Geospatial Modeling of Asthma Population in Relation to Air Pollution

A Decision Support for Health Administration

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Abstract

Current observations indicate that asthma is growing every year in the United States, specific reasons for this are not well understood. The study forms an ongoing research effort to investigate the spatio-temporal behavior of asthma in relation to air pollution. The association between environmental variables that affect populations of Asthma and the relatedness to air pollution are investigated using Geographic Information Systems (GIS) tools and applications. Health data concerning asthma obtained from Mississippi State Department of Health (MSDH) for a 9-year period of 2003-2011, and data of air pollutant concentrations (PM) collected from 100 EPA sites, and are analyzed to establish the impact of air quality on human health specifically related to asthma. Disease mapping using geospatial techniques provides valuable insights into the spatial nature, variability, and association of asthma to air pollution. Asthma patient hospitalization data of Mississippi has been analyzed and mapped using quantitative Choropleth techniques in ArcGIS. Patient data have been geocoded to their respective zip codes. Potential air pollutant sources of interstate highways, industries, and other land use data have been integrated in common geospatial platform to understand their adverse contribution on human health. Data from hospitals and emergency clinics are being injected into analysis to further understand their proximity and easy accessibility to patients. At the current level of analysis and understanding, spatial distribution of Asthma is observed in the populations of zip code regions in gulf coast, along the interstates of south, and in counties of Northeast Mississippi. It is also found that asthma is prevalent in most of the urban population. This GIS-based project would be useful to make health risk assessment and provide information support to the administrators and decision makers for establishing satellite clinics on future.

Methods

Asthma Hospitalization Data

Hospital Network Data and Number of Patient Beds

Data Integration and Analysis

Geocoded to Zip dyCode Boundaries

Quantitative Choropleth Mapping of Diseased Population

PM$_{2.5}$ Ground data

Kriging Technique

Geocoded to Sreet lines

References

1. Asthma's impact on the nation, data from CDC national Asthma Control Program.

Future Work

1. Study asthma population in relation to air pollution.
2. Establish a quantitative relationship between PM$_{2.5}$ and Asthma related Hospitalizations.
3. Find the underserved and over served clusters of diseased population.
4. Use remotely sensed data (MODIS), Kriging techniques for understanding spatial distribution of Asthma.

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