(Syndromic) surveillance of birthweight, gestation, and infant mortality

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OBJECTIVE

This study uses data on births in New York City between 2000-2005 to investigate the spatial pattern of birthweight and gestation, two primary risk factors for infant mortality. The analysis uses SatScan to perform normal-distribution cluster detection after controlling for individual-level demographic variables. While previous research has investigated neighborhood effects and spatial patterns of low birth weight and infant mortality, few studies have done so with individual-level information and continuous outcomes. The overarching goal is to develop a framework to better understand demographic and spatial patterns of infant mortality, birthweight, and gestation to inform public health practice.

BACKGROUND

The New York City Department of Health publishes infant mortality figures by neighborhood in its annual Vital Statistics report. Though the infant mortality rate has fallen dramatically over the past 20 years (from 13.4 per 1000 in 1988 to 5.4 per 1000 in 2007) neighborhood variation can be quite high. However, due to the small numbers of infant deaths, some neighborhoods having fewer than 10 per year, it is difficult to distinguish elevated risk from random variation. Additionally, spatial patterns of mortality may be driven largely by spatial patterns of demographic characteristics. In these cases, it may be preferable to describe the risk in terms of the underlying demographics and then focus on the residual spatial pattern. Finally, two types of patterns are of interest to public health—those comprised of areas of *persistent* high risk and *emergent* patterns resulting from changing risk. Random variation can blunt the former while reducing power to see the latter.

Low birthweight and pre-term gestation are two primary risk factors for infant mortality and their spatial patterns have implications for understanding infant death. This study attempts to build on efforts that have traditionally relied on binary indicators by using birthweight in grams Large numbers allow for robust identification of underlying spatial patterns and the risk implied by these patterns can be compared to infant mortality outcomes.

METHODS

Using birth certificate data from 2000-2005 (n=742,822), patterns of zipcode-referenced birthweight and gestation were analyzed using SaTScan's normal model. We then modeled birthweight and gestation adjusting for a number of factors including mother's demographics and health status including congenital conditions such as gestational diabetes, as well as characteristics of the pregnancy. Residuals were mapped to zipcodes and modeled in SaTScan. Persistent patterns and clusters were identified by performing these operations with individual years, as well as a combined model. To demonstrate the identification of emergent clusters, we fit the statistical model to birth data for 2005 and used these residuals in the SaTScan model.

METHODS

The unadjusted pattern of birthweight by zipcode is quite clear with three distinct areas of low birthweight in Queens, Brooklyn, and Harlem/Bronx, each of these areas correspond to neighborhoods with high infant mortality though the clusters are at a scale larger than a neighborhood. SaTScan identifies each of these areas as candidate clusters. After adjusting for the factors described above, the spatial pattern becomes slightly less discernible. However, SaTScan again identifies two candidate clusters corresponding to the more significant clusters in Brooklyn and Harlem/Bronx (cross-hatched in Fig.1). The Brooklyn residual cluster includes portions of the borough not identified by the scan of raw birthweights. Similar analyses will be run on gestation data.

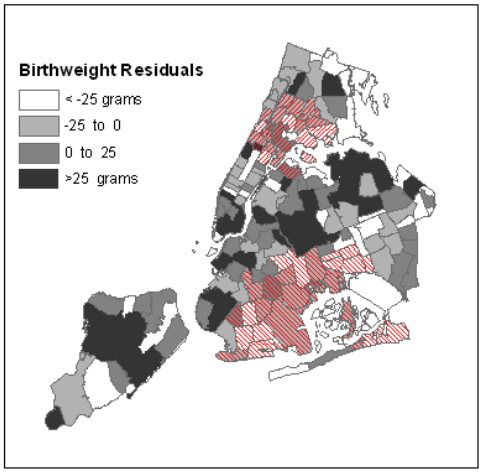

Figure 1. Mean residuals by zipcode with clusters.

CONCLUSIONS

The output of the model described suggests an expected pattern of birthweight based on the characteristics of births and the clustering of residuals highlights areas of interest not accounted for in the model. Taken together, this could aid in understanding infant mortality and addressing observed yearly patterns.

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