

TITLE

Linking Asthma Exacerbation with Exposure to Particulate Matter in the Atlanta Metro Area: Transforming Environmental Measurements for Linkage with HMO Records

THEME

Advance Environmental Public Health Science and Research

KEYWORDS

Asthma, Air monitoring, Office Visits, Exposure estimate, PM_{2.5}

BACKGROUND

Literature suggests that there is a correlation between asthma exacerbation and increased ambient particulate matter. Systems that track asthma are usually not compatible with systems that track environmental hazards related to asthma, resulting in difficulty integrating the two systems. Health and Environment Linked for Information Exchange-Atlanta (HELIX-Atlanta) is an effort to build an environmental public health tracking (EPHT) network in five counties in the Metropolitan Atlanta area (Fulton, Clayton, Cobb, Dekalb, and Gwinnett). The HELIX-Atlanta Respiratory Health Team (RH Team) will contribute to these efforts by providing lessons learned with respect to methods for integrating and analyzing respiratory health and environmental data for environmental public health surveillance. This presentation will provide an overview of the RH Team project, focusing on methods used to develop exposure estimates.

OBJECTIVE(S)

Attendees will understand:

- 1) The overall goals and strategy for linking acute asthma office visits with exposure to particulate matter 2.5 microns or less in size (PM_{2.5}), in the Atlanta Metropolitan area.
- 2) Methods for generating daily PM_{2.5} exposure estimates that combine Moderate Resolution Imaging Spectroradiometer (MODIS) satellite data with ambient monitoring data for the purpose of gap-filling.

METHOD(S)

The selected respiratory health measure for this project was number of daily acute asthma visits to a Kaiser Permanente-GA medical facility (KP-GA) from 2002-2004. Residential address is being geocoded for all members in the KP-GA network for these years. Due to existing temporal and spatial data gaps, PM_{2.5} data from the Environmental Protection Agency (EPA) Air Quality System (AQS) monitoring station network and from the National Aeronautics and Space Administration's (NASA) MODIS data are being used to derive exposure estimates. The air exposure estimates utilized for this project will be 24-hour averaged PM_{2.5} for 2002-2004. We assessed the correlation between MODIS satellite estimates and monitoring data to determine the feasibility of utilizing MODIS satellite data for gap filling. Averaged hourly monitor measurements along with daily monitor measurements were compared to MODIS estimates for the location of the monitoring sites in order to determine the correlation between the observed measurements at the site and the corresponding MODIS data. A spatial analysis technique incorporating both monitoring measurements and MODIS satellite estimates was utilized to develop annual PM_{2.5} concentration estimates for 10x10 km grids within the geographic

region. The variability of PM_{2.5} among the five counties in the Atlanta Metropolitan area was examined from these estimates. Daily PM_{2.5} will be produced at the same geographic resolution for linkage with acute asthma office visits. Each asthma visit and member in the KP-GA network will be assigned the PM_{2.5} concentration of the grid cell within which they lie. Daily acute asthma visits for a particular grid will be determined and stratified by age and gender for spatial-temporal analyses.

RESULT(S)

MODIS satellite data was found to be useful for gap-filling for the months April through September. The correlation between the monitors and remote sensing data for months April-September was 0.60. However, the correlation was 0.2 between October and March because the MODIS satellite is unable to measure particulate matter throughout the entire atmosphere. PM_{2.5} varied among the counties, with the highest concentrations (28.1-35 µg m³) occurring in Fulton and Clayton counties.

DISCUSSION/RECOMMENDATION(S)

Daily acute asthma office visit data from KP-GA and air pollution data from EPA and NASA are accessible data sources for examining the feasibility of linked acute asthma data with air pollution data in the five-county Atlanta Metropolitan area. There are limitations with the asthma and hazard measure selected for this project. The asthma measure does not provide the spectrum of asthma chronic and acute measures. Furthermore, it does not capture every case of asthma exacerbation in the region. MODIS satellite data while providing good spatial coverage of PM_{2.5} is unavailable in cloudy conditions and does not correlate well with monitors during the cool season when asthma hospital visits are high. During the warm season (April-September), the atmosphere is typically well-mixed in the southeastern US, therefore the surface PM_{2.5} values correlate well with values throughout the atmosphere. During the cool season (October-March), atmospheric mixing is weaker and thus the correlation degrades. Therefore, we are using AQS monitor data alone for this period. By combining the two PM_{2.5} data sources for this project, we were able to produce PM_{2.5} exposure estimates for the entire year. We will use these estimates to evaluate the spatial and temporal relationship between PM_{2.5} and acute asthma office visits for the selected time.

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