2018, I spent one and a half days with the Colorado EPHT Program staff. The Colorado team included a program coordinator, program manager, epidemiologist, data coordinator, and health communications specialist. The team presented an overview of their program and provided detailed information about building partnerships, developing a portal, data stewardship and use, and communication and outreach. In addition, the team demonstrated their portal and discussed innovative ways they were using data. For example, they explained their new Targeted Lead Outreach Tool (https://www.colorado.gov/pacific/cdphe/lead-outreach-tool), which displays data for childhood blood lead testing rates, lead exposure risk based on community characteristics, and a map that combines testing rate and exposure risk to prioritize areas for intervention.

Prior to the site visit, I was tasked with developing North Carolina's EPHT program and was not sure how to prioritize steps in the development process. During calls and my site visit, the Colorado EPHT team reviewed how they developed their program, including the challenges and lessons learned. This helped me realize that although North Carolina has limited resources, we already have much of the surveillance infrastructure for gathering health and environmental data. The Colorado team helped me identify two main priorities for developing our program—1) developing a portal for public access to data and 2) organizing our surveillance efforts under the EPHT Program. Finally, we briefly discussed my pilot project focusing on understanding our outdoor air quality data and continuing to examine asthma data and the Colorado team provided helpful insights. I am grateful to the Colorado EPHT Program staff for providing their time and expertise to guide the development of our EPHT Program.

Pilot Project

Background

The population of North Carolina is rapidly increasing; it has grown by 600,000 people since 2010 (6.4%)[1], and is now the 9th most populous state. The increase in population has been accompanied by an increase in industry, traffic, and other local sources of outdoor air pollution. Air pollution indicators such as particulate matter (PM) and ozone, have been linked with increased risk of a multitude of adverse

health outcomes including all-cause mortality, and exacerbation of cardiovascular and respiratory conditions, specifically asthma.

Last year, my predecessor updated our asthma surveillance data, developed indicators of indoor air quality, and examined correlations between the two to provide actionable data for stakeholders examining issues surrounding healthy homes and environmental triggers of asthma. I proposed to build on that work by developing our capacity to track outdoor air quality indicators, an additional environmental trigger of asthma. In my original proposal, this project aimed to address the following goals:

- Update our indicators for asthma emergency department (ED) visits and hospitalizations using existing data.
- Identify data sources and establish data sharing agreements for outdoor air quality indicators, specifically ozone and PM2.5.
- Develop an analysis plan to describe and quantify the association between outdoor air quality indicators and asthma indicators

However, based on conversations during my site visit and advice from the Colorado EPHT team, I eliminated the third goal to focus efforts on reorganizing our surveillance data and developing a portal.

As the population of North Carolina increases and changes, tracking air quality and asthma will be useful to inform and identify areas of the state that need additional planning, policy change, or public health intervention.

Methods

Data Sources: Air quality monitoring data were obtained from the CDC's EPHT portal and from the North Carolina Department of Environmental Quality, Division of Air Quality (DAQ). Data about asthma ED visits were obtained from the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT), the state's syndromic surveillance system. Data about asthma hospitalizations were obtained from the North Carolina State Center for Health Statistics. Data use agreements were established as necessary.

Indicators: In accordance with the EPHT indicators, we calculated the following indicators.

We examined the following indicators for ozone and PM2.5:

- Number of days with maximum 8-hour average ozone concentrations exceeding the National Ambient Air Quality Standard (NAAQS)
- Percent of days with PM2.5 levels exceeding the NAAQS
- Annual average ambient concentration of PM2.5 in micrograms per cubic meter

Asthma was defined as an ICD-9-CM code 493 or ICD-10-CM code J45. Using this definition, we calculated the following asthma Indicators for the state, and when possible, by region or county.

- Annual number of ED visits for asthma

- Annual crude rate of ED visits for asthma per 10,000 population
- Annual number of hospitalizations for asthma

Annual crude rate of hospitalizations for asthma per 10,000 population. The midyear resident population was used as the denominator for rates. Age-adjustment was completed using the direct method with the 2000 US Standard population.

Analysis period: Outdoor air quality data were available for 2000–2015. Asthma-related ED visit data were available for 2008–2014 and hospitalizations for 2008–2017. ICD-10-CM codes were implemented in 2015 and substantial changes in asthma coding has been observed; therefore, comparisons of asthma before and after 2015 are not possible.

Results

Air Quality

During 2000–2015, overall the number of days in North Carolina with ozone levels exceeding the NAAQS has decreased (Figure 1). In 2015, counties with exceedances were those with urban or industrial centers. The percent of days of PM2.5 levels exceeding NAAQS have also decreased over time (Figure 2). The only county with an exceedance in 2015 was Wake County, a large urban area. The average annual PM2.5 level has also decreased over time. During 2000, most counties with a monitor experienced an average level of 10.4–12.4 micrograms per cubic meter (Figure 3). In 2015, only two counties with monitors had an annual average in this range.

These decreases in PM2.5 and days of ozone exceedances have occurred following steps such as the passage of the NC Clean Smokestacks Act in 2002, which has reduced harmful emissions from coal-fired power plants operating in North Carolina. More information is available in a report from the North Carolina Division of Air Quality, found here: https://files.nc.gov/ncdeq/Air%20Quality/Air_Quality_Trends_in_North_Carolina.pdf.

Asthma

During 2008–2014, the annual number of asthma-related ED visits decreased nearly 10% from 47,052 to 44,716 (Table 1). A slight decline (9%) was also observed in the crude rate of asthma-related ED visits, which decreased from 50.5 to 45.0 per 10,000 people. Similarly, the number and crude and adjusted rates of asthma-related hospitalizations also decreased slightly (Table 2); the adjusted rate of asthma-related hospitalizations decreased from 11.4 to 9.0 per 10,000 people. In mid-2015, ICD-10-CM codes were implemented, which resulted in a change in asthma coding, prohibiting examination of trends before and after 2015. The number and rate of hospitalizations during 2016–2017 have remained steady at approximately 5.0 hospitalizations per 10,000 people.

During 2008–2014, asthma-related ED visits occurred throughout the state (Figure 4), however, the highest rate of asthma ED visits each year was observed in Pasquotank, a small county in the northeast (Figure 5).

Next Steps

The ASTHO EPHT fellowship provided me with a better understanding of the components of a successful EPHT program and helped me to identify priorities for building North Carolina's program. Next steps for this pilot project are:

- Estimate additional indicators of asthma and air quality for North Carolina overall and by county.
- Analyze indicators of asthma by demographic characteristics to understand the populations with the highest burden of asthma ED visits and hospitalizations.
- Develop a Story Map and other methods for sharing North Carolina's experience with asthma and air quality over time.
- Partner with researchers interested in analyzing asthma and air quality data to improve recommendations for planning, resource allocation, and policy intervention.

Next steps for building the North Carolina EPHT Program include:

- Organize health and environmental surveillance data already collected by the North Carolina Division of Public Health under the EPHT program.
- Create an advisory board for the EPHT program consisting of interested stakeholders.
- Create best practice recommendations for presenting data as part of the North Carolina's EPHT program.
- Develop a web portal tool to allow for quality data visualization.
- Design a plan for reporting indicator data to CDC.
- Continue to pursue additional resources to support EPHT program staff.

Conclusion

The ASTHO EPHT: Peer-to-peer fellowship was a valuable experience. The guidance provided by the Colorado EPHT program staff has helped to re-focus our efforts to develop North Carolina's EPHT program and promises to be a valuable resource in the future. This experience illustrated that although our staff and resources available to build the EPHT program are limited, through appropriate prioritization, NC DPH can take steps to develop their EPHT program. We are grateful to Colorado for providing their time and expertise and to ASTHO for support for this program.

Tables & Figures

Table 1. Number and crude rate per 10,000 persons for asthma-related emergency department visits—North Carolina, 2008–2014.

Year	Number of ED visits	Crude Rate per 10,000
2008	47,052	50.54
2009	48,639	51.47
2010	46,214	48.34
2011	46,368	48.04
2012	49,296	50.57
2013	44,437	45.12
2014	44,716	44.97

Table 2. Number and crude and adjusted rate per 10,000 persons for asthma-related hospital discharges—North Carolina, 2008–2013.

Year	Number of hospital discharges	Crude Rate per 10,000	Adjusted Rate per 10,000
2008	10,703	11.5	11.4
2009	11,007	11.6	11.6
2010	10,464	10.9	10.9
2011	9,884	10.2	10.1
2012	9,854	10.1	10.1
2013	9,123	9.3	9.2
2014	9,035	9.1	9.0
2015*	7,999	8.0	7.8
2016*	4,956	4.9	5.1
2017*	4,954	4.8	5.0

**Note: ICD-9CM to ICD-10CM conversion occurred in October 2015. Use caution when interpreting results.*

Figure 1. Number of days with ozone above the National Ambient Air Quality Standard based on air monitors—North Carolina, 2000–2015.

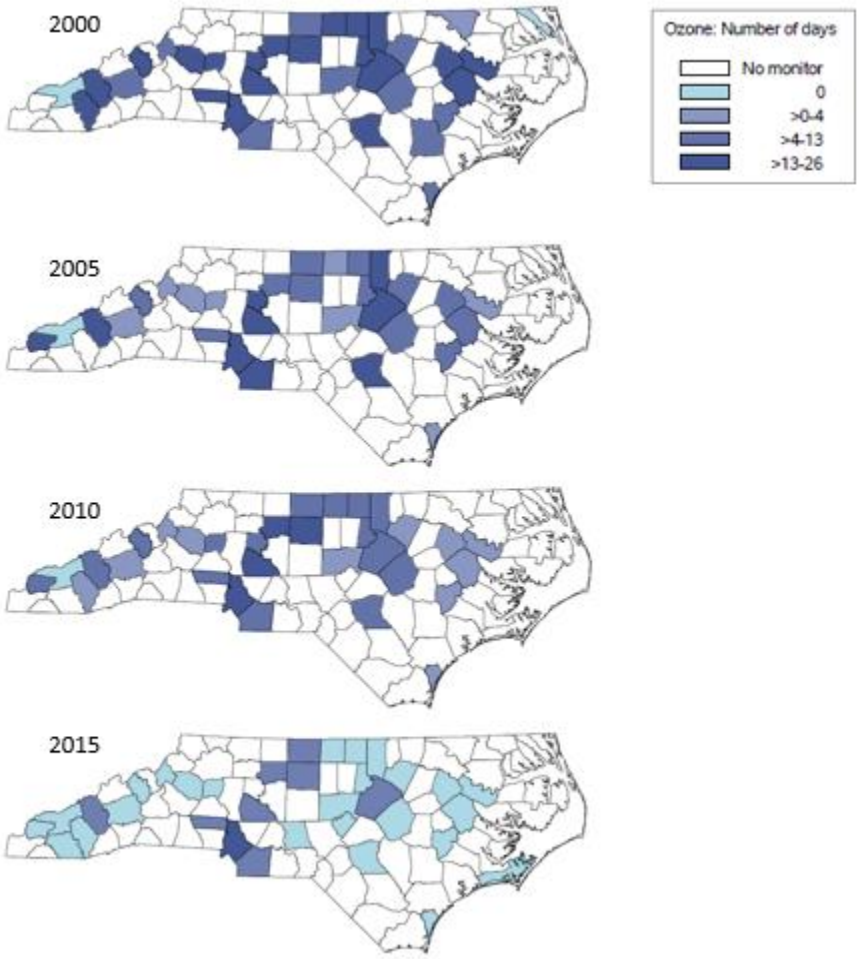

Figure 2. Percent of days of PM2.5 above the National Ambient Air Quality Standard based on air monitors—North Carolina, 2000–2015.

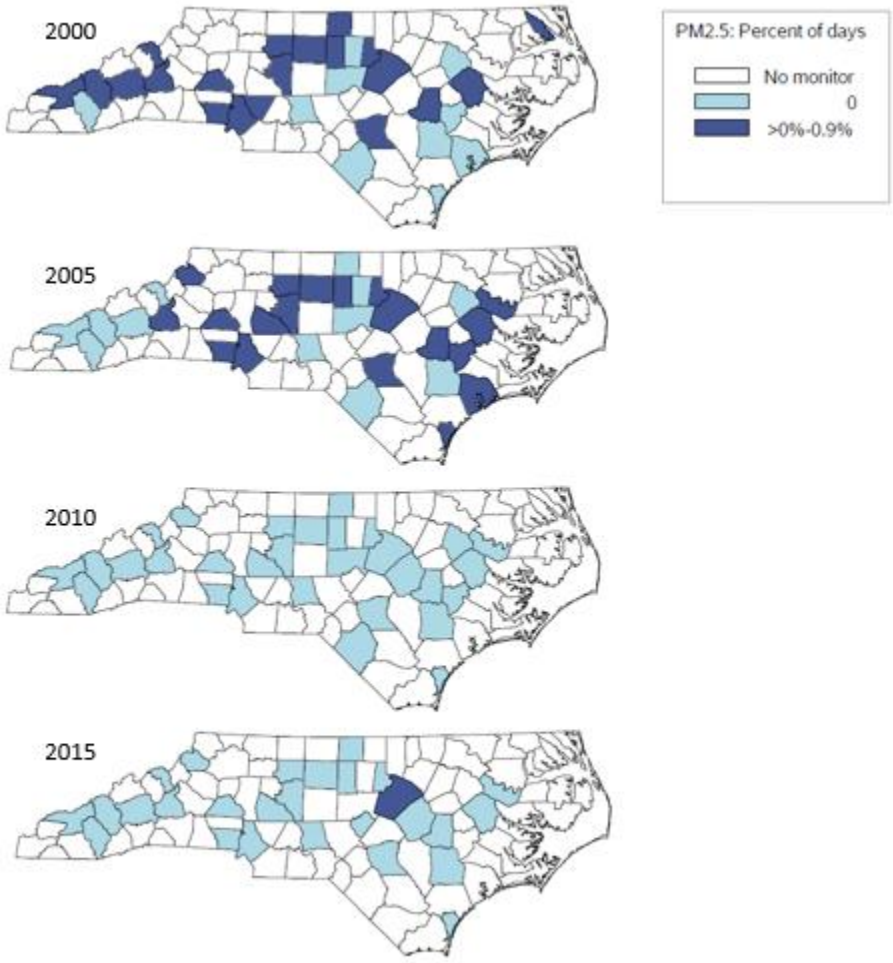

Figure 3. Average annual PM2.5 level in micrograms per cubic meter based on air monitors—North Carolina, 2000–2015.

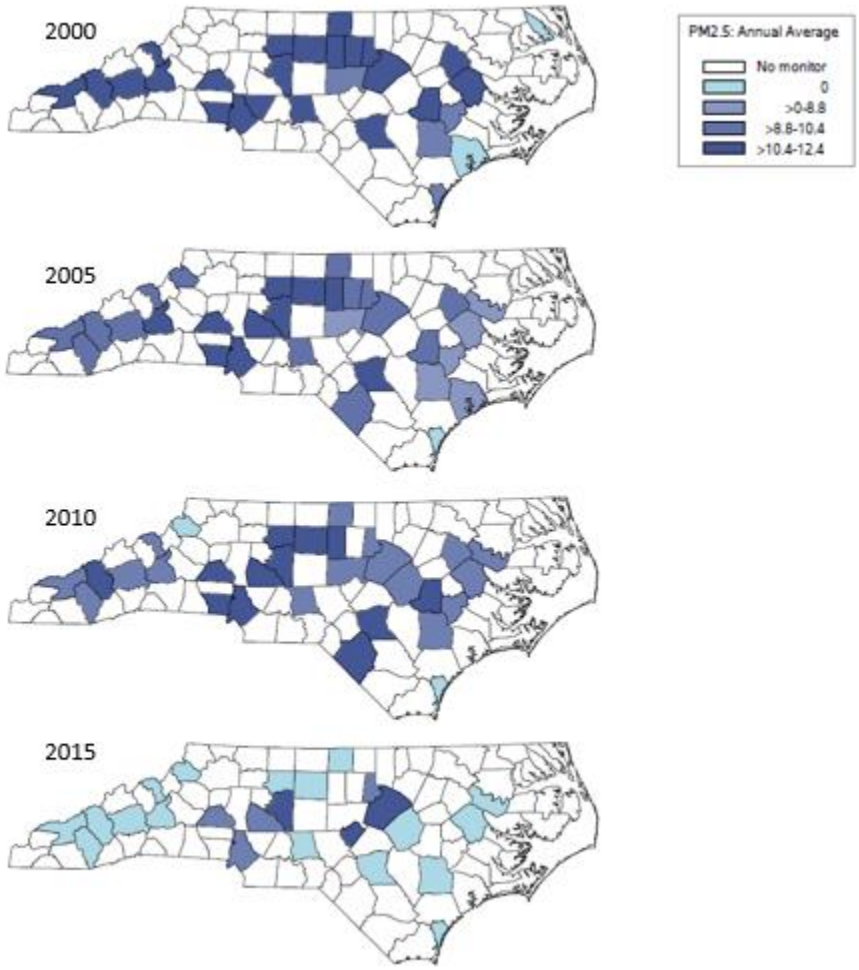

Figure 4. Numbers of asthma emergency department visits by county—North Carolina, 2008–2014.

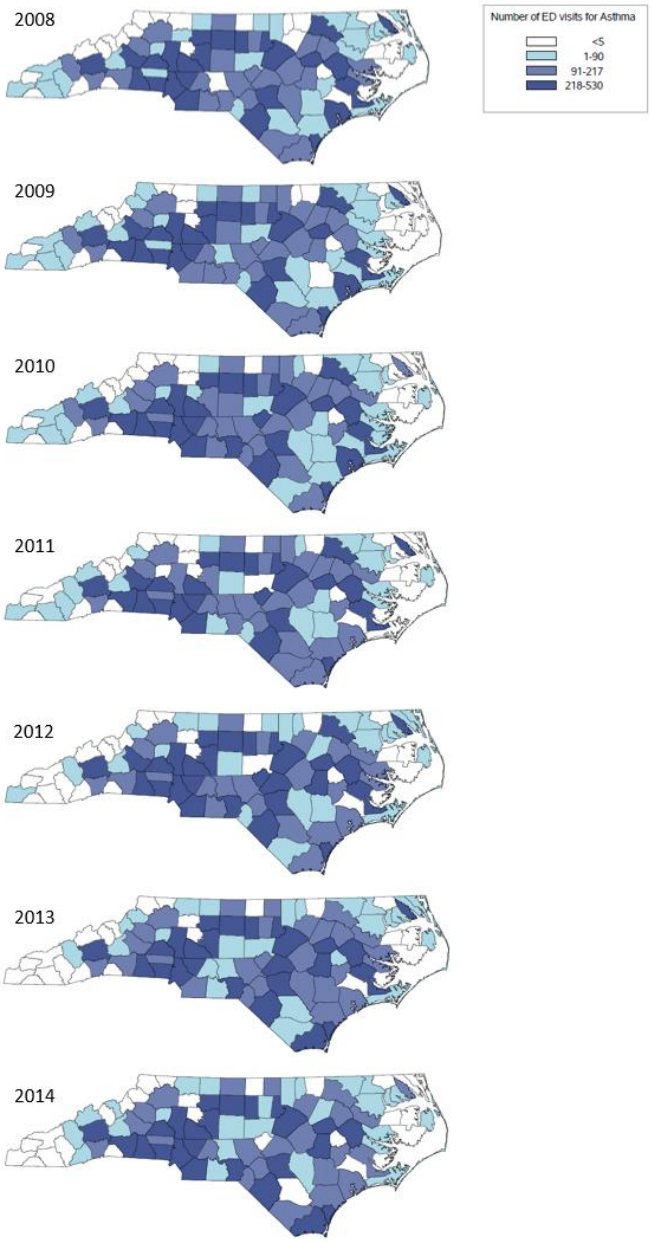

Figure 5. Crude rate of asthma emergency department visits per 10,000 people by county—North Carolina, 2008–2014.