A small-area index of socioeconomic deprivation to capture health inequalities in France[☆]

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ABSTRACT

In the absence of individual data, ecological or contextual measures of socioeconomic level are frequently used to describe social inequalities in health. This work focuses on the methodological aspects of the development and validation of a French small-area index of socioeconomic deprivation and its application to the evaluation of the socioeconomic differentials in health outcomes. This index was derived from a principal component analysis of 1999 national census data from the Strasbourg metropolitan area in eastern France, at the census block level. Composed of 19 variables that reflect the multiple aspects of socioeconomic status (income, employment, housing, family and household, and educational level), it can discriminate disadvantaged urban centres from more privileged rural and suburban areas. Several statistical tests (Cronbach's alpha coefficient, convergent validity tests with other deprivation indices from the literature) provided internal and external validation. Its successful application to another French metropolitan area (Lille, in northern France) confirmed its transposability. Finally, its capacity to capture the social inequalities in health when applied to myocardial infarction data shows its potential value. This study thus provides a new tool in French public health research for characterising neighbourhood deprivation and detecting socioeconomic disparities in the distribution of health outcomes at the small-area level.

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Introduction

The existence of inverse gradients between the socio-economic status (SES) of populations and the incidence or mortality rates of numerous health outcomes, such as low birth weight (Krieger et al., 2003; Pattenden, Dolk, & Vrij-heid, 1999), cardiovascular diseases (Avendano et al., 2006; Kaplan & Keil, 1993; Mackenbach, Cavelaars, Kunst, & Groenhof, 2000), mental health (Curtis et al., 2006; Tello et al., 2005), respiratory diseases (Ellison-Loschmann et al., 2007; Prescott, Godtfredsen, Vestbo, & Osler, 2003), and some types of cancers (Steenland, Henley, & Thun, 2002; Ward et al., 2004), is solidly established today. These social inequalities in health are not limited to the extreme ends of the social scale (Marmot, 2005), and they present an important health policy challenge (Adler & Newman, 2002; Wilkinson & Marmot, 2003).

In the absence of individual data, which are not gener-ally routinely available, ecological (or contextual) measures of SES are frequently used to describe health inequalities. Although some epidemiological studies are based on only one socioeconomic indicator (income, educational level, or occupation) (Finkelstein et al., 2003; Kunst, Groenhof, Mackenbach, & Health, 1998; Winkleby, Jatulis, Frank, &

Fortmann, 1992), SES is usually recognized as complex and multidimensional, integrating different components that may be either material (e.g., housing conditions, income, or occupation), social (e.g., social position or isolation, or family support) or both (Braveman et al., 2005; Folwell, 1995).

Area-based deprivation indices for the measurement of the economic or social disadvantages of urban areas were proposed in the 1980s (Townsend, 1987). Initially designed for health care planning and resource allocation, they have been recently used to evaluate and analyse health inequalities (Carstairs, 1995; Eibner & Sturm, 2006; Niggebrugge, Haynes, Jones, Lovett, & Harvey, 2005). These measures, including Townsend's, Carstairs', and Jarman's indices, as well as the more recent Index of Multiple Deprivation, combine contextual indicators such as unemployment rate or proportions of overcrowded or of non-owner-occupied households (Carstairs & Morris, 1991; DETR, 2000; Jarman, 1983; Townsend, Phillimore, & Beattie, 1988). Since the end of the 1990s, numerous other area-based deprivation indices have emerged – in the United States (Eibner & Sturm, 2006; Messer et al., 2006; Singh, 2003), Canada (Pampalon & Raymond, 2000), New Zealand (Salmond, Crampton, & Sutton, 1998), Japan (Fukuda, Nakamura, & Takano, 2007), Italy (Cadum, Costa, Biggeri, & Martuzzi, 1999; Cesaroni, Agabiti, Rosati, Forastiere, & Perucci, 2006; Tello et al., 2005), Spain (Benach & Yasui, 1999), and Belgium (Lorant, 2000).

In France, on the other hand, this field has been the object of relatively little research (Challier & Viel, 2001; Lasbeur et al., 2006; Lucas-Gabrielli, Tonnellier, & Vigneron, 1998). Challier and Viel (2001) proposed a deprivation index at the resolution of the municipality and the canton in the district of Doubs, while Lucas-Gabrielli et al. (1998) focused on developing a classification of the social-health landscape of France at the scale of "employment zones" (which normally are not supposed to include fewer than 25,000 members of the labour force).

The 1999 French census made available a substantial quantity of demographic and economic information at a new and finer scale. The French census block (called IRIS in French for Ilots Regroupés pour l'Information Statistique, that is, housing blocks regrouped for statistical information) corresponds to a neighbourhood of residence of 2000 inhabitants on average and is comparable to the US census block group (National Institute of the Statistic and the Economic Studies, 2008). The multitude of information routinely available at this resolution offered us the opportunity to construct a new socioeconomic deprivation index at a finer geographical resolution than previously in France. This type of work at this small-area scale has developed slowly in France because very little relevant health or environmental data was available at this scale, for comparison with the socioeconomic deprivation index.

This article describes methodological aspects of the development of this new deprivation index and demonstrates its application to the evaluation of socioeconomic differentials in health outcomes at the census block level. This work took place in three consecutive stages. First, we conducted a multidimensional analysis of a relevant selection of available data to create at the census block level

a small-area index of socioeconomic deprivation intended to characterise the contextual deprivation in French metropolitan areas. Then, we verified its validity by testing its content and construct validities. We simultaneously verified its reliability by reproducing the same multidimensional approach on another French metropolitan area at the same scale. Finally, we further demonstrated its validity by illustrating its capacity to capture health inequalities in an example using myocardial infarction data.

Methods

Study area

The study area is the Strasbourg metropolitan area (SMA) located in eastern France in the Bas-Rhin district (or department, an administrative subdivision of France). This area is composed of 28 municipalities (of which 21 are rural and 7 are urban) (316 km^2) subdivided into 190 census blocks (for a total of around 450,000 inhabitants). In our study, a rural municipality is defined by a low population density (mean: 565 inhabitants/km^2) and is composed of one or two census blocks, while an urban municipality is characterised by a high population density (mean: 2835 inhabitants/km^2) and by a number of census blocks higher than two. For reasons related to the confidentiality of information at so fine a scale, 16 blocks with very small populations (fewer than 250 inhabitants) had to be excluded from all stages of this work. The loss of information related to their exclusion was very limited since their population accounted for only 0.8% of the total population of the SMA.

Data

The demographic and socioeconomic data come from the 1999 national population census, conducted by the National Institute for Statistics and Economic Studies (INSEE). The census database is structured into different domains, including employment, family and household, educational level, housing, immigration status, and income; together these regroup a collection of very diverse quantitative variables, such as proportions of unemployed people, foreigners, blue-collar workers, households without cars, people aged 15 years or older with general or vocational maturity certificates, etc. Accordingly, we selected 52 variables from the available data, endeavouring to apply theoretical concepts of deprivation (Krieger, Williams, & Moss, 1997), relying on the indicators most often used in the literature (Challier & Viel, 2001; Jordan, Roderick, & Martin, 2004; Morris & Carstairs, 1991; Pampalon & Raymond, 2000), and using the same definitions as INSEE most often uses in its studies (see Supplementary Table A available in the online version of the paper). All but 2 of the 52 variables were proportions (the exceptions were mean number of people per room and median income per consumption unit). Some variables, intentionally redundant, were introduced into the analysis to determine statistically which were most discriminating for characterising deprivation (e.g., unemployment among total labour force, among men, among women).