

The usefulness of area-based socioeconomic measures to monitor social inequalities in health in Southern Europe

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Background: The study objective was to investigate the association between health outcomes and several small-area-based socioeconomic measures and also with individual socioeconomic measures as a check on external validity. **Methods:** Cross-sectional design based on the analysis of the Barcelona Health Interview Survey of 1992. A representative stratified sample of the non-institutionalised population resident in Barcelona city (Spain) was obtained. The present study refers to the 4171 respondents aged over 14. We studied perceived health status, presence of chronic conditions and smoking as health outcomes. Area socioeconomic measures (1991 census) were generated at census tract level and individual socioeconomic measures were educational level and social class obtained through the survey. **Results:** With individual socioeconomic measures we observed that the lower the educational level or social class, the higher the probability of reporting a perceived health status of fair, poor or very poor and of presenting some chronic condition. With regard to smoking, among men this trend was similar [odds ratio (OR) = 1.5; 95% confidence interval (CI) = 1.2–1.9 in social classes IV–V with respect to social classes I–II], while among women it was reversed (OR = 0.7; 95% CI = 0.5–0.9). With the different area-based socioeconomic indicators differences were also observed in this sense, with the exception of smoking in women for which these indicators do not show any differences by socioeconomic level. **Conclusions:** With several census area-based socioeconomic measures similar effects on inequalities in health have been observed. In general, these inequalities were in the same sense as those obtained with individual-based measures. Small-area-based socioeconomic measures from the Spanish census could greatly enhance analysis of social inequalities in health, overcoming the absence of socioeconomic data in public health registries and in medical records.

Keywords: census, small areas, social inequalities in health, socioeconomic factors

Area-based socioeconomic measures have demonstrated their usefulness in research and monitoring of health inequalities, not only in conducting ecological studies, but also in studies with data on individuals. In some countries, mainly the USA, utilisation of these measures in individual-based studies has been proposed as one solution for the shortage, or absence, of socioeconomic data in public health surveillance systems.^{1,2} However, this solution can lead to problems, such as the lack of consensus as to which kinds of area-based socioeconomic measures, and at which geographical level, are meaningful for monitoring socioeconomic inequalities in health.^{2,3} As a consequence, a variety of studies using area-based socioeconomic measures have been undertaken in the USA, employing different levels of geographic aggregation, and a wide variety of health outcomes.^{4–7}

In Southern Europe, area-based socioeconomic measures have been used in the study of inequalities in health by means of ecological designs⁸ and there is less experience in their use in conjunction with individual-based health data.⁹ As the shortage or absence of individual-based socioeconomic measures is a common problem in several countries there is a need to develop feasible ways to monitor health inequalities. In the present study, a variety of socioeconomic indicators were

elaborated, at census tract level, based on data obtained from the Spanish national census. The health data were obtained from a health survey conducted in the city of Barcelona, since this source also provides individual level socioeconomic indicators. The aim of this study was to investigate the association between health outcomes and several small-area-based socioeconomic measures and also with individual socioeconomic measures as a check on external validity. Thus, we can determine whether these census area-based socioeconomic measures can be applied as a valid substitute for individual-based information in cases where the latter cannot be obtained.

Methods

Design, study population and sources of information

The data analysed in this study were collected in 1992 by the Barcelona Health Interview Survey (ESB92), a periodic cross-sectional population survey carried out in the city of Barcelona, in the north-east of Spain. A representative stratified sample of the non-institutionalised population resident in Barcelona according to the population census of 1991 was obtained. The census tracts of the city were grouped into five strata, based on sociodemographic variables obtained from the 1986 census (variables based on age and sex distribution, educational level, occupational level, employment status and migration). The sample size in each stratum depended on the variability of sociodemographic variables in it. The sampling unit in each stratum was the individual and in each stratum a random sample of people was obtained. Total sample size was established as 5004 individuals, with an alpha error of 5% and a maximum

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Table 1 Distribution of the population interviewed over 14 years by the area-(census tract) based socioeconomic measures (1991 census)

Area based socioeconomic measures (%)	Least	Greatest	Range	25%	50%	75%	Mean	SD
Male unemployment	0.0	39.0	39.0	9.0	11.2	14.2	12.1	4.6
Female unemployment	0.0	57.5	57.5	14.4	18.3	23.3	19.3	6.8
All unemployment	0.0	43.3	43.3	11.8	14.2	17.2	14.9	4.7
Male inadequate education	1.3	50.7	49.4	8.3	12.7	18.7	14.1	7.6
Female inadequate education	3.1	64.2	61.1	14.3	20.2	28.4	21.7	9.9
All inadequate education	2.3	57.9	55.6	11.5	16.8	23.8	18.1	8.7
Male low social class	0.0	81.7	81.7	18.9	32.1	45.6	33.4	17.6
Female low social class	0.0	63.5	63.5	10.6	15.4	22.7	17.9	10.2
All low social class	0.0	75.9	75.9	13.8	21.1	31.5	23.8	13.1

Source: Barcelona Health Interview Survey 1992
SD, standard deviation

global error of 1.6% (this global error is half the width of the desired sample confidence interval). The information was collected through face-to-face interviews carried out at home, between February 1992 and January 1993. The non-response rate was 9%.¹⁰ The present study refers to the 4171 respondents aged over 14.

Census tract level indicators were obtained from the 1991 Spanish national census.¹¹

Variables

The health outcomes were: (i) perceived health status, possible responses being: very good, good, fair, poor or very poor; a dichotomous outcome variable was created (1 = fair, poor or very poor; 0 = very good, good); (ii) presence of at least one chronic condition from a list of 21 common illnesses (1 = at least one chronic condition; 0 = none); and (iii) smoking: people who smoked one or more cigarettes daily at the time of the survey were considered current smokers, those who had smoked one or more cigarettes a day in the past (6 months ago or before) but did not smoke at the time of the survey were considered ex-smokers, and those who declared themselves non-smokers, or who smoked less than one a day were labelled non-smokers. A dichotomous outcome variable was created (1 = smokers, 0 = ex-smokers and non-smokers).

From the Health Interview Survey the socioeconomic variables were educational attainment (the highest examination passed) and social class. Educational level was categorised as follows: (i) illiterate or no education; (ii) primary education (<9 years of schooling); (iii) secondary education (9–12 years) and (iv) higher education, being the equivalent of a university degree or an average of 13 years or more of schooling. Social class data were obtained from the Spanish adaptation of the British Registrar General classification.¹² Class I includes managerial and senior technical staff and free professionals; class II includes intermediate occupations and managers in commerce; class III consists of skilled non-manual workers; class IV contains skilled (IVa) and partly skilled (IVb) manual workers; and class V includes unskilled manual workers. People with no paid job (e.g. homemakers, students) and those unemployed were assigned the social class of the head of the household, with the exception of those who had previously worked, who were classified according to their last occupation. For analysis purposes in logistic models social classes are grouped into classes I–II, class III, and classes IV–V.

According to the 1991 census,¹¹ the population of Barcelona was 1 643 542 inhabitants, the city being divided into 1812 census tracts. The smallest census tract had a population of

235 inhabitants, the largest 7396, and the median was 815. Based on the information available in the 1991 Spanish census, deprivation indicators were selected following theoretical criteria^{2,13} and previous experience in Spain:^{14,15} (i) unemployment was defined as the percentage of unemployed in the population aged 15–64 years; (ii) inadequate education as the percentage of people who were illiterate or with no education in the population aged over 10; (iii) low social class as the number of persons with unskilled occupations divided by all people who had ever worked. These indicators were elaborated both separately and jointly for men and women.

Data analysis

In the data analysis each person was assigned a weight to adjust for the sample stratification.¹⁶ Values of the socioeconomic indicators in the census tracts of residence of those individuals interviewed by the ESB92 survey were considered. These indicators were categorised into quartiles (first quartile being least deprived). Table 1 shows a summary of these indicators: percentages of unemployment and of inadequate education are higher among women than among men, whereas for low social class the highest values are observed among men.

Associations between health variables and socioeconomic indicators (individual and area-based) were assessed. Logistic regression models were fitted, the dependent variables being the dichotomous health variables, and the independent variables were each of the socioeconomic measures taken separately, and age (which was considered as a confounder). Socioeconomic level was treated as a categorical variable, and the reference category was always the least unfavourable situation (social classes I–II, higher education and quartile 1 in the area-based measures), which was compared with the groups most deprived (social classes IV–V, illiterate or no education and quartile 4 in the area-based measures). Models were fitted separately for the two sexes. All statistical analyses were carried out using SPSS version 8.0.

Results

Table 2 presents certain sociodemographic and health-related characteristics of the population under study. It may be seen that 18.0% of the population is aged from 15 to 24 years, 20.1% are 65 or older, the proportion of elderly being higher among women. Secondary education is the most common educational level, achieved by 31.9% of the population (35.9% of men, 28.5% of women) and the most frequent social class is IVa

Table 2 Distribution of the demographic variables and health outcomes (number of cases and percentages), men and women aged over 14 years

	Men		Women		Total	
	n	%	n	%	n	%
Total	1943	100	2228	100	4171	100
Age (years)						
15–24	372	19.2	378	17.0	751	18.0
25–44	656	33.8	670	30.1	1326	31.8
45–64	555	28.6	701	31.5	1256	30.1
≥65	359	18.5	479	21.5	839	20.1
Social class						
I	257	13.2	167	7.5	424	10.2
II	274	14.1	318	14.3	592	14.2
III	457	23.5	506	22.7	963	23.1
IVa	522	26.9	649	29.1	1171	28.1
IVb	205	10.6	199	8.9	404	9.7
V	64	3.3	189	8.5	253	6.1
Missing data	164	8.4	200	9.0	363	8.7
Education						
Higher	418	21.5	317	14.2	735	17.6
Secondary	697	35.9	635	28.5	1332	31.9
Primary	488	25.1	592	26.6	1080	25.9
No education	261	13.5	500	22.4	761	18.3
Illiterate	73	3.8	183	8.2	256	6.1
Missing data	5	0.3	1	0.0	6	0.1
Perceived health status						
Very good	362	18.6	358	16.1	720	17.3
Good	1220	62.8	1269	56.9	2489	59.7
Fair	295	15.2	505	22.7	801	19.2
Poor	45	2.3	77	3.4	121	2.9
Very poor	14	0.7	15	0.7	30	0.7
Missing data	5	0.3	4	0.2	10	0.2
Chronic conditions						
No	1311	67.5	980	44.0	2291	54.9
Yes	628	32.3	1246	55.9	1874	44.9
Missing data	3	0.2	3	0.1	6	0.1
Smoking						
Non-smoker	664	34.2	1576	70.7	2240	53.7
Ex-smoker	428	22.0	133	5.9	560	13.4
Smoker	851	43.8	519	23.3	1370	32.8
Missing data	–	–	1	0.0	1	0.0

Source: Barcelona Health Interview Survey 1992

(28.1%), followed by class III (23.1%). With regard to health, a good perceived health status is the most common, observed in 62.8% of men and 56.9% of women. Women report fair or poor perceived health more than men. Suffering at least one chronic

condition was reported by 44.9% of the population, the proportion being higher among women. Current smokers accounted for 32.8% of the population (43.8% of men, 23.3% of women).

When we studied the association between health-related variables and socioeconomic indicators, it was observed (table 3) that among men, the lower the educational level or social class, the higher the probability of reporting a perceived health status of fair, poor or very poor, of presenting some chronic condition, and of being a smoker. With the area-based socioeconomic indicators differences were also observed in this sense, all indicators showing the same general pattern. Odds ratios (OR) for perceived health status of fair, poor or very poor, of the least privileged quartile versus the most privileged one ranged from 1.9 for male unemployment to 3.1 for all low social class. With regard to chronic conditions, all the area-based socioeconomic measures yielded similar results (ORs from 1.2 to 1.4), although some lose statistical significance. Regular smoking shows differences according to the area-based socioeconomic measures ranging from an OR of 1.8 with inadequate education to 1.4 with female unemployment.

Among women, OR of having a fair, poor or very poor perceived health increase as educational level and social class decrease (table 3). Chronic conditions follow the same pattern while for smoking this trend is reversed, with more smoking among women of higher educational level and upper social classes. When we take into account socioeconomic indicators of small areas, smoking does not show differences by socioeconomic level in females, although poor self-perceived health and chronic conditions show the same pattern as when individual-based socioeconomic level is used. ORs of having a poor perceived health, comparing the less privileged socioeconomic level with the most privileged one, using area measures, range between 1.7 (for male unemployment) and 2.5 (for manual workers). With respect to chronic conditions the area-based socioeconomic variables yield ORs ranging from 1.1 for male unemployment to 1.6 for inadequate education among women; however, some of them are not statistically significant.

Discussion

The various socioeconomic indicators, based on census tract data, have revealed social inequalities in health outcomes using information collected by a health interview survey. This shows, in a Southern European country, the utility of census data as socioeconomic indicators in the absence of social class or educational level, as reported by Krieger *et al.*^{1,2,4-7} in the USA.

Observed social inequalities in health

In both men and women, similar effects were observed for each health-related aspect using several small-area-based socioeconomic measures. For the presence of chronic conditions and poor health the differences observed with area-based measures were in the same sense as those observed with individual-based measures. In other studies that have analysed the influence of socioeconomic variables on a variety of health-related variables, it has been observed that area-based socioeconomic measures slightly underestimate the associations observed with individual-based variables.¹ However, from the statistical point of view, some authors have found a general, although not universal, tendency for aggregate proxies to exaggerate the effects of micro-level variables, but the difference between coefficients based on micro and aggregate socioeconomic proxies depends on both the sample and the variables used.¹⁷

Studies done in European and American cities found a higher frequency of fair and poor self-perceived health and chronic conditions in the poor inner city neighbourhoods.¹⁸⁻²⁰ In some of these studies differences were due to the lower socioeconomic level of people living in these areas,¹⁸ but in other studies it has been suggested that characteristics of the area itself play a role in explaining these results.^{19,20}

With regard to smoking, in men it was observed that a lower socioeconomic level is associated with a higher proportion of smokers, such inequalities having also been observed with area-based socioeconomic indicators; on the other hand, in women it was observed that the probability of being a smoker was smaller in the less privileged social classes, or those with lower educational level, and no inequalities were observed when area-based socioeconomic indicators were employed. According to one model for the diffusion of smoking within societies,²¹ in the data used for the present study (year 1992) Barcelona would be situated at the beginning of the third phase of the smoking epidemic in which prevalence in men decreases mainly in the upper classes, while reaching a peak among women. Studies carried out in Barcelona using more recent data²² report a higher consumption of tobacco among women in the lower social classes, suggesting that the end of the third phase has been reached.

Several studies,^{18,23-26} conducted in different countries, have reported the influence of residential neighbourhood in tobacco consumption, and it has been observed that the probability of being a smoker is clearly higher in poorer areas, even after taking the individual's socioeconomic group into account. The results of the present study, reflecting a different association for men and women between tobacco consumption and neighbourhood deprivation could in fact be pointing to the same important positive association between these variables, in both men and women, but while in men deprivation enhances the effect of the individual's socioeconomic situation when looking at tobacco consumption, in women the result is to hide the inverse association observed at individual level.

When we use different approaches to obtain the socioeconomic level of the person (individual or area based), individuals are differentially classified. For this reason, when we compare extreme groups using different classifications, the results change. The most important finding of this article is that we found socioeconomic inequalities in health regardless of the socioeconomic indicator used (individual or area based).

In the absence of an individual socioeconomic measure, the aggregate measure picks up individual as well as contextual effects. In this study, we have observed that in the health variables (self-perceived health and chronic conditions), for which the contextual effect observed in previous studies seems to be less important, the effect size tends to be similar or lower with area-based indicators. In contrast, smoking, which has a clear relationship with the context, has higher effect size. In order to check these hypotheses it would be necessary to carry out a study differentiating the effects of individual-based and area-based socioeconomic indicators. In any case, it is important to see that area-based socioeconomic measures can be applied to monitor health inequalities when individual-based information is not available.

No important differences were observed when the socioeconomic indicators were considered jointly for the two sexes, compared to considering them separately. Some earlier studies have used deprivation indicators for a particular sex, for example male unemployment,^{27,28} because they supposedly represent an advantage over using the total value, or unemployment in women.

Methodological considerations

Area-based socioeconomic measures are easy to obtain through the address of a person, in contrast to the socioeconomic individual measures which usually have to be assessed through a survey. The Census is the only source of reliable and comparable socioeconomic data with a complete coverage of Spain's population at the small-area level, and the same happens in other countries. However, census data have certain limitations, for example they cannot completely characterise the socioeconomic

Table 3 Health outcomes by socioeconomic measures (individual and area based)

Health outcomes	Socioeconomic measures		Men		Women			
	Measure	Individual or area based	% Least deprived ^a	% Most deprived ^b	OR most deprived/least deprived (95% CI)	% Least deprived ^a	% Most deprived ^b	OR most deprived/least deprived (95% CI)
Fair, poor or very poor perceived health status	Social class	Individual	14.1	23.2	1.9 (1.4–2.5)	13.9	34.8	2.5 (1.8–3.3)
	Education	Individual	9.9	34.2	2.7 (1.8–4.1)	8.6	47.0	4.9 (3.1–7.6)
	Male unemployment	Area	14.3	23.7	1.9 (1.3–2.7)	21.9	33.9	1.7 (1.3–2.2)
	Female unemployment	Area	13.1	21.2	2.1 (1.5–3.0)	22.2	34.3	2.0 (1.5–2.7)
	All unemployment	Area	13.5	23.4	2.0 (1.4–2.9)	21.0	33.3	1.8 (1.4–2.4)
	Male inadequate education	Area	12.7	22.9	2.3 (1.7–3.3)	21.1	35.2	2.0 (1.5–2.7)
	Female inadequate education	Area	11.3	23.8	2.5 (1.8–3.6)	21.8	34.6	1.9 (1.4–2.5)
	All inadequate education	Area	12.0	23.8	2.4 (1.7–3.4)	21.7	34.8	1.9 (1.5–2.6)
	Male low social class	Area	12.9	23.5	2.6 (1.8–3.7)	20.2	35.8	2.3 (1.7–3.1)
	Female low social class	Area	13.1	23.8	2.7 (1.9–3.9)	22.2	35.5	1.9 (1.5–2.6)
	All low social class	Area	11.0	24.6	3.1 (2.1–4.4)	19.4	37.1	2.5 (1.8–3.3)
	Social class	Individual	28.3	36.0	1.5 (1.1–1.9)	40.3	63.8	1.8 (1.4–2.3)
	Education	Individual	22.2	60.8	2.4 (1.7–3.4)	35.9	76.5	1.8 (1.3–2.5)
	Male unemployment	Area based	28.5	35.2	1.3 (0.9–1.7)	52.9	58.3	1.1 (0.8–1.4)
	Female unemployment	Area	30.1	33.4	1.3 (1.0–1.7)	54.3	57.8	1.3 (1.0–1.7)
All unemployment	Area	31.0	33.6	1.2 (0.9–1.6)	53.4	57.9	1.2 (0.9–1.6)	
Male inadequate education	Area	31.4	37.2	1.3 (1.0–1.8)	52.3	59.9	1.5 (1.1–1.9)	
Female inadequate education	Area	27.0	36.3	1.4 (1.1–2.0)	49.6	60.6	1.6 (1.2–2.0)	
All inadequate education	Area	28.5	37.4	1.4 (1.0–1.9)	51.0	61.2	1.5 (1.2–2.0)	
Male low social class	Area	29.4	33.1	1.3 (1.0–1.8)	52.3	57.3	1.4 (1.0–1.8)	
Female low social class	Area	30.8	34.5	1.4 (1.1–1.9)	52.6	58.9	1.5 (1.1–1.9)	
All low social class	Area	29.0	33.2	1.4 (1.0–1.9)	51.8	59.7	1.4 (1.1–1.9)	
Presence of chronic conditions	Social class	Individual	28.3	36.0	1.5 (1.1–1.9)	40.3	63.8	1.8 (1.4–2.3)
	Education	Individual	22.2	60.8	2.4 (1.7–3.4)	35.9	76.5	1.8 (1.3–2.5)
	Male unemployment	Area based	28.5	35.2	1.3 (0.9–1.7)	52.9	58.3	1.1 (0.8–1.4)
	Female unemployment	Area	30.1	33.4	1.3 (1.0–1.7)	54.3	57.8	1.3 (1.0–1.7)
	All unemployment	Area	31.0	33.6	1.2 (0.9–1.6)	53.4	57.9	1.2 (0.9–1.6)
	Male inadequate education	Area	31.4	37.2	1.3 (1.0–1.8)	52.3	59.9	1.5 (1.1–1.9)
	Female inadequate education	Area	27.0	36.3	1.4 (1.1–2.0)	49.6	60.6	1.6 (1.2–2.0)
	All inadequate education	Area	28.5	37.4	1.4 (1.0–1.9)	51.0	61.2	1.5 (1.2–2.0)
	Male low social class	Area	29.4	33.1	1.3 (1.0–1.8)	52.3	57.3	1.4 (1.0–1.8)
	Female low social class	Area	30.8	34.5	1.4 (1.1–1.9)	52.6	58.9	1.5 (1.1–1.9)
	All low social class	Area	29.0	33.2	1.4 (1.0–1.9)	51.8	59.7	1.4 (1.1–1.9)

Table 3 (continued)

Health outcomes	Socioeconomic measures		Men			Women		
	Measure	Individual or area based	% Least deprived ^a	% Most deprived ^b	OR most deprived/least deprived (95% CI)	% Least deprived ^a	% Most deprived ^b	OR most deprived/least deprived (95% CI)
Smoking	Social class	Individual	39.6	48.8	1.5 (1.2-1.9)	32.5	18.8	0.7 (0.5-0.9)
	Education	Individual	41.1	39.1	1.3 (1.0-1.8)	38.8	7.3	0.3 (0.2-0.5)
	Male unemployment	Area	38.6	49.3	1.6 (1.3-2.1)	25.4	24.3	1.1 (0.8-1.5)
	Female unemployment	Area	38.3	47.7	1.4 (1.1-1.9)	25.3	22.8	0.8 (0.6-1.1)
	All unemployment	Area	37.7	49.4	1.6 (1.3-2.1)	25.3	25.2	1.0 (0.8-1.4)
	Male inadequate education	Area	38.4	51.3	1.7 (1.3-2.2)	24.5	23.0	0.9 (0.7-1.3)
	Female inadequate education	Area	36.8	50.4	1.8 (1.4-2.3)	24.5	24.8	1.1 (0.8-1.5)
	All inadequate education	Area	38.0	51.8	1.8 (1.4-2.3)	24.4	24.7	1.1 (0.8-1.4)
	Male low social class	Area	37.6	49.8	1.6 (1.3-2.1)	25.2	23.8	0.9 (0.7-1.2)
	Female low social class	Area	35.3	48.8	1.7 (1.3-2.2)	21.5	24.7	1.3 (1.0-1.7)
	All low social class	Area	38.2	50.7	1.7 (1.3-2.2)	26.0	25.3	1.0 (0.8-1.4)

Source: Barcelona Health Interview Survey 1992 and census 1991 for area data. Prevalences (%) and odds ratios (ORs) comparing the most and least deprived. Men and women aged over 14 years

OR, odds ratio; CI, confidence interval

a: The groups least deprived are: social classes I-II, higher education and quartile 1 in the rest of the measures

b: The groups most deprived are social class IV-V, illiterate or no education and quartile 4 in the rest of the measures

context due to an underestimation of the population mainly due to homeless persons with no fixed residence, foreign immigrants not included in the census and certain other marginal groups. Furthermore, conditioned in part by the universal character of the census, the data are limited to broad demographic characteristics and to the socioeconomic information considered most relevant, and although in the present study the usefulness of census-based socioeconomic data has been noted for the study of social inequalities in health, it must be taken into account that the indicators are partial approximations to the underlying socioeconomic reality and ought to be reviewed and updated periodically.^{2,8} Another limitation in using census data is that it is updated only once every 10 years. In the present study, 1991 census data has been related to 1992 health interview data. Although only a short time period had elapsed between collection of the two sets of data, we cannot discount the possibility that a certain degree of misclassification could have occurred if the socioeconomic characteristics of particular neighbourhoods had varied. In general it is considered that the five years nearest to the census is the period recommended for the utilisation of these data for studies of this nature.¹

In regard to the complex sampling design of the ESB92, it should be pointed out that although the sample design was taken into account through appropriate weighting, it was not taken into account in the calculation of variances, and as a consequence standard errors could be slightly underestimated. In any case, according to Guillén and colleagues, the differences in confidence intervals for the ORs, when sample design is not taken into account, are generally very small.¹⁶

The fact that we used aggregated data raises the question of the 'ecological fallacy'. This bias is usually reported when both dependent and independent variables are based on aggregated data, although there are some authors¹⁷ who consider that this type of bias can also arise in studies similar to that presented here, because due to the absence of socioeconomic individual data, area indicators combine both individual and contextual effects, and this is independent of the size of the area studied. Krieger *et al.*,⁴⁻⁷ however, consider that this bias is not relevant in this study design, since the unit of observation was the individual for both the dependent variables (health outcomes) and the independent variables (living in an area with certain sociodemographic characteristics). Thus, the validity of using area-based socioeconomic measures depends on the extent to which areas constitute meaningful geographical units, as is more likely in the smaller areas. In the present study we used the census tract, which, apart from being the greatest level of disaggregation permitted by the Spanish census, has a size similar to what in other countries has been considered suitable for studies of this type (i.e. 500–1000 inhabitants).^{1,29,30} However, the aim of this study was to find a substitute for the respondent's individual sociodemographic characteristics rather than to examine contextual effects.

Implication of findings

Area-based socioeconomic measures derived from census data can be applied to all members of a population, and may capture socioeconomic aspects not included in individual-based measures. In Spain, and perhaps in other European countries, these measures can overcome the absence of socioeconomic data at the individual level. Furthermore, their use in combination with individual-based measures permits carrying out multilevel analyses and to study both influences (individual and area level) on health outcomes. In order to fully develop the possibilities of small-area-based socioeconomic measures, we must explore in more depth the various types of socioeconomic data, based on various geographical units, and investigate their application to a variety of health-related aspects, similar to what is already being done in other countries.⁴⁻⁷ This would lead to progresses in the

study of social inequalities in health, which in turn would contribute to improve the health planning needed to reduce these inequalities.

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Key points

- Utilisation of area-based socioeconomic measures in individual-based studies has been proposed as one solution for the shortage of socioeconomic data.
- In Southern Europe, area-based socioeconomic measures have been used in ecologic studies and there is less experience in their use in conjunction with individual-based health data.
- In this study, with several census area-based socioeconomic measures similar effects on inequalities in health have been observed.
- And in general, these inequalities were in the same sense as those obtained with individual-based measures.
- In Spain small-area based socioeconomic measures from the census can overcome the absence of socioeconomic data at the individual level.

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