ASTHMA AND POTENTIAL TRIGGERING ENVIRONMENTAL FACTORS IN THE STATE OF ALASKA

ENVIRONMENTAL PUBLIC HEALTH TRACKING
ASTHO FELLOWSHIP REPORT

Submitted by

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I. Introduction and background

The Centers for Disease Control and Prevention (CDC)'s National Environmental Public Health Tracking (EPHT) Network is an integrated system centralizing health, exposure, and environmental hazard data from national, state, and local sources in the U.S. This system makes these data accessible to the public in user-friendly formats such as maps, graphs, and tables, making for a powerful educational and communication tool in addressing public health issues.

Twenty–six states and local health departments receive funding from CDC to develop their own tracking network but Alaska in not one of them. In recognizing the many benefits of EPHT, the Alaska Section of Epidemiology's Environmental Public Health Program (EPHP), submitted a proposal to the Association for State and Territorial Health Officials (ASTHO)'s EPHT State-to-State Peer Fellowship Program in a step towards building EPHT capacity in Alaska. In this proposal we described our plan to compile and analyze asthma data along with air quality data and information on other environmental parameters.

In January 2016, ASTHO granted EPHP the fellowship, which has been instrumental in providing program staff with practical experience and access to technical experts in agencies inside and outside Alaska.

Thanks to ASTHO's support, we were partnered with staff from the Washington Tracking Network (WTN) at the Washington State Department of Health. A site visit with WTN on May 10-11, 2016 was informative and fruitful for building a sustainable EPHT program. One of the fruits of this support is the completion of the initial phase of the establishment of a tracking system for asthma and its potential environmental triggers in the state of Alaska.

II. Project Activities
a. Visit with Our Mentor, the Washington Tracking Network

The visit with WTN's staff was the essential component of this fellowship. It provided our program with an opportunity to learn how to build a sustainable tracking program, with a malleable information technology infrastructure that could support a portal and adapt to increased demand on the system over time. The site visit was also a chance for our program to build an inter-state relationship that is a valuable asset in the context of EPHT, nationally.

WTN recommended initial steps towards an EPHT network that included identification of key partners, followed by the development of a technical advisory group, in order to both create a shared vision among all entities of what should be accomplished with the program and ensure a consistent and reliable data stream. In addition, WTN staff emphasized the importance of contracting and negotiating with data custodians to secure data sharing agreements.

WTN staff provided us with detailed technical information about the establishment of a secure portal and the management of the interface between confidential and publicly-available health information. They shared the many sources from which they obtained data, discussed data quality issues, advised us on how to make partnerships durable, and suggested different cost effective avenues (such as interns and partnerships with universities) to aid our program.

Our WTN mentors provided practical ideas for best management practices. For example, they emphasized the importance of dedicated staff for continuous outreach and communication with partners as well as indicators they monitor to evaluate the effectiveness and efficiency of their tracking tools and communication efforts.

Benefits

The visit with WTN was beneficial for many reasons. WTN staff

- Provided a complete and detailed overview of a well-established tracking program
- Presented tried tools and methods to successfully build and run such a program and ensure its longevity
- Shared diverse sources of data and best ways to exploit them
- Discussed data handling and presentation
- Emphasized communication and outreach in addition to the establishment stable collaborations and partnerships

b. Asthma Tracking Project

i. Project Description

In Alaska, asthma is one of the most common chronic diseases. In 2013, 9.3% of adults were suffering from asthma[1] and 19% of young Alaskan people reported having had asthma at some

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[1] CDC, 2013. Adult Asthma Data: BRFSS Prevalence Tables and Maps. Available at: http://www.cdc.gov/asthma/brfss/2013/tableC1.htm

point in their life[2]. Aside from a considerable negative impact on the health and well-being of Alaskans, the disease is associated with high direct medical costs. According to the latest estimate in 2005, the total direct cost for asthma care in Alaska was approximately $118 million, the largest fraction of which was allotted to pharmacy and outpatient visits[3]. Although asthma mitigation is improving on an individual basis, sound public health practices need to be implemented to manage the disease at a larger scale.

Currently, the state of Alaska does not have an asthma registry or a surveillance program to address such health and financial burdens; therefore, asthma data are not consistently and systematically collected, making difficult any rigorous analysis of the main causes of asthma, the geographic distribution, and the demographics of the affected population in the state. These data are essential to characterize the asthma burden in Alaska, develop programs, implement policies, and inform decisions that will help manage asthma at the community and state levels, ultimately protecting health and reducing costs.

In order to initiate our asthma tracking, we set the following immediate goals:

- Establish partnerships with the appropriate data custodians and obtain data
- Find a dissemination platform
- Initiate data analysis to illustrate the benefits of EPHT and obtain buy-in from partners for further development and expansion

ii. Partnerships with Data Providers

In a first step, we collected asthma, air quality, and pollen data. We developed relationships with staff from the hospital discharge database and the Alaska Department of Environmental Conservation (DEC) – Division of Air Quality and we engaged all stakeholders involved in pollen monitoring in Alaska. Through these partnerships, we obtained key data such as in- and outpatient asthma reports based on hospital discharge information, pollen counts for Anchorage and Fairbanks, and available historical particulate matter concentrations for Alaska.

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[2] CDC, 2014, Youth Risk Behavior Surveillance. Morbidity and Mortality Weekly Report; Vol. 63; No. 4, pp. 1-168. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6304a1.htm

[3] Institute of Circumpolar Health Studies, 2007. A Report on the Burden of Asthma in Alaska. Available at: https://www.uaa.alaska.edu/instituteforcircumpolarhealthstudies/research/archives/asthma/asthma_burden_2007.pdf

iii.   Identification of a Data Dissemination Platform

The State of Alaska Department of Health and Social Services' Indicator-Based Information System for Public Health (AK-IBIS) is a website that provides statistical numerical data as well as contextual information on the health status of Alaskans and the State of Alaska's health care system. This website makes available to the public information on various health indicators, population characteristics, health risk factors, health care services, and health outcomes. For a limited number of datasets, AK-IBIS is also equipped with a query system. This existing platform will be a convenient conduit to disseminate environmental public health data related to asthma and its potential triggers.

iv.   Preliminary Analyses

Outpatient discharge rates for asthma may be used as a proxy for acute asthma episodes. These episodes are expected to occur more frequently in patients who do not manage their asthma and in those who have their asthma under control but may be subjected to asthma-exacerbating agents such as air pollutants, pollen, extremely cold temperatures, and environmental factors potentially encountered indoors such as cigarette smoke and pet dander.

Therefore, we compiled hospital outpatient hospital discharge data for asthma as the primary diagnosis and performed spatial and temporal analyses of rates distributions. When data were available, we examined correlations between $PM_{2.5}$ concentrations in Alaska boroughs and rates of acute asthma episodes approximated with outpatient discharge data. Finally, we obtained detailed pollen and mold counts for years 2000 to 2015 in Anchorage and Fairbanks for various plant species and analyzed yearly trends to identify peaks of pollen concentration and their potential correlation with asthma rates. Below are some examples of data analyses and results.

Asthma Data

We analyzed the distribution of outpatient hospital visits associated with asthma at the borough and ZIP Code levels and studied annual asthma trends for years 2008 to 2012. Figure 1 is a map of the annual average discharge rates for outpatients who visited emergency rooms for asthma as the primary diagnosis at borough level between 2008 and 2012. It shows that the Kenai Peninsula Borough had the highest rate of admissions to the emergency room for asthma. The outpatient discharge rate for asthma in the Kenai Peninsula exceeded the 80th percentile of all

discharge rates in the state, followed by the Juneau Borough, the Fairbanks North Star Borough, and the Anchorage Borough.

Figure 2 is a time-distribution of asthma-related outpatient discharge rates for year 2010 among boroughs. Years 2008 to 2012 (not shown) were also plotted and show comparable results with the Matanuska-Susitna Borough displaying the lowest asthma rates and the Kenai Peninsula the highest.

Additionally, some boroughs such as Juneau, Kodiak Island, and Anchorage often display spikes in asthma rates in the Spring and Fall. This observation remained true for all years and could sometimes be extended to other boroughs. It is unclear whether these spikes are related to environmental factors or not.
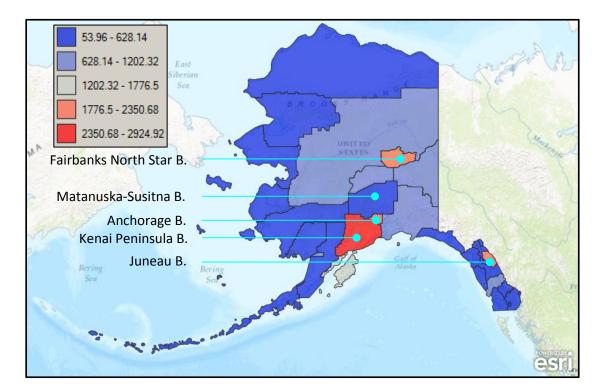

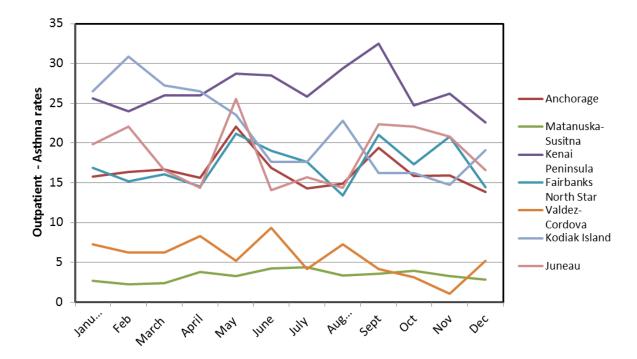**Figure 1. Rates of outpatient hospital visits for asthma in Alaska boroughs (per 100,000)**

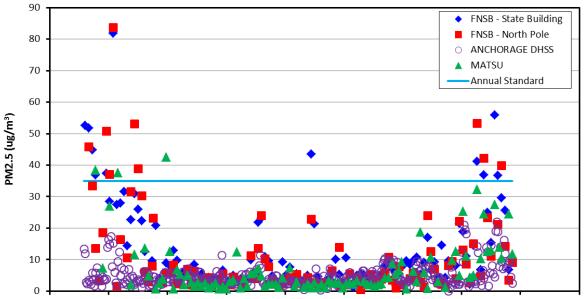**Figure 2. Comparison among Alaska boroughs of asthma-related outpatient discharge rates for 2010**

Air Quality Data

We collected partial air quality data from various monitoring stations in Anchorage, Fairbanks, and the Matanuska Susitna Borough, but more time is needed for an exhaustive data compilation. It would have been interesting to analyze air quality data from the Kenai Peninsula Borough since it consistently showed the highest rates of asthma-related hospital discharge rates; however, no air monitoring data were available for this area. Therefore, we studied concentrations of $PM_{2.5}$ in the Fairbanks North Star Borough and the Anchorage Borough, both characterized by high asthma rates, as well as the Matanuska-Susitna Borough, which was one of the boroughs having an asthma-related outpatient discharge rate below the 20th percentile of the asthma-related outpatient hospital discharge rates observed in the state.

Figure 3 shows the variations in concentrations of $PM_{2.5}$ for these boroughs over the course of 2010. The plotted data are compared with the primary daily $PM_{2.5}$ standard of 35 $\mu g/m^3$ established by the US EPA.

Figure 3 shows that PM$_{2.5}$ concentrations exceeded the daily standard in the studied boroughs in the cold months, especially between November and February, with marked peaks in January. This could be explained by an increase in wood burning and idling vehicles, two common practices in winter in Alaska. PM$_{2.5}$ concentrations were especially high in the Fairbanks North Star Borough, with concentrations sometimes over twice the US EPA daily standard.

Preliminary air quality analyses do not show any obvious correlation between asthma-related outpatient discharge rates and PM$_{2.5}$ concentrations, but more detailed analyses will be necessary before concluding whether an association exists or not.

Figure 3. PM2.5 concentrations for 2010 for FNSB, Anchorage and Matanuska-Susitna Borough monitoring stations.

Pollen Data

We obtained pollen data collected in Anchorage and Fairbanks for years 2008 to 2010. Pollen counting was generally performed from April to November and data were provided for various species of trees, weed, grass, and mold. We plotted simple concentration trends over time. Variations in tree pollen, and grass and weed pollen for year 2010 in Anchorage, are shown in Figures 4 and 5, respectively.
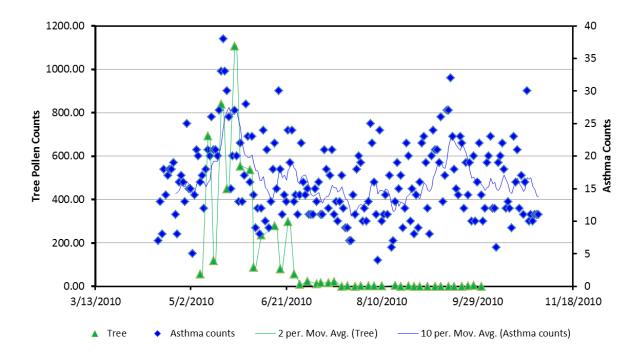
Figure 4. 2010 Anchorage tree pollen and asthma counts. Trend lines represent moving averages.
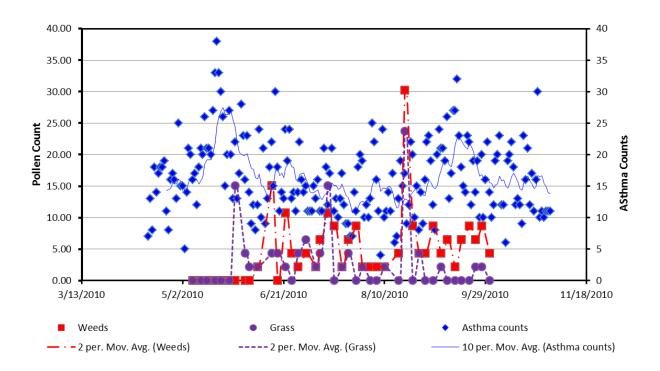

Figure 5. 2010 Anchorage grass and weed pollen, and asthma counts. Trend lines represent moving averages.

In both figures, asthma-related counts of outpatient hospital discharge in Anchorage in 2010 were overlaid with pollen data and moving averages were displayed as trend lines. A peak in tree pollen at the end of May 2010 seems to coincide with a peak in asthma counts. Similar trends were observed on different years (not shown) however, a more rigorous analysis will be needed to determine the significance of this correlation.

v. Accomplishments and Upcoming Tasks

We compiled and organized data for asthma-related in- and outpatient discharge rates, air quality, and pollen counts in Alaska since the early 2000's. Even though our preliminary analyses did not provide a clear association between asthma discharge rates and pollen or air quality data, we identified boroughs and ZIP code areas (not shown) of Alaska where asthma rates were high compared to other regions. We also showed seasonal variations of $PM_{2.5}$ concentrations and pollen counts. These preliminary analyses, although requiring refinement, provide a convenient visual representation of general trends, which can now be incorporated in the AK-IBIS platform.

This first step towards the creation of an asthma tracking program allowed us to organize the compiled data in a way that will make them accessible to potential users. In the future, we would like to expand this body of data to include tobacco consumption, temperature variations, and socioeconomic factors.

In a next step, we will have to solidify our relationship with existing and future data providers through the creation of a technical advisory group. This will ensure that all partners are in agreement regarding the direction taken by the tracking program and will formalize the data-sharing process. In addition, we plan to streamline the data extraction process to handle potentially increasing data loads and make them available to the public in a timely manner.

Finally, we plan to incorporate these data to AK-IBIS to make them publicly accessible both as metadata and raw data available for queries.

III. Conclusions

Our participation in the EPHT State-to-State Peer Fellowship Program was a positive experience, which enabled our program to take the first steps towards the establishment of an asthma

tracking program for the State of Alaska. The visit with our mentor, the WTN, was an invaluable learning experience, which provided us with strategic information about the building of a quality tracking program and ensure its sustainability. WTN staff also demonstrated the potential of EPHT as a powerful tool to communicate on a variety of public health issues.

As we develop our EPHT program, we will likely face multiple challenges due to limited technical, financial, and human resources. However, we may overcome these difficulties through extensive collaboration with partners in other state agencies, universities, and non-profit institutions.

Alaska faces several public health challenges that can be attributed in part to its vast land size that is dotted with small isolated villages. For example, many villages lack basic public health infrastructure such as in-home piped water and septic systems, and remain accessible only by small airplane or boat. Throughout rural Alaska, local economies are poorly developed and many residents live below the federal poverty line. Despite these challenges, Alaska enjoys a collaborative public health and environmental health partnership among private, tribal, local, state, and federal agencies. However, we see the need for better environmental public health indicator tracking that would aim to consolidate the aforementioned agencies' data collection efforts. At the very least, we need to promote and coordinate data sharing to make these data available to academic researchers, policy makers, legislators, and others who have an interest in them. In the future, we would like to expand our tracking initiative to other environmental health concerns. For example, tracking climate change-associated indicators is a priority need that can inform public health policy and action. We could also use EPHT to assess the extent of lead screening in the state, and to evaluate the reach of our hair mercury monitoring program. Ultimately, we hope to develop this tool as much as possible to serve our primary purpose of promoting and protecting the health of all Alaskans.