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Sociodemographic differences in the severity and duration of disease amongst patients undergoing hip or knee replacement surgery

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ABSTRACT

Background Differences in the use of hip and knee replacement by sex, age, ethnicity or socioeconomic status may lead to differences in disease severity between those who have surgery.

Methods Analyses used data collected from 117 736 patients in 2009–10 via the Patient Reported Outcome Measures (PROMs) programme in England. Adjusted differences were estimated in the Oxford Hip Score (OHS) or the Oxford Knee Score (OKS), both expressed on a scale from 0 to 48, and the proportion with longstanding problems (>5 years), expressed as odds ratios (ORs).

Results Women had more severe pain and disability than men on average (difference OHS 2.3 and OKS 3.3), but less often longstanding problems. Compared with white patients, average severity was higher in South Asian patients (difference OHS 2.7 and OKS 3.0) and in black patients (difference OHS 0.9 and OKS 1.6), who also more often had longstanding problems (OR 1.40 for hip and 1.54 for knee). Patients from deprived areas had more severe disease (difference OHS 3.6 and OKS 3.3 between least and most deprived quintile).

Conclusions There is evidence that non-white and deprived patients tend to have hip and knee replacement surgery at a later stage in the course of their disease.

Keywords access to healthcare, health inequalities, patient-reported outcomes, surgery

Introduction

Despite the removal of financial barriers to healthcare with the establishment of the British National Health Service (NHS), informal barriers seem to persist. In 1968, it was observed: '... higher income groups know how to make better use of the service: they tend to receive more specialist attention; occupy more of the beds in better equipped and staffed hospitals; receive more elective surgery; have better maternal care, and are more likely to get psychiatric help and psychotherapy than low income groups ...'[1] More than 40 years later variations persist in the use of secondary care that seem to be unexplained by variation in need.[2] A review of the literature concluded: 'the utilization of general practitioner (GP) services is broadly equitable, but that of specialist services relative to need tends to favour the better off'.[3]

Hip and knee replacement are common elective operations: 68 907 primary hip and 76 870 primary knee procedures were carried out in England and Wales in 2010.[4] Osteoarthritis is the primary indication for surgery in nearly all patients; causing damage to the cartilage, and chronic pain and walking disability. Surgery is generally effective in relieving pain and improving mobility.[5–7]

Women are more likely than men to develop osteoarthritis and to need surgery,[8,9] but the number of women who have

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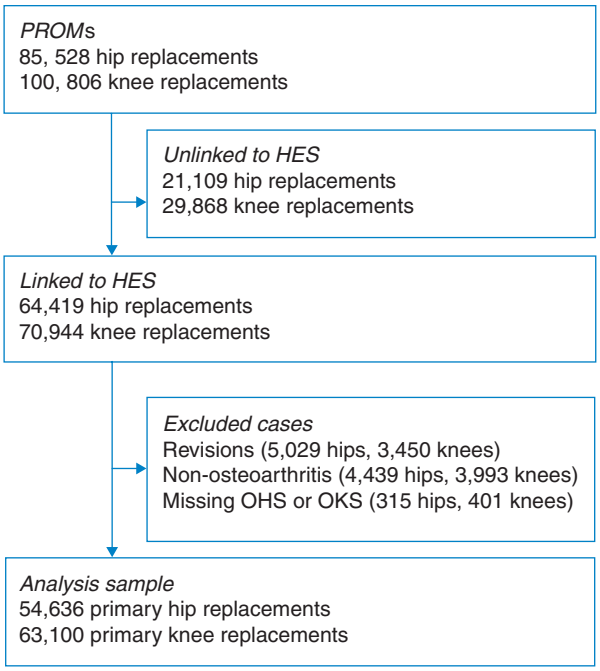

Fig. 1 Flowchart showing sample size after linkage to Hospital Episode Statistics (HES) and exclusions

surgery, although higher, is not proportionately higher.[10,11] Similarly, there seems to be under-provision of surgery in socioeconomically deprived areas, relative to estimated numbers in need of surgery.[8–15] A limitation of previous studies is that separate unlinked datasets have been used to compare estimated numbers in need of surgery with the numbers of people having surgery in different groups. As a consequence, it remains unclear what forms of selection and self-selection occur from within groups.

Information on disease severity routinely collected from patients at the time of surgery, via the Patient Reported Outcome Measures (PROMs) programme in England, provides new opportunities to explore and monitor differences in access to elective surgery between groups. If there were differences in access, we might expect to see differences in disease severity and in duration of problems between patients at the time of surgery. In this paper, we describe how disease severity and duration are associated with sex, age, ethnicity and socioeconomic status in patients undergoing hip or knee replacement. We expand on the results of a pilot study, which found that patients from deprived areas tended to have more severe conditions.[16]

Methods

Data sources

We used data from the National PROMs Programme for elective surgery[17] linked at patient level to data from the Hospital Episode Statistics (HES) database.[18] HES covers all admissions to NHS hospitals in England and admissions of NHS patients to private sector hospitals and treatment centres in England. Privately funded procedures in private sector hospitals are not included in the National PROMs Programme, accounting for 12–14% of procedures in England and Wales in 2010.[4]

Patients completed a questionnaire before their operation, either at the preoperative assessment clinic or on admission to hospital. We excluded patients who either: did not have a linked record in HES; underwent revision rather than primary joint surgery [see Office of Population Censuses and Surveys (OPCS-4.5) procedure codes used to identify revisions in Annex 1 of the PROMs Programme methodology[19]]; or who did not have a primary International Classification of Diseases, 10th revision (ICD-10) diagnosis code of osteoarthritis (M15, M16 and M17). Our final samples included 54 636 hip and 63 100 knee replacement patients who had their surgery between April 2009 and October 2010 (Fig. 1).

We used the Oxford Hip Score (OHS) and the Oxford Knee Score (OKS) as our measures of disease severity at the time of surgery.[20,21] These are derived from patient responses to 12 questions about pain and limits on physical functioning and everyday activities caused by the hip or the knee (Box 1). Responses to each question are measured on a five-point scale, and values associated with each response are added up to produce an overall scale from 0 (worst) to 48 (best). Both instruments have been shown to be internally consistent, reliable and to correlate with surgeon assessed measures of symptoms.[20–24]

Box 1 Questions used to assess the severity of hip and knee problems.

OHS	OKS
During the past 4 weeks…	During the past 4 weeks…
1 How would you describe the pain you usually have from your hip?	1 How would you describe the pain you usually have from your knee?
2 Have you had any trouble washing and drying yourself (all over) because of your hip?	2 Have you had any trouble washing and drying yourself (all over) because of your knee?
3 Have you had any trouble getting in or out of a car or using public transport because of your hip? (whichever you tend to use)	3 Have you had any trouble getting in or out of a car or using public transport because of your knee? (whichever you tend to use)
4 Have you been able to put on a pair of socks, stockings or tights?	4 For how long have you been able to walk before pain from your knee becomes severe? (with or without a stick)
5 Could you do the household shopping on your own?	5 After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your knee?
6 For how long have you been able to walk before pain from your hip becomes severe? (with or without a stick)	6 Have you been limping when walking, because of your knee?
7 Have you been able to climb a flight of stairs?	7 Could you kneel down and get up again afterwards?
8 After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your hip?	8 Have you been troubled by pain from your knee in bed at night?
9 Have you been limping when walking, because of your hip?	9 How much has pain from your knee interfered with your usual work (including housework)?
10 Have you had any sudden, severe pain — 'shooting', 'stabbing' or 'spasms' — from the affected hip?	10 Have you felt that your knee might suddenly 'give way' or let you down?
11 How much has pain from your hip interfered with your usual work (including housework)?	11 Could you do the household shopping on your own?
12 Have you been troubled by pain from your hip in bed at night?	12 Could you walk down one flight of stairs?

A categorical measure of symptom duration was derived from responses to a single question asking patients how long they had experienced problems with the hip or the knee on which they were about to have surgery. Four response categories included: 'Less than 1 year'; '1–5 years'; '6–10 years' and 'More than 10 years'. We defined longstanding problems as durations of symptoms of more than 5 years, but our results were robust to an alternative cut-off of 10 years.

Self-reported comorbidities were measured using a 12-item index, with the question phrased 'Have you been told by a doctor that you have any of the following?'[25] These included: heart disease; high blood pressure; problems caused by a stroke; leg pain when walking due to poor circulation; lung disease; diabetes; kidney disease; diseases of the nervous system; liver disease; cancer (within last 5 years); depression and arthritis. Data on sex and age were also collected in the PROMs questionnaires.

Information on ethnicity and socioeconomic status were extracted from HES records, along with an identifier for the patient's GP practice. Self assigned ethnicity should have been collected from NHS patients using the 2001 Census ethnic categories. We grouped the data into the five main Census categories: White (White British, White Irish, other White); Mixed (White and Black Caribbean, White and Black African, White and Asian, other mixed); Asian or Asian British (Indian, Pakistani, Bangladeshi, other Asian); Black or Black British (Black Caribbean, Black African, other Black); and Chinese or other ethnic group (Chinese, other ethnic group). Where ethnicity was not stated, we treated the value as missing. An exercise was undertaken to reduce the amount of missing ethnicity and deprivation data, using patient data from previous hospital admissions. The remaining missing values were multiply imputed, with final estimates averaged over 10 imputed datasets.[26]

Socioeconomic status was measured with the English Index of Multiple Deprivation (IMD) for the lower super output area (LSOA) of the patient's residential postcode.[27] There are 32 482 LSOAs in England, each covering an average population of around 1500 people (400 households), with geographical boundaries selected to make the areas as similar as possible with respect to housing types and tenures. The overall index is a weighted average of indices covering: income; employment; health and disability; education skills and training; barriers to housing and services;

living environment and crime. Indices are based on indicators extracted from administrative data, with factor analysis used to combine indicators in some cases. We derived five socioeconomic groups based on quintiles of the national ranking of LSOAs according to IMD.

Statistical methods

We estimated adjusted differences in mean preoperative OHS and OKS by sex, age, ethnicity and socioeconomic status adjusting each factor for the other factors using multivariable linear regression. We adjusted for comorbidities (except for arthritis) because unrelated illnesses may be associated with reporting of joint pain or disability on the OHS[28] and may affect fitness for surgery. We accounted for the effects of clustering of patients at the GP practice level by using Huber–White robust (clustered) variance estimates. We tested alternative ways of deriving covariates, preferring categorical forms of variables to allow for non-linearity in relationships in a way that allowed results to be presented in a simple format.

We estimated adjusted odds ratios (ORs) for having had hip or knee problems for more than 5 years using multivariable logistic regression. Statistical analyses were carried out using Stata V.11.[29] Statistical results are presented with their 95% confidence intervals. Tables 1 and 2 also report two-sided p values for tests of significance for subsets of coefficients (using the Wald test).

Results

Sample characteristics

Table 1 summarizes patients' characteristics in each sample. Women comprised 61% of patients undergoing hip replacement and 57% of patients undergoing knee replacement. Two-thirds of patients in each sample were aged between 61 and 80 years old. More than 98% of hip replacement patients were white, and more than 95% of knee replacement patients. South Asian people were the second largest ethnic group amongst knee replacement patients. Patients living in socioeconomically deprived areas were less well represented in the samples: those in the bottom two IMD groups based on national quintiles made up 29% of hip replacement and 34% of knee replacement patients.

At the time of surgery, patient scores from the OHS and OKS were fairly symmetrically distributed over the range from 0 to 40. Nearly one-fifth (19%) of patients undergoing a hip replacement and 44% of patients undergoing a knee replacement reported having had problems for more than 5 years (Table 1). Patients who reported longstanding problems tended to have lower OHS and OKS scores but average differences were small (less than one point).

Table 1 Summary of patient characteristics

	Hip replacement	*Knee replacement*
Sex		
Women	33 089 (60.6)	35 943 (57.0)
Men	21 547 (39.4)	27 157 (53.0)
Age group		
<51 years	3000 (5.5)	1722 (2.7)
51–60	7886 (14.4)	8797 (13.9)
61–70	18 426 (33.7)	22 563 (35.8)
71–80	19 175 (35.1)	22 999 (36.5)
>80 years	6149 (11.3)	7019 (11.1)
Ethnicity		
White or White British	50 428 (98.7)	56 748 (95.0)
Mixed ethnicity	80 (0.2)	196 (0.3)
Asian or Asian British	163 (0.3)	1775 (3.0)
Black or Black British	264 (0.5)	731 (1.2)
Chinese or other ethnic group	152 (0.3)	309 (0.5)
Number with missing ethnicity	3549	3341
Deprivation group based on IMD		
1 (least deprived)	12 728 (23.6)	12 979 (20.8)
2	13 232 (24.5)	14 007 (22.4)
3	12 109 (22.4)	13 991 (22.4)
4	9310 (17.2)	11 865 (19.0)
5 (most deprived)	6672 (12.3)	9630 (15.4)
Number with missing IMD	585	628
Mean (SD) OHS or OKS	17.6 (8.2)	18.5 (7.8)
Problem for more than five years	10 233 (18.7)	27 443 (43.5)
No of patients	54 636	63 100

Figures are numbers (percentages) unless stated otherwise.
Percentages are based on the complete data for the relevant variable.

Sex

Women had lower mean scores, i.e. more severe conditions, than men. The adjusted differences were 2.3 (95% confidence limits 2.2, 2.5) on the OHS and 3.3 (3.2, 3.4) on the OKS (Tables 2 and 3). In contrast, women were less likely than men to report longstanding problems; with adjusted ORs of 0.96 (0.92, 1.00) for hip and 0.71 (0.69 to 0.73) for knee replacement.

Age

Patients who had a hip or knee replacement at an unusually young or old age had lower (worse) scores than average. The adjusted differences between the youngest group (<51 years)

Table 2 Disease severity and duration at the time of **hip replacement** according to sex, age, ethnicity and deprivation

	OHS			*Longstanding problems (duration >5 years)*		
	Mean score	*Adjusted diff. (95% CI)*	*p value*	*%*	*Adjusted OR (95% CI)*	*p value*
Sex						
Women	16.7	−2.3 (−2.5, −2.2)	<0.001	18.2%	0.96 (0.92, 1.00)	<0.001
Men	19.1	reference		19.5%	reference	
Age group						
<51 years	16.8	−1.4 (−1.7, −1.1)	<0.001	40.9%	4.26 (3.90, 4.64)	<0.001
51–60	17.2	−1.0 (−1.2, −0.8)		26.1%	2.20 (2.06, 2.35)	
61–70	18.2	−0.1 (−0.2, 0.1)		19.4%	1.50 (1.42, 1.58)	
71–80	18.0	reference		13.9%	reference	
>80 years	15.8	−1.9 (−2.2, −1.7)		11.5%	0.81 (0.74, 0.88)	
Ethnicity						
White or White British	17.6	reference	<0.001	18.5%	reference	0.01
Mixed ethnicity	16.2	−0.6 (−2.6, 1.3)		28.8%	1.22 (0.73, 2.05)	
Asian or Asian British	13.8	−2.7 (−4.0, −1.5)		23.3%	0.86 (0.58, 1.26)	
Black or Black British	15.2	−0.9 (−1.9, 0.5)		32.2%	1.40 (1.07, 1.84)	
Chinese or other ethnic group	17.5	0.2 (−1.1, 1.5)		28.9%	1.58 (1.09, 2.29)	
Deprivation group based on IMD						
1 (least deprived)	19.2	reference	<0.001	16.8%	reference	0.006
2	18.2	−0.9 (−1.2, −0.7)		18.2%	1.08 (1.02, 1.16)	
3	17.5	−1.6 (−1.8, −1.4)		19.1%	1.12 (1.05, 1.20)	
4	16.6	−2.4 (−2.6, −2.1)		19.7%	1.11 (1.04, 1.19)	
5 (most deprived)	15.1	−3.6 (−3.9, −3.4)		21.0%	1.11 (1.03, 1.20)	

and those aged 71–80 were 1.4 (1.1, 1.7) on the OHS and 3.2 (2.9, 3.6) on the OKS. The adjusted differences on the OHS and OKS between the over 80s and those aged 71–80 were 1.9 (1.7, 2.2) and 1.2 (1.0, 1.4), respectively.

Durations of problems with the hip or knee decreased sharply with increasing age. Comparing odds of longstanding problems in patients aged 50 or younger and those aged 71–80, ORs were 4.26 (3.90, 4.64) for hip and 2.71 (2.45, 3.00) for knee replacement.

Ethnicity

Patients who were South Asian had the lowest (worst) mean scores at time of surgery, and black patients also had lower mean scores than white patients. The adjusted differences between South Asian and white patients were 2.7 (1.5, 4.0) on the OHS and 3.0 (2.7, 3.3) on the OKS. Comparing black and white patients, adjusted differences were 0.9 (−0.5, 1.9) on the OHS, which was not statistically significant at the 5% level, and 1.6 (1.1, 2.1) on the OKS.

As well as more severe conditions, non-white patients were generally more likely to report longstanding problems. Comparing South Asian and white patients, adjusted ORs were 0.86 (0.58, 1.26) for hip replacement, which was not statistically significant, and 1.26 (1.14, 1.39) for knee replacement. Comparing black and white patients, adjusted ORs were 1.40 (1.07, 1.84) and 1.42 (1.36, 1.46), respectively, for hip and knee replacement.

Socioeconomic deprivation

Patients from more deprived areas had lower (worse) mean scores than those living in less deprived areas, with a systematic gradient across the five IMD quintiles. The adjusted differences between patients from the least and most deprived group were 3.6 (3.4, 3.9) on the OHS and 3.3 (3.1, 3.6) on the OKS. (Tables 2 and 3).

Durations of problems were also slightly longer in hip replacement patients from the most deprived quintile. Compared with the least deprived, adjusted ORs of having longstanding problems were 1.11 (1.03, 1.20) for hip replacement and 1.04 (0.98, 1.10) for knee replacement, which was not statistically significant (Tables 2 and 3).

Table 3 Disease severity and duration at the time of **knee replacement** according to sex, age, ethnicity and deprivation

	OKS			*Longstanding problems (duration >5 years)*		
	Mean score	*Adjusted diff. (95% CI)*	*p value*	*%*	*Adjusted OR (95% CI)*	*p value*
Sex						
Women	17.0	−3.3 (−3.4, −3.2)	<0.001	35.9%	0.71 (0.69, 0.73)	<0.001
Men	20.5	reference		48.2%	reference	
Age group						
<51 years	15.9	−3.2 (−3.6, −2.9)	<0.001	62.4%	2.71 (2.45, 3.00)	<0.001
51–60	17.0	−2.1 (−2.3, −1.9)		51.8%	1.75 (1.66, 1.84)	
61–70	18.7	−0.6 (−0.8, −0.5)		47.0%	1.42 (1.36, 1.46)	
71–80	19.3	reference		38.5%	reference	
>80 years	18.1	−1.2 (−1.4, −1.0)		33.7%	0.83 (0.78, 0.88)	
Ethnicity						
White or White British	18.6	reference	<0.001	43.1%	reference	<0.001
Mixed ethnicity	17.7	−0.1 (−1.2, 0.9)		40.3%	0.89 (0.67, 1.19)	
Asian or Asian British	14.0	−3.0 (−3.3, −2.7)		49.6%	1.26 (1.14, 1.39)	
Black or Black British	15.3	−1.6 (−2.1, −1.1)		53.2%	1.54 (1.33, 1.79)	
Chinese or other ethnic group	17.2	−0.4 (−1.2, 0.4)		49.2%	1.26 (1.00, 1.58)	
Deprivation group based on IMD						
1 (least deprived)	20.3	reference	<0.001	42.1%	reference	0.7
2	19.4	−0.9 (−1.1, −0.7)		43.2%	1.03 (0.98, 1.08)	
3	18.5	−1.5 (−1.7, −1.4)		43.0%	1.01 (0.96, 1.06)	
4	17.5	−2.3 (−2.5, −2.1)		44.0%	1.02 (0.97, 1.07)	
5 (most deprived)	16.0	−3.3 (−3.6, −3.1)		45.6%	1.04 (0.98, 1.10)	

Discussion

Main findings of this study

On average, patients from more socioeconomically deprived areas had more severe hip and knee problems at the time of surgery, and more often longstanding problems. Symptoms also tended to be more severe and more often of a longstanding duration in patients from South Asian and black groups than in white patients. Taken together, our findings suggest that patients from more deprived areas and non-white patients tend to have surgery later in the course of their disease.[30]

The observed differences were systematic but not large. All differences were less than half a standard deviation of the distribution of scores (Table 1), which is defined as a 'moderate' effect using Cohen's classification.[31] Another possible comparison is with 'minimally important differences', defined as the smallest change in scores that patients perceive as beneficial. Suggested values for the OHS and OKS are 8.4 and 3.8, respectively, based on differences between groups in their mean change in scores before and after surgery; comparing those who said their hip or knee was 'a little better' to those who said it was 'about the same'.[32]

Women had more severe hip and knee disease but were less likely to have longstanding problems, which is consistent with osteoarthritis being a more rapidly deteriorating condition in women than in men.[33,34] Disease severity was also greater in younger and older patients, compared with those aged between 61 and 80 years. However, the proportion with longstanding problems decreased sharply with age, which partly reflects the complexity of the impact of age on hip and knee replacement practice.[35]

What is already known on this topic?

Numbers of people in need of hip and knee surgery have been estimated to be higher in more deprived areas, based on a simple measure of disease severity.[8,9] Lower educational attainment and lower income have also been found to be associated with greater severity of pain and disability amongst people who report hip pain.[36] However, numbers of hip replacement operations performed in deprived areas were lower than in affluent areas in 2002, and were equal for knee replacement.[10]

Although women received more hip and knee operations than men,[10] the numbers of women who had surgery fell

short of the higher estimated numbers in need of it.[9,11] Non-white people also had higher rates of estimated rates of need for hip and knee surgery.[9] At the area level though, people living in areas with non-white populations appeared to have more knee operations relative to estimated need than those living in predominantly white areas, whilst there was no difference for hip operations.[9,11]

Differences in rates of surgery between different groups, relative to estimated need, do not appear to be related to differences in patients' healthcare seeking behaviour. In a survey of people with chronic hip and knee pain, the proportions who reported seeking help from GPs were the same for people living in deprived and affluent areas, given a similar level of pain severity, and were higher for women than men.[37] A study focusing on attitudes to seeking help for other health problems also found no evidence of sex, socioeconomic or ethnic differences.[38] In contrast, rates of GP referral to specialist care for hip pain have been found to be lower for women than men, lower for elderly patients, and lower for patients from deprived areas.[39]

What this study adds

By studying variation in disease severity at the time of having surgery, we found further evidence that there are differences in the use of surgery by socioeconomic status. These findings are consistent with existing small area estimates of need and use and with the results of a pilot study that looked at the relationship of socioeconomic status to disease severity, although not duration of disease.[16] Our finding that women have more severe symptoms at the time of surgery than men is also consistent with evidence of lower provision relative to need.

Whereas we found evidence of slightly greater severity and longer durations of problems in South Asian and black patients than in white patients, previous small area estimates did not suggest under provision of surgery in areas with relatively high numbers of people from non-white ethnic groups.[11] In this instance, previous inferences related to individuals may have been biased when founded on findings collected for areas ('ecological fallacy').

By highlighting systematic differences in disease severity, our findings draw attention to the lack of an agreed severity threshold for surgery. A European survey of referring practitioners and orthopaedic surgeons found disagreement over the level of pain and functional impairment that would justify surgery.[40] Moreover, in the UK, differences in GP referral associated with socioeconomic status were more likely to occur for hip pain than for conditions where there was explicit guidance.[39] In general, differences in the use of surgery appear more likely to occur at the GP referral stage, with evidence from Europe that orthopaedic surgeons tend to apply less stringent criteria than GPs,[40] and are less likely to view old age and obesity as reasons to avoid surgery.[41]

The differences we observe in disease severity by sex and age may also be partly explained by surgeons' criteria; most importantly, the expected postoperative outcome and the risk of revision surgery. For example, the most recent figures of the National Joint Registry of England and Wales demonstrate clear relationships between patients' sex and age and the rate of revision surgery in the first 5 years after the primary joint replacement.[35] For younger patients, there is also a case for postponing surgery for moderately severe conditions, given that artificial joints have a limited lifetime. However, surgeons may also unconsciously use criteria for surgery that tend to favour advantaged groups, such as participation in sport and professional requirements.[40]

Finally, our findings highlight the potential importance of patient expectations when seeking help and making decisions about surgery. On the one hand, some patients will have good reasons for not wanting to have a major operation with a long recovery period. In particular, some elderly people may prefer to manage the pain and to live with limited mobility.[42] On the other hand, less well-off people may tend to be more accepting of chronic pain and functional limitation,[43] which may mean they delay seeking help or having surgery.

Limitations of this study

Our final samples represent roughly 60% of all patients who had a hip or knee replacement in the NHS in the relevant period, based on the following two estimates: first, around 80% of patients who had a hip or knee replacement between April 2009 and January 2011 completed a pre-operative PROMs questionnaire;[17] second, our linkage of PROMs data to HES led to the further exclusion of around a quarter of patients (Fig. 1). A separate analysis of all HES records between May and December 2009 did not reveal differences in the characteristics of patients in our sample and those in HES (including patients who did not complete a PROMs questionnaire). There was also no evidence of systematic age or sex differences between our HES linked and unlinked samples. It is not clear whether the lower representation of patients from deprived areas in our samples is due mainly to the age profile of these areas, non-linkage to HES or under provision of surgery.

The lack of information on behavioural risk factors, such as obesity and smoking, both more prevalent in deprived areas,[44] meant that it was not possible to say whether some

of the observed variation in disease severity and duration could have been due to variation in fitness for surgery. However, we were able to measure and adjust for comorbidity, including heart disease, high blood pressure, poor circulation and diabetes, which we would expect to be strong determinants of surgical fitness.

Patients' recall of the duration of their symptoms may be imprecise and inaccurate. Using HES data will have introduced further errors in data on of ethnicity and socioeconomic status. Additionally, socioeconomic status was measured at the area level rather than at the individual level. It is likely that all these sources of error have contributed to an underestimation of the ethnic and socioeconomic differences in disease severity and duration. Ethnicity data recorded in HES, although imperfect, have previously been demonstrated to be valuable in identifying inequalities in healthcare.[45]

Conclusion

We found systematic differences in severity between patients from different sociodemographic groups, although the differences were not large. Longer durations of symptoms in non-white and deprived patients suggest that some people in these groups may tend to have surgery later in the course of their disease, rather than not at all. It is likely to be health service factors, as well as differences in patient decision-making, which affect the use of hip and knee replacement surgery.

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