Health data for Delaware:

The path towards creating Delaware's Environmental Public Health Tracking Network

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ABSTRACT

The environment impacts health and contributes to factors that not only protect us from disease but also increase our risk for certain negative health outcomes. The Delaware Division of Public Health (DPH) embarked on an endeavor in 2014 to provide its communities with timely, high-quality data on the environment, risk and protective factors, and health outcomes through a data sharing platform. Through strong partnerships with the Department of Natural Resources and Environmental Control and key opportunities, these efforts coalesced into the development of Delaware's Environmental Public Health Tracking Network. We share our analyses and presentation of asthma hospitalization and air quality data and describe our path towards creating Delaware's Environmental Tracking Network.

INTRODUCTION

Health and the environment in which we live are inherently connected.[1] Recent events such as those in Flint, Michigan underscore the impacts of the environment on the health status of our population.[2] Whether it is contamination of a population's drinking water supply or changing temperatures and their impact on vectors (e.g., mosquitoes) that cause vector- borne diseases (e.g., Zika, West Nile Virus), there is an emergent need for communities to have access to relevant, timely data about the environment in which they live. Furthermore, across the country, there is an increasing demand for public health agencies to share data with their communities for data-informed decision making intended to affect change. Through the development and implementation of interventions, programs, and policies that are informed by data, public health and its partners can make positive impacts on the lives of the people who reside in our communities.[3]

To support efforts for data sharing and exchange, the Delaware Division of Public Health (DPH) embarked on an endeavor to build a Web-based interactive data portal that shares environmental, health, and other related data with our communities. This article describes the division's collaborative effort to develop Delaware's Environmental Public Health Tracking Network.

BACKGROUND

Delaware's Environmental Public Health Tracking Network is part of a national effort to provide communities and key stakeholders with data to inform the development, implementation, and evaluation of population health activities.[4] The National Environmental Public Health Tracking Program is a surveillance network of systems, resources, and programs focused on the compilation, presentation, and sharing of environmental hazard, exposure, and health outcome data and information.[4] Twenty-six state and local health departments are currently funded by the Centers for Disease Control and Prevention (CDC) to develop local tracking networks. Experts in the field worked collaboratively to develop indicators and nationally consistent data measures that were implemented by participating jurisdictions.[5] Additionally, state and local health departments participating in the national tracking network share locally derived measures that are meaningful to their geography and population-specific health priorities.[6] While the national tracking network shares data at the state and county levels, local tracking networks have the ability to share data at smaller geographic areas. Delaware recognized the significant benefits of participating in the national tracking network and invested resources to create a local tracking network.

METHODS

Over a period of three years, DPH's Epidemiology, Health Data, and Informatics Section led efforts to build DPH's data sharing platform. The team recognized early on that the process would require commitment and determination. Discussions led the DPH team to conceptualize the framework for data sharing. Opportunities became available that supported efforts that would actualize their vision.

Conceptual framework for data sharing

In December 2014, DPH drafted an internal proposal entitled, Health Data for Delaware, with a vision that "Delawareans have access to usable, meaningful, timely, and high-quality data about…the health of the communities in which they live."[7]

The proposal outlined three overarching areas related to data exchange and sharing for Delaware to be positioned to identify health priorities, measure health indicators, monitor trends, and catalyze change. As outlined in the proposal, Delawareans must have (1) access to their own health data; (2) access to data about the community in which they live; and (3) the tools to make the necessary changes that positively impact individual and population health factors and outcomes. Public health is by definition focused on population health and population-based approaches for addressing the factors that influence and mediate health outcomes through prevention (primary, secondary, and tertiary) and response measures. As such, the aforementioned proposal focused on addressing the second priority area, access to data about the community in which they live.

Planning and evaluating current processes and data sharing platforms available in the state was a necessity. During the conceptual phase of the project, DPH conducted an initial assessment of public health's data sharing platforms. The results of the assessment identified two areas that needed to be addressed including (1) requests for DPH data are submitted by both internal and external stakeholders through either direct contact with DPH staff or online through the Delaware Health Statistics Center for vital records data (e.g., birth, death, etc.), and (2) data are made available to the public through non-query based tools such as downloadable document files (e.g., portable document format, Microsoft® Excel table, etc.). As a result of the first finding, DPH initiated a quality improvement project to centralize and standardize DPH's data request process. To address the second finding, DPH submitted an application to the CDC's National Environmental Public Health Tracking Network funding opportunity and drafted the Health Data for Delaware proposal.[7]

Opportunities

Two funding announcements and a state-to-state peer fellowship provided key opportunities for DPH to begin the internal process of conceptualizing and describing the design of a data sharing platform that reflected DPH's vision to make health risk/protective factor and outcome data available to its communities. The first funding announcement posted in 2014 was the CDC's Implementation of the Environmental Public Health Tracking Network (CDC-RFA-EH14-1405). The funding announcement gave jurisdictions (state or local health departments) an opportunity to submit proposals that would support the development of a local tracking network and participate in, by sending data to, the National Environmental Public Health Tracking Network. DPH collaborated with the Delaware Department of Natural Resources and Environmental Control (DNREC) Division of Air Quality and internal DPH sections including Health Systems Protection to submit a proposal. Figure 1 illustrates the resources, inputs, strategies (activities), outputs, short- and mid-term outcomes, and long-term outcomes in the Delaware EPHTN's logic model. Although DPH was not selected as an award recipient, DPH's application laid the groundwork for the development of the Delaware EPHTN.

Figure 1. Delaware Environmental Public Health Tracking Network Logic Model
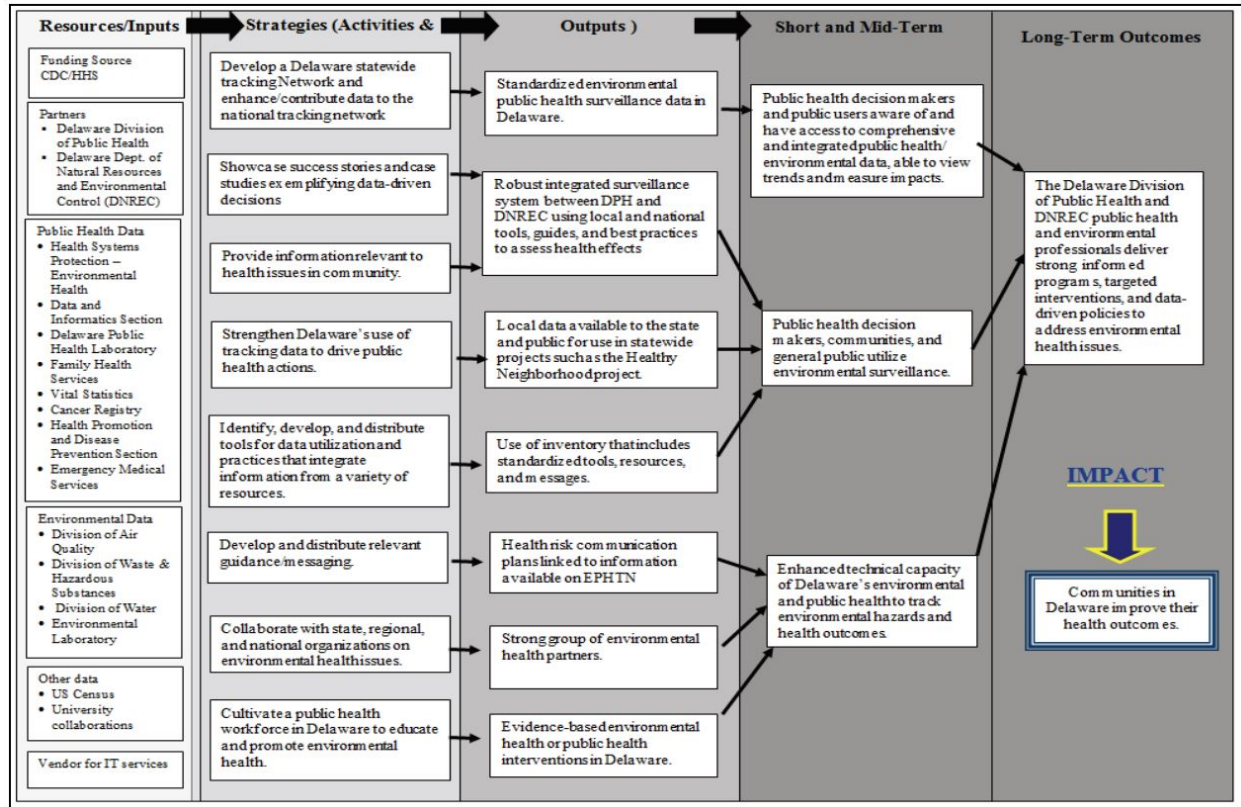
In June 2016, DNREC released a funding opportunity, the Strategic Opportunity Fund for Adaptation (SOFA) that provided state agencies with an opportunity to use funding to implement adaptation recommendations outlined in the Climate Framework for Delaware (Executive Order 41, Governor Jack Markell). DPH submitted a proposal and was awarded funding to evaluate the feasibility of and implement an environmental public health tracking network in Delaware. An already strong DPH – DNREC collaboration was reaffirmed with the commitment of both agencies to work on the project.

Congruently, Delaware submitted an application to participate in the Association of State and Territorial Health Officials' (ASTHO) 2016 Environmental Public Health Tracking, State-to-State Peer Fellowship Program. Although the ASTHO fellowship did not provide monetary support for the pilot project, the additional guidance and expertise of the CDC, ASTHO, and Kentucky, as Delaware's state tracking network mentor, ensured that DPH's approach and activities were grounded in best practices and with a support network of experts. Furthermore, DPH wanted to ensure that the project funded through DNREC resulted in a viable sustainable platform for data transmission and sharing with CDC's EPHTN. The continued support and guidance of the Kentucky tracking network team enhanced DPH's understanding of the information technology requirements, processes for ensuring continued support and engagement of stakeholders, and communication and outreach components of the tracking network to ensure appropriate and effective use of the data by the community.[8]

## Systematic approach to develop the Delaware EPHTN

The development of the Delaware EPHTN focused primarily on the data portal aspect of the tracking network. As a result of participating in the ASTHO fellowship program, many resources

became available to the Delaware tracking network team. We reviewed the technical specifications and identified the "best parts" of each states' environmental public health tracking networks. We also assessed DPH's current data needs using the framework described in the Heath Data for Delaware proposal. We involved the Delaware Department of Technology and Information (DTI) in discussions regarding the design and development of the data sharing platform to assess the utility of using existing data platforms and resources. It was also important that the data sharing platform was configured for expansion to include additional datasets and present sub-county data. And to ensure sustainability of the project, DPH devised a plan that included resource allocation (funding and staff).

A larger vision – beyond the data portal

As mentioned previously, the National EPHTN is a surveillance system and network of programs, resources, and people that come together to use data to catalyze action and respond to environmental hazards and their impacts on health. State and local health departments have shared many success stories using tracking data to inform policy, target prevention activities, identify communities at risk, impact city or state planning, improve surveillance, support epidemiologic studies, and educate communities.[9] DPH focused initially on the data sharing platform with a larger vision to expand its efforts into a fully functioning tracking network. Figure 2 illustrates the conceptual framework for the Web- based data portal.

Figure 2. Conceptualization and Illustration of an Interactive Web-Based Data Portal for Delaware Communities.
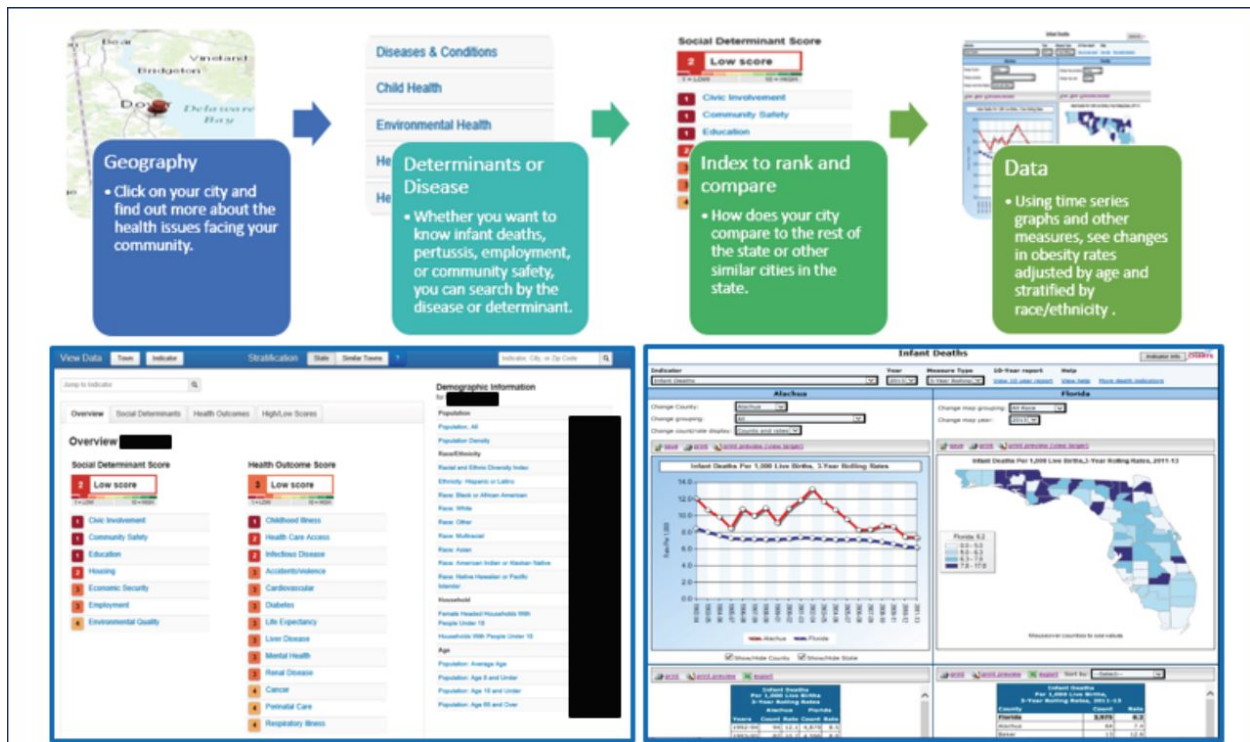
Left picture: Connecticut Health Equity Index: https://www.sdoh.org/ Permission granted to use screen capture; Right picture: Florida Charts: http://www.floridacharts.com/charts/default.aspx, infant mortality

DPH outlined specific requirements for the design of the data portal that included the ability to: (1) present data in community profiles; (2) query, overlay, analyze, and readily export data; (3) upload data and add or edit content in a DPH-managed technical solution; (4) allow users to create charts, graphs, maps, filter(s), conditionally format data; and (5) include the CDC nationally consistent data measures with the functionality to include additional measures and data on demand. Figure 3 illustrates the data content areas that are included in the national tracking network.

Figure 3. Proposed Delaware Environmental Public Health Tracking Network Data Content Areas
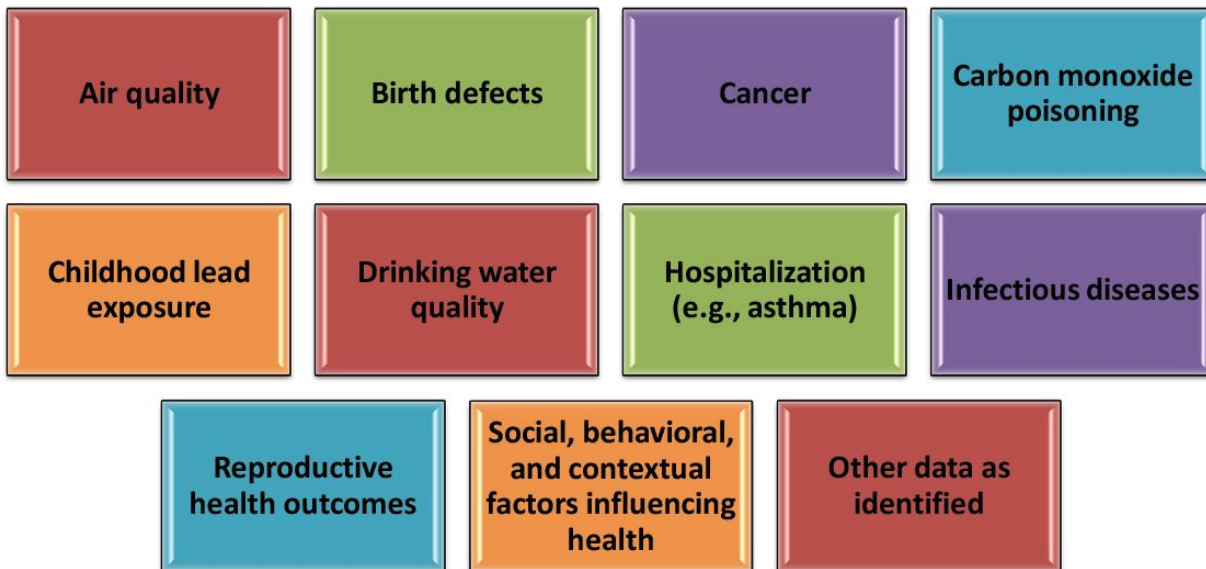
Content areas include the Nationally Consistent Data Measures required to participate in the Centers for Disease Control and Prevention's National Environmental Public Health Tracking Network. Additional content areas were included to address the intent of the Health Data for Delaware proposal.[7]

Data analysis

We analyzed data from the Delaware Hospital Discharge dataset (years 2000-2014) to calculate and present time trends of age-adjusted inpatient hospitalization rates per 100,000 population using the 2000 U.S. standard population and corresponding 95% confidence intervals (CI). Rates were stratified by sex and age group. Hospital discharges were defined as a principal diagnosis codes beginning with 493 (ICD-9 for asthma) following the National Environmental Public Health Tracking Network's nationally consistent data measures. Graphs presenting county-level data are available upon request and will be available as part of the Delaware EPHTN once the data portal is operational. Using DNREC's Air Monitoring program data, we presented air quality data available from monitoring stations across the state stratified by county that measure 8-hour average ozone concentrations, number of days of Particulate Matter (PM) 2.5, and annual concentrations of PM 2.5 that exceeded the National Ambient Air Quality Standard (NAAQS). National standards for air quality were used to establish acceptable levels of ozone concentration and particulate matter and identify geographic areas that exceeded standard levels. Data requests

were submitted to both DNREC and DPH for access to these data for purposes of the Delaware EPHTN. Although not completed for the initial phase of the project, future activities include presenting data geospatially by census- derived geographic aggregations (when permissible) with the additional ability to overlay environmental and health data simultaneously.

RESULTS

Development of Delaware's EPHTN

DPH continues to make steady, incremental progress towards building Delaware's EPHTN. The results that we documented thus far reflect the establishment of a strong, viable, and sustainable infrastructure. The data sharing platform will be self-sustained and housed with DPH's cross-cutting section; the Epidemiology, Health Data, and Informatics (EHDIS). Because this project builds upon DPH's vision of healthy people in healthy communities and the mission of EHDIS, which states successful completion of this project is a priority.

> Optimizing the use of science, practice, and technology, the Epidemiology, Health Data, and Informatics Section will serve as the coordinating unit within the Division of Public Health to lead, support, and facilitate the compilation and analysis of public health data for the generation of epidemiologic evidence and translation of findings into practical and actionable information for internal and external partners.

To ensure sustainability of the project, DPH will submit an application to participate in the National EPHTN during the next available funding cycle. Dedicated staff in EHDIS will ensure that existing data on the portal are updated according to a predefined schedule. Furthermore, the state of Delaware has recently engaged in an open data initiative, which may support updates of the data in the portal.

Working with the state's information technology team (DTI), DPH completed the required technical documents necessary to build an outward facing data sharing platform. Specifications for the design of the system were defined by the DPH team to meet the national EPHTN requirements and reflect the additional components described in Delaware's health data proposal.

Data presentation

An important outcome of this project was the compilation and presentation of both asthma and air quality data that meet the requirements of the National EPHTN's nationally consistent data measures.

Asthma

Figure 4 illustrates fluctuations in hospitalization rates for asthma among females and males living in Delaware between 2000 and 2014. Statewide age-adjusted hospitalization rates for asthma were highest among females compared to males. In 2014, females continued to have higher hospitalization rates for asthma diagnoses as compared to males (female= 14.4 hospitalizations per 10,000 population; male= 10.4 hospitalizations per 10,000 population).

Figure 4. Age-Adjusted Inpatient Hospitalization Rates for Asthma by Sex, Delaware, 2010-2014

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Female	17.3	18.6	16.6	19.5	17.2	18.3	19.3	17.7	15.5	17.9	15.2	13.7	14.4	13.6	14.4
Male	12.4	14.1	13.4	15.5	14.5	15	16.9	15.7	14.2	17.6	14.7	9.8	10.9	11.3	10.4

1. Rates are age-adjusted to the 2000 U.S. standard population.
2. Rates are based on counts of hospitalizations of Delaware residents.
3. Hospital discharges were defined as a principal diagnosis code beginning with 493 (ICD-9 for asthma) following the National Environmental Public Health Tracking Network's Nationally Consistent Data Measures.
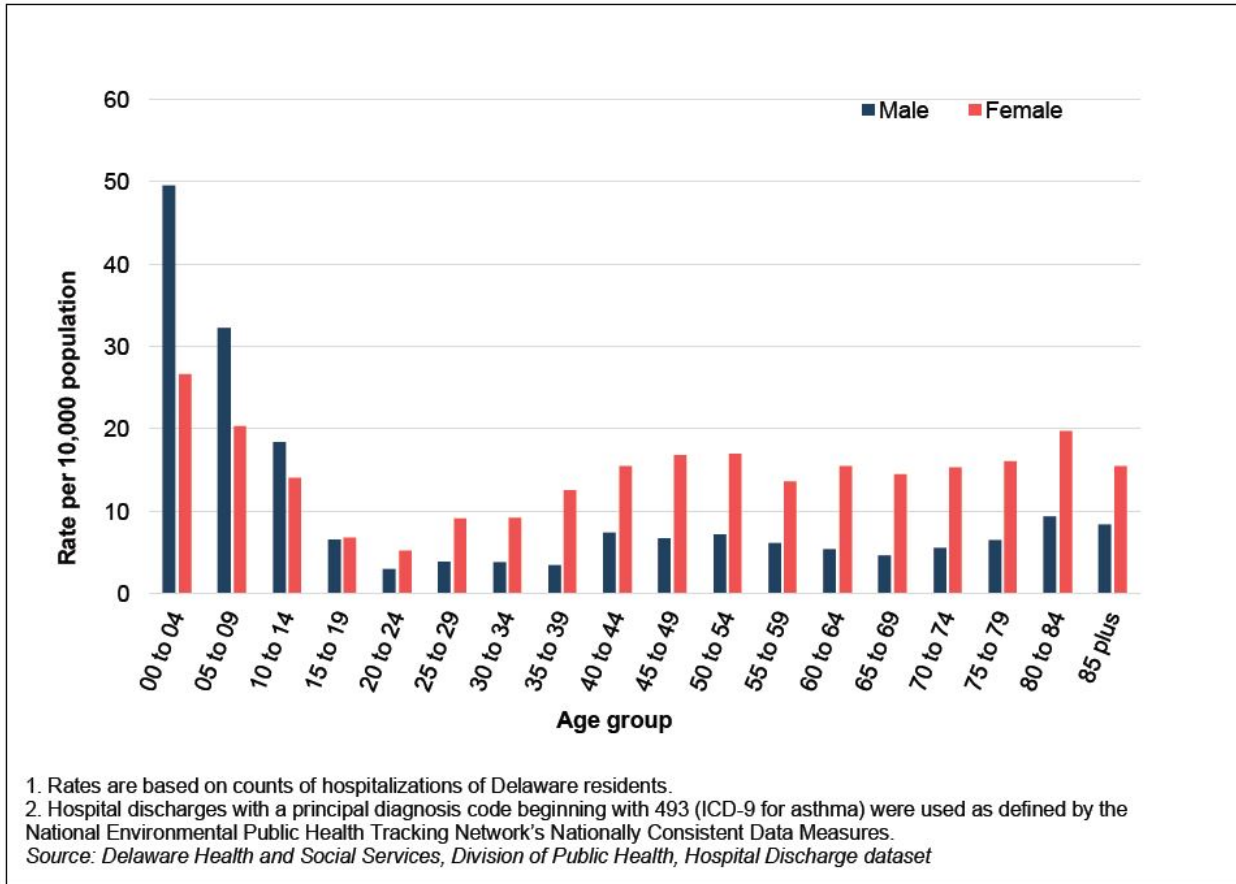*Source: Delaware Health and Social Services, Division of Public Health, Hospital Discharge dataset*

County-specific rates are not presented here but are available upon request. Rates varied considerably across the three counties. The highest hospitalization rates occurred in 2014 among Kent County and New Castle County females (Kent= 16.9, 95% CL: 14.2, 19.6 per 10,000 population; New Castle= 15.7, 95% CL: 14.2, 17.2 per 10,000 population). Age-adjusted hospitalization rates for asthma were most often higher for females compared to males across the three counties.

Overall, hospitalization rates were lowest across the state among females and males living in Sussex County (females= 9.2 per 10,000 population; males= 5.6 per 10,000 population), although there was more variability in the Sussex County rates compared to Kent and New Castle counties given the smaller number of hospital discharges.

Figure 5 illustrates the age-specific inpatient hospitalization rates per 10,000 population for asthma by 5-year age groups for the state from 2010-2014.

Figure 5. Inpatient Hospitalization Rates for Asthma by Age Group, Delaware, 2010-2014

1. Rates are based on counts of hospitalizations of Delaware residents.
2. Hospital discharges with a principal diagnosis code beginning with 493 (ICD-9 for asthma) were used as defined by the National Environmental Public Health Tracking Network's Nationally Consistent Data Measures.
Source: Delaware Health and Social Services, Division of Public Health, Hospital Discharge dataset

Hospitalization rates for asthma diagnoses were highest among the very young; in particular children under 10 years of age. Rates were disproportionately higher among males than females in children under 15 years of age; however, rates among females surpassed those of males in children older than 14 years of age and among adult populations. Rates were lowest among males in the 20 to 39 year age group. Most notably, the highest reported hospitalization rates across the state occurred among males younger than 5 years of age living in New Castle County (Age 0-5 years= 62.3 hospitalizations for asthma per 10,000 population).

Air Quality

Figure 6 illustrates the number of days with maximum 8-hour average ozone concentration in exceedance of the NAAQS that varied considerably from year to year and were relatively similar across the three counties. New Castle County air monitors recorded the highest number of days exceeding the NAAQS measured in 2016 at 10 days compared to Sussex County (3 days) and Kent County (2 days).

Figure 6. Number of days with maximum 8-hour average ozone concentration in exceedance of the National Ambient Air Quality Standard by county, Delaware, 2000-2016
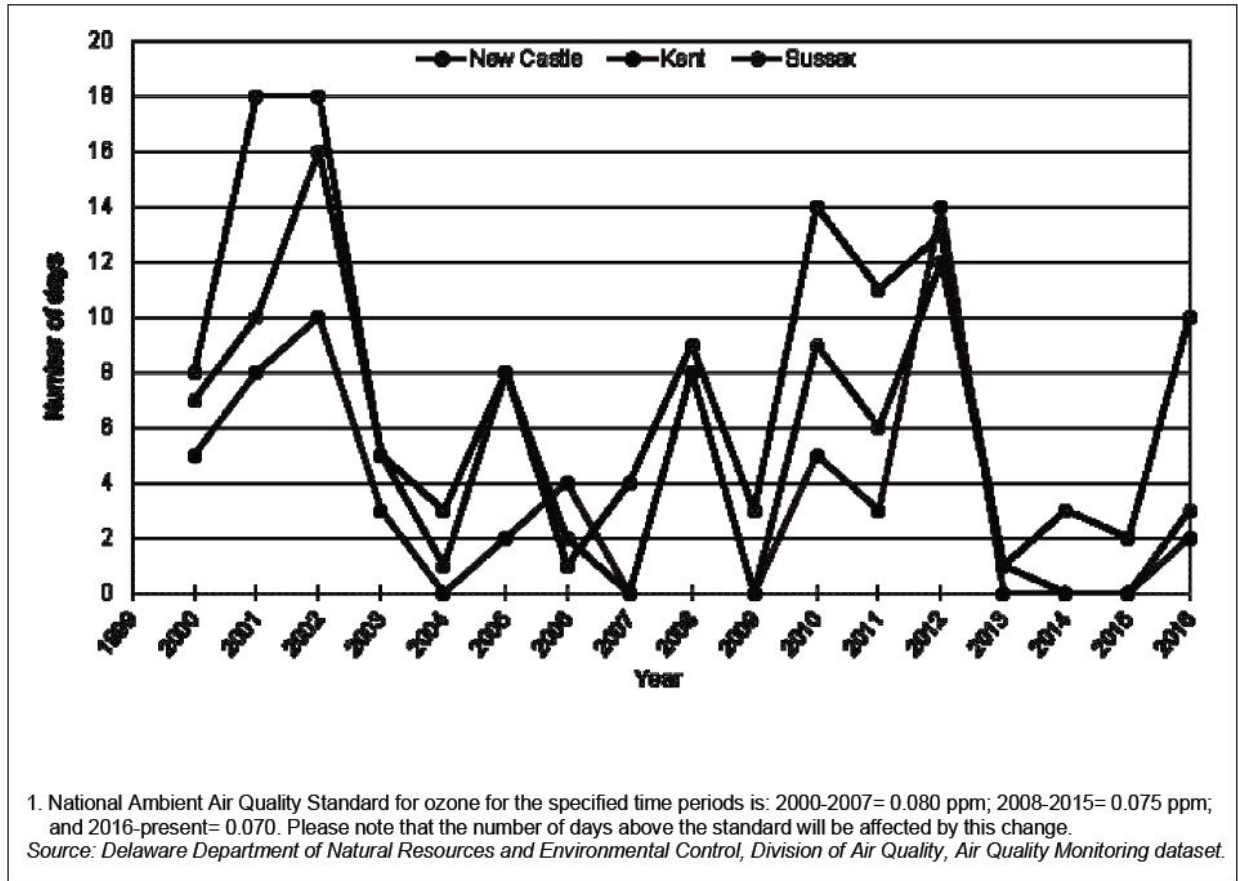
1. National Ambient Air Quality Standard for ozone for the specified time periods is: 2000-2007= 0.080 ppm; 2008-2015= 0.075 ppm; and 2016-present= 0.070. Please note that the number of days above the standard will be affected by this change.
Source: Delaware Department of Natural Resources and Environmental Control, Division of Air Quality, Air Quality Monitoring dataset.

Figure 7 presents the number of days with PM 2.5 levels that exceeded the NAAQS level of 35.0 micro-grams per cubic meter in Delaware from 2000-2016. New Castle County air monitors recorded one day each in 2010, 2011, and 2013 that measured PM 2.5 above the national standard level. For the past three years, no counties in Delaware recorded days in which PM 2.5 levels exceeded the national standard.

Figure 7. Number of days with Particulate Matter (PM) 2.5 levels in exceedance of the of the National Ambient Air Quality Standard1 by county, Delaware, 2000-2016

1. National Ambient Air Quality Standard for PM 2.5 is 35.0 micrograms per cubic meter.
Source: Delaware Department of Natural Resources and Environmental Control, Division of Air Quality, Air Quality Monitoring dataset.
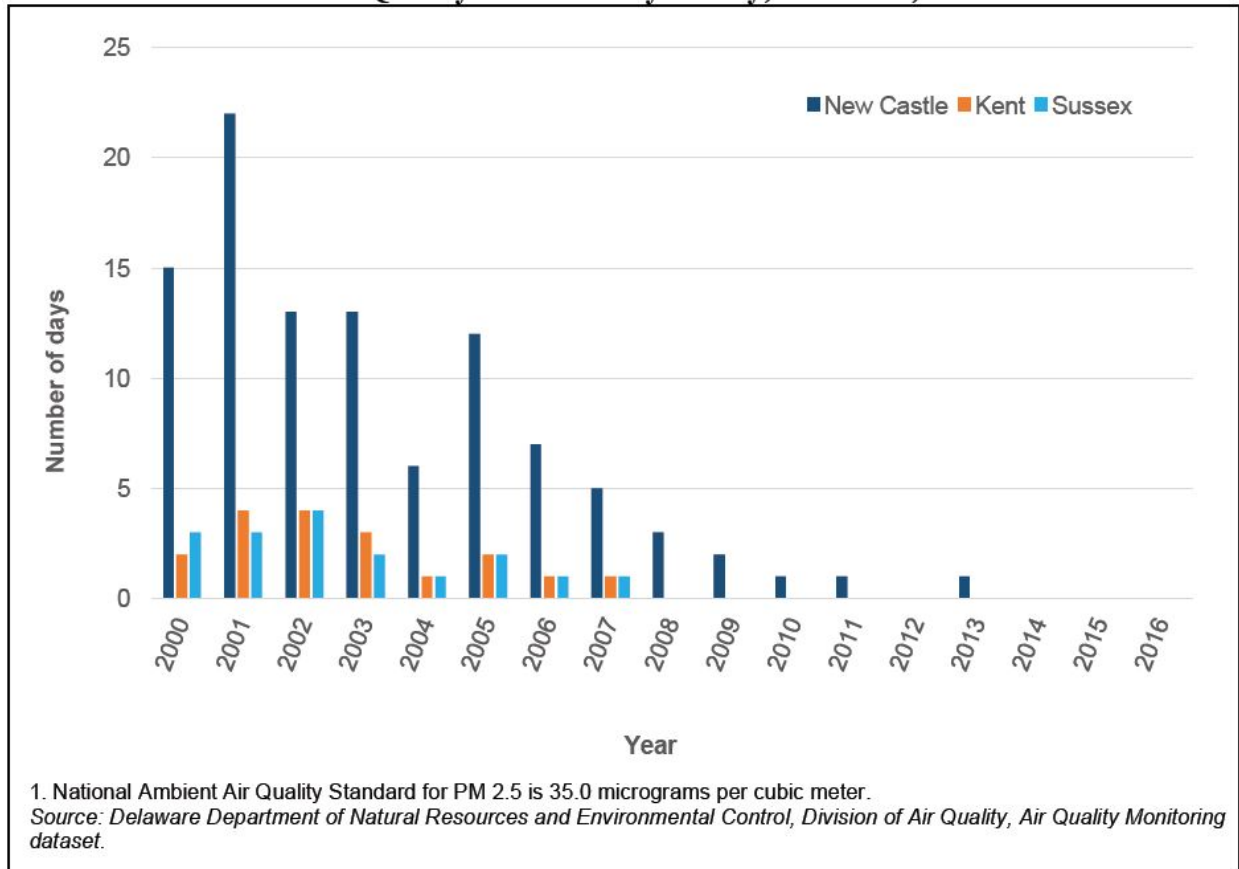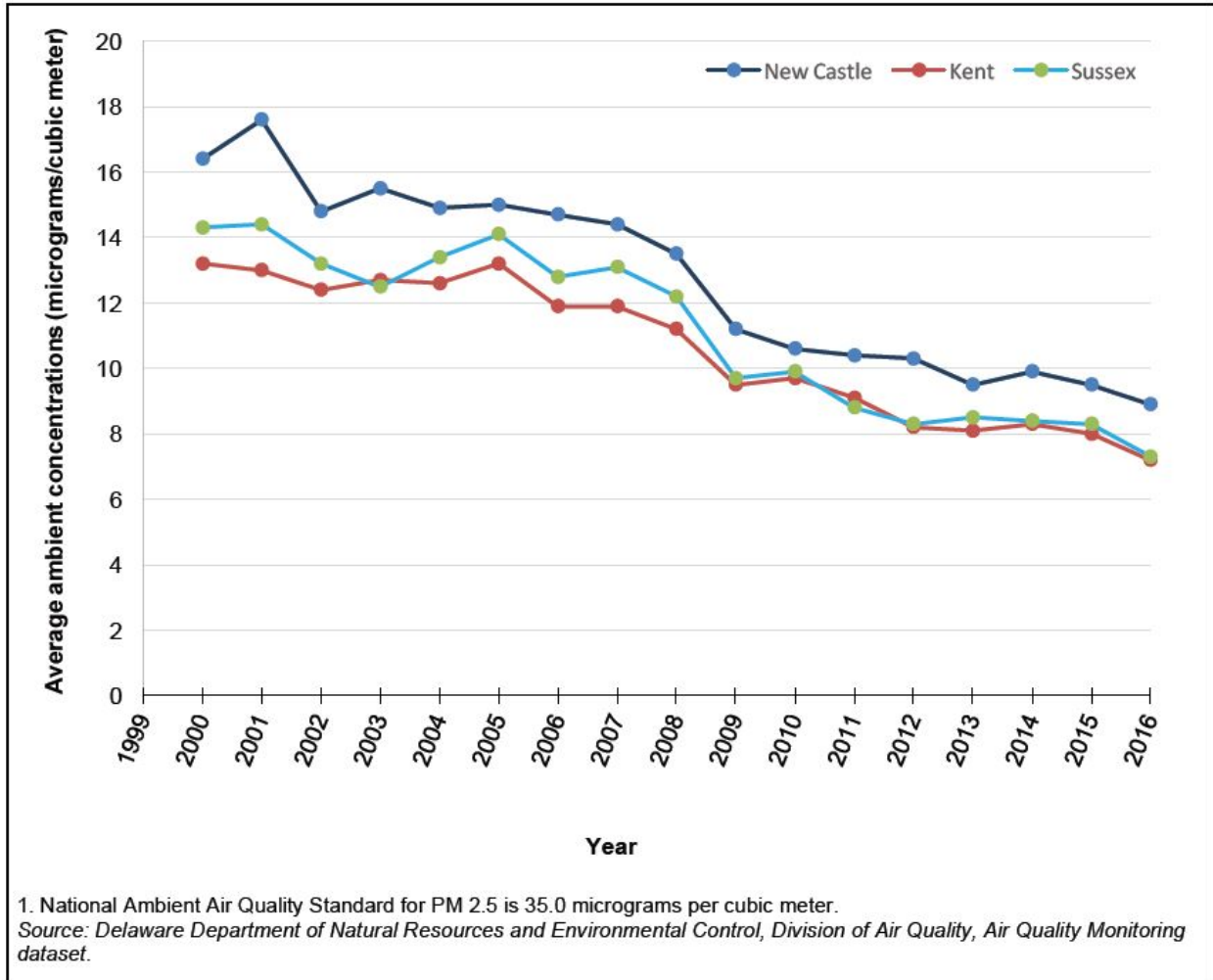
Figure 8 presents the annual average concentration of PM 2.5 by county from 2000 to 2016. Annual average concentrations in all three counties remained below the NAAQS over the 17-year period. Highest concentrations were reported in 2000 or 2001 (New Castle= 17.6 mg/ m3; Sussex= 14.4 mg/m3; Kent= 13.2 mg/m3).

Figure 8. Annual average concentration of Particulate Matter (PM) 2.5 by county, Delaware, 2000-2016

1. National Ambient Air Quality Standard for PM 2.5 is 35.0 micrograms per cubic meter.
Source: Delaware Department of Natural Resources and Environmental Control, Division of Air Quality, Air Quality Monitoring dataset.

Interpretation and use of data

DPH understands that the display of tracking data in the absence of context or statistical associations does not infer causality (e.g., environmental hazard X caused health outcome Y). However, tracking data can be used to describe trends and patterns and to determine whether further investigation is needed. These data may also assist with generating and/or screening hypotheses to elucidate reasons for correlations or statistical associations of environmental and health factors. Analytic studies can be designed to more fully understand the causal relations between environmental exposures and health outcomes.

CONCLUSION

DPH continues to make progress on its path towards creating the Delaware's EPHTN. With support from DNREC, DPH Leadership, and the many partners that have contributed to our successes thus far, we are achieving our vision of "Delawareans having access to usable, meaningful, timely, and high-quality data about… the health of the communities in which they live."

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