

**2016—2017 ASTHO Environmental Public Health Tracking Fellowship**

**Indoor Air Quality and Asthma**

**Final Report**

Submitted by

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Environmental Public Health Tracking: Peer-to-Peer Fellowship Program

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## Introduction

Environmental Public Health Tracking (EPHT) is the ongoing collection, integration, analysis, interpretation, and dissemination of data from environmental hazard monitoring, and from human exposure and health effects surveillance. The Centers for Disease Control and Prevention (CDC) currently funds 26 state and local health departments to develop local tracking networks. These networks feed into the National Tracking Network, which is a system of integrated health, exposure, and hazard information and data from a variety of national, state, and city sources. North Carolina is not one of the funded states.

In 2016, the North Carolina Division of Public Health's Environmental Epidemiologist was accepted into ASTHO's 2016–2017 Environmental Public Health Tracking: Peer to Peer Fellowship Program and paired with an EPHT-funded mentor state. Fellowship activities included a site visit to the mentor state and a pilot project to advance EPHT in North Carolina.

## Site Visit

In my role as Environmental Epidemiologist, I attended an all-day retreat at the Massachusetts Department of Public Health (MDPH) on February 22, 2017. I met with several staff from the MDPH Environmental Public Health Tracking Program, who presented a comprehensive overview of their program. Topics included building partnerships, information technology, obtaining and submitting data, and communicating data with stakeholders. It was helpful to hear about the challenges of creating a state tracking portal and how MDPH overcame those challenges (for example, how they were able to create a tracking website that is separate from the MDPH's main website). I enjoyed the demonstration of MDPH's state tracking portal and learned about the tradeoffs between static community profiles (easy to access but not customizable; surprisingly popular among stakeholders) and queryable data with maps and multiple layer options (highly customizable but difficult for some stakeholders to use). I also gained many ideas for evaluating and improving North Carolina's current and future tracking websites from the enlightening presentation on usability testing with screen capture and recording software.

During my site visit, we also discussed my pilot project on indoor air quality and asthma, and the MDPH tracking staff gave me a multitude of helpful suggestions on how to analyze the data and present my results. I learned a great deal of valuable information during my site visit and am grateful to the MDPH tracking program staff for taking the time to meet with me and share their tracking experiences.

After returning from my site visit, I met with several of my colleagues in the Occupational and Environmental Epidemiology Branch to share what I learned from the MDPH tracking staff, which will help North Carolina improve and advance our tracking efforts.

## Pilot Project

### *Background*

Asthma is a leading public health concern in North Carolina, and our state has a strong history of conducting robust asthma surveillance. Unfortunately, North Carolina's Asthma Program lost its funding in 2015. One of the Occupational and Environmental Branch's priorities is to develop an asthma surveillance program that continues the work of our Asthma Program and meets the needs of our stakeholders while being sustainable without any dedicated asthma funding. The ASTHO tracking fellowship provided an opportunity to begin developing our state's asthma surveillance program. Since many asthma triggers can be present in indoor environments, the pilot project examined the relationship between asthma and indoor air quality issues such as mold and pest infestations.

### *Introduction*

The Occupational and Environmental Epidemiology Branch receives approximately 900 calls each year related to residential indoor air quality concerns. The Branch's two industrial hygiene consultants discuss concerns with callers and provide guidance on fixing the underlying issues causing the indoor air quality problems or working with their landlord to address the underlying issues. The consultants keep logs of all indoor air quality calls they receive. For the pilot project, the call logs were used to develop an indoor air quality indicator. In addition, the asthma-related emergency department (ED) data indicator was updated, and these two indicators were used to perform a preliminary ecological study to explore the relationship between indoor air quality calls and asthma-related ED visits in North Carolina.

### *Methods*

The two industrial hygiene consultants in the Occupational and Environmental Epidemiology Branch provided call logs that included information on 2,213 indoor air quality calls received during 2014–2015. Data cleaning and analysis were performed using Microsoft Excel and SAS 9.4. Missing data,

such as county of residence and call type, were retrospectively entered whenever possible. Non-residential calls, duplicate entries, and calls not related to indoor air quality were excluded.

Data on asthma-related ED visits were obtained from NC DETECT (North Carolina’s syndromic surveillance system), county population data were obtained from the NC State Center for Health Statistics, and data on number of housing units per county were obtained from the U.S. Census Bureau. County rates of asthma-related ED visits (defined as ED visits with an ICD-9-CM or ICD-10-CM code for asthma in the first or second diagnosis position) were calculated per 10,000 residents, and county rates of residential indoor air quality calls were calculated per 10,000 housing units. Rate of owner-occupied housing units, percent of people living in same house one year ago, and percent of persons in poverty were obtained from the U.S. Census Bureau for each county.

Descriptive statistics were calculated using PROC FREQ, and correlation between variables was measured using Pearson correlation with PROC CORR in SAS 9.4.

### *Results*

The Occupational and Environmental Epidemiology Branch received 1,829 residential indoor air quality calls during 2014—2015. Most calls (82%) were related to mold and moisture concerns. Other common topics included pests and pesticide use (15%), sewage/sewer (4%), methamphetamine labs (3%), formaldehyde (3%), smoke/soot/fire (2%), asbestos (1%), and radon (1%). Some calls were related to multiple hazards.

| <b>Hazard</b>        | <b>Number (%)</b> |
|----------------------|-------------------|
| Mold/moisture        | 1,503 (82)        |
| Pests/pesticides     | 275 (15)          |
| Sewage/sewer         | 65 (4)            |
| Methamphetamine labs | 52 (3)            |
| Formaldehyde         | 48 (3)            |
| Smoke/soot/fire      | 37 (2)            |
| Asbestos             | 22 (1)            |
| Radon                | 18 (1)            |
| Other                | 173 (9)           |

Note: Percentages add to more than 100 because calls were often related to multiple hazards.

Although information on health concerns was not systematically recorded and the level of detail in the comments field varied considerably, it is worth noting that 21% of calls included a mention of health concerns in the comments field. The following are excerpts from several comments:

*“Five people sick with nausea and headaches. Described odor in house as rotten egg smell.”*

*“Caller has mold in shower and tub. Believes mold is making her sick.”*

*“Caller’s apartment has mold from water leak in apartment above. Caller and her daughter have respiratory problems and allergies they believe are related to mold.”*

*“House has mold and standing water. Caller having frequent asthma attacks.”*

*“Caller smells mildew in apartment and was told that landlord painted over mold. Her two young children have asthma.”*

Nearly three quarters of calls (70%) were related to rental housing versus owner-occupied housing (26%).

| <b>Rent/Own</b> | <b>Number (%)</b> |
|-----------------|-------------------|
| Rent            | 1,099 (70)        |
| Own             | 411 (26)          |
| Other           | 55 (4)            |

\*Missing = 264

Among the 888 calls with available information on dwelling type, half were related to indoor air quality concerns in houses, 29% in apartments, 10% in mobile/manufactured homes, and 3% in townhouses/condominiums.

| <b>Dwelling Type</b>     | <b>Number</b> |
|--------------------------|---------------|
| House                    | 440 (50)      |
| Apartment                | 257 (29)      |
| Mobile/manufactured home | 90 (10)       |
| Townhouse/Condominium    | 26 (3)        |
| Other                    | 75 (8)        |

\*Missing = 941

County rates of indoor air quality calls ranged from 0 to 15.6 calls per 10,000 housing units. However, the number of calls per county was small (57% of counties had fewer than 10 calls over the two-year period), so many of the county rates were unstable and unreliable. County rates of indoor air quality calls were not correlated with county rates of asthma-related ED visits ( $r=0.18$ ,  $p\text{-value}=0.07$ ).

To increase the stability of the rates, regional rates were also calculated for the Mountains (Western) region, Piedmont (Central) region, and Coastal Plains (Eastern) region of North Carolina. The Coastal Plains region had the highest rate of indoor air quality calls (3.9 calls per 10,000 housing units) and also had the highest rate of asthma-related ED visits (121.1 visits per 10,000 population). However, the number of regions was too small to calculate a stable correlation coefficient.

| Region                      | Rate of Residential IAQ Calls per 10,000 Housing Units | Rate of Asthma-related ED Visits per 10,000 Population |
|-----------------------------|--|--|
| Mountains (Western NC)      | 2.4  | 64.0   |
| Piedmont (Central NC)       | 3.1  | 83.3   |
| Coastal Plains (Eastern NC) | 3.9  | 121.1  |

Rate of owner-occupied housing units, percent of people living in same house one year ago, and percent of persons in poverty were obtained from the U.S. Census Bureau for each county. Percent of persons in poverty was weakly correlated with rate of asthma-related ED visits ( $r=0.35$ ,  $p\text{-value}=0.0003$ ), and rate of owner-occupied housing was also weakly correlated with rate of asthma-related ED visits ( $r=-0.34$ ,  $p\text{-value}=0.0006$ ). No other statistically significant correlations were observed.

### *Limitations*

Several limitations to the indoor air quality call data should be noted. The main limitation is that North Carolina does not have a surveillance system to track residential indoor air quality, and most residents with indoor air quality concerns do not call/get referred to the Occupational and Environmental Epidemiology Branch. Therefore, the call logs should be considered a convenience sample of residents with indoor air quality concerns that is not representative of the general population. Another limitation is that each industrial hygiene consultant logged calls in a different format, so the variables and level of detail varied among the call logs.

### *Next Steps*

To further explore the relationship between indoor air quality and asthma, we propose fitting a regression model to the data, controlling for confounders such as rate of owner occupied housing and percent of residents in poverty.

Since most residential indoor air quality calls will be handled by our state's 85 local health departments beginning July 1, 2017, we encourage local environmental health specialists to maintain call logs and submit them annually to the Occupational and Environmental Epidemiology Branch. To minimize the burden on local staff and improve the quality of the data, OEEB staff could design a basic call log template with drop-down menus for variables such as county, hazard, and call type, accompanied by an online training resource.

### Conclusion

The ASTHO EPHT: Peer-to-Peer Fellowship was a valuable experience and served to advance North Carolina's tracking efforts and prepare us to become a funded EPHT state. The North Carolina Division of Public Health is grateful to the Massachusetts Department of Public Health and ASTHO for their support, guidance, and mentorship throughout the fellowship.