

Mapping the uncertainty of noncontagious disease clusters boundaries in Brazil

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Objective

Cluster finder tools like SaTScan (1) usually do not assess the uncertainty in the location of spatial disease clusters.

Using the nonparametric intensity function (2), a recently introduced visualization method of spatial clusters, we study the occurrence of several noncontagious diseases in Minas Gerais state, in Southeast Brazil.

Introduction

The intrinsic variability that exists in the cases counting data for aggregated-area maps amounts to a corresponding uncertainty in the delineation of the most likely cluster found by methods based on the spatial scan statistics (3). If this cluster turns out to be statistically significant, it allows the characterization of a possible localized anomaly, dividing the areas in the map in two classes: those inside and outside the cluster. But, what about the areas that are outside the cluster but adjacent to it, sometimes sharing a physical border with an area inside the cluster? Should we simply discard them in a disease prevention program? Do all the areas inside the detected cluster have the same priority concerning public health actions? The intensity function (2), a recently introduced visualization method, answers those questions assigning a plausibility to each area of the study map to belong to the most likely cluster detected by the scan statistics. We use the intensity function to study cases of diabetes in Minas Gerais state, Brazil.

Methods

We use the intensity function to visualize the plausibility of each area of some study map to belong to a possible cluster in the map.

Results

Minas Gerais state is located in Brazil southeastern region and composed of 853 municipalities or areas with an estimated population of 19,150,344 in 2005. The population at risk consisting of 7,033,712 adults aged 45 years or older with a total of 28,039 cases of diabetes (type I and II jointly) in the period of January 2002 to May 2011. All data were obtained

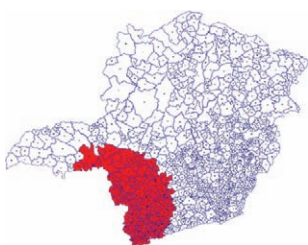


Fig. 1. Cluster detected by circular scan for diabetes cases in Minas Gerais.

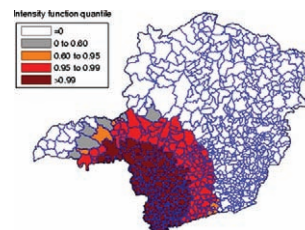


Fig. 2. Intensity function for diabetes cases in Minas Gerais.

from the Brazilian Ministry of Health (www.datasus.gov.br) and Brazilian Institute of Geography and Statistics (www.ibge.gov.br). Fig. 1 presents the most likely cluster found by circular scan. Fig. 2 shows the intensity function.

The intensity function map (Fig. 2) shows clearly that areas with the highest quantiles correspond (Fig. 1) to areas belonging to the primary cluster detected by circular scan. But, the intensity function map also shows a significant number of areas (red color) with a high plausibility to belong to a possible real cluster and some areas (orange color) with intermediate to high intensity function values.

Conclusions

Given a study map with an observed number of cases distributed among its areas, the intensity function value for each area represents the importance of that particular area in delineating a possible cluster of anomalies in the map. This is shown clearly in the results obtained for diabetes cases in Minas Gerais.

Keywords

Intensity function; spatial scan statistics; diabetes; delineation of spatial clusters

Acknowledgments

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