



Original Full Length Article

Socioeconomic status and its association with the risk of developing hip fractures: A region-wide ecological study



Carlen Reyes^{a,b}, Maria García-Gil^{b,c,d}, Josep Maria Elorza^b, Francesc Fina-Avilés^e, Leonardo Mendez-Boo^e, Eduardo Hermosilla^b, Ermengol Coma^e, Cristina Carbonell^e, Manuel Medina-Peralta^e, Rafel Ramos^{b,c,d,f}, Bonaventura Bolibar^b, Adolfo Díez-Pérez^g, Daniel Prieto-Alhambra^{b,g,h,i,*}

^a Primary Health Care Center Eap Sardenya, Biomedical Research Institute Sant Pau (IIB Sant Pau), Sardenya 466, Barcelona 08025, Spain

^b Institut Universitari d'Investigació en Atenció Primària Jordi Gol (IDIAP Jordi Gol), Gran Via Corts Catalanes 587, 08007 Barcelona, Spain. Universitat Autònoma de Barcelona (UAB), Bellaterra, Spain

^c Research Unit, Family Medicine, Girona, Jordi Gol Institute for Primary Care Research (IDIAP Jordi Gol), Maluquer Salvador 11, Girona 17002, Spain

^d TransLab Research Group, Department of Medical Sciences, School of Medicine, University of Girona, Emili Grahit 77, Girona 17003, Spain

^e Primary Care Services Information System, Catalan Health Institute (ICS), Gran Via Corts Catalanes 587, Barcelona 08007, Spain

^f Primary Care Services, Girona, Catalan Institute of Health (ICS), Maluquer Salvador 11, Girona 17003, Spain

^g Musculoskeletal Research Unit and RETICEF, IMIM Research Foundation, Parc de Salut Mar and Instituto de Salud Carlos III, Doctor Aiguader 88, Barcelona 08003, Spain

^h MRC Lifecourse Epidemiology Unit, University of Southampton, Southampton General Hospital, Southampton SO16 6YD, United Kingdom

ⁱ Oxford NIHR Musculoskeletal Biomedical Research Unit, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Windmill Road, Oxford OX3 7HE, United Kingdom

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ABSTRACT

Purpose: To determine the association between socioeconomic deprivation (SES) and hip fracture risk.

Methods: Retrospective cohort study using a population-based database (primary care records) of over 5 million people. Eligibility: all living subjects registered during the period 2009–2012 and resident in an urban area. Measures: a validated SES composite index (proportion of unemployed, temporary workers, manual workers, low educational attainment and low educational attainment among youngsters) estimated for each area based on census data. Outcome: incident hip fracture rates as coded in medical records using ICD-10 codes. Statistics: zero-inflated Poisson models fitted to study the association between SES quintiles and hip fracture risk, adjusted for age, sex, obesity, smoking and alcohol consumption.

Results: Compared to the most deprived, wealthy areas had a higher hip fracture incidence (age- and sex-adjusted incidence 38.57 (37.14–40.00) compared to 34.33 (32.90–35.76) per 10,000 person-years). Similarly, most deprived areas had a crude and age- and sex-adjusted lower risk of hip fracture, RR of 0.71 (0.65–0.78) and RR of 0.90 (0.85–0.95), respectively, compared to wealthiest areas. The association was attenuated and no longer significant after adjustment for obesity: RR 0.96 (0.90–1.01). Further adjustment for smoking and high alcohol consumption did not make a difference.

Conclusion: Wealthiest areas have an almost 30% increased risk of hip fracture compared to the most deprived. Differences in age–sex composition and a higher prevalence of obesity in deprived areas could explain this higher risk.

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Introduction

Despite that the hip fracture incidence has stopped increasing in most developed countries [1], the continuous ageing of the population allows us to foresee an increase in chronic comorbidities, such as osteoporosis and ultimately, an increase on the hip fracture incidence [2].

Abbreviations: SIDIAP, Information System for the Development of Research in Primary Care; SES, socioeconomic status.

* Corresponding author at: Senior Clinical Research Fellow, Musculoskeletal Epidemiology Unit, Botnar Research Centre, Nuffield Orthopaedics Centre, Windmill Road, Oxford OX3 7LD, United Kingdom. Fax: +44 1865 737640.

The most direct consequences of the hip fracture are the excess mortality, followed by the disability, the loss of quality of life and the institutionalization of the persons affected [3]. Direct and indirect costs of patients suffering hip fracture double those without [4], remaining a significant challenge for health care systems today and a major public health problem [5]. Efforts are being made in order to correctly identify the population at risk throughout the detection of individual risk factors, such as smoking [6], alcohol consumption [7] or low body mass index (BMI) [8]; however, these can only partly explain the great burden of these fractures.

In the last years, the search for other environmental risk factors, which could contribute to the increased risk of hip fracture, has paved

the way for socioeconomic studies. Some of these risk factors have already been identified, such as the marital status [9], having a low educational attainment [10] or being unemployed [9]; still, data on the relation between socioeconomic status (SES) indexes and hip fracture remain scarce and conflicting [9,11–13].

Several of these studies support that people pertaining to a low SES are at increased risk [14,15], while others have failed to detect an association between low income or unemployment with the hip fracture [16,17] or even reported an increased risk of hip fracture in the wealthiest areas [18]. Nevertheless, the fact that the hip fracture incidence is not randomly distributed among the social classes, places the SES as a key factor in the occurrence of this event, and as a leading cause of possible health inequities.

Health inequities in western countries have been reported in many diseases including musculoskeletal disorders [19,20]. Being able to understand the role that the SES plays on the risk of hip fracture can continue to improve health care policies in order to adequately distribute the health care services available. The aim of this study was therefore to determine the impact of SES on the risk of hip fracture on a primary care population setting.

Methods

Study design and sources of data

We carried out a retrospective ecological study using data from the Information System for the Development of Research in Primary Care (SIDIAP) [21]. SIDIAP is a clinical database of anonymized longitudinal primary care patient records, which includes information of five million people (80% of the Catalanian population and 10.2% of the total population of Spain) attended in 274 primary practices by 3414 general practitioners (GP) [22]. The SIDIAP database is based on the information provided by the Spanish national health system, which covers the practical totality of the population. The GPs are the gatekeepers of this system, and all subjects are allocated to a GP of the public system depending on their main home address. The information recorded includes demographic information, clinical diagnoses (International Classification of Diseases 10th revision [ICD-10]), hospital referrals, laboratory tests and treatments (drug dispensed in community pharmacies). GPs meeting predefined standards of quality were allowed to contribute to the SIDIAP [21] database, providing reliable clinical data for biomedical research [23,24]. The quality of these data has been previously documented [21–24], and SIDIAP has been widely used to study the epidemiology of a number of health outcomes including osteoporotic fractures [23].

Study exposure

The main exposure considered for this study was the ecological MEDEA index of deprivation. It was calculated using the following census-based socioeconomic indicators: unemployment, manual work, temporary work, low educational attainment and low educational attainment among young people. The construction and validation of MEDEA has been described in detail elsewhere [25]. Briefly, a higher MEDEA score is indicative of higher deprivation.

SIDIAP was linked to the 2001 census, after harmonization of the census residences/addresses information and allocation of each individual to his/her census section. A MEDEA index score based on the census data for its population was assigned to each of the census section included, and this was the main study exposure.

All living subjects registered during the period 2009–2012 were included in the study. Rural areas were excluded, as MEDEA has only been validated for urban populations.

Study outcome

Incident fractures in the study period (1/1/2009 to 31/12/2012) were ascertained within both primary care and hospital episodes data using ICD-10 codes.

Confounders and potential explanatory variables

A set of covariates were defined a priori and adjusted for, in multi-variable regression models to explore either confounding or potential causal pathways.

The following variables were characterized at baseline (1/1/2009) at a census section level (percentage of people with the risk factor/characteristic of interest): age, sex, smoking, high alcohol consumption and obesity.

Statistical analysis

Variables were described as weighted means since data were aggregated on the basis of census tract, which led to unequally sized population units. Means were therefore weighted according to the sample size of each of the census sections included in the analysis. Weighted one-way ANOVA contrasts were performed to contrast statistical differences between MEDEA quintiles. MEDEA scores were categorized into quintiles. Age- and gender-standardized incidence rates were calculated for each of the study outcomes according to MEDEA quintile. Non-parametric test (an extended version of the Wilcoxon rank-sum test [26]) for trends for grouped data across ordered groups was performed to contrast trends through MEDEA quintiles. The association between MEDEA quintiles (the higher, the more deprived) and the incidence of these outcomes in 2009–2012 was evaluated using age and sex-adjusted zero-inflated Poisson regression. The aggregated nature of the data resulted in a higher incidence of zeros than expected if we considered that the data were Poisson distributed. Thus, the association between the MEDEA quintiles (the higher, the more deprived) and the incidence of the studied hip fractures in 2009–2012 was evaluated using age and sex-adjusted, zero-inflated, Poisson regression modelling (IRR and 95%CI). We further adjusted for lifestyle factors (smoking, high alcohol consumption and obesity) and finally fitted a multivariate model, adjusted for all these factors and for common comorbidities (hypertension and diabetes) to study potential causal pathways. Sex and age were included as covariates in both models for hip fracture, as well as in the modelling of excess of zeros. Smoking and obesity were also predictors of excess of zeros and, hence, included in the inflation part of the model. In addition, a clustered “sandwich” estimator was calculated to estimate the variance-covariance matrix, which allowed us to account for the correlation between individuals living in the same census tract [27].

Results

Cohort characteristics

Baseline characteristics are shown in Table 1. The wealthiest population accounted for a greater number of old women, a lower proportion of smokers, high alcohol consumption and obese subjects compared to the most deprived population.

Percentages of people in each of the socioeconomic categories included in the MEDEA index are shown in Table 2. People pertaining to the wealthiest social class reported half of the prevalence of manual, temporary work, unemployment and low educational attainment compared with the most deprived.

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