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Inequalities in mortality in small areas of eleven Spanish cities (the multicenter MEDEA project)

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ABSTRACT

The objectives of this study are to identify inequalities in mortality among census tracts of 11 Spanish cities in the period 1996–2003 and to analyse the relationship between these geographical inequalities and socioeconomic deprivation. It is a cross-sectional ecological study where the units of analysis are census tracts. We obtained an index of socioeconomic deprivation and estimated SMR by each census tract using hierarchical Bayesian models which take into account the spatial structure. In the majority of the cities geographical patterns in total mortality were found in both sexes, which were similar to those for the index of socioeconomic deprivation. Among men, four specific causes of death (lung cancer, ischemic heart diseases, respiratory diseases and cirrhosis) were positively associated with deprivation in the majority of cities. Among women the specific causes diabetes and cirrhosis were positively associated, while lung cancer was negatively associated with deprivation. The excess of mortality related with deprivation was 59,445 deaths among men and 23,292 among women. These results highlight the importance of intra-urban inequalities in health.

1. Introduction

Within European countries, there are many examples of systematic inequalities in health between social classes, the most deprived population groups having worse health and higher mortality (Whitehead and Dahlgren, 2006; Mackenbach et al., 2008; Marmot et al., 2008). Moreover, most of these inequalities have increased over time (Shaw et al., 1999; Mackenbach et al., 2003; Borrell et al., 2008).

In the last two decades, the number of studies treating geographical area as a health determinant has increased, probably due to re-awakened interest in social and environmental determinants of health (Krieger, 2008; Jerrett et al., 2005), availability of data at the small area level and development of methodology and software to analyse the spatial distribution of health based on Geographical Information Systems (Krieger, 2003; Rushton, 2003). The analysis of inequalities in health in geographical areas is important for at least three reasons. First, there are contextual factors at the area level that explain health outcomes, such as the physical environment, urban sprawl, the labour market, leisure facilities, educational facilities, health care and social institutions, just to name a few (Macintyre et al., 2002; Macintyre and Ellaway, 2003). Second, the identification of geographical areas with worse health and socioeconomic

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conditions facilitates the implementation of interventions and policies to tackle inequalities in health (Kjellstrom, 2008). And third, monitoring health inequalities can be more feasible and routinely done using ecological data (Borrell and Pasarin, 2004).

An understanding of the processes occurring in urban areas is a key factor to understand the economic, cultural, political and health transformations in a given country since today the majority of the world's population lives in urban areas (Kjellstrom, 2008; UN-Habitat, 2006; Galea and Vlahov, 2005). In addition, socioeconomic inequalities in health tend to be larger in urban areas with deprived and poor populations being concentrated in marginalized neighbourhoods and urban slums located at the centre or peripheral areas of these cities (Diez Roux, 2007; van Lenthe et al., 2005; Borrell and Pasarin, 2004).

Small area analysis permits gaining a deeper understanding of geographic patterns and clusters of inequalities in health and has proved to be essential in uncovering local-level inequalities often masked by health estimates from large areas such as states, regions or cities. Moreover, the rise of Bayesian methodologies and other powerful new small-area techniques have provided better statistical tools to carry out these analyses (Lawson et al., 2000; Clayton and Bernardinelli, 1992). For all these reasons, the description of health inequalities in small areas of cities has importance for researchers, policy makers and the general population.

Intra-urban inequalities in mortality have not been analysed a great deal in Europe (van Lenthe et al., 2005; Stafford et al., 2004) and have only been studied in a small number of cities in Spain (Dominguez-Berjon et al., 2005; Ocana-Riola et al., 2008; Nolasco et al., 2009). Moreover, when studying inequalities within cities, the areas usually analysed are neighbourhoods, mainly because of the difficulties which an analysis of smaller areas entails. Therefore, the objectives of this study are to identify inequalities in total mortality, and in cause-specific mortality, among census tracts of eleven large Spanish cities, as well as to analyse the relationship between these geographical inequalities and socioeconomic deprivation at the turn of the 21st century.

2. Methods

2.1. Design

This study was carried out in the framework of a project known as MEDEA (*Socioeconomic and environmental inequalities in mortality in small areas of Spanish cities*—http://www.proyectomedea.org/) conducted jointly by 10 Spanish research groups. This study uses a cross-sectional ecological design whose goal is to analyse mortality inequalities at the small area level in Spanish cities. The units of analysis were the census tracts of the 11 largest cities included in the study according to the 2001 Population and Households Census. These cities included 20.5% of the Spanish population in 2001 and are located in a variety of regions (Autonomous Communities) of Spain, from the wealthiest to the poorest: Catalunya (city of Barcelona), Comunidad de Madrid (Madrid), Euskadi (Bilbao), Aragón (Zaragoza), Comunitat Valenciana (Alicante, Castellón and Valencia), Galicia (Vigo), Andalucía (Córdoba, Málaga, Sevilla).

2.2. Study population and information sources

The study population consisted of people residing in the cities during the period 1996–2003. Mortality data were obtained through the mortality registries of the Autonomous Communities or from the mortality registry of the city in the case of Barcelona.

Expected number of deaths in each census tract were calculated taking as reference mortality rates by sex, age (5 year age-specific mortality rates) and cause of death for Spain, year 2001, which were provided by the National Institute of Statistics (Instituto Nacional de Estadística). In order to elaborate an index of socioeconomic deprivation the source of data was the 2001 Population and Household Census. The Population and Household Census was also used to obtain information on the number of inhabitants stratified by sex, age (in five-year groups) and census tract.

2.3. Variables

Number of deaths by five-year age groups, sex, census tract of residence, and the underlying cause of death were extracted from mortality registries. The census tract was obtained through the postal address of the deceased provided by either the Death Certificate or by the Local Census. Due to technical problems in geocoding place of residence, for some deaths could not be geographically referenced, the proportions varying from 0.13% in Bilbao to 14.28% in Vigo. Except for Vigo, these percentages were always lower than 7%. Underlying causes of death were coded using the International Classification of Diseases: 9th revision (ICD-9) for deaths occurred between 1996 and 1998, and 10th revision (ICD-10) for those occurred between 1999 and 2003.

The present study has analysed all-cause mortality, and mortality for 10 of the leading specific causes of death in Spain (lung, breast and prostate cancer, diabetes, mental diseases, Alzheimer, ischemic heart diseases, cerebrovascular diseases, respiratory diseases and cirrhosis). These causes accounted for 43.9% of all deaths among men and 68.6% among women in Spain for the year 2001.

2.4. Socioeconomic deprivation index

Material deprivation refers to the lack of access to conditions related with health such as a healthy job, housing, home facilities or a safe environment. Many indicators have been proposed to measure deprivation (Dominguez-Berjon et al., 2001). In this study, a deprivation index was calculated for each census tract using the methodology proposed by Dominguez-Berjon et al. (2008) (principal component analysis), based on the socioeconomic indicators available for each census tract. Five simple indicators were included in this index (year 2001): (a) Unemployment: percentage of people aged 16 years or over actively seeking a job in relation to the total economically active population; (b) Low educational level: percentage of people aged 16 years and over with less than 5 years of schooling or with 5 years of schooling or more who did not complete basic compulsory education, in relation to the total population aged 16 years and over; (c) Low educational level in young people (16–29 years); (d) Manual workers: percentage of people aged 16 years or over, employed, who are manual workers in relation to the total employed population aged 16 years or over; and (e) Temporary workers: percentage of people aged 16 years or over, employed in temporary jobs, in relation to the total employed population aged 16 years or over. The index is normalized with a mean 0 and standard deviation of 1. The index of deprivation accounted for more than 75% of the variability of the socioeconomic indicators included.

2.5. Data analysis

The observed deaths (O_i) for each census tract ($i=1,\ldots,n$) follow a Poisson distribution with mean $\mu_i=E_i\theta_i$, where E_i were