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

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OBJECTIVE

There is a great deal of interest in spatial patterns of infant mortality. However, small numbers can make spatial patterns difficult to discern and may mask areas of persistently high risk. This study investigates the spatial pattern of birthweight and gestation, two primary risk factors for infant mortality, using normal-distribution methods available in SaTScan and for which data is available in much greater quantity.

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 (to 5.9 per 1000 in 2006) neighborhood variation can be quite high. However, due to the small numbers of infant deaths, some neighborhoods having fewer than 10, it is difficult to distinguish elevated risk from random variation. Moreover, two types of patterns are of interest to public health—those comprised of areas of *persistent* high risk and *emergent* patterns resulting from new risk. Random variation can blunt the former while reducing power to see the latter. Additionally, spatial patterns of mortality may be driven largely by spatial patterns of demographic characteristics. In these cases, its preferable to describe the risk in terms of the underlying demographics rather than unadjusted patterns. The small quantity of deaths can make it difficult to discern any residual spatial pattern.

Low birthweight and gestation are two primary risk factors for infant mortality and their spatial patterns have implications for understanding infant death. Methods that can describe these patterns and identify clusters of low birthweight and gestation could prove useful in addressing this issue. This study attempts to build on efforts that have traditionally relied on binary indicators by using birthweight in grams. Large numbers allow for more 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 2000-2004 (n=620,097), 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 age, race, and weight of mother, parity, insurance and pre-natal care status, and a number of flags for health and congenital conditions such as gestational diabetes. 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 identify emergent clusters, we fit the statistical model to birth data for 2005 (122,725) and used these residuals in the SaTScan model. Infant mortality measured by Health Center District (HCD) were compared to zipcode-clusters.

RESULTS

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 high infant mortality HCD's though they are at a scale larger than a neighborhood (cross-hatched in fig. 1). 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 (red, in fig.1) and Harlem/Bronx(green). 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.

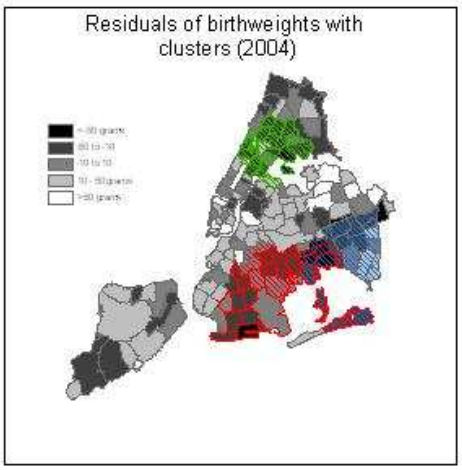

Figure 1. Mean residuals by zipcode with clusters.

CONCLUSIONS

Understanding the spatial pattern of risk for infant mortality could enhance public health practice. 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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