Geospatial Modeling of Asthma Population in Relation to Air Pollution

A Decision Support for Health Administration

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Abstract

Current demographic data indicate that asthma is growing every year in the United States, specifically reasons for this are not well understood. This study demonstrates an ongoing research effort in the investigation of the spatio-temporal behaviour of asthma and its relation to air pollution. The association between environmental variables such as air quality and asthma related health issues over Mississippi State were investigated by using Geographic Information Systems (GIS) tools and applications. Health data concerning asthma are obtained from Mississippi Department of Health (MSDH) for a period of 2003-2011. The data of air pollutant concentrations (PM2.5) collected from USEPA web resources are analyzed geospatially to establish the impacts of air quality on human health. The study was conducted by using quantitative Choropleth techniques in ArcGIS software. Patients 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. Existing 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, understanding spatial distribution of asthma is observed in the popualtion of zip code regions of Gulf Coast, along the interstates of south, and counties of Northeast Mississippi. Asthma episodes are prevalent in most of the urban populations. This study based project would be useful to make health risk assessment and provide information support to the administrators and decision makers for establishing satellite clinics in future.

Introduction

1. Asthma is an economic problem in United States. CDC estimates $56 billion each year (CDC, 2009).
3. A GIS-based research conducted by Rob., 2003 has found that there is a good correlation between Asthma and poverty. Be also found that inner-city population have higher prevalence of Asthma than those live in rural regions.
4. Foody, 2006 has published that the long term Asthma disease in the USA is identified in spatial pattern of disease, which is significant to plan and provide health care needs to the Asthma population. Also, it was found that time and space are important factors for dimension health GIS analysis.
5. Relationships between Disease and Environmental Factors: A critical review on public health and GIS. Rushton., 2003 concludes that establishing relationships between disease rates and exposures to environmental factors is an area of increased interest in GIS and spatial analysis of health data.
6. Al-Hamdan et al., 2009 has estimated daily PM2.5 levels combining MODIS data and Environmental Protection Agency (EPA) ground data.

Main objectives for this research were, (1) Identify the Asthma disease spatial clusters, (2) Identify potential areas for Asthma, (3) Number of patients are overestimated or underestimated, (4) The percentage increase in air pollution lead to what percent increase in hospitalization.

Methods

Data Integration and Analysis

Geocoded to Zip dyCode Boundaries

Geocoded to Sreet lines

Quanitative Choropleth Mapping of Diseased Population

Kriging Technique

PM2.5 Ground data

Study Region: Mississippi State Department of Health

Project Partners

Asthma Patient Hospitalisation Data

Hospital Network Data and Number of Patient Beds

Geocoded to Zip code data

Data Integration and Analysis

Project Partners

Conclusion

1. Asthma impact on the nation, data from CDC national Asthma control program:

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