Built Environment, Air Quality and Asthma in Southern California:

A Cluster Analysis of Children's Asthma Rate and Its Relationship with Air Pollution and Built Environment

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Introduction:

Southern California Association of Governments (SCAG) is mandated to perform environmental justice analyses on the low-income or minority populations regarding benefits and burdens of proposed projects in the region, in compliance with Title VI of the Civil Rights Act of 1964 (Title VI). The objective of this research is to analyze the relationship between built environments and children's potential risk of asthma in urban area. This research tests a hypothesis that higher car/truck traffic volume and concentration of air pollution may be associated with the disproportionately high risk of asthma, by using data from the California Environmental Protection Agency's CalEnviroScreen (CES), a screening methodology to identify communities disproportionately burdened by multiple sources of pollution, and data from California Environmental Health Tracking Program (CEHTP) for children's asthma status. The research estimates air pollution, traffic volumes, and socio-economic status in urban areas of SCAG region, and examines the spatial correlation between the built environment characteristics and the children's potential risk of asthma in the region.

Data and Methods:

Asthma Data: Asthma Emergency Department (ED) Visit Rates in 2012 by ZIP Code from CEHTP are assigned to 2010 Census Tract using population weight.

Exposure Data: Data for outdoor air quality was assessed from CES. Concentrations of particulate matter less than 2.5 lm (PM2.5), O3, Diesel PM, and Toxic Release Concentration from Facilities (TRI) by census tract were compiled from different data sources: Air Monitoring Network, California Air Resources Board (CARB), Risk Screening Environmental Indicators (RSEI), Toxic Release Inventory (TRI).

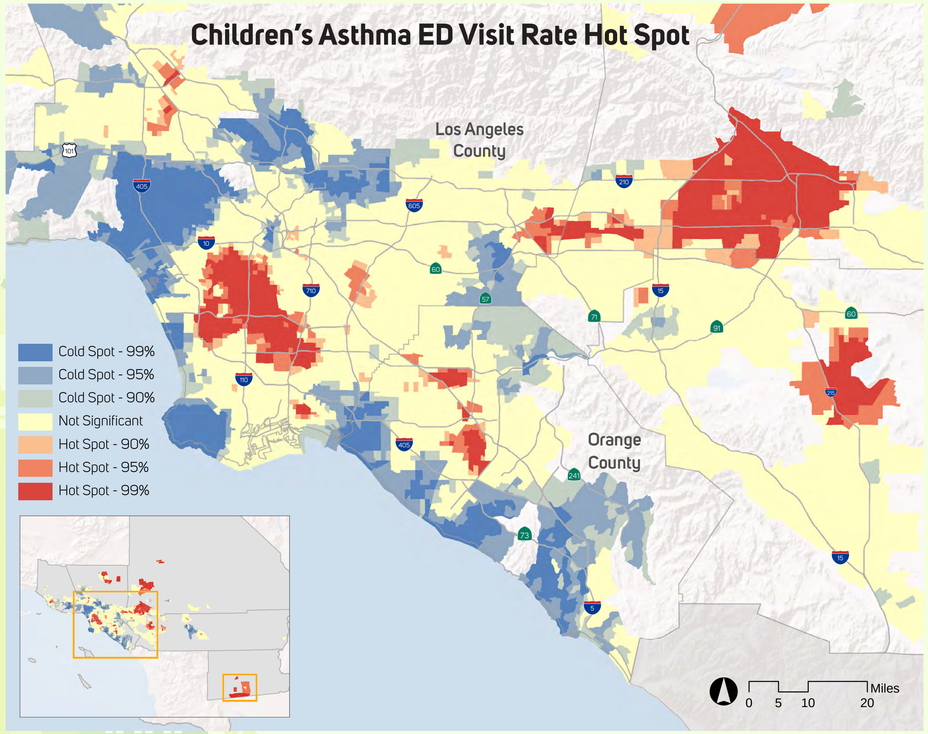
Built Environment: Traffic volume data were compiled under the California Department of Transportation's (Caltrans) Highway Performance Monitoring System (HPMS), and accessed through CES by census tract level.

Spatial Statistics: Hot Spot Analysis (Getis-Ord Gi*) was applied to evaluate spatial correlation of asthma ED visit rates. Clusters of over 95% confidence level were extracted to compare summary statistics.

Conclusion:

The results of our statistical analysis show that children's asthma ED visit rates disproportionately affect minority and impoverished communities. However, communities inside the asthma hot spot clusters do not have higher concentration of air pollution and traffic variables, compared to the rest of SCAG urban areas.

This study used data aggregated all of the data to the census tract level which could have caused the results to be skewed the way they are. Furthermore, the asthma rate data only accounts for emergency deparment visits which may not capture all of the children with asthma. Future studies may improve upon our results by acquiring finer scaled air pollution, transportation, and asthma data.



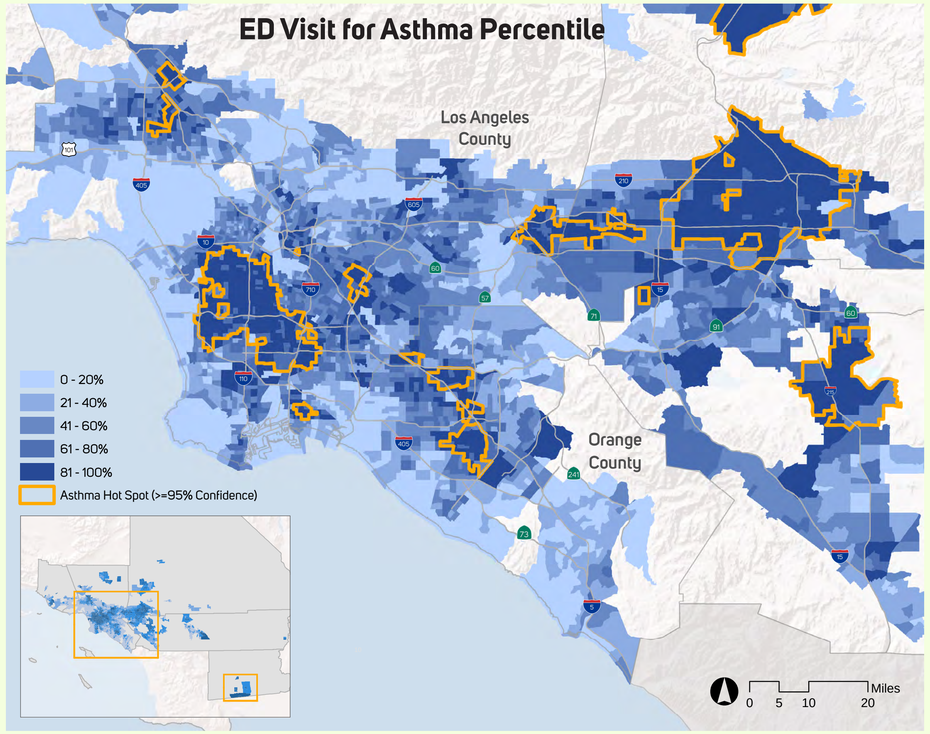
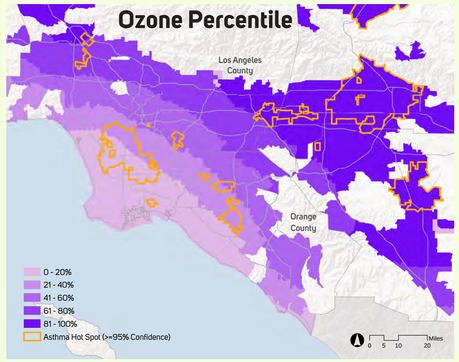
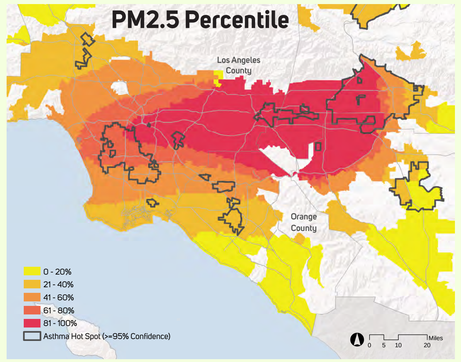


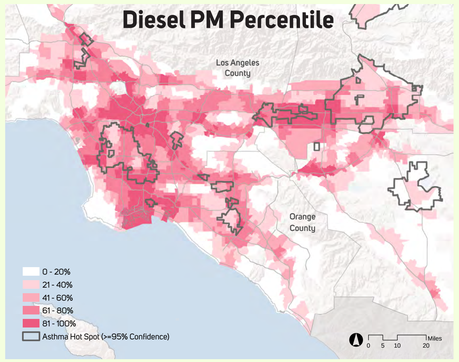
Table 1. Summary Statistics in and outside of Asthma Cluster

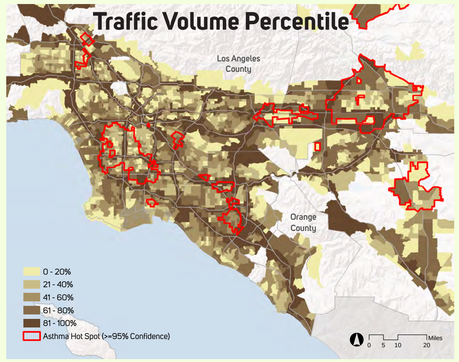
Variable	Mean Inside Asthma Cluster *	Mean Outside Asthma Cluster *	SCAG Region Average
ED Visit Rate for Asthma (per 10,000)	13.79	7.30	8.37
Ozone (lbs.)	0.2287	0.1319	0.1479
PM2.5 (lbs.)	11.3318	11.2760	11.2852
Diesel (lbs.)	21.1790	22.5228	22.3012
TRI (lbs.)	5865.0	5846.6	5849.6
Traffic**	1288.5	1472.0	1441.7
Distance to Freeway (mi.)	1.53	1.32	1.35
Poverty % (per tract)	54.6	33.8	37.2
% Minority *** (per tract)	82.2	45.6	51.6

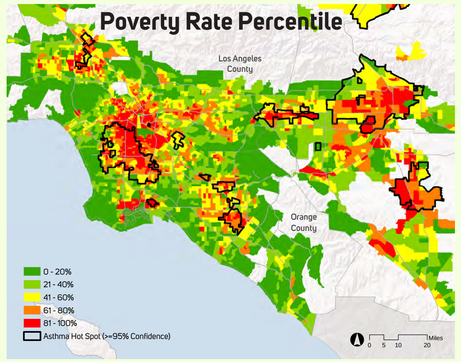
* Getis-Ord Gi* Hot Spot Analysis, 95% Confidence Interval
** Traffic: Traffic density – Sum of traffic volumes adjusted by road segment length (vehicle-kilometers per hour) divided by total road length (kilometers) within 150 meters of the census tract boundary.
*** Minority: All racial groups except Non-Hispanic White

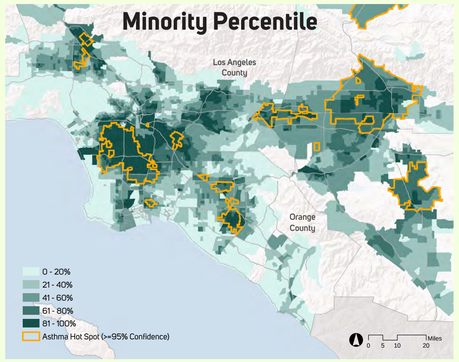












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