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The relationship between socioeconomic status and fracture in a fracture clinic setting: Data from the Nottingham Fracture Liaison Service

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ABSTRACT

Background: This study aims to better understand the relationship between socioeconomic status (SES), fractures in those that attend an outpatient fracture clinic and a diagnosis of osteoporosis. This will further aid our ability to risk stratify patients' with fractures for further investigation and secondary management of their bone health.
Method: This is a cross sectional analysis using data from the Nottingham Fracture Liaison Service of patients attending the outpatient fracture clinic from 1/01/08 to 31/12/11. Logistic regression adjusted for age and gender were used to investigate SES, fractures and a diagnosis of osteoporosis. Fisher's exact test was used to compare DXA attendance in those living in most deprived and least deprived area. A cut off of 65 years was used to conduct subset analysis of a younger and an older group.
Results: 6362 patients (1346 male, 5016 female; mean (SD) age, 69 (12)) were included in the study. There was no relationship between SES, proportion of fracture types and having a diagnosis of osteoporosis. Prevalence of osteoporosis in each SES quintile from 1 (most deprived) to 5 (least deprived) was 26.68%, 29.04%, 24.83%, 25.67% and 26.68% respectively. The least deprived quintile compared with the most deprived was not associated with a diagnosis of osteoporosis (OR 0.97; 95% CI 0.76–1.25, $p = 0.837$). Those living in the most deprived area were less likely to attend their bone density scan appointment compared to those living in the least deprived area (OR 0.56; 95% CI 0.44–0.7, $p < 0.0001$).
Conclusion: This study has shown that there is no relationship between SES, fracture types and a diagnosis of osteoporosis in those that present to the fracture clinic. SES should not be used to risk stratify patients for further bone health management after fractures. Those living in the most deprived areas are less likely to attend their bone density scan and efforts need to be made to improve attendance in this group.

Introduction

The prevalence of osteoporosis and its consequence, a fragility fracture, is expected to rise due to an ageing population and it is estimated that by 2050, there will be a 135% and 57% rise in the numbers of hip and vertebral fractures [1]. The idea that social deprivation being a predictor for adverse health was first highlighted in the Black Report in 1980 and again in its subsequent review 10 years later [2]. The reason for this is multifactorial ranging from unequal access to healthcare, lifestyle choices that have a negative contribution towards good health, and being less likely to attend for screening for diseases. This has certainly been the case in chronic diseases such as cardiovascular disease [3], cancer [4] and diabetes mellitus [5]. There is now emerging evidence that this is also true for bone health and that one's socioeconomic state (SES) influences one's risk of developing osteoporosis and fragility fractures. In hip fracture, good data exists that has shown that those living in areas that are more socially deprived to have higher hip fracture incidences and worse outcomes [6–8]. However, the relationship between SES and other fractures has not been as extensively studied or its findings been as consistent. Brennan et al. in their review highlighted the conflicting evidence that exists between SES and low trauma fractures citing the limited number of high quality studies that used varied markers of SES, such as income, employment, and level of education [9]. Establishing a relationship if one exists is

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important as it means the treatment of fractures and osteoporosis needs to include a socio-public health perspective. Studies in cardiovascular disease where identifying those socially deprived and focussing resources to screen, treat and managed these group of patients improved outcomes [10]. Hence, the purpose of this study is to better understand the relationship between SES and patients that attend an outpatient fracture clinic. If SES appears to influence fractures in this group, then this study will further aid our ability to risk stratify individuals for further investigation, i.e. bone densitometry, and secondary management of their bone health. This study aims to examine the association between SES in patients that attend an outpatient fracture clinic and their diagnosis of osteoporosis. If those in certain SES were more likely to have bone mineral density (BMD) diagnostic of osteoporosis, this will aid our ability to risk stratify patients presenting to the fracture clinic for further bone health management.

Methods

Setting and study population

The Nottingham University Hospital serves a population of 640,000 (Nottingham city, Broxtowe, Gedling and Rushcliffe district) [11]. It is the only hospital in Nottingham where acute trauma is assessed and treated. Hence, within the local organisational set up, residents here who sustain fractures are treated in this hospital via a single accident and emergency department based in this centrally located hospital. A patient with a fracture that does not need inpatient assessment or treatment, such as hip fractures, are seen in the out-patient 'Fracture Clinic' which is run by a dedicated orthopaedic team. Data was collected from all new patients ($\geq$50 years old) to the fracture clinic on their demographic details, fracture details, and residential postcode over a four year period from 1 January 2008 to 31 December 2011. This was obtained from the clinic notes, the hospital administrative and result reporting system. Patients who did not have a fracture, suffered a pathological fracture or were non-residents within Nottingham were excluded from the study. Non-residents were identified if their residential postcode did not have the Nottinghamshire postcode of NG, or reside in Sutton-in-Ashfield, Mansfield, Newark or Grantham where although they have a NG postcode, they are served by their local hospital which runs its own fracture clinic. BMD results were obtained from those that were referred and attended their dual energy X-ray absorptiometry (DXA) scan. Patients were not referred if they did not sustain an osteoporotic fracture, e.g. metatarsal, finger, patella and calcaneum; not a low trauma injury; were living in a care home (either a residential or nursing home) and based on clinical information were subjectively felt to be frail; unable to comply with the scanning procedure, e.g. unable to lie flat; significant cognitive impairment; have had a DXA done in the last 3 years; under secondary care for osteoporosis; or were terminally ill prior to the scan.

Indices of multiple deprivation

The English Indices of Multiple Deprivation (IMD) provide a relative measure of deprivation at small area level across England. It is based on the concept that deprivation is based on multiple domains and not just poverty. The IMD 2010, commissioned by the Department for Communities and Local Government, is the most recent publication using indicators obtained in the year 2008. These small homogenous areas of relatively even size of around 1500 people are known as Lower layer Super Output Area (LSOA). There are 32,482 LSOA in England. Based on seven different weighted domains of deprivation (income; employment; health and disability; education; crime; barriers to housing and services; and living environment deprivation), an overall cumulative index/score is calculated which ranks LSOA from the most deprived (number 1) to the least deprived (number 32,482). The IMD provides a good indicator of a local area's socioeconomic status in England. The IMD of each LSOA is accessible through the Office of National Statistics by using the residential postcode [12].

Five equal quintiles were divided (1, most deprived; 5, least deprived) based on all IMD scores for England. Each patient is ranked in order and is placed into their respective quintile based on their IMD score.

Statistical analysis

Baseline characteristics including patient demographics and fracture types were grouped into 5 socioeconomic quintiles. Logistic regression adjusted for age and gender was used to investigate the relationship between SES with fractures and osteoporosis. Subset analysis was done in wrist, upper arm and ankle fractures as these are prevalent and important fragility fractures; and in the elderly and young patients using an age cut off of 65 years, to assess the influence of SES on this group of patients and their diagnosis of osteoporosis. This age cut off was used based on our clinical experience where those above 65 years were managed within a healthcare of the elderly medicine set up. Hence, this arbitrary cut off has relevance to the organisation and delivery of bone health services. Osteoporosis was defined as a standard deviation of less than 2.5 below the young adult mean (T score ≤ -2.5). Fisher's exact test was used to compare DXA attendance in SES 1 and 5. Statistical significance was defined as a p value of <0.05.

Results

6362 patients' data were analysed, of which 1346 were men and 5016 were women. The mean (SD) age was 69 (12) years (IQR 59–78). Age (OR 1.06, 95% CI 1.05–1.07, $p < 0.001$) was a risk factor for osteoporosis and men are less likely to develop osteoporosis (OR 0.64, 95% CI 0.5–0.81, $p < 0.001$). Quintiles were similar in size and distribution by age and gender (Table A1). 2688 (42%) patients suffered a wrist fracture, which appears to be the most prevalent fracture sustained in our cohort. This was followed by upper arm (925 patients, 15%) and ankle (635 patients, 10%) fractures. The distribution by fracture by site is summarised in Table A2. Similar numbers of fractures and fracture types were observed in each SES quintile over the 4 years (Table A2).

3851 (61%) patients were referred for a DXA scan from the Fracture Clinic. The reasons for not referring have been described in the methodology section. In those not referred for a DXA but were deemed to be at risk for further fragility fractures, our local osteoporosis specialist nurse would highlight this to the individual's primary care physician to risk stratify and initiate further management, if appropriate. 75.4% (596 patients) in the most deprived quintile compared to 84.9% (787 patients) in the least deprived quintile attended their DXA scan. Those in the most deprived quintile were less likely to attend a DXA scan compared to the least deprived quintile, (unadjusted OR 0.56; 95% CI 0.44–0.70; $p < 0.0001$).

In those that had a DXA scan, the prevalence of osteoporosis was 28.3% (709/2506 patients) in women and 18.8% (105/558 patients) in men. Prevalence of osteoporosis in each SES quintile from 1 (most deprived) to 5 (least deprived) was 26.7% (159/596 patients) in quintile 1, 29% (158/544 patients) in quintile 2, 24.8% (143/576 patients) in quintile 3, 25.7% (144/561 patients) in quintile 4 and 26.7% (210/787 patients) in quintile 5 respectively. When each SES was compared with SES quintile 1, there was no relationship between a diagnosis of osteoporosis and SES (Table A3). When the patient's subset of wrist, upper arm and ankle fractures were analysed, logistic regression when adjusted for age

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