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Do rates of hospital admission for falls and hip fracture in elderly people vary by socio-economic status?

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Summary *Objective*. To determine the relationship between hospital admissions for falls and hip fracture in elderly people and area characteristics such as socio-economic deprivation.

Study design. Ecological study of routinely collected hospital admissions data for falls and hip fracture in people aged 75 years or over for 1992–1997, linked at electoral ward level with characteristics from census data.

Methods. In total, 42,293 and 17,390 admissions were identified for falls and hip fracture, respectively, from 858 electoral wards in Trent. Rate ratios (RRs) for hospital admissions for falls and hip fracture were calculated by the electoral wards' Townsend score divided by quintiles. RRs were estimated by negative binomial regression and adjusted for the ward characteristics of age, gender, ethnicity, rurality, proportion of elderly people living alone and distance from hospital.

Results. There was a small but statistically significant association at electoral ward level between hospital admissions for falls and the Townsend score, with the most deprived wards having a 10% higher admission rate for falls compared with the most affluent wards (adjusted RR 1.10, 95% CI 1.01–1.19). No association was found between hospital admission for hip fracture and deprivation (adjusted RR 1.05, 95% CI 0.95–1.16).

Conclusion. There is some evidence of an association at electoral ward level between hospital admissions for falls and socio-economic deprivation, with higher rates in deprived areas. No such association was found for hip fracture. Further work is required to assess the impact of interventions on reducing inequalities in hospital admission rates for falls in elderly people.

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Introduction

Falls are a major cause of disability and the leading cause of mortality due to injury in people aged 75 years and over in the UK. Hip fracture is the most common serious injury related to falls in older people; following hip fracture, up to 33% of people will die in the following year. Community studies have estimated that about half of people aged 85 years and over will fall at least once a year and the incidence is rising.[1,2] Falls and hip fracture can also have a detrimental impact on function, quality of life and change in residential status; for example, up to 50% of older people who have a hip fracture are subsequently unable to live independently.[3–5]

The National Service Framework for Older People[2] aims to reduce the number of falls that result in a serious injury. The NHS therefore needs to take action to prevent falls in populations of older people regardless of socio-economic status. Whilst we know that there are steep socio-economic gradients for hospital admissions for falls in children,[6] little is known about the population level factors related to high admission rates for falls in elderly people such as socio-economic status, type of housing, population density and urban or rural living areas. Such knowledge would clearly help to decide whether fall prevention programmes should be targeted to specific populations.[7] More is known about population level factors associated with hip fracture, although few studies have been conducted in the UK. There is substantial variation in the incidence of hip fracture between populations,[8] and fracture rates may[9] or may not be higher in urban compared with rural areas.[10] Low income is associated with higher hip fracture rates in some[11,12] but not all[13] studies.

The aim of this study was to determine whether rates of hospital admission for falls and hip fracture are related to material deprivation at the population level.

Methods

Study population

Our sample consisted of all hospital admissions for falls or hip fracture from 858 electoral wards in the Trent region between 1 April 1992 and 31 March 1997 for adults aged 75 years or over. These admissions were identified from the Trent NHS regional admissions databases using ICD-9 and ICD-10 diagnosis codes. For falls, codes E880–E888 and W00–W19 were used. Patients with hip fracture were identified by searching on ICD codes relating to fractured neck of femur (ICD 9 820, 821; ICD 10 S72). This strategy, which has been validated, included other fractures of femur in order to maximize ascertainment of cases of fractured neck of femur.[14,15] Each individual was linked to his or her respective electoral ward (using 1991 Census data) using their residential postcode on admission. The data were aggregated at electoral ward level by total number of admissions for hip fracture and falls. The population at risk were those people aged 75 years or over in each electoral ward, estimated using the 1991 Census.

The Townsend score associated with each electoral ward was used as a proxy for material deprivation, with higher scores being associated with greater deprivation.[16] We used data for other electoral ward characteristics that may affect rates of admission for falls or fractured neck of femur such as the percentage of elderly people living alone,[17] percentages of Asian and Black residents, distance from hospital to centroid of ward in kilometres and Carstairs rurality score.[18] Ethical approval was obtained from Trent MREC and all the LRECs in Trent.

Statistical analysis

The crude annual admission rates for both falls and hip fracture were estimated in each ward by dividing the total number of admissions over the 5-year study period for each electoral ward by five and by the population aged 75 years and over in each ward. Negative binomial regression was used to estimate univariate and multivariate rate ratios (RR) for admissions for falls and hip fracture with 95% confidence intervals, as there was evidence of overdispersion of the data using Poisson regression.[19,20]

Our main explanatory variable was the Townsend score (categorized by quintiles calculated from the 858 wards) associated with each electoral ward. The following variables were included as potential confounders: Carstairs rurality score, the percentage of Asian and Black people per ward, the percentage of elderly people in the population living alone, and the distance from the nearest hospital associated with each electoral ward. Multivariate models were fitted and adjusted for gender and age-band by including the proportion of males aged 75 years and over per ward, the proportion of people aged 80–84 years (out of the total number aged 75 years and over for each ward) and the proportion of people aged 85 years and over (similarly). The 5% level of statistical significance (two-sided) was used in this study. All analyses were performed using Stata 7.0 software.

Sample size and power calculation

A post-hoc power calculation showed that the study had a power of 95% to detect an incidence RR of 1.15 between the top and bottom fifths of deprivation by ward for falls, which had a coefficient of variation of 0.31, using a 5% two-sided significance level. For hip fractures, the power was 85% to detect an incidence RR of 1.15, with a coefficient of variation of 0.35.[21]

Results

The study population

There were a total of 315,211 individuals aged 75 years and over registered at the 1991 Census in the 858 wards in Trent. Of those aged 75 years or over, 31.3% were aged 80–84 years, 21.1% were aged 85 years or over and 35.2% were male. The median number of people aged 75 years and over per ward was 283 and the median total ward population was 4112 (Table 1). The median proportion of elderly people living alone was 5.5%, the median Townsend score was −0.67 and 55% ($n = 472$) of the wards were classified as predominantly urban. The median proportions of Asian and Black individuals per ward were small (0.23 and 0.20%, respectively). Individual level data on the admissions showed that there were 42 293 admissions for a fall and 17 390 admissions for a hip fracture during the study period. Of those admitted for falls and hip fracture, 33 589 (79.4%) and 14 221 (81.8%) were women, respectively. Of the 43 806 total admissions, less than 0.5% ($n = 172$) had missing data for residential postcodes on admission.

Relationship between admission rates for falls, hip fracture and socio-economic status

The overall mean admission rate for falls in this study was 26.7 per 1000 population per year, calculated using the total number of people aged 75 years and over as the denominator. Table 2 shows the univariate and multivariate analyses of admissions for falls. An increased rate of admission was found in those wards in the top two-fifths of Townsend score (i.e. most deprived) compared with those in the bottom fifth of Townsend score (i.e. most affluent) adjusted for age, proportion of males, ethnicity, rurality and distance from hospital (adjusted RR 1.11, 95% CI 1.02–1.20, and RR 1.10, 95% CI 1.01–1.19, respectively). The overall mean admission rate for hip fracture in this study was 10.9 per 1000 population per year. No consistent relationship was found between the Townsend score and hip fracture rate on multivariate analysis (Table 3).

Discussion

This study of hospital admissions for falls and hip fracture found a significant association between deprivation (as measured by the Townsend score) and hospital admissions for falls in adults aged

Table 1 Characteristics of study population in 858 electoral wards in Trent region, based on 1991 census data.

Characteristic	Median per ward	Interquartile range		Total number of individuals	Total population (%) 75 +
Number of males, 75–79 years	54	31	90	60,128	19.1
Number of females, 75–79 years	80	43	138	90,906	28.8
Number of males, 80–84 years	31	17	51	34,079	10.8
Number of females, 80–84 years	55	30	99	64,996	20.6
Number of males, 85–89 years	12	7	20	13,069	4.1
Number of females, 85–89	30	15	52	34,238	10.9
Number of males, 90 years or over	3	1	6	3523	1.1
Number of females, 90 years or over	12	6	22	14,272	4.5
Total number of males, 75 years or over	101	56	166	110,799	35.2
Total number of females, 75 years or over	181	93	316	204,412	64.8
Total population 75 years or over	283	151	483	315,211	100.0
Total population	4112	2204	6936	4,606,654	
Elderly people living alone (%)	5.5	4.61	6.66		
Townsend score	−0.67	−2.51	1.96		
Distance from hospital (km)	9.38	4.64	18.17		
Asian (%)	0.23	0.06	0.60		
Black (%)	0.20	0.09	0.46		

Table 2 Univariate and multivariate analysis of admissions for falls in 858 wards during study period, for all admissions ($n = 42,293$).

Townsend score divided by qintiles	Percentiles[a]	Admissions	Total population 75 years and over	Rate per 1000 population per year	Univariate analyses 95% CI			Multivariate analyses[b] 95% CI		
					IRR	Lower	Upper	IRR	Lower	Upper
Most affluent	−2.95	5385	42,330	25.0	1.00			1.00		
2	−1.45	5643	44,682	24.1	0.97	0.90	1.05	0.96	0.89	1.04
3	0.10	7169	55,599	25.8	1.03	0.95	1.11	1.01	0.94	1.10
4	2.74	10,226	70,600	29.4	1.17	1.08	1.26	1.11	1.02	1.20
Most deprived		13,870	102,000	29.3	1.15	1.07	1.24	1.10	1.01	1.19

[a] Cutoffs for each quintile, these values represent the largest value in each category.
[b] Mutually adjusted for Carstairs' rurality score (categorized as predominantly urban and rural), % Asian, % Black, % age bands, % male, distance from hospital and % elderly people living alone at ward level.

Table 3 Univariate and multivariate analyses of admissions for hip fracture in 858 wards during study period, ($n = 17,390$).

Townsend score divided by quintiles	Percentiles[a]	Admissions	Total population 75 years and over	Rate per 1000 population per year	Univariate analyses 95% CI			Multivariate analyses[b] 95% CI		
					IRR	Lower	Upper	IRR	Lower	Upper
Most affluent	−2.95	2350	42,330	10.7	1.00			1.00		
2	−1.45	2356	44,682	10.2	0.95	0.86	1.04	0.96	0.88	1.06
3	0.10	2959	55,599	10.4	0.97	0.88	1.06	0.99	0.90	1.08
4	2.74	4155	70,600	11.7	1.08	0.99	1.18	1.09	0.99	1.20
Most deprived		5570	102,000	11.5	1.04	0.95	1.14	1.05	0.95	1.16

[a] Cutoffs for each quintile, these values represent the largest value in each category.
[b] Mutually adjusted for Carstairs rurality score (categorized as predominantly urban and rural), % Asian, % Black, % age bands, % male, distance from hospital and % elderly people living alone at ward level.

75 years or over. The rates of admission for falls were 10% greater in the two most deprived fifths of wards compared with the most affluent fifth of wards. While these are not particularly high RRs, the absolute number of hospital admissions for falls that occurs is so great that, if this represents a real trend, the increase is likely to have an important public health implication. In contrast, no consistent relationship was found between deprivation and hip fracture admission rates.

Discussion of methodology

This study was based on routinely collected data on NHS hospital admissions that we have not been able to validate. However, a recent systematic review demonstrated a median accuracy of 91% for diagnostic codes and 69.5% for procedure codes.[22] We have no reason to suspect that injuries, and in particular coding of falls, would be coded any more or less accurately or less completely for subjects according to their postcode of residence, hence the chance of bias due to this is small. If at all, we may have underestimated the rate of admission for falls, but we do not think it would have altered the observed relationship with socio-economic status. The data in many cases is more than 95% complete[23] and although data were not available for private admissions, we expect that the vast majority of patients were admitted to NHS hospitals. In our analyses, overdispersion was apparent in the data, probably due to multiple admissions for the same individual or measurement error of potential confounders, and we have taken account of this by using negative binomial regression. Finally, our use of routinely collected data limited us to an area, rather than an individual level measure of deprivation, and therefore we must be cautious in drawing conclusions concerning individual deprivation and injury morbidity as it is likely that there is some residual confounding. It is also possible that we underestimated the confounding by age by using only three age bands in the multivariate analysis. A strength of this study is that the possible confounding effects of proximity to hospital, ethnicity, rurality and percentage of elderly people living alone have been included.

Interpretation

Our finding of an increased rate of falls resulting in hospital admission associated with material deprivation is important yet not entirely unexpected. However, our contrasting finding of no socio-economic variation with hip fracture admission is surprising in view of both our findings for falls and previous reports.[11,12] Our estimates of the rate of hospital admission for both falls and hip fracture are similar to previous reports that have used these and other data.[14,15,24–26] The association between socio-economic deprivation and hospital admissions for falls may derive from a higher rate of falls in deprived areas, or a higher rate of admission following a fall, or a combination of these. It is possible that a minor fall that occurs in an individual with multiple co-morbidity or a poor living environment/social support network is more likely to lead to admission to hospital. In contrast, someone who is otherwise healthy and/or has an adequate living environment/social support network may not be admitted to hospital. Both environmental living conditions and chronic disease are closely related to socio-economic deprivation, so it is possible that this association explains our findings.[16,27,28] Indeed, the lack of a socio-economic association with hip fracture suggests that the incidence of falls severe enough to lead to a fractured hip does not differ by social group.

Implications of these findings

Preventing falls and fractures in individuals depends on identifying those most at risk, including those with balance or gait problems, visual impairment, impaired cognition, postural hypotension, and those with home hazards such as poorly fitting carpets, poor lighting or unsafe stairs. The evidence points to the benefits of multiple screening and intervention programmes.[29–32] At a population level, this can include the promotion of appropriate weight-bearing and strength-enhancing physical activity[33] that prevents falls and also osteoporosis.[34] Our results suggest that by implementing interventions that are known to be effective for prevention of falls—such as multiple intervention schemes—or providing increased support at home to elderly people who have fallen, we may be able to reduce the socio-economic differences in hospital admission rates for falls in elderly people. Further work is required to assess the impact of such interventions on reducing inequalities in hospital admission rates for falls in elderly people.

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