

Providing Geographic Focus for Public Health Preparedness & Assessment

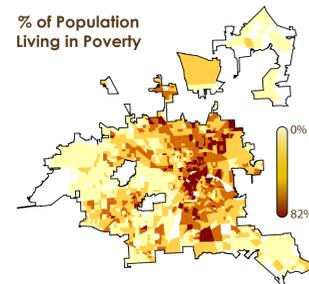
Locating Houston's Most Vulnerable Populations

Monica Slentz, B.S.P.G. & Mark Perry, M.P.H.

Introduction:

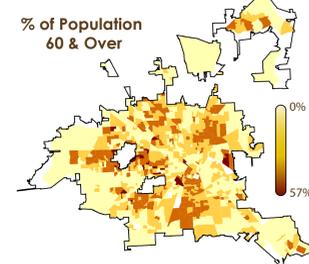
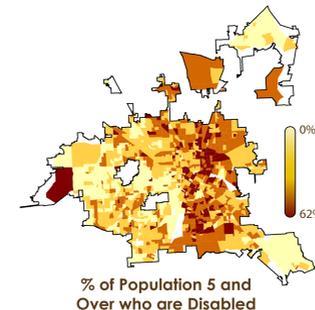
The Houston Department of Health and Human Services is responsible for the City's response to public health emergencies. The department's Bureau of Public Health Preparedness conducts assessment and planning activities to facilitate public readiness. In June 2008, the department's Community Health Statistics program (CHS) assisted in these efforts by identifying Houston communities where residents may be particularly susceptible to the impact of public health emergencies. Using data from the U.S. Census 2000, ESRI ArcGIS software, and the scan statistic software SaTScan™, CHS identified clusters of census geographies where greater than expected numbers of vulnerable persons reside.

The Task - Derive Meaningful Inferences From Multiple Datasets Simultaneously



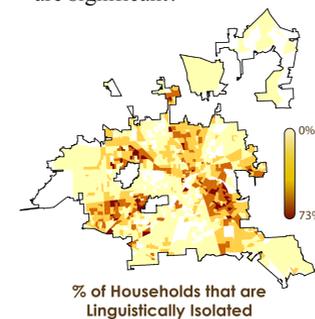
For purposes of this project, CHS defined vulnerable populations to include persons living in poverty, those who are disabled, adults 60 and over, and those households where residents have pronounced difficulty speaking English (these are referred to by the U.S. Census Bureau as "linguistically isolated households").

Discerning meaningful patterns in the spatial distributions of multiple datasets at once can be challenging.



Upon visual inspection, many questions arise. How do these different distributions relate to one another? Which similarities are significant?

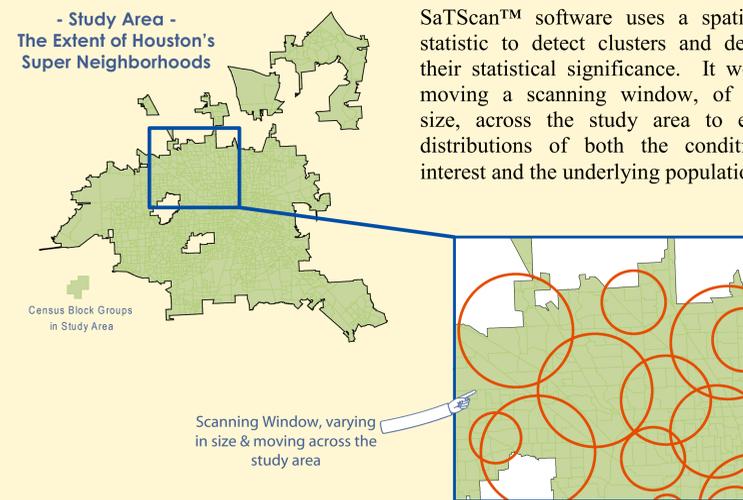
Which apparent spatial clusters represent meaningful patterns, and which may occur merely by chance?



To resolve these questions, and draw "actionable" conclusions, CHS applied cluster analysis techniques which identify clusters both within & between multiple datasets simultaneously.

The Method - Cluster Analysis, Identifying Hot Spots with SaTScan™ using Multivariate & Univariate models

- Study Area -
The Extent of Houston's Super Neighborhoods



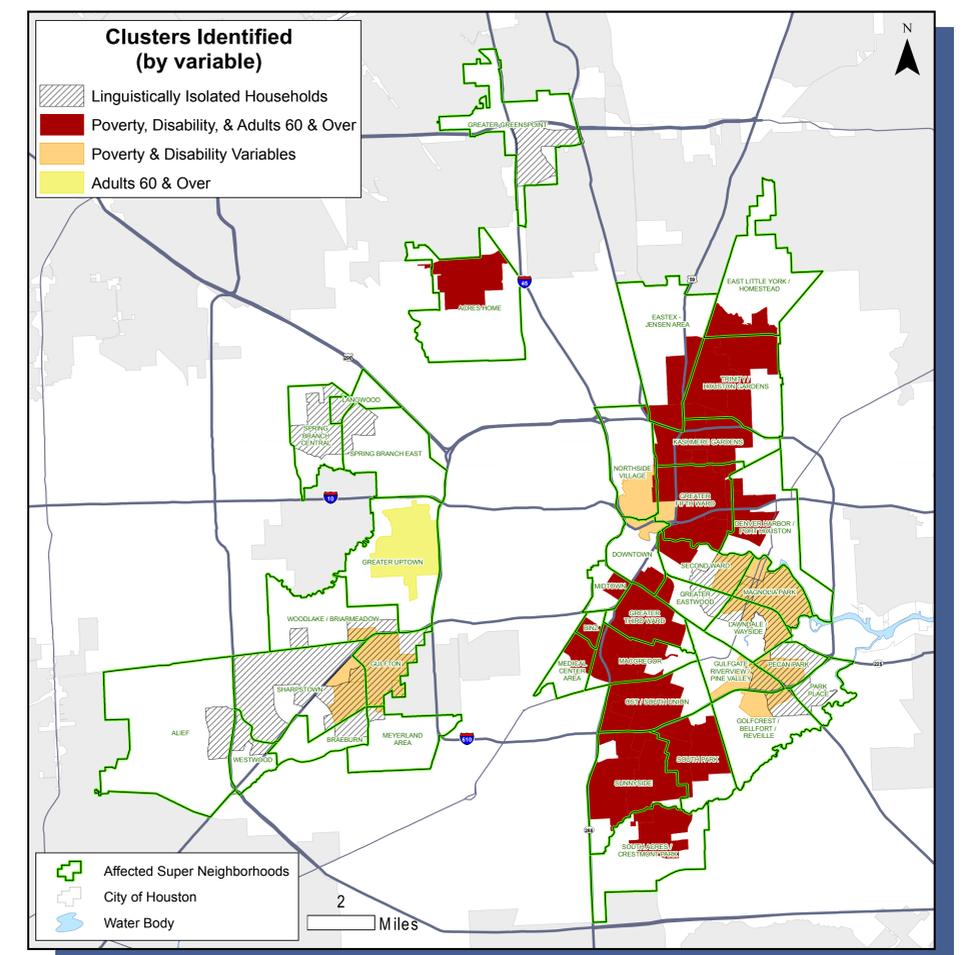
SaTScan™ software uses a spatial scan statistic to detect clusters and determine their statistical significance. It works by moving a scanning window, of varying size, across the study area to examine distributions of both the conditions of interest and the underlying population.

The study area was defined by the extent of Houston's 88 Super Neighborhoods (collections of adjacent residential neighborhoods, defined by the City's Department of Planning and Development, which share similar socio-demographic characteristics). Census data was downloaded at the block group level from the American FactFinder website (<http://factfinder.census.gov>). The spatial analyses searched for clusters of census block groups sharing significantly higher than expected counts of vulnerable persons and households.

The authors prepared 2 purely spatial scan statistic models using the vulnerable population data. The first model was multivariate, and examined the distributions of persons in poverty, those who are disabled, and those 60 and over. Using this model, clusters are identified if they occurred in one of the datasets alone or across multiple datasets. The second model was univariate, examining linguistically isolated households alone. Both were Poisson models, without covariates identified, and were run under the null hypothesis that vulnerable populations were randomly distributed across the study area.

Clusters were limited to a maximum radius of 1 mile and were allowed to overlap, as long as the center of one cluster did not fall within the boundary of a neighboring cluster. These model parameters allowed for the identification of irregularly shaped and adjoining collections of clusters. Several hundred statistically significant and overlapping clusters of vulnerable populations were identified throughout Houston, and ranked according to Log Likelihood Ratio (LLR). Clusters with LLR values in the top decile for each model were considered to be the most statistically significant; each of these clusters exhibits Monte Carlo empirical p-values of less than 0.05.

The Result - Statistically Significant Clusters of Vulnerable Populations by Type of Vulnerability



Conclusions

Communities east of downtown Houston, stretching in a line from north to south across the city, may be particularly vulnerable to the effects of public health emergencies due to higher than expected numbers of persons who are impoverished, disabled, and those who may have special needs due to advancing age. In addition, there are Super Neighborhoods in the central east and southwest areas of Houston which may be vulnerable due to high numbers of persons who are impoverished, disabled, and those who live in households which may not have access to emergency preparedness or response announcements due to language barriers.