

An additional dimension to health inequalities: disease severity and socioeconomic position

Jenny Eachus, Philip Chan, Nicky Pearson, Carol Propper, George Davey Smith

Abstract

Objective—To investigate the association between the severity of hip pain and disability, and a number of measures of socioeconomic position, using a range of individual and ecological socioeconomic indicators.

Design—Interviewer administered and self completed questionnaires on symptoms of pain and disability, general health and socioeconomic indicators, completed by people reporting hip pain in a cross sectional, postal, screening questionnaire.

Setting—40 general practices from inner city, suburban and rural areas of south west England.

Participants—954 study participants who had reported hip pain in a postal questionnaire survey of 26 046 people aged 35 and over, selected using an age/sex stratified random probability sample.

Data—Individual indicators of socioeconomic position: social class based on occupation, maximum educational attainment, car ownership, gross household income, manual or non-manual occupation and living alone. Area level measures of socioeconomic position: Townsend scores for material deprivation at enumeration district level; urban or rural location based on the postcode of residence. Severity of hip disease, measured by the pain, disability and independence components of the New Zealand score for major joint replacement. Self reported comorbidity validated using general practice case notes and summary measures of general health.

Main results—Increasing disease severity was strongly associated with increasing age and a variety of measures of general health, including comorbidity. The data provide considerable evidence for the systematic association of increased severity of hip disease with decreasing socioeconomic position. Measures of socioeconomic position that were systematically associated with increasing disease severity, standardised for age and sex, included educational attainment (relative index of inequality 1.95 (95% confidence intervals 1.29 to 2.62) and income (relative index of inequality 4.03 (95% confidence intervals 3.43 to 4.64)). Those with access to a car (mean disease severity 15.5) had statistically significant lower severity of hip disease than those without (mean 17.5, $p < 0.01$). Similar results were found for access to higher or further education and

living with others. For a given level of income, people with greater comorbidity had more severe hip pain and disability. The gradient in disease severity between rich and poor was steepest among those with the most comorbidity.

Conclusions—People with lower socioeconomic position experience a greater severity of hip disease. The poorest sector of the population seem to be in double jeopardy: they not only experience a greater burden of chronic morbidity but also a greater severity of hip disease. This study has implications for health care provision, if the National Health Service is to live up to its principle of equal treatment for equal medical need.

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Over the past few years the issue of inequalities in health has been raised from being politically taboo in Britain,¹ to being embraced within the key political goal of reducing the “health gap” between rich and poor.² One of the founding principles of the National Health Service was that there should be equal treatment for equal medical need, but a compromise had to be built in, which allowed private practice to coexist alongside statutory health care provision, resulting in an inevitable compromise of the equity goal.³ Today, after half a century of comprehensive services that are universally available and free at the point of delivery, there is clear evidence of inequalities in health that are widening in certain groups of society.^{4,5} The recent independent inquiry,⁶ into inequalities in health provided 39 recommendations of methods to reduce reversible inequalities. Its publication has been welcomed for highlighting the problems of inequalities but the recommendations have been criticised for lack of prioritisation, vagueness and for not being costed.⁵ The challenge of how to direct health care resources to where they are most needed remains unmet.

In investigating the extent of inequalities in morbidity across the socioeconomic hierarchy, some investigators have used summary measures of health, while others have used disease specific measures. A clear social class gradient has been demonstrated for global self assessed health,⁷ myocardial infarction, stroke, diabetes and chronic bronchitis.⁸ Limiting longstanding illness,⁹ and disability,¹⁰ increase as household income decreases, as do the prevalences of angina, diabetes, bronchitis,¹¹ and arthritis.¹² Psychiatric disorders are more common in civil servants with lower pay and employment grades.¹³ Increased educational attainment has

Department of Social
Medicine, University
of Bristol, Canynge
Hall, Whiteladies
Road, Bristol BS8 2PR
J Eachus
P Chan
N Pearson
G Davey Smith

Department of
Economics, University
of Bristol
C Propper

Correspondence to:
Professor G Davey Smith.

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been associated with lower prevalences of self reported diabetes, heart disease and chronic respiratory disease,¹⁴ and arthritis.¹⁵⁻¹⁶ Ecological measures have demonstrated inequalities at area level, with the prevalence of many forms of self reported chronic morbidity being higher in more deprived areas.¹⁷⁻¹⁸ Evidence about urban and rural health is mixed, with a review concluding that people from urban areas have poorer health in general, but those from certain rural areas have poorer access to high quality care.¹⁹ Recent evidence asserts that to understand determinants of inequalities in health, studies must use more than one measure of socioeconomic position.²⁰

A largely ignored dimension of the issue of inequalities in health, is the degree to which disease severity is associated with socioeconomic position. Despite warnings in the literature about possible differential reporting of disease by educational attainment,¹⁴⁻²¹ and income,²² and the inadequacy of studies relying on just one or two simple questions to pick up the range within musculoskeletal, respiratory and mental diseases,²¹ there still remain a dearth of studies that have investigated the association between disease severity and socioeconomic position. One study that has gone some way to investigate this, comprised 1044 men aged under 55 with ankylosing spondylitis. Mean scores for pain, physical activity and disease impact were statistically significantly higher for unemployed men compared with employed men.²³

To try and resolve this gap in the research evidence, this study focuses on severity of hip disease rather than prevalence and examines the association between severity and a number of measures of socioeconomic position, using a wide range of socioeconomic indicators.

Methods

STUDY DESIGN

A multistage sampling strategy,²⁴ was adopted to take an age/sex stratified random sample of 28 080 people aged 35 and over from 40 general practices in the counties of Avon and Somerset in south west England. The last British Census (1991) revealed that Avon had a resident population of almost 1 million (932 674),²⁵ whereas Somerset, which is geographically much larger and more rural, had a population of almost half a million (460 368).²⁶ The percentage of the population that was of pensionable age was 22% for Somerset and 19% for Avon.

After checking the names and addresses with the general practices, those who had died, moved out of the area or had a terminal illness were removed from the sample. A postal screening questionnaire comprising questions on general health, musculoskeletal disease of any joint, symptoms of hip and knee disease, back problems and sociodemographic indicators, was sent to 26 046 people. A question derived from the American Health and Nutrition Examination Survey,¹⁶ was used as the key screening question for hip problems.

Details of the screening phase of the project including follow up of non-responders and

validation of the questionnaire are published elsewhere.¹⁸ Essentially, 22 204 people provided useable responses to the hip screening question. A total of 3169 (14%) reported hip pain on screening, equating to a prevalence of 143 per 1000 people aged 35 and over (95% confidence intervals: 136 to 150 per 1000). An analysis of the effect of the cluster design across 40 practices on the prevalence of self reported pain revealed only minimal effects on the width of the confidence intervals. To adjust for this design effect, the standard errors around the prevalence of people reporting hip pain would need to be inflated by a design factor of just 1.12 for all men and 1.32 for all women.²⁷

Those reporting hip pain were invited to attend a study clinic for a detailed orthopaedic and general assessment. Study clinics were held at general practices and hospitals throughout the region. People too elderly or unwell to attend a clinic were offered an assessment at home. All those who attended a clinic had their travel expenses reimbursed and were able to bring dependants to the clinics if necessary. They completed a detailed, interviewer administered questionnaire about symptoms of pain and function in the hip, knee and lower back. They were also asked to self report details of their domestic circumstances and their general health.

MEASURES OF SOCIOECONOMIC POSITION

Several indicators of socioeconomic position were measured at individual and ecological level. The ecological measures were enumeration district and ward level Townsend scores for material deprivation, and urban and rural status derived from the postcode of each study participant. The following individual level measures of socioeconomic position were collected: social class based on each respondent's most recent full time occupation (housewives with no other occupation were assigned their partner's occupation, where given); manual/non-manual occupation, gross household income; maximum educational attainment (derived from a list of academic and trade qualifications and age at which the respondent left school); access to any higher or further education; living alone and access to a car.

MEASURES OF ILL HEALTH

Severity of hip disease, indicated by pain and disability in or around the hip joint, was assessed by a continuous score from 0 to 80 using three of the four components of a score for assessing global disease severity, the New Zealand score for major joint replacement (the New Zealand Score).²⁹ Measures of pain (40 points), disability (20 points), involvement of other joints in the disease process and the degree to which independence was threatened (20 points) are all taken into account by this scoring system. For the purpose of these analyses, the fourth component of the score about clinical and radiological examination findings and which carried a maximum of 20 points, was not included as not all the clinic attenders were able to be examined or have radiology. Prevalence and incidence estimates of hip

disease that may require primary hip replacement surgery, based on data from all four components of the score, are reported elsewhere.²⁷

Comorbidity was self reported on the screening questionnaire. The variables were grouped into respiratory, cardiovascular or eye diseases, depression and cancers. A summary score was devised to indicate the burden of chronic comorbidity experienced by each study member. Reporting any one from each major disease group gave a score of 1 and an additional 0.5 was given for each extra disease from within a disease group. The sum across all disease groups formed the comorbidity score, which ranged from 0 to 5.5. Because of the small numbers in some of the groups, the comorbidity score has been collapsed into three groups, for ease of interpretation and presentation. A score greater than 1 but less than 2.5 is referred to as "considerable comorbidity" and a score of 2.5 or more is referred to as "multiple comorbidity".

In addition to these details from the postal screening questionnaire, clinic attenders completed Likert scales to assess their general health, how their health compared with that of a year ago and the extent to which their physical and/or mental health interfered with their social life.

Full ethical committee approval was granted for all stages of the data collection.

VALIDATING THE ILLNESS MEASURE

To test the validity of using the New Zealand score for this purpose, Spearman's rank correlation was used to correlate the score with a battery of variables: age, four measures of general health and comorbidity.

SUBJECTS INCLUDED IN THE STUDY

Full details of the clinic invitation criteria have been described elsewhere.²⁷ Essentially, 2027 of the 3169 people who had reported hip pain on screening were invited to a study clinic. A total of 1405 (69%) people attended a study clinic or were given a home visit. There were no statistically significant differences between clinic attenders and non-attenders in terms of comorbidity, with the exception that women who attended a clinic had a statistically significant higher prevalence of cataract than women who did not attend. For all three measures of service utilisation asked on the postal questionnaire (GP consultation in the past 12 months for hips, currently waiting to see a hospital doctor and currently on a waiting list for a hip replacement), there were significant differences for both sexes, with attenders more likely to have accessed care for hip disease.²⁷

A total of 1382 people completed sufficient questions to be assigned a hip disease severity score. The mean age of the 23 people who were not able to be assigned a hip need score was 70, with a standard deviation of 18. This compares with a mean of 65 and standard deviation of 13 for those who were assigned a score.

As data on deprivation and urban/rural status are derived from postcodes, these data were available for a larger subset of respondents with a hip disease severity score (1381

than the details on social class (1366), income (1018), education (1165), car ownership (1144), living alone (1155), self assessed general health measures (1276) and affect of health on social life (1250), which were obtained using self completed questionnaires at clinic and home visits. For this reason, the data set for the main analysis comprises the set of people who completed all relevant questionnaires and questions (954). This is referred to as the "main set" throughout. For comparison, and to assess possible bias, the analyses were also carried out on the largest set available for each variable, the "full set" for each variable.

STATISTICAL ANALYSIS

Those with a hip prosthesis in situ were treated for the purposes of these analyses in exactly the same way as those without. The scores for each hip are not additive, and as there is no reason to suppose that one hip might have a different association with socioeconomic position than another, the analysis has been presented for the left hip only. The analysis was also carried out for the right hip and at person level, taking the score of each person's most severe hip to indicate their maximum need. Any differences between findings using left hip, right hip and most severe hip are reported. The analysis was also separately carried out for the 354 men and 600 women in the main set and similar results were found.

A comparison of the main set with those excluded because of incomplete data was carried out using a two sample test for proportion ("Prtest" command in the statistical package STATA) for each of the sexes, three age groups, socioeconomic position measured by enumeration district level Townsend score for material deprivation, and level of comorbidity.

The association of the age and sex standardised New Zealand score with measures of general health, and with individual and area measures of socioeconomic position, was assessed using Spearman's rank correlation. Pearson's product moment correlation coefficient was also used for continuous variables (age, enumeration district and ward level Townsend scores). *t* Tests assuming equal variances were used for two factor, categorical variables (car ownership, any further or higher education since leaving school, urban or rural status, manual/non-manual occupation and any comorbid, chronic conditions). The non-parametric Mann-Whitney U test was also carried out, and produced similar findings to the other methods.

To look at gradients in mean disease severity across the socioeconomic hierarchy, the continuous measure, enumeration level Townsend score for deprivation (deprivation category) was quintilised. Social class was broken into five major groups according to the Registrar General's classification of occupations, and education was presented as five groups, depending on qualifications and school leaving age.

A relative index of inequality,²⁹⁻³² was calculated to measure the extent to which ill health is

Table 1 Age standardised prevalence per 100 of self reported musculoskeletal disorders (any joint) across the socioeconomic hierarchy, measured using the Townsend Score for material deprivation

	Men		Women	
	number	prevalence (SE)	number	prevalence (SE)
1st fifth (affluent)	2597	14.1 (0.6)	3037	27.3 (0.8)
2nd fifth	2367	15.1 (0.6)	2851	28.6 (0.8)
3rd fifth	1624	16.1 (0.8)	1920	30.6 (1.0)
4th fifth	1696	16.1 (0.8)	2162	30.5 (0.9)
5th fifth (deprived)	2024	17.7 (0.7)	2516	34.5 (0.9)
test for trend* p value	<0.001		<0.001	
Relative index of inequality (95% CI)	1.47 (1.22 to 1.77)		1.57 (1.36 to 1.82)	

*The test for trend was carried out using logistic regression, with deprivation scored as 1 (affluent) to 5 (deprived) and treated as a continuous variable.

Table 2 Comparison of the characteristics of those who attended a clinic and were assigned a score for severity of hip disease, had full data on socioeconomic position and self assessed health with those who were excluded because of incomplete data

	Main analysis group (n=954)		Those excluded from main analysis (n=451)	
	number	% (95% CI)	number	% (95% CI)
Men	354	37.1 (32.1 to 42.1)	147	32.6 (25.0 to 40.2)
Women	600	62.9 (59.0 to 66.8)	304	67.4 (62.1 to 72.7)
35-54	242	25.4 (19.9 to 30.9)	75	16.6 (8.2 to 25.0)
55-74	532	55.8 (51.6 to 60.0)	219	48.6 (42.0 to 55.2)
75+**	180	18.9 (13.2 to 24.6)	157	34.8 (27.3 to 42.3)
Most deprived	173	18.1 (12.4 to 23.8)	106	23.6 (15.5 to 31.7)
Deprived	181	19.0 (13.3 to 24.7)	101	22.4 (14.3 to 30.5)
Average	207	21.7 (16.1 to 27.3)	74	16.4 (8.0 to 24.8)
Affluent	186	19.5 (13.8 to 25.2)	94	20.9 (12.7 to 29.1)
Most affluent	207	21.7 (16.1 to 27.3)	75	16.7 (8.3 to 25.1)
No comorbidity	394	41.3 (36.4 to 46.2)	173	38.4 (31.2 to 45.6)
Mild comorbidity	294	30.8 (25.5 to 36.1)	131	29.1 (21.3 to 36.9)
Moderate comorbidity	168	17.6 (11.8 to 23.4)	84	18.7 (10.4 to 27.0)
Severe comorbidity	98	10.3 (4.3 to 16.3)	62	13.8 (5.2 to 22.4)

**(<0.01).

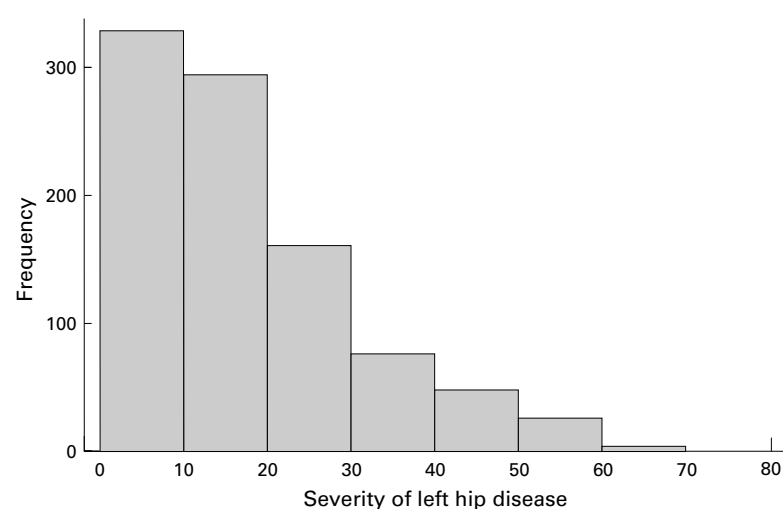


Figure 1 Distribution of the New Zealand score for severity of hip disease (n=954).

systematically associated with socioeconomic position. The relative index of inequality can be interpreted as the health differential between the hypothetical person at the bottom of the socioeconomic hierarchy and the hypothetical person at the top of the hierarchy. For this analysis, each category of a socioeconomic indicator was ranked by socioeconomic position, beginning with the richest. The cumulative proportion of the population at the midpoint of each category was calculated to produce a range from 0 (richest) to 1 (poorest). This was regressed against age and sex standardised severity of hip disease to produce a coefficient that is the slope of the regression

KEY POINTS

- Lower socioeconomic position is associated with increased severity of hip disease.
- The association of socioeconomic position and severity of hip disease is seen with a variety of different indicators of socioeconomic position.
- Those with the lowest incomes experience more comorbidity, as well as greater severity of hip disease, than their richer counterparts.
- This additional dimension of inequalities in health—that of disease severity—reinforces the need to introduce policies to reduce such inequalities.

of a socioeconomic group's relative morbidity on its relative rank. An F test for trend across the categories of each measure of socioeconomic position was also carried out

Results

A total of 22978 (88%) people responded to screening questionnaire. Table 1 reproduces previously published data from the screening questionnaire,¹⁸ demonstrating the systematic increasing gradient in the age standardised prevalence of self reported musculoskeletal disease of any joint for men and women as material deprivation increases. The gradient is steeper for women than for men. The test for trend reveals the difference across the groups is statistically significant.

Table 2 describes the characteristics in terms of age, gender, deprivation category (measured by Townsend score for material deprivation at enumeration district level) and comorbidity for the 954 people, for whom there are complete data and who comprise the main set for this analysis, and the 451 people who were excluded because of incomplete data. The poorest response rate among the clinic attendees with a hip severity score was to the question asking for self reported details of gross household income (74%). In the main set, there were almost twice as many women as men, 75% were aged 55 or above, 41% of the sample had no comorbidity and only 10% had multiple severe comorbidity. Those excluded from the main set because of incomplete data were similar in terms of gender, socioeconomic position measured by deprivation category and levels of comorbidity. The only statistically significant difference between the groups is that those excluded comprised a greater proportion of people aged 75+. This reflects the fact that many home visits were carried out in this age group and the response to self completed questionnaires on general health and socioeconomic position was not as good for home visits as it was for those who attended a study clinic.

Figure 1 illustrates the distribution of severity of left hip disease in the main set. For the left hip, 35% of the sample had a New Zealand score of below 10, indicating only mild pain or limitation while 9% of the sample had a score of 40 or above, suggesting severe disease. The

Table 3 Correlations of the crude score for severity of hip disease with age and the age and sex standardised score with measures of self reported health

Measure of ill health	Total mean (SE)	number
<i>Age</i>		
35-54	13.2 (13.6)	242
55-74	15.6 (15.0)	532
75+	20.8 (15.1)	180
total	16.0 (14.9)	954
correlation coefficient	0.18**	
<i>Affect of ill health on social life</i>		
not at all	15.9 (2.8)	453
slightly	15.9 (2.8)	195
moderately	16.0 (3.1)	128
quite a bit	16.4 (3.2)	131
extremely	16.3 (3.2)	47
total	16.0 (2.9)	954
correlation coefficient	0.05	
<i>Health compared with year ago</i>		
much better	15.4 (2.6)	39
better	15.6 (2.7)	77
same	15.8 (2.9)	533
worse	16.5 (3.0)	268
much worse	16.0 (3.0)	37
total	16.0 (2.9)	954
correlation coefficient	0.12**	
<i>General health</i>		
excellent	15.3 (3.2)	34
good	15.3 (2.7)	243
fair	16.1 (2.7)	366
poor	16.3 (3.1)	256
bad	16.9 (2.9)	55
total	16.0 (2.9)	954
correlation coefficient	0.15**	
<i>Comorbidity</i>		
none	15.4 (2.8)	394
1 chronic condition	16.0 (2.9)	294
considerable comorbidity	16.6 (3.0)	168
multiple comorbidity	17.1 (2.9)	98
total	16.0 (2.9)	954
correlation coefficient	0.19**	

**($p < 0.01$). Spearman's rank correlation used for each measure.

minimum score was 0 and the maximum score was 70, out of a possible 80, for both the left hip and the right hip.

Table 3 investigates the association between severity of hip disease and age. This illustrates that increasing disease severity is positively associated with increasing age. The table also reports mean disease severity, standardised for

age and sex, for categories of self assessed general health and comorbidity. For health compared with a year ago, general health and comorbidity, there is a clear gradient in the means, with mean disease severity increasing as general health deteriorates. Correlation coefficients for these are highly statistically significant, although not large. Although not statistically significant, an increasing gradient in mean severity is evident for each measure of ill health. Comorbidity and general health are the two measures of health most highly correlated with the New Zealand score and comorbidity shows the steepest gradient in mean scores.

Table 4 investigates the difference in mean age and sex standardised severity of hip disease and socioeconomic position using a number of dichotomous socioeconomic indicators and comorbidity. The table shows that for access to a car, any higher or further education and living alone, the less advantaged had a higher mean severity of hip disease than the more advantaged. Testing the difference between these means, *t* tests reveal that the differences observed are statistically significant. Similar results were found when the analysis was carried out for the right hip and the most severe hip. No differences were found for age and sex standardised disease severity with urban or rural status. Those with at least one chronic comorbid condition had a statistically higher mean severity of hip disease than their fitter counterparts. These findings held when the analysis was reproduced for the full set available for each variable. Non-parametric tests revealed similar findings.

Table 5 continues analysis of the degree of association between disease severity standardised for age and sex, where this is a continuous measure, and socioeconomic position, measured at individual and ecological level. The standardised means demonstrate that much of the difference in means observed for

Table 4 Dichotomous indicators of socioeconomic position and comorbidity by severity of hip disease standardised for age and sex ($n=954$)

	Socioeconomic indicator					
	car available for use	any higher or further education	living alone	manual occupation	living in rural location	comorbidity
Left hip						
mean New Zealand score of "yes" group (SE)	15.5 (0.1)	15.4 (0.2)	17.5 (0.2)	16.0 (0.1)	16.0 (0.2)	16.4 (0.1)
mean New Zealand score of "no" group (SE)	17.5 (0.2)	16.3 (0.1)	15.6 (0.1)	16.0 (0.1)	16.0 (0.1)	15.4 (0.1)
<i>t</i> statistic	-9.1**	-4.7**	-7.8**	-0.2	0.1	-4.8**

**($p < 0.01$).

Table 5 Association of hip disease severity, standardised for age and sex, with socioeconomic position using individual and area level measures

Socioeconomic position	Social class		Educational attainment		Income category		ED level Townsend score quantile	
	number	mean (SE)	number	mean (SE)	number	mean (SE)	number	mean (SE)
1 (most deprived)	42	15.6 (2.5)	430	16.5 (2.8)	177	17.0 (3.1)	190	16.0 (3.0)
2	175	16.0 (3.0)	69	17.5 (2.8)	268	17.2 (2.5)	191	16.2 (3.0)
3	436	16.2 (2.9)	90	14.7 (5.6)	212	15.9 (2.8)	190	15.9 (2.8)
4	261	15.8 (2.9)	177	15.6 (2.7)	115	15.0 (2.6)	189	16.1 (2.8)
5 (most affluent)	40	15.7 (2.7)	188	15.3 (2.9)	182	14.0 (2.2)	194	15.8 (2.8)
Correlation coefficient† (p value)		-0.02 (0.61)		-0.18 (<0.01)**		-0.41 (<0.01)**		0.02 (0.45)
RII		0.23 (-0.45-0.92)		1.95** (1.29-2.62)		4.03** (3.43-4.64)		0.23 (-0.58-1.05)
test for trend p value		0.51		<0.01		<0.01		0.57

*($p < 0.05$), **($p < 0.01$). †Spearman's rank correlation.

Table 6 Mean severity of hip disease, standardised for age and sex, within self assessed comorbidity categories by income (n=954)

Comorbidity measure	None		One comorbid condition		Considerable comorbidity*		Multiple comorbidity†		Total	
	mean (SE)	number	mean (SE)	number	mean (SE)	number	mean (SE)	number	mean (SE)	number
Income										
£20 000+	13.9 (2.1)	97	13.6 (1.8)	55	14.9 (2.6)	22	14.9 (3.2)	8	14.0 (2.2)	182
£15 000–19 999	14.3 (2.2)	54	15.5 (3.3)	26	15.4 (2.4)	23	16.6 (2.3)	12	15.0 (2.6)	115
£10 000–14 999	15.7 (2.9)	93	15.8 (2.7)	64	16.6 (3.0)	47	15.5 (2.6)	18	15.9 (2.8)	212
£5000–9999	17.0 (2.4)	91	17.2 (2.4)	99	17.3 (2.7)	47	17.7 (2.8)	31	17.2 (2.5)	268
<£5000	16.3 (2.0)	59	16.6 (3.1)	50	17.7 (3.1)	39	18.2 (2.6)	29	17.0 (3.1)	177
Total	15.4 (2.8)	394	16.0 (2.9)	294	16.6 (3.0)	168	17.1 (2.9)	98	16.0 (2.9)	954

*A comorbidity score of greater than 1 but less than 2.5. †A comorbidity score of greater than 2.5.

social class and deprivation measured at enumeration district level in unstandardised data is explained by age and sex, but a gradient remains for income and educational attainment. A similar pattern was found for education for the right hip and most severe hip but, for income, the gradient was similar for the right hip and stronger for the most severe hip. Using median scores, compared with mean scores, resulted in similar patterns, with education and income again displaying clear gradients across the socioeconomic hierarchy of age/sex standardised median disease severity.

The correlation coefficients, although not large, reveal that as socioeconomic position decreases, so disease severity increases. The correlation is statistically significant for educational attainment and income category. Similar findings were obtained when the analysis was repeated for the most severe hip and the right hip. This analysis was also carried out with income adjusted for household size, and a strong association was found with disease severity. Treating the categorical variables as continuous produced statistically significant *F* tests for trend for income and educational attainment ($p < 0.01$).

The table also reports age and sex standardised relative indices of inequality. Both education and income are systematically associated with disease severity, with income having the strongest association, revealing that for each decrease in socioeconomic position (defined by education or income) there is an increase in disease severity. Analysis of the full set available for each variable produced similar means, medians and relative indexes of inequality, with the association for income and education again proving highly statistically significant. (Tables are available from the first author on request).

Table 6 reveals that, using income as an indicator of socioeconomic position, poorer people not only experience a higher mean severity of hip disease but also greater comorbidity. Within comorbidity categories, disease severity increases as income decreases. In addition, the gradient between rich and poor is steepest among those with the greatest burden of comorbidity. Also within income bands, there is a general pattern of mean severity of hip disease increasing as comorbidity increases. This is most marked in the poorest group. A similar pattern was found for educational attainment but there was no clear pattern for social class or deprivation.

Discussion

The study has replicated the finding that there is an association between socioeconomic position and morbidity and it has also allowed for the examination of how the severity of hip disease is distributed across the socioeconomic hierarchy, measuring socioeconomic position by a battery of different indicators. Our study adds to the growing body of work demonstrating the need to use multiple measures of socioeconomic position in health studies.^{20–33}

INDIVIDUAL LEVEL INDICATORS OF SOCIOECONOMIC POSITION

The results show significant difference between mean hip disease levels using dichotomous individual level measures of socioeconomic position (any further or higher education, access to a car and living alone). Categorical variables (income and educational attainment) are also significantly associated with increasing severity of hip disease.

The systematic association of income and educational attainment with disease severity complements the literature on income inequalities in health measured at individual level and extends the findings of two large surveys in the United States that revealed that the prevalence of arthritis increases in those with fewer years of formal education.^{15–16}

All individual level socioeconomic measures revealed an association of disease severity with ability to command resources at an individual level. After standardising for age and sex, however, the gradient in the means for social class disappeared. This may be explained by the fact that the majority of the main set are older women and many of these will not have had full time occupations. In such cases, a woman's social class will have been ascertained from her husband's last main occupation or, if this was not given, from her full time occupation that she held in her early adulthood or a part time position. In such cases, the social class assigned can only be a proxy for a woman's socioeconomic position in later life.

ECOLOGICAL INDICATORS OF SOCIOECONOMIC POSITION

Despite previous work on this cohort (table 1) finding a systematic association between self reported musculoskeletal disease and area deprivation, this survey did not reveal any statistically significant association of the severity of mean hip disease with ecological measures of socioeconomic position (material deprivation and urban or rural location). In addition, there

was also no gradient in median hip disease severity by area level measures. Although the differences between the self reported, binary variable and the severity score could be partially explained by the different types of measures being used, there may be other factors that explain why area level effects are weak in identifying inequalities in disease severity that are clearly observable at individual level. This could have important implications as the majority of health care resources are allocated at area level and underestimating the burden of disease among the poorest people may serve to exacerbate inequalities in provision.

While there is some evidence of people living in rural areas having better general health,³⁴ and less chronic disease,³⁵ another study found that those living in rural parishes in East Anglia had a higher proportion of acute and chronic morbidity.³⁶ In contrast with these findings, this study found no difference in the severity of hip disease between those living in urban areas and those living in rural areas. Defining urban and rural status just as a binary variable based on postcode of residence may be too crude and mask any real differences as postcode groups cover large areas in rural parts of the country and a binary classification makes no distinction between inner city and suburban areas, and small market towns, classifying all of these as urban.

THE NEW ZEALAND SCORE AND SELF REPORTED MORBIDITY

The New Zealand priority setting tool was chosen because it incorporates a wide variety of variables collected at study clinics and covers pain, disability, comorbidity and the degree to which independence is threatened. The symptoms of a chronic disease, such as osteoarthritis, may change from day to day and even at different times within a day. In view of this, measuring morbidity using questionnaire data is difficult. Other scoring systems used in surgical practice were largely designed to assess the efficacy of treatment rather than need,^{37 38} and tend to have a narrower focus. The strength of the New Zealand Score for the purposes of this research is that it covers the broader issues around the impact of arthritis, including disability, handicap and degree to which independence is threatened.

As systematic underreporting of illness by people with lower socioeconomic position has been highlighted,⁹ the data were examined to ascertain whether there was any systematic difference in mean severity of hip disease across the socioeconomic hierarchy within categories of self assessed comorbidity. The data in table 6 reveal that for a person with a given hip disease score, a poor person is more likely to be also suffering more of the chronic comorbid conditions, or to rate their health as worse across the large number of questions asked, than one who is richer. This needs to be interpreted in the light of a Finnish study,²¹ which compared detailed health interview data with simple self reported questions on morbidity. Less educated people underestimated the prevalence of

self reported arthritis, mental health problems and chronic respiratory disorders when compared with examination data. Dutch health surveys have shown large variations in prevalence of self reported health problems by education and income,¹⁴ and it has been suggested that if there is a socioeconomic differential in reporting bias, this leads to an underestimate of socioeconomic inequalities in health.³⁹ As both countries have publically funded health care systems, it is probable that these findings would apply to the United Kingdom.

Class differentials in the reporting of chronic morbidity can plague self assessed summary measures.⁴⁰ In addition, people have different perceptions of what is limiting, different pain thresholds and different propensity to report ill health depending on their educational attainment, and so relying on self reported summary measures can be misleading in assessing the severity of a disease and lead to gross underestimates.²¹

LIMITATIONS OF THE STUDY

As the data include several different measures of socioeconomic position and self assessed general health, several caveats need to be made. Firstly, as is common in surveys,¹⁰ the income question had the poorest response despite care being taken to explain in the introduction the scope of the question. It is obviously a sensitive area and, in addition, requires a degree of mental arithmetic. Those excluded from the main analyses (largely because of missing data for the income question) were significantly more likely to be women and aged 55 or over and in view of the fact that arthritis is more common in women and increases with age,⁴¹ it is not surprising that the mean severity of hip disease was higher in this group (19.7) than in the main set (16.0), meaning that our findings, with regard to income in particular, may be an underestimate. In fact, the association of disease severity with socioeconomic position was stronger in the full set for all indicators, with income, maximum educational attainment, any higher education, car ownership and living alone again reaching statistical significance. This suggests that if anything, the associations reported here may be underestimates of the true associations.

Our findings are based on cross sectional data and without longitudinal data it is not possible to disentangle causal relations. In addition, there is increasing evidence to support the hypothesis that the whole of the life course influences current disease status.⁴² Ascertaining which came first, the hip disease or the low socioeconomic position, is not easy from these data but the breadth of measures of socioeconomic position can provide clues. While occupation, access to a car or living alone may be situations that change suddenly, lifetime educational attainment and gross household income are more general indicators of lifetime socioeconomic position. It is the latter two indicators that were the most strongly correlated with disease severity, suggesting that instead of disease leading to downward social mobility, other factors may

predispose poorer people to more severe hip disease. For example, being in a manual occupation, such as farming, may be associated with low income and may predispose to arthritis of the hip.⁴³

FUTURE RESEARCH

There is now a considerable body of research exploring the factors underlying inequalities in health.^{6 44} However, similar analytical studies do not exist regarding differences in disease severity rather than prevalence. More research, both quantitative and qualitative, is needed to investigate the reasons for the greater severity of hip disease experienced by poorer people. Future research may answer the following questions: is it a reflection of inequities in access to and use of health care services; unmet need for treatment; a large prevalence pool of people too ill with comorbidity to be operated on, or a result of broader sociological factors, and is this finding evident for other chronic conditions?

It seems that inequalities in a tax funded health care system occur not simply because of different persons' ability to command health care resources,⁴⁵ or because the poorest people experience a higher prevalence of morbidity but also because, for a common chronic disorder, such as disease of the hip, the pain and disability experienced by poorer people is more severe than that of their richer counterparts. This has implications for the modern National Health Service if it is to continue striving to direct care and resources to those in the most medical need.

In conclusion, these data reveal that the amount of pain and disability experienced by people with hip disease is associated with lower socioeconomic position, measured by a variety of indicators. People with lower socioeconomic position experience a greater severity of hip disease. As there is also a clear gradient between greater comorbidity and decreasing socioeconomic position, the poorest sector of the population appear to be in double jeopardy: they not only experience greater severity of hip disease but also a greater burden of comorbidity. This study has implications for health care provision if the National Health Service is to live up to its principle of equal treatment for equal medical need.

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