Socio-economic inequality in small area use of elective total hip replacement in the English NHS in 1991 and 2001

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Abstract
This study compares socio-economic inequality in small area use of elective total hip replacement in the English NHS in 1991 and 2001. Hospital episode statistics and census data are aggregated to a common geography of frozen 1991 electoral wards. The Townsend deprivation score is used to indicate the socio-economic status of each ward. Two main measures of inequality are examined: (i) the indirectly age-sex standardised utilisation rate ratio between most and least deprived quintile groups, and (ii) the concentration index of deprivation-related inequality in age-sex standardised utilisation ratios between small areas. The utilisation rate ratios were 1.41 [1.36-1.47] in 1991 and 1.27 [1.23-1.32] in 2001. The proportionate increase in use required to bring the bottom quintile to the level of top thus fell from 41% to 27%. The concentration index was 0.069 (0.059 to 0.079) in 1991 compared to 0.060 [0.050 to 0.071] in 2001. Socio-economic small area inequality in use of total hip replacement appears to have fallen slightly between 1991 and 2001. One possible explanation is that increased hip replacement rates in the 1990s may have lowered barriers to access and allowed this health technology to diffuse further among lower socioeconomic groups.

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1. Introduction

International evidence suggests that there are substantial socio-economic inequalities in the delivery of specialist health services, even in the UK and other high-income countries with publicly funded health systems (Goddard and Smith 2001, Dixon et al. 2003, Van Doorslaer, Koolman and Jones 2004, Van Doorslaer et al. 2000). Studies of total hip replacement in the English NHS have yielded particularly striking examples. Administrative data show that people living in deprived areas are less likely to receive hip replacement (Chaturvedi and Ben-Shlomo 1995, Dixon et al. 2004) while survey data suggest they may be more likely to need it (Milner et al. 2004). However, previous studies have not examined change in inequality over time.

This paper presents evidence on the change in socio-economic inequality in small area use of elective total hip replacement in the English NHS, comparing 1991 with 2001. This was a period of large-scale health care reform in England, involving at least two major reforms that may have influenced socio-economic inequality in health care delivery: (1) the introduction and subsequent abolition of the Conservative "internal market" 1991-7, and (2) the introduction in 1995 of a revised NHS resource allocation formula designed to reduce geographical inequalities in health care delivery.

Two datasets, for 1991 and 2001, were assembled from routine NHS data sources: Hospital Episode Statistics (HES) on hospital utilisation in England and the corresponding decennial National Censuses in 1991 and 2001. Both datasets contain information on over 8,000 electoral wards in England (over 95% of the total). To improve comparability, a common geography of frozen 1991 wards was adopted. The Townsend deprivation score was employed as an indicator of socio-economic status. Inequality was analysed in two ways. First, for comparability with previous small area studies of hip replacement, by using simple range measures based on indirectly age-sex standardised utilisation ratios (SURs) by deprivation quintile groups. Second, using concentration indices of deprivation-related inequality in use based on indirectly age-sex standardised utilisation ratios for each individual small area. Each SUR is the observed use divided by the expected use, if each age and sex group in the study population had the same rates of use as the national population.

2. Background

In the general health policy literature, inequality in hip replacement is routinely cited as an example of socio-economic inequality in health care (Le Grand 2006). The example is striking, since hip replacement is performed routinely and is one of the most common, effective and low-risk of all surgical procedures (Fitzpatrick et al. 1998). Small area studies consistently find that deprived areas have relatively low hip replacement rates. Yet deprived individuals and areas have greater need for hip replacement (Bradley and Ibanez 1994). Survey evidence for this in England includes higher rates of consultation for osteoarthritis (the primary cause of hip problems) in deprived areas (Charturvedi and Ben-Shlomo 1995) and greater prevalence and severity of hip disease among individuals with low levels of income and education (Eachus et al. 1996, Milner et al. 2004).

Little is known about the causes of this inequality. One possibility is that underlying socio-economic inequality in *health* may cause some of the observed inequality in use of *health care*. Disadvantaged individuals are more likely than others of the same age to have severe multiple co-morbidity (e.g. obesity, heart disease, lung disease, diabetes). This may lower their capacity to benefit from surgery – with higher risks of poor outcomes, a longer post-operative recovery, and more rapid long-term deterioration – and in some cases may render them unfit for surgery altogether.

Inequality in health care delivery may also be driven by supply factors. There may be less supply of primary care and/or surgical facilities in deprived areas. There may also be less enthusiasm for surgery among GPs and/or surgeons working in deprived areas. The enthusiasm for surgery (or "practice style") of different GPs and surgeons varies considerably (Clark et al. 2004). There is considerable room for discretion about appropriate indications and timing for hip replacement surgery (Quintana et al. 2000, Fortin et al. 2002), and substantial small area variations have been documented internationally (Merx et al. 2003).

Finally, there may be demand factors. Disadvantaged patients may have relatively low expectations and may face relatively high practical, cultural and educational barriers to seeking specialist care. Such barriers may include limited ability to access and understand medical information and to "work the system" through diplomacy, advocacy and networking. For example, one study that found education-related inequalities in hip replacement utilisation in England concluded that this was “more evidence of the effectiveness of the ‘sharp elbows’ of the middle class in the welfare state” (Propper et al. 2005).

3. Methods

3.1 Data

Two ward level datasets were created, one for 1991 and one for 2001. Each linked utilisation counts for elective total hip replacement procedures from the Hospital Episode Statistics (HES) for those two years with data from the National Censuses for 1991 and 2001 (Office of Population Censuses and Surveys 1991, Office of National Statistics 2001). The Census data included population numbers by age-sex strata and a variety of socio-economic measures, some of which make up established deprivation indices. HES contains information on all NHS hospital inpatient cases in England, including day cases, but excludes private hospital admissions. HES data were obtained from the extract held by the Centre for Health Economics at the University of York. Data were obtained for financial years 1991/2 and 2001/2 on finished first consultant episodes by start age, sex, ward code, and admission method (elective or emergency) for total prosthetic replacement of hip joint (OPCS4 codes W37, W38, W39) including both primary replacements and revisions.

To ensure that a common set of small areas was examined in each year, record-linkage between HES and Census data was in each case performed using frozen 1991 ward codes provided by HES. This minimises the risk that apparent changes in inequality might be an artefact of electoral ward boundary changes between 1991 and 2001. For 1991, the HES data used a frozen 1991 ward identifier that was based on an old government code. Using a lookup table provided by the Office of National Statistics (ONS) labour market statistics helpdesk, this was linked to an ONS code that was itself linkable to the ward coding on the 1991 census database. One to one matching of the frozen HES code with the ONS code and one to one matching of the ONS code to the census 1991 ward code allowed the linking of the HES data with the census data. The resulting data set contained 8,519 wards.

For 2001, the HES data contained a frozen 1991 ward identifier that was based on a post 1996 ward coding. This variable did not directly allow a link to the 2001 census. However, the HES data also contained a series of variables from which was derived a current residence code. The current residence code was identical to the ward code for 2001 in the Office for National Statistics Ward History Database (WHD). The ward code for the 2001 census was identical to the ward code for 2003 in the WHD. The 2001 census data was added to the HES data via the current residence code, using linkages from the WHD. The data set was then aggregated using the frozen 1991 code. The resulting data set contained 8,145 wards.

3.2 Inequality measures

The Townsend deprivation Z-score was used to indicate the socio-economic status of each ward (Townsend 1987, Carstairs 2000). This index has four components: (i) unemployment – unemployed residents over 16 as a percentage of all economically active residents over 16), (ii) overcrowding – households with one person per room and over as a percentage of all households, (iii) non-car ownership – households with no car as a percentage of all households, and (iv) non home ownership – households not owning their own home as a percentage of all households. Each component is normalised to zero by subtracting the mean and dividing by the standard deviation, following a log-transformation for unemployment and overcrowding, and these four component Z-scores are then summed. The resulting Townsend score ranges from about –8 to about +13, with higher values indicating greater deprivation.

Inequality was assessed using: (i) the indirectly age-sex standardised utilisation rate ratio between most and least deprived quintile groups, and (ii) the concentration index of deprivation-related inequality in age-sex standardised utilisation ratios between small areas.

Our measure of utilisation for each small area (or group of small areas) is the indirectly age-sex standardised utilisation ratio (SUR). This is the observed count of hip replacement episodes divided by the expected count, given the population size and age-sex structure of that area. The expected count is computed as:

$$E = \sum_{j=1}^{k} n_j r_j$$

where n_j is the population in age-sex stratum j and r_j is the national utilisation rate for age-sex stratum j (i.e. the national count in the relevant year divided by the national population in that year).

Use of SURs allows for the effects of age and sex on utilisation. It also facilitates comparison between 1991 and 2001, by allowing for the increase in national utilisation rates.

For both 1991 and 2001, SURs were computed using five ten-year age bands over 44 years (45-54, 55-64, 65-74, 75-84 and 85+) for each sex (i.e. ten strata in all). SURs were computed for Townsend deprivation quintiles and deciles, and also for each small area.

We initially performed a rate ratio analysis (Clayton and Hills 1993), looking at the ratio between the SUR of the most affluent quintile group divided by the SUR of the most deprived quintile group. Subtracting one from this ratio gives us a figure that has a clear intuitive interpretation – it allows us to say that affluent areas have X% higher use than deprived areas. More precisely, this figure is the proportionate increase in use required for people living in the most deprived fifth of areas to reach the level of utilisation enjoyed by people living in the most affluent fifth.

This rate ratio analysis was performed to facilitate comparison with previous small area studies (Chaturvedi and Ben-Shlomo 1995, Dixon et al. 2004). We also conducted a concentration index (CI) analysis at small area level, in order to exploit information on the entire distribution rather than just selected groups (Wagstaff, Paci and van Doorslaer 1991).

The CI is based on the health care concentration curve, which plots the cumulative fraction of the population ranked by socio-economic status (starting with the lowest) against the cumulative fraction of utilisation. In our case, the unit of analysis is the small area rather than the individual; the socio-economic status of each area is the negative of its Townsend deprivation score; and utilisation is the area's SUR. The CI is twice the area between the concentration curve and the diagonal representing perfect equality. The CI ranges from –1 to +1, with positive values indicating inequality favouring more affluent areas. A value of +1 would imply that all health care utilisation were concentrated on the single most affluent area.

The CI of deprivation-related small area inequality in utilisation is:

$$CI = \left(\frac{2}{n.\mu}\right)\sum_{i=1}^{n} y_i F_i - 1$$

where y_i is the SUR for area i, n is the number of areas, $\mu = (1/n)\sum y_i$ is the mean SUR, and F_i is the fractional deprivation rank of area i. The fractional deprivation rank is defined as the cumulative fraction of small areas ranked by the negative of the Townsend deprivation score.

So, for example, F_i = 0.20 means that area *i* just fits into the most deprived fifth of areas: 20% are more deprived and 80% are less deprived.

This CI can also be computed as:

$$CI = \left(\frac{2}{\mu}\right)\text{cov}(y_i, F_i)$$

It is possible to decompose the CI using the "partial CI" approach (Gravelle 2003). This allows one to estimate the partial contribution of the degree of inequality in socio-economic status, the partial contribution of "need" variables, and the partial contribution of other variables. In our case, however, such decomposition is of limited interest because the only "need" variables are age and sex and there are no "other" variables. Furthermore, non-linearity in the underlying explanatory model for utilisation – in this case arising from the count data nature of the utilisation variable – means that decompositions could only be approximate (Van Doorslaer, Koolman and Jones 2004).

3.3 Statistical inference

Exact confidence intervals for SURs and rate ratios by Townsend deprivation quintile were calculated by assuming a Poisson process (Breslow and Day 1987, Clayton and Hills 1993).

Confidence intervals for concentration indices of deprivation-related inequality in SURs by small area were computed using a "convenient regression" approach (Kakwani, Wagstaff and Van Doorslaer 1997). The basic approach was to estimate β and its confidence interval in the following OLS regression:

$$2\sigma_F^2\left(\frac{y_i}{\mu}\right) = \alpha + \beta F_i + e_i$$

where σ^2 is the variance of F_i and as before F_i is the fractional deprivation rank of area *i*, y_i the SUR for area *i* and μ the mean SUR. In addition, a Newey-West estimator was used to allow for autocorrelation, with a Huber-White sandwich correction for heteroskedasticity. All calculations were performed using Stata 9.0

4. Results

4.1 Descriptive statistics

The 1991 dataset contained 8,519 wards - i.e. 100% of wards in the 1991 census - covering a total adult population over 44 of 17,833,376. Episodes for adults over 44 make up 96.2% of all elective hip episodes in HES for 1991. The dataset contains 97.1% of this HES data (i.e. for adults over 44), with 1.8% lost due to missing ward code in HES and 1.1% lost through linkage. The ward mean adult population over 44 was 2,093 (range: 235 – 13,778, standard deviation 1,443). 7,371 (86.5%) of the wards contained cases of elective hip replacement procedures in 1991, with a mean of 3.34 procedures per ward (range 0 to 31).

The 2001 dataset contained 8,145 wards, covernig a total adult population of 20,823,857. The dataset uses socio-economic data from 100% of wards in the 2001 census and links to 88.6% of frozen 1991 ward codes in the 2001 HES data. Episodes for adults over 44 make up 96.7% of all elective hip episodes in HES for 2001. The dataset contains 93.5% of this HES data (i.e. for adults over 44), with 0.6% lost due to missing ward code in HES and 6.0% lost through linkage. The ward mean adult population over 44 was 2,557 (range: 176 – 13,945, standard deviation 1,495). 7,651 (93.9%) of the wards contained cases of elective hip replacement procedures in 2001, with a mean of 4.71 procedures per ward (range 0 to 53).

In 1991, the crude national hip replacement rate per adult over 44 was 160 per 100,000. By 2001, this had risen to 184 per 100,000. National rates broken down by age and sex group for 1991 and 2001 are presented in table 1.

4.2 Deprivation quintile rate ratio analysis

Figure 1 illustrates the socio-economic gradient in SURs for 1991 and 2001. Deprivation increases to the right along the x-axis, so the downward slope reflects higher utilisation among more affluent groups. In each year, an initially steep socio-economic gradient is observed, that flattens in the more affluent half of the distribution. The gradient for 2001 is somewhat flatter than that for 1991, suggesting a slight decrease in inequality.

Table 2 presents hip replacement rates (crude and adjusted), SURs and rate ratios by deprivation quintile groups for 1991 and 2001. Rate ratios were computed relative to the bottom quintile. Standardised utilisation rates for the most affluent quintile fell from 1.135 in 1991 to 1.075 in 2001, whereas the SUR for the most deprived quintile rose from 0.804 to

0.843. The rate ratios between top and bottom quintiles were 1.41 [1.36-1.47] in 1991 and 1.27 [1.23-1.32] in 2001. The proportionate increase in use required to bring the bottom quintile to the level of top thus fell from 41% to 27%. The 95% confidence intervals do not overlap, so this change is statistically significant.

Corresponding SURs for deprivation deciles were 0.737 and 1.105 in 1991, and 0.758 and 1.105 in 2001. The proportionate increase in use required to bring the bottom decile to the level of top fell from 49.9% to 45.8%. The corresponding increase to reach the level of the middle (fifth) decile fell from 45.7% to 41.1%.

4.3 Concentration index analysis

Figure 2 presents concentration curves of deprivation-related inequality in SURs between small areas for 1991 and 2001. In this figure, the x-axis has been reversed so that deprivation is decreasing and socio-economic status increasing as one moves to the right. Both curves lie below the diagonal, indicating socio-economic inequality favouring affluent areas. For the first four-fifths of the distribution, the concentration curve for 2001 lies inside the curve for 1991. This indicates less inequality in 2001 for that part of the distribution - i.e. an increase in the share of admissions for the less affluent and a decrease for the more affluent. The curves then cross so that the 1991 curve lies slightly inside the 2001 curve for the final (most affluent) fifth of the distribution. This was due to an increase in the share of total admissions for the top 5% of better off wards. This increase in inequality right at the top of the distribution offset the inequality reduction in the bottom four-fifths of the distribution.

The concentration index for standardised utilisation ratios indicates that on the whole inequality fell slightly from 0.069 in 1991 to 0.060 in 2001. The linear regression method outlined in the methods section above yielded 95% confidence intervals of 0.059 to 0.079 and 0.050 to 0.071 respectively. Based on that method, the decline in inequality does not appear to be statistically significant.

5. Discussion

5.1 Statement of principal findings

Socio-economic inequality in use of elective total hip replacement appears to have decreased between 1991 and 2001. The proportionate increase in use required to bring the bottom quintile to the level of top fell significantly from 41% to 27%. The concentration index for standardised utilisation ratios fell from 0.069 to 0.060. Based on a linear regression method, this change was not statistically significant. One reason for this lack of significance is that an inequality increase in the top 5% of the distribution offset the inequality decrease elsewhere. Another is that our method of statistical inference is conservative. It uses a linear explanatory model, corrected for heteroskedasticity, rather than a non-linear count data model with explicit assumptions about the increased noise in SUR ratio estimates for wards with small populations and hence small denominators.

5.2 Strengths and weaknesses of the study

The main strength of our study is that it enables direct comparison of the degree of inequality between 1991 and 2001 using common data sources, common variable definitions, and a common geography. Another strength is that it uses data covering virtually all adults in England. This helps to avoid selection bias. Selection bias may arise if people more likely to suffer from inequality are also less likely to participate in studies, potentially leading to underestimation of inequality and non-random variation from one sample to another. Our approach is less susceptible to such problems than most survey approaches, since HES data cover all NHS operations in England and Census data provide reasonably accurate estimates of the relative population size and demographic structure of English wards. Our datasets contain socioeconomic data from 100% of wards in both 1991 and 2001, and utilisation data from 97.1% and 93.5% of the relevant HES records in 1991 and 2001 respectively.

This study did not include independent sector utilisation. About a quarter of hip replacements in England are undertaken in the independent sector, primarily due to long NHS waiting times (Williams et al. 2000, Sheldon et al. 1995). This non-NHS utilisation is concentrated among individuals and areas of high socio-economic status, particularly in the South East of England. Inequality in NHS utilisation therefore underestimates overall socio-economic inequality in utilisation, as much of the utilisation in affluent areas is unobserved.

Another weakness is that small area studies may be subject to ecological bias. In particular, small area deprivation scores mask variation in socio-economic status between individuals living within each area.

Another issue is that we have no measures of need for hip replacement other than age and sex. We know from survey data that arthritis prevalence and severity are higher in more deprived areas. However, we do not know whether this pattern of need changed from 1991 to 2001.

A final issue is that, even with high standards of dataset assembly and cleaning, some measurement error will remain due to coding and boundary changes and human error by data entry clerks. However, hip replacement is such a routine and clear-cut procedure that HES coding errors are unlikely to be substantial. Furthermore, our large sample of over 8,000 small areas for each year allows us to detect a signal of inequality – and change therein – even if there is considerable measurement noise.

5.3 Comparison with results of other studies

No previous studies have attempted to examine change in hip replacement inequality over time. However, the findings of this study for each year taken individually are broadly consistent with those of previous cross-sectional studies that have found socio-economic inequality in use of NHS hip replacement during this period. This includes both small area studies (Chaturvedi and Ben-Shlomo 1995, Dixon et al. 2004) and survey studies with detailed individual level data on income and need (Milner et al. 2004, Propper et al. 2005).

One possible discrepancy, however, is that one of the two survey studies found that socio-economic inequality was related to education rather than current income (Propper et al. 2005). That study was based on a specialist interview survey sample of 904 individuals in the South West of England in 1994, following up the large-scale Somerset and Avon Survey of Health. It contained detailed data on severity of arthritis pain and disability. It found evidence of education-related inequality in both NHS and private expenditure on care for arthritis in the last 12 months but no firm evidence of income-related inequality. However, it is possible that the requirement to attend specialist clinic may have selected out the kinds of low-income individuals most likely to suffer from inequality – i.e. those least likely proactively to seek care in specialist clinics.

To our knowledge, this is the first study of any kind to examine change over time in socio-economic inequality in health care delivery in the UK. However, some summary studies have been conducted in other European countries that underwent major health care reform in the 1990s. For example, a study in Sweden found a possible increase in pro-rich inequality between 1988/9 and 1996/7 following market-oriented reforms and an increase in user fees, based on the proportion of individuals having needed but not sought medical care (Burstrom 2002). A study in Spain found that pro-rich inequality had decreased between 1987-2001 following the development of a modern Spanish National Health System (Garcia Gomez and Lopez Nicolas 2006). Finally, a study in Switzerland found that pro-rich inequality in specialist visits did not vary significantly between 1982, 1992, 1997 and 2002 despite a major health care reform in 1996 designed to reduce inequality by expanding health insurance coverage and increasing “solidarity” (i.e. cross-subsidy between rich and poor, sick and healthy) (Leu and Schellhorn 2006).

5.4 Possible explanations and implications for clinicians and policymakers

One possible explanation for the observed decline in NHS inequality is that barriers to access may have fallen along with the general increase in hip replacement rates during the 1990s. A broadening of admissions criteria may have helped to "mop up" some of the unmet needs in deprived areas. It has been estimated that NHS plus independent hip replacement activity was 6% below overall population “need” in 1994-5 (Frankel et al. 1999). This suggests there was substantial unmet need in deprived areas in the 1990s, with below-average NHS and non-NHS utilisation. This explanation would be consistent with a general trend of decreasing inequality over time associated with the diffusion path of new health technologies. Initially, access to a costly new technology is highly restricted and affluent groups may tend to gain a larger share as they are better able to "work the system". Over time, however, inequality may fall as access becomes less restricted and the technology diffuses to wider groups.

Another possible explanation is a change in independent sector utilisation patterns. Total NHS and independent sector utilisation appear to have grown at a similar rate, as the national share of independent sector utilisation was relatively stable at 20-30% (Williams et al. 2000, Sheldon et al. 1995). However, it is not known whether rates of independent sector growth varied between socio-economic groups. If rates of independent sector growth were faster among the second most affluent quintile compared with the most affluent - thus increasing the private share among the second quintile and decreasing the private share among the affluent quintile - then this might account for more equal NHS use in this part of the distribution.

A third possible explanation is change in the pattern of need: need for hip replacement may have increased in deprived areas relative to affluent areas.

It is also possible that the decline in socio-economic inequality may be due to a more general decrease in small area variations, due to greater uniformity of clinical standards and “practice style” across the country. For example, one study found a slight decrease in regional variation in hip replacement rates between the eight regions of England between 1991 and 2001 (Dixon, Shaw and Dieppe 2006).

Another possibility is increased awareness by GPs and surgeons of socio-economic inequality in hip replacement rates, and increased efforts to tackle that inequality.

Finally, it is possible that hip replacement inequality may have been influenced by large-scale national policies during this period: in particular, the Conservative “internal market” 1991-7 and the introduction in 1995 of a revised NHS resource allocation formula designed to reduce geographical inequalities in health care delivery.

5.5 Unanswered questions and future research

It is not known what caused this apparent decline in socio-economic inequality from 1991 to 2001. Given the continuing importance of market-oriented reform of health care in the UK and across the world, it would be of particular interest to identify the inequality impact (if any) of the Conservative “internal market” reforms 1991-7 (Cookson and Dawson 2006, Burgess et al. 2005, Le Grand et al. 1998, Mannion 2005). Further research is needed to disentangle the inequality effects of NHS reform from those of other changing factors over which national policy-makers had less control.

Rather than wait until better data become available, there is considerable scope to tackle policy-oriented research questions of this kind through creative use of existing data (Lakhani et al. 2005). For example, the data and methods used in this study could be extended by making use of HES data for additional years and by constructing time-varying and geographically-varying policy environment variables. It would then be possible to test for interaction effects between the policy environment and the slope of the socio-economic gradient in small area utilisation of hip replacement and other health services.

Future research could also fruitfully examine the inequality impact of the current market-oriented "system reforms". Under the banner of "choice", the UK Labour Government is embarking on a major programme of market-oriented NHS "system reform" (Department of Health 2005). The impact of such reforms on socio-economic inequality is a major policy issue. One concern is that allowing money to follow patient demand may generate tensions with existing needs-based geographical resource allocation formulae: purchasers in affluent, high-demand areas may over-spend and lobby for additional resources. Another concern is that market reform may result in the closure of unprofitable local services, which may disproportionately harm disadvantaged patients who are less able to travel long distances. A third concern is that disadvantaged groups may be less able to make well-informed choices and to avoid poor hospitals. A final concern is that hospitals may skew activity towards low-risk, high-profit treatments that disproportionately benefit affluent and healthy patients.

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Table 1: National rates of hip replacement per 100,000 population by age and sex

	1991		2001	
Age group	Male	Female	Male	Female
45-54	36	45	40	43
55-64	121	143	141	167
65-74	201	292	282	371
75-84	272	350	279	407
85 plus	111	132	186	205

Table 2: Elective total hip replacement rates (crude and adjusted) and standardised utilisation ratios by Townsend deprivation quintile groups, comparing 1991 and 2001

		Townsend quintile (5 = most deprived)				
		1	**2**	**3**	**4**	**5**
1991	Crude rate	171	178	169	166	131
	Adjusted rate	181	182	168	163	128
	SUR	1.14	1.14	1.06	1.02	0.80
	CI lower	1.10	1.11	1.03	1.00	0.78
	CI uppper	1.17	1.17	1.08	1.04	0.82
	Rate ratio	1.41	1.42	1.31	1.27	1
	CI lower	1.36	1.36	1.27	1.23	n/a
	CI uppper	1.47	1.47	1.36	1.31	n/a
2001	Crude rate	193	197	197	191	156
	Adjusted rate	198	199	195	189	155
	SUR	1.08	1.08	1.06	1.02	0.84
	CI lower	1.05	1.05	1.04	1.00	0.83
	CI uppper	1.10	1.10	1.08	1.05	0.86
	Rate ratio	1.27	1.28	1.26	1.21	1
	CI lower	1.23	1.24	1.22	1.18	n/a
	CI uppper	1.32	1.32	1.30	1.25	n/a
Diff (01 - 91)	SUR	-0.06	-0.06	0.00	0.00	0.04
	Rate ratio	-0.14	-0.14	-0.06	-0.05	n/a

Figure 1: Small area inequality in elective hip replacement by Townsend deprivation quintiles, comparing England in 1991 and 2001

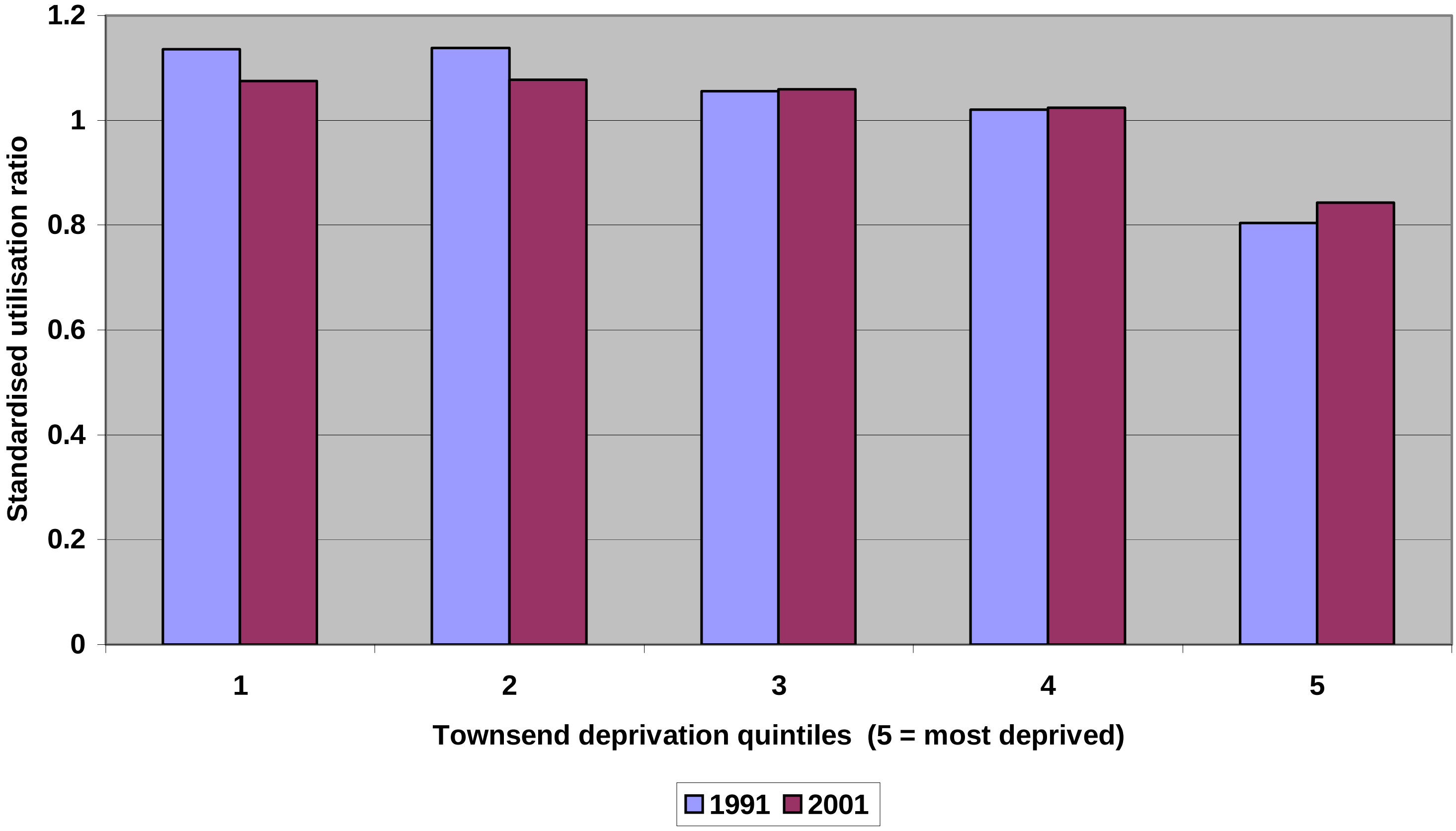

Figure 2: Concentration curves of deprivation-related inquality in small area standardised utilisation ratios in 1991 and 2001