Spatial analyses for assessing health interventions

Emmanuel Bonnet (1, 2), David Zombré (3,4), Bertrand Meda (3,4), Valéry Ridde (3,4)

1 – IRD - Institut de recherche pour le développement UMI 236 RESILIOUNCES – Centre de Ouargaye-Burkina Faso
2 – Identité et Diversifications de l’Environnement des Espaces et des Sociétés – Caen (IDEES), France
3 – Montreal Hospital Research Centre (CRCHUM), Montreal, Canada. 4 - School of Public Health (ESPUM), University of Montreal, Montreal, Canada

Background

The assessment of public health interventions is often restricted to an analysis of average effects, which vary according to geographic entities and approximate measures of distance. Traditional methods used for health evaluation do not make it possible to report on the spatial variability of locations and effects of interventions; much less the factors associated with them. Spatial analysis uses methods and tools that complement the qualitative and quantitative approaches used in public health. It makes it possible to:

- Explain the health phenomena that have been identified through knowledge of the situation's relation to other units;
- Produce spatialised results in the form of spatial statistics and mapping;
- Assess if the effects of interventions are the same throughout an entire region while examining if the potential differentiations are indicative of inequities;
- Explain why the state of health differs from one area to another in a region;
- Evaluate the socio-spatial and temporal dimensions of states of health or other expected effects from health interventions.

With the prospect of universal healthcare coverage in the LDCs, spatial analysis is thus a means of improving assessment of interventions but also of strengthening action in places where issues of equity are most acute. In the context of Burkina Faso, affected by high mortality and infant and maternal morbidity rates, experiments in exemption from health care payment in the region de Ouargaye was conducted. Spatial analysis makes it possible to:

- Use methods and tools that complement the procedures for point data through mobile means: Kernel Density Analysis;
- Characterise the spatial distribution using centrographic procedures used for health evaluation do not make it possible to report on the spatial variability of locations and effects of interventions; much less the factors associated with them. Spatial analysis uses methods and tools that complement the qualitative and quantitative approaches used in public health. It makes it possible to:

Methods and data

EXEMPLE 1 : Analysis of the selection of the indigent for exemption from healthcare payments in the region of Ouargaye

- Data

Data produced by Global Positioning Systems concerning the indigent populations. Using smoothing procedures for point data through mobile means: Kernel Density Analysis.

- Spatial analyses and statistics used in this example.

  - Map algebra for producing a map that characterises the regions of Ouargaye.
  - Producing a summary map that characterises the indigent.
  - Evaluation of accessibility to a CSPS.
  - Thiesse polygons make it possible to assess accessibility to a CSPS.

1. Analysis of the selection of the indigent for exemption from health care payment in the region de Ouargaye in Burkina Faso

- The selection of indigent populations appears to be spatially more diversified in the south. There was no particular selection in these areas (no where a committee selected more than in another); all types of selection were carried out here, by both the VSCS and the COGES.

- The characterisation of spatial distribution using centrographic procedures used for health evaluation do not make it possible to report on the spatial variability of locations and effects of interventions; much less the factors associated with them. Spatial analysis makes it possible to:

- Spatial analyses and statistics used in this example.

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  - Thiesse polygons make it possible to assess accessibility to a CSPS.

2. Analysis of the selection of the indigent for exemption from health care payment in the region de Ouargaye in Burkina Faso

- The two greatest concentrations are in the northwest and the southeast. This orientation, together with the elongated form, seems to correspond to the main road network. This confirms that the combination of accessibility to the road network and proximity to a CSPS was a major determinant in the selection of the indigent for all of the communities but applied more systematically for the COGES.

- The small size of the polygons suggests a geographic coverage of CSPSs driven by a concern for efficacy. However, moving southward, the polygons grow larger. The distances to be covered are therefore greater for inhabitants in the southern regions and for those in the east and west margins when the CSPS is off-centre.

- The summary map confirms the efforts undertaken by Burkina Faso in recent decades to overcome the geographical barrier of access to services.

EXEMPLE 2 : Assessing the effects of exemption from payment on seeking health care in the Dor region

- Data

  - Three household panel type surveys carried out in 2008, 2009 and 2012
  - Socio-demographic, health and spatial data on children under five years of age
  - Events of recourse to health care, infant morbidity (malaria, diarrhoea, pneumonia and malnutrition) and populations at risk were compiled on the scale of the 102 sectors identified.

- Spatial analyses and statistics used in this example.

  - Hotspot analysis (Getis-Ord GI* statistic): the analysis identifies the areas where high and low values are concentrated (clusters).
  - Kernel density estimation: this tool calculates household densities having recourse to a CSPS in the neighbourhood of each household.
  - Map Algebra: producing a summary map that characterises the density of recourse over the period.

Results

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Conclusions

- If spatial analyses are commonly used to illustrate spatial patterns of diseases, they are also useful in the analysis of health care interventions. Mapping, spatial statistics or indeed identification of clusters can provide more complete medical knowledge and provide new evidence.

- The proposed method appears to be innovative and useful for enhancing the distribution of benefits of health interventions for populations.

- The findings resulting from these examples contribute to a better estimation of the needs of vulnerable populations and to identifying the most exposed places in order to improve the health of these populations.

References

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Data management and analysis: All data were entered into PRAs and data analysis was performed with SPSSV 19 (Stat Corp), ArcGIS 10.2 and Geoda.

Ethical considerations: Informed consents were obtained from the parent or legal guardians of all enrolled children. The study protocol was revised and approved by the National Ethics Committee of Burkina Faso and the Institutional Review Board of CRCHUM.

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Contact

Emmanuel Bonnet - Geographer - Emmanuel.bonnet@ird.fr

Institut de Recherche pour le Développement (IRD) - Centre de Ouargaye - Burkina Faso