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Spatial analysis of fetal mortality and social exclusion: an ecological study

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ABSTRACT

Objective: To analyze the spatial dynamics of fetal mortality and its relation with social exclusion. **Method:** An ecological study, whose units of analysis will be the municipalities of Pernambuco. The calculation of the fetal mortality rates will include fetal deaths of residents in Pernambuco between 2010 and 2017, recorded in the Mortality Information System. The social exclusion index will be elaborated with data from the 2010 Census of the Brazilian Institute of Geography and Statistics that present statistical significance with fetal mortality. The index calculation will use the technique of factorial analysis by main components with varimax orthogonal rotation. In the spatial analysis, the empirical Bayesian method will be applied, and the local and global Moran spatial autocorrelation indexes will be calculated. **Expected results:** Identifying the relation between social exclusion and the spatial dynamics of fetal mortality, in order to assist in the development of health actions by identifying areas that need priority attention.

Keywords: Spatial analysis; Fetal mortality; Health information systems, Poverty.

INTRODUCTION

Fetal mortality is an important indicator of the population's health, and of the quality of care for women during pregnancy and childbirth[1]. That is because stillborns are concentrated mainly in areas with precarious living conditions and difficult access to health services[1]. Fetal death or stillbirth is defined as a birth without signs of life with a lower gestational age limit, generally between 20 and 28 weeks[1]. For national research purposes, the cutoff point is 22 weeks and, for international comparisons, 28 weeks[1,2].

Annually, in the world it is estimated that there are 2.6 million stillbirths, 98% of which are located in low- and middle- income countries, such as Brazil[1]. In 2015, the Brazilian fetal mortality rate was 10.8 deaths per thousand births[2]. The Northeast Region had the highest rate with 13.2 deaths per thousand births[2].

Research studies that identify the relation between the spatial distribution of fetal mortality and social exclusion in the territory allow revealing inequities among population groups[3]. This is because social exclusion refers to the basic unmet needs of the population, which include weaknesses in health care[3].

Clusters of fetal mortality and social exclusion can be detected by means of spatial analysis[3]. Visualization, exploratory analysis, or data modeling methods allow for the integration of epidemiological, health care, socioeconomic and geo-referenced environmental information. When used in research studies which link social exclusion strata with stillbirth, spatial analysis will identify areas that need priority in health interventions[3].

GUIDING QUESTION:

How is social exclusion related to the spatial dynamics of fetal mortality?

OBJECTIVE:

To analyze the spatial dynamics of fetal mortality and its relation with social exclusion.

METHOD:

An ecological study will be carried out in the state of Pernambuco, Northeast of Brazil. The analysis units will be 184 municipalities. The district of Fernando de Noronha will be excluded for not having close neighbors, a necessary condition for the application of the selected spatial analysis technique.

All the fetal deaths of residents in the state, registered in the Mortality Information System (*Sistema de Informações sobre Mortalidade*, SIM) and occurred between 2010 and 2017 will be included. The calculation of the Fetal Mortality Rate (FMR) will use data from the SIM and from the Live Birth Information System (*Sistema de Informações sobre Nascidos Vivos*, Sinasc).

The calculation of the Social Exclusion Index (SEI) will be performed by the technique of factorial analysis by main components. Data from the 2010 Census of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*, IBGE) will be used. The Pearson's correlation of all the variables with the FMR will be measured. Variables with a p-value <0.01 and with adequate weights in the construction of the index will be included. Bartlett's test of sphericity will be applied and the main components will be computed to create the index, and varimax rotation will be used in

the self-value matrix of the main components to obtain the final SEI.

In the spatial analysis, using the TerraView® program version 4.2.2, thematic maps of fetal mortality and social exclusion by municipalities will be prepared. The local empirical Bayesian method will be applied to mitigate random fluctuations in rates and indexes.

To estimate the spatial autocorrelation of fetal mortality rates and social exclusion indexes, the Global and Local Moran Indexes will be calculated. The results will identify nearby areas with similar risks for the occurrence of the analyzed outcomes. The values vary between -1 (inverse correlation) and +1 (direct correlation), results close to zero demonstrate the absence of a significant spatial autocorrelation between neighboring areas. The Box Map will be obtained from the information in the Moran dispersion plot, divided into four quadrants. The map of the Local Indicator of Spatial Association (LISA) will detect clusters with significance levels of 95%, 99% and 99.99%. The Moran Map will detect statistically significant areas in each quadrant.

The research project was approved by the Research Ethics Committee of the Health Sciences Center of the Federal University of Pernambuco (CAEE: 13981419.6.0000.5208).

EXPECTED RESULTS:

To identify the relation between social exclusion and the spatial dynamics of fetal mortality, in order to assist in the development of health actions by identifying areas that need priority attention.

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