

Geospatial Pattern and Spatial Analysis

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Abstract

Geospatial Patterns of Perceived Versus Actual Clinic Service Areas

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Integrating public health and primary care is a critical strategy to meeting the quadruple aim of patient experience, population health, spending, and clinician experience. With electronic health records and geospatial information system (GIS), clinicians are better equipped to understand the geographies they serve. The objective of this study was to calculate the accuracy of the clinician perceived service area (SA) compared to the clinic's actual SA. Study participants were asked to generate the practice's perceived SA by circling areas that they thought represented their practice's SA on a blank paper map. The perceived SA maps were digitized and read in to a GIS and translated into U.S. census tracts that could be compared to the actual SA. Counts were created for analysis by summing up totals for missed and overlapping tracts, as well as tracts that were perceived, but not part of the actual SA. Accuracy for this study was measured based on how much overlap existed between the perceived SA and the actual SA, along with the amount of census tracts drawn that were not a part of the actual SA. Under these conditions, three of the fourteen perceived SA sketches were considered accurate compared to the other sketches. Clinicians and administrators missed nearly 25% of the census tracts in actual SAs. More importantly, we believe that the proposed method is a useful first step in helping clinicians better understand their patients, the communities they serve, and ultimately the resources and needs of those communities.

Administration, management, leadership Communication and informatics Other professions or practice related to public health Social and behavioral sciences

Abstract

Geospatial Longitudinal Analysis of Health Series at the Census Tract Level: Achievable and Useful

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Spatial data analytics can detect patterns of clustering of events in small geographies across a region. These analyses are static, using one time point, without consideration of longitudinal drift in the hot or cold spots. This study aimed to: (a) explore the stability of clustering with small case numbers per census tract, and (b) assess the clustering changes over time, particularly in the cooling of hot spots. Analysis at the census tract level (n=233) is conducted in Mecklenburg County, NC, on two health indicators compiled from birth certificates in 2001-2014, namely cases with hypertension during pregnancy and adolescent pregnancy. First, data were derived from per year and per multi-year moving counts in different ways:

aggregated spatially first to census tracts and then further based on known health covariates (aim a), and then assessed for clustering using a global Moran's I. With evidence of clustering, local indicators of spatial association were next calculated to pinpoint hot spots. Time series (aim b) identified changes in hot spots of hypertension during pregnancy and adolescent pregnancy across space and years. Even though one-year longitudinal resolution provides rich visual mapping information, a caveat is whether a sufficient number of cases per census tract exists. We find that spatial aggregation and use of 2-, 3- and 4-year moving windows help stabilize the clustering of rare health events. Through sensitivity analysis and trade-off analysis between spatial and temporal resolutions, we make best practice recommendations for public health program evaluation in the presence of small numbers.

Public health or related research

Abstract

Log Transformation of Dependent and Independent Variable: Example From Public Health Geo-coded Tobacco Data

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Dependent variables in linear models which exhibit non-constant variance, heteroscedasticity, or lack of normality are candidates for transformation. In this study examining the influence of percentage of Black, minority, less than twelve years of education, fifteen to twenty four year olds, log of population per zip code, and median income on the number of tobacco outlets per zip-code (n=545), the dependent variable is transformed using various techniques. The QQ-plot (generated by R software) of the response (number of tobacco outlets per zip-code) displays right skewness. Initial residual plots show right-opening megaphone shape, indicating non-constant variance. These violations of linear models assumptions indicate the necessity of implementing a Box-Cox transformation to normalize the dependent variable. Though square root and logarithmic transformations perform comparatively well in normalizing the response, the logarithmic transformation is selected due to its common usage and simpler interpretation. Subsequent regression models are constructed using log number of tobacco outlets as the dependent variable. The final model, then, demonstrates that percent Black and minority per zip-code contribute little to the adjusted R². Relative importance diagnostics reveal that these variables are of little significance in predicting the response variable in relation to log of population. Thus, as the log transformation of both the independent variable population and the dependent variable number of tobacco outlets illustrates, the association between greater proportions of Black and minority residents in zip-codes with a higher number of tobacco outlets may be an artifact of overall population, as the two predictors are positively correlated.

Biostatistics, economics Conduct evaluation related to programs, research, and other areas of practice
Planning of health education strategies, interventions, and programs Public health or related education
Public health or related public policy Public health or related research

Abstract

Spatial panel analysis of HIV prevalence among incarcerated population in the US

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HIV is a severe health issue for incarcerated populations in the US. In 2010, the HIV rate among inmates in state and federal prisons was three times more than the non-incarcerated population. The purpose of this

study was to explore the demographic and spatial factors influencing the state level HIV rate using Spatial Durbin Fixed effects model among the prisoners across the 48 states. National Prisoner Statistics and Bureau of Justice database was used to extract data on HIV rate among prisoners for 2000- 2010. It was seen that increase in HIV rate of own state led to increase in HIV rate among the neighboring states. The HIV prevalence was seen to cluster in the South and South eastern parts. While percentage of blacks, females, non US citizen, incarceration rate and population aged less than 18 years significantly increased the HIV rate among prisoners; percentage of whites reduced the rate. Additionally while increase in blacks, females, proportion of non US citizen, incarceration rate and proportion of population below age 18 of own state increased the HIV rate of the neighboring states; increase in white population decreased it. Finally, the study reported that there was no impact of Hispanic population on HIV rate. It is of prime importance to examine the state level variation in HIV rate across time because evaluating the spatial pattern will help in accessing the relevant local information and provide federal agencies with better knowledge to target intervention and prevention programs in controlling and reducing HIV prevalence.

Epidemiology Provision of health care to the public Public health or related research

