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Socioeconomic inequalities in mortality in Barcelona: A study based on census tracts (MEDEA Project)

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ABSTRACT

The aim of this study is to describe inequalities in socioeconomic indicators and in mortality by sex in the census tracts of Barcelona city during the period 1996–2003. The results show that there is excess mortality in coastal and northern areas. This distribution is similar to that of socioeconomic deprivation and therefore there is an association between mortality and socioeconomic indicators, not only for total mortality but also for the specific causes of death studied. This type of analysis can be useful for planning of public health policy since it allows small areas with high mortality risk to be detected.

Introduction

Various studies both in Spain and other countries have shown the existence of geographical inequalities in mortality and morbidity, with areas of greater social and material deprivation presenting higher mortality (Benach and Yasui, 1999; Levin and Leyland, 2006; Cooper et al., 2001; Borrell et al., 1997; Benach et al., 2001). The analysis of small geographical areas allows us to identify and analyse social- and mortality-related geographical patterns in detail, as well as to detect areas susceptible of intervention (Domínguez-Berjón, 2002; Adams-Jones et al., 1995; Domínguez-Berjón et al., 2001). In the last decade, studies of mortality in small geographical areas have acquired considerable importance, above all in urban areas where inequalities are usually larger (Borrell and Pasarín, 2004).

The geographical distribution of mortality in small areas is normally presented using maps, where the display of mortality inequalities between different geographical areas is more efficient than through the use of tables of statistics (Martínez et al., 2005). In small geographical areas we may have extreme values of relative risks (both high and low), which dominate the geographical patterns displayed on mortality maps. However, it may be that these extreme relative risks present large variability as a result of reduced population numbers. This high variability affecting mortality indicators in some of the small areas, in our case the standardised mortality ratio (SMR) can be controlled using statistical methods based on a Bayesian approach. In order to estimate the relative risk in a small area, these methods perform a weighting between the information provided by the area in question and that from the rest of areas or neighbouring areas, thus a smoothing of the SMR is obtained (Clayton and Bernardinelli, 1992) that will be more pronounced in those areas having higher variability.

The majority of studies of geographical inequalities in mortality have used larger areas than those of the present study (census tract) (Odoi et al., 2005; Ruiz-Ramos et al., 2004; Nolasco et al., 2004). Those studies have shown the need to have information about health indicators in the most highly disaggregated areas possible. As in other cities, the first studies conducted in Barcelona used municipal districts (10 areas), later neighbourhoods (38 areas) and more recently the Primary Health Care Zones (66 areas) (Borrell and Arias, 1993, 1995; Pasarín et al., 1999). As the unit of analysis got progressively smaller it became possible to detect areas of deprivation, which were masked by the larger territorial units. The census tract may help to detect

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patterns which would not be evident with other geographical units (Domínguez-Berjón et al., 2005; Domínguez-Berjón and Borrell, 2005). Therefore, the aims of the present study are to describe socioeconomic inequalities (year 2001) and those of mortality (years 1996–2003) in the census tracts of Barcelona and to analyse the relationship between mortality inequalities and the socioeconomic level of these areas.

Methods

Design

This study belongs to a project called MEDEA that analyses mortality inequalities at the small area level in different Spanish cities. It is a cross-sectional ecological study. The units of analysis were the 1491 census tracts of the city of Barcelona according to the 2001 Census of Population and Households. In that year, the city of Barcelona had a population of 1,503,884 inhabitants, the census tracts ranging in size from 91 to 7003 inhabitants, with a median of 923.

Study population and information sources

The population under study is that resident in the city of Barcelona during the period 1996–2003. All deaths among residents of the city of Barcelona that occurred between 1996 and 2003 were included.

The source of mortality data was the Barcelona mortality register, which includes age, sex, census tract of residence, and the underlying cause of death for all deaths occurring in the city of Barcelona during the period of study ($N = 132{,}922$). The census tract is obtained through the postal address of the deceased provided by either the death certificate or by the local census using software specifically designed by the Local Council of Barcelona. Due to problems in geocoding the place of residence, 2.08% of all the deaths could not be geographically referenced. The underlying cause of the deaths occurring between 1996 and 1998 was coded according to the International Classification of Diseases, 9th Revision (ICD-9), and those occurring between 1999 and 2003 were coded using the 10th revision of this classification (ICD-10). The present study analyses all-cause mortality, and mortality for the seven leading specific causes of death in Spain. These causes account for 49.4% of all deaths among men and 41.1% among women in Spain for the year 2001. The set of ICD-9 and ICD-10 codes corresponding to the causes studied appears in the footnote of Table 1. Information about the number of inhabitants stratified by sex, age (in 5-year groups) and census tract were obtained from the 2001 Population and Household Census. The expected numbers of deaths in each census tract were calculated taking as reference the deaths by sex, age and cause for Spain, year 2001, provided by the National Institute of Statistics (INE, Instituto Nacional de Estadística). In addition, we used a deprivation index for each census tract that had previously been calculated by the MEDEA project (Domínguez-Berjón et al., in press), based on the five indicators of socioeconomic level available for each census tract. The source of data for these census tract socioeconomic indicators in Barcelona was the 2001 Population and Household Census.

Mortality indicator

The mortality indicator utilised, the age-standardised SMR obtained by the indirect method, is defined as the ratio between observed and expected deaths. The expected number of deaths for each census tract was calculated using the specific mortality rates for Spain for the year 2001; these standard rates were chosen in order to permit comparisons with other Spanish cities using the same methodology.

Deprivation index

For the analysis of socioeconomic inequalities an index of deprivation was calculated, through principal components

Table 1
Distribution of the population and deprivation index in the year 2001 and number of deaths per cause of death in 1996–2003 by census tract and total Barcelona (BCN)

	Census tract			Barcelona				
	Min	Max	Mean	P25	P50	P75	Total BCN	%
Population of Barcelona (no. of inhabitants)	91	7003	1009	746	923	1166	1503884	–
Deprivation index	−1.92	4.34	0.00	−0.70	−0.15	0.58	–	–
Cause of death (no. of deaths)—Men								
Malignant tumour of colon	0	8	1.31	0	1	2	1950	3.0
Malignant tumour of trachea, bronchi and lung	0	21	3.95	2	3	5	5896	9.1
Malignant tumour of prostate	0	7	1.25	0	1	2	1864	2.9
Diabetes mellitus	0	6	0.87	0	1	1	1289	2.0
Ischaemic heart disease	0	29	5.12	3	5	7	7636	11.8
Cerebrovascular diseases	0	14	3.21	2	3	4	4783	7.4
Cirrhosis and other chronic diseases of liver	0	9	1.04	0	1	2	1552	2.4
All causes of death	7	184	43.28	31	41	52	64530	100
Cause of death (no of deaths)—Women								
Malignant tumour of colon	0	8	1.19	0	1	2	1776	2.7
Malignant tumour of trachea, bronchi and lung	0	4	0.66	0	0	1	977	1.5
Malignant tumour of breast	0	12	1.70	1	1	3	2539	3.9
Diabetes mellitus	0	11	1.16	0	1	2	1728	2.6
Ischaemic heart disease	0	38	4.22	2	4	6	6293	9.6
Cerebrovascular diseases	0	34	4.95	3	4	7	7383	11.3
Cirrhosis and other chronic diseases of liver	0	6	0.75	0	1	1	1121	1.7
All causes of death	4	258	44.02	29	41	53	65628	100

International classification of diseases (ICD): malignant tumour of colon (ICD9: 153, ICD10: C18); malignant tumour of trachea, bronchi and lung (ICD9: 162, ICD10: C33, C34); malignant tumour of breast in women (ICD9: 174, ICD10: C50); malignant tumour of prostate (ICD9: 185, ICD10: C61); diabetes mellitus (ICD9: 250, ICD10: E10-E14); ischaemic heart disease (ICD9: 410-414, ICD10: I20-I25); cerebrovascular diseases (ICD9: 430-434, 436-438, ICD10: I60-I69); cirrhosis and other chronic diseases of the liver (ICD9: 571, ICD10: K70, K72.1, K74, K76.1.9).