

An ecological study of NHS funded elective hip arthroplasties in England from 2003/04 to 2012/13

Shailen Sutaria¹ , Graham Kirkwood² and Allyson M Pollock² 

¹Clinical Effectiveness Group, Centre for Primary Care and Public Health, Queen Mary University of London, London E1 2AB, UK

²Institute of Health and Society, Newcastle University, Newcastle upon Tyne NE2 4AX, UK

Corresponding author: Shailen Sutaria. Email: shailen000@yahoo.co.uk

Summary

Objectives: To examine the impact of NHS-funded private provision on NHS provision, access and inequalities.

Design: Ecological study using routinely collected NHS inpatient data.

Setting: England.

Participants: All individuals undergoing an NHS-funded elective hip arthroplasty in England from 2003/2004 to 2012/2013.

Main outcome measures: Annual crude and standardised rates of hip arthroplasties per 100,000 population performed by NHS and private providers between 2004/2005 and 2012/2013.

Results: Age standardised rates of hip arthroplasty increased from 116.4 (95% CI 115.4–117.4) to 148.7 (147.6–149.8) per 100,000 between 2004/2005 and 2012/2013. Provision shifted from NHS providers to private providers from 2007/2008; NHS provision decreased 8.6% and private provision increased 188% between 2007/2008 and 2012/2013. There is evidence of risk selection; private sector hip arthroplasties on NHS patients from the most affluent areas increased 228% from 10.8 (10.2–11.5) to 35.4 (34.3–36.5) per 100,000 compared to an increase of 186% from 8.8 (8.1–9.4) to 25.2 (24.1–26.4) per 100,000 among patients from the least affluent areas between 2007/2008 and 2012/2013. There was no statistically significant ($p > 0.05$) widening in any measure of inequality (absolute, relative difference and slope and relative slope of index inequality) in hip arthroplasty rates between 2004/2005 and 2012/2013.

Conclusion: Private provision substituted for NHS provision and did not add to overall provision favouring patients living in the most affluent area. Continuing the trend towards private provision and reducing NHS provision is likely to result in risk selection and widening inequalities in provision of elective hip arthroplasty in England.

Keywords

Epidemiology, quantitative research, health policy, health service research

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Introduction

The 2012 Health and Social Care Act places duties on NHS England and Clinical Commissioning Groups to ‘have regard to the need to reduce inequalities between patients with respect to their ability to access health services’.¹

Following the NHS Plan in 2000, private providers of healthcare services have expanded rapidly. In 2003, privately owned independent sector treatment centres were commissioned to treat NHS patients, focussing on high-volume elective surgical procedures, despite concerns about cost, quality and the ‘cherry picking’ of healthier patients over those with more complex health problems.^{2–5} The ‘free choice’ agenda⁶ allowed any private provider of healthcare to provide elective care to any NHS patient, provided they had registered with the relevant body.⁷ Commercial tendering of NHS services is now virtually compulsory.⁸ Between April 2013 and August 2014, a third of contracts to provide NHS clinical services were awarded to the private sector, and between 2015 and 2016, NHS England expenditure on private sector provision of secondary care services reached £8.7 billion, representing 7.7% of total NHS expenditure in 2015/2016.^{9,10}

Elective hip arthroplasty is a common elective procedure with demonstrable improvements in quality of life.^{11–13} In 2017, over one-third of NHS-funded elective hip arthroplasties were performed by the private sector.¹⁴ Variations in elective hip arthroplasty rates are well documented, with female and older patients and those living in the most deprived areas less likely to receive treatment relative to need.^{15–17} Early studies into the impact of commercial contracting and independent sector treatment centres suggested no impact on equity,¹⁸ although a Scottish study found private provision of NHS-funded elective hip arthroplasties was associated with reduced

Figure 1. Number and rates of NHS-funded elective and emergency hip arthroplasties in England 1997–2013. Rates indicate age-adjusted rates, directly standardised to 2013 European population with 95% confidence intervals.

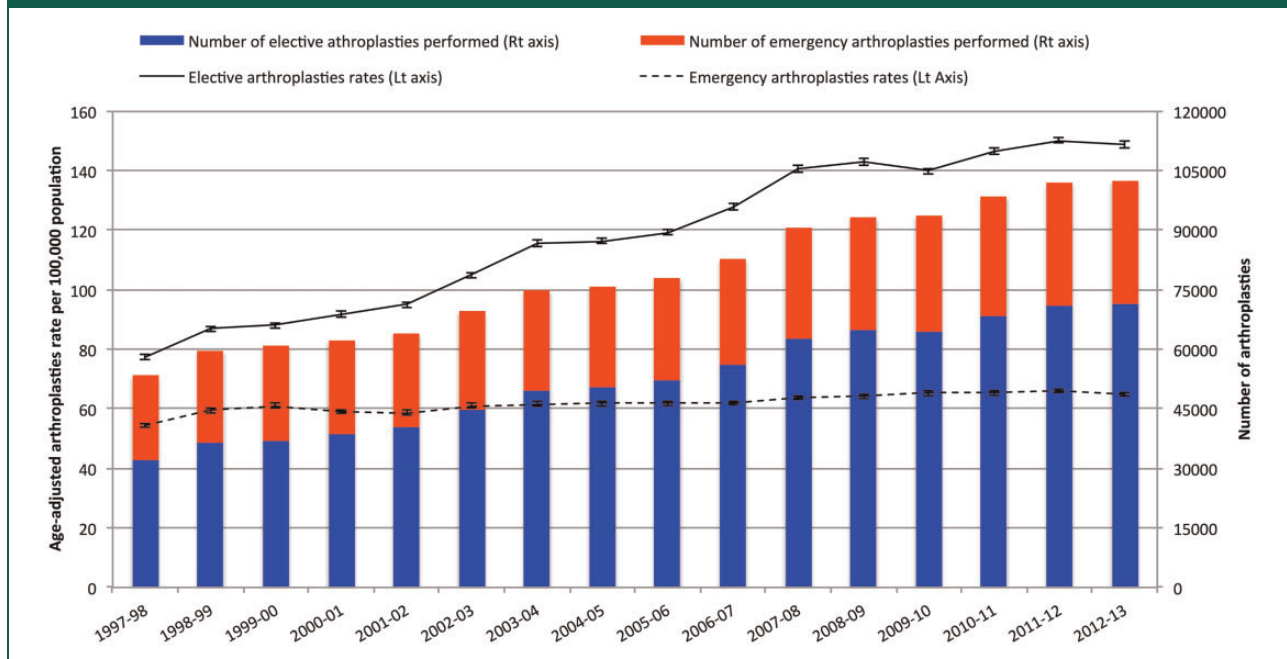


Table 1. Crude and adjusted rates of NHS-funded elective and emergency arthroplasties in England between 1997/1998 and 2012/2013.

Financial year	Population (England)	No. of arthroplasties	Elective arthroplasties per 100,000 population		Emergency arthroplasties per 100,000 population	
			Crude rate	Adjusted rate ^a	Crude rate	Adjusted rate ^a
1997–1998	48,664,777	53,983	66.2	77.3 (76.5–78.2)	43.4	54.4 (53.7–55.1)
1998–1999	48,820,583	60,027	74.4	86.9 (86–87.8)	47.6	59.4 (58.6–60.1)
1999–2000	49,032,872	61,423	75.2	88 (87.1–88.9)	49	61 (60.3–61.8)
2000–2001	49,233,311	62,613	78.3	91.7 (90.8–92.6)	47.9	59.1 (58.3–59.8)
2001–2002	49,449,746	64,443	81.1	95 (94–95.9)	48.2	58.7 (57.9–59.4)
2002–2003	49,679,267	70,002	89.7	104.9 (104–105.9)	50.3	61.1 (60.3–61.8)
2003–2004	49,925,517	75,122	99	115.5 (114.5–116.5)	50.7	61.6 (60.9–62.4)
2004–2005	50,194,600	76,152	100.1	116.4 (115.4–117.4)	50.9	61.7 (60.9–62.4)
2005–2006	50,606,034	78,405	102.7	119.3 (118.3–120.3)	51.5	61.9 (61.1–62.6)
2006–2007	50,965,186	83,121	110	127.8 (126.8–128.9)	52.3	62 (61.3–62.8)
2007–2008	51,381,093	91,066	121.8	140.5 (139.4–141.6)	54.5	63.8 (63.1–64.6)
2008–2009	51,815,853	93,873	124.7	142.8 (141.7–143.9)	55.1	64.1 (63.4–64.9)

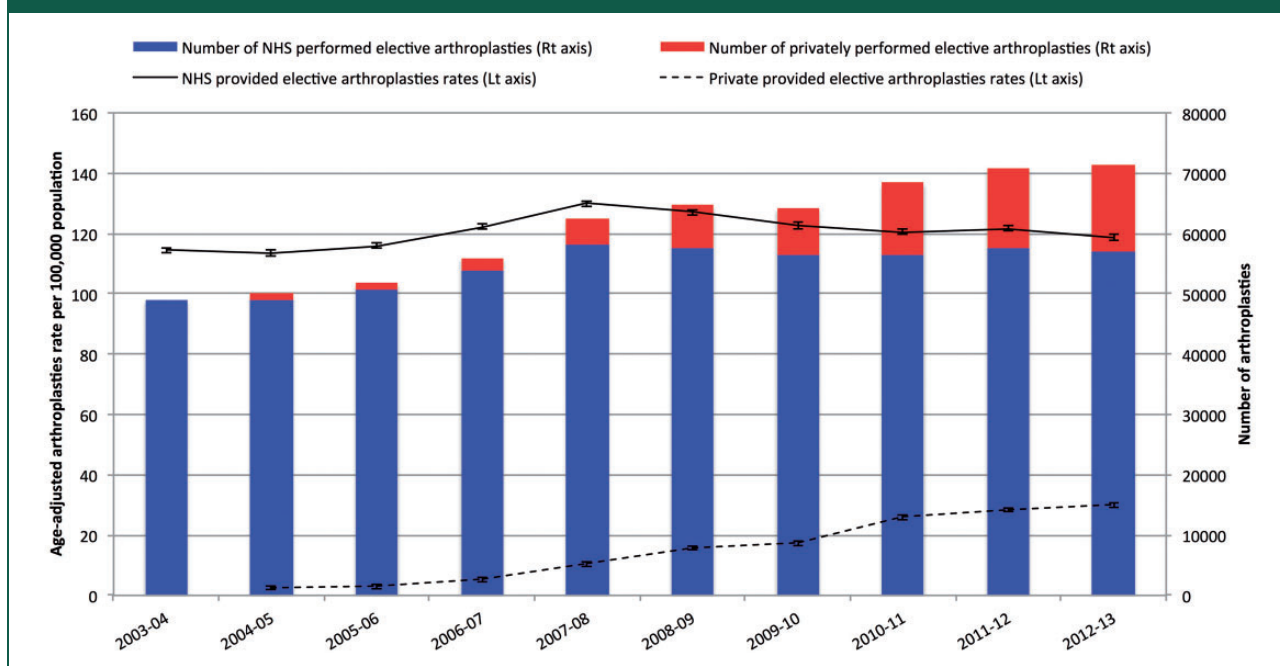
(continued)

Table 1. Continued.

Financial year	Population (England)	No. of arthroplasties	Elective arthroplasties per 100,000 population		Emergency arthroplasties per 100,000 population	
			Crude rate	Adjusted rate ^a	Crude rate	Adjusted rate ^a
2009–2010	52,196,381	94,017	122.9	139.8 (138.7–140.9)	56.5	65.2 (64.4–65.9)
2010–2011	52,642,452	98,824	129.8	146.6 (145.5–147.7)	57.1	65.3 (64.5–66)
2011–2012	53,107,169	102,302	133.5	150.2 (149.1–151.3)	58.5	66.1 (65.4–66.9)
2012–2013	53,493,729	102,939	133.5	148.7 (147.6–149.8)	58.2	65 (64.2–65.7)

^aAdjusted rates standardised by age and population to 2013 European standard population.

Figure 2. Number and rates of NHS-funded elective hip arthroplasties in England by provider type 2003–2013. Rates indicate age-adjusted rates, directly standardised to 2013 European population with 95% confidence intervals.



NHS provision and increased age and socioeconomic inequalities in treatment rates.¹⁹

Method

All episodes of NHS-funded elective and emergency primary hip arthroplasty (including hip resurfacing and hybrid hip replacements) by NHS or private provider performed in England from 1 April 1997 to 31 March 2013 were extracted from Hospital Episode Statistics using OPCS4 procedure codes as defined by the Scottish Arthroplasty Project.²⁰

Patient-level variables including age at time of admission, gender and area-level socioeconomic

deprivation (index of multiple deprivation, IMD) were obtained for each patient based on the 2001 lower layer super output area of residence. The IMD score was transformed into population quintiles with IMD 1 representing the 20% of patients living in the most deprived areas and IMD 5 representing the 20% of patients living in the least deprived areas in the population.

Statistical analysis

Numbers of elective and emergency hip arthroplasties and crude and age standardised rates per 100,000 population with 95% confidence intervals (CI) were

Table 2. Age-sex distribution of individuals undergoing NHS-funded elective hip arthroplasties from 2004/2005 to 2012/2013 by provider type.

Age band	NHS performed			Privately performed		
	Male	Female	Overall	Male	Female	Overall
0–59	25%	18%	21%	15%	20%	17%
60–64 years	14%	12%	13%	14%	17%	15%
65–69 years	17%	16%	17%	19%	20%	20%
70–74 years	18%	18%	18%	21%	20%	20%
75–79 years	14%	17%	16%	17%	15%	16%
80–84 years	8%	12%	10%	10%	6%	9%
Over 85	3%	6%	5%	4%	2%	3%
	100%	100%	100%	100%	100%	100%

calculated for each financial year from 1997/1998 to 2012/2013; standardisation was to the 2013 European population. Population denominators for England by financial year were obtained from mid-year Office of National Statistics estimates corresponding to each financial year. Numbers of elective NHS-provided and private-provided hip arthroplasties and crude and age standardised rates per 100,000 population were calculated for each financial year from 2003/2004 to 2012/2013. Crude and standardised rates were calculated by IMD quintile for each provider type and for all providers from 2004/2005 to 2012/2013.

Measures of inequality

Absolute and relative differences in age-standardised hip arthroplasties rates between the 20% least deprived and the 20% most deprived population for each year of data from 2004/2005 onwards were calculated. We examined trends in absolute and relative differences over time by performing simple linear regression, using least squares methods.

We calculated slope of index inequality (SII) and relative slope of index inequality (RII) for each year from 2004/2005 onwards to measure the difference in age-standardised rates by taking into account the inequality across all adjacent quintiles of relative deprivation, rather than focusing only on the extremes, using previously developed techniques.^{21,22}

For each year, the age-standardised rates for each IMD quintile were ranked and weighted according to the distribution in the population. The slope index of

inequality (SII) is the linear regression coefficient that shows the relation between the age-standardised rates in each IMD quintile and the cumulative fraction of population ranked by deprivation. The SII can be interpreted as the absolute effect on treatment rates of moving from the lowest socioeconomic level through to the highest and has the advantage over more simple measures of inequalities by making use of all the data.²³

As SII is sensitive to the mean arthroplasty rate of the population, we also calculate the relative index of inequality by dividing the SII by the mean rate in the population. We examined trends in SII and RII over time by performing simple linear regression.

All analysis was performed using Stata version 14 and Microsoft excel. All significance testing is to $p < 0.05$.

Patient and public involvement

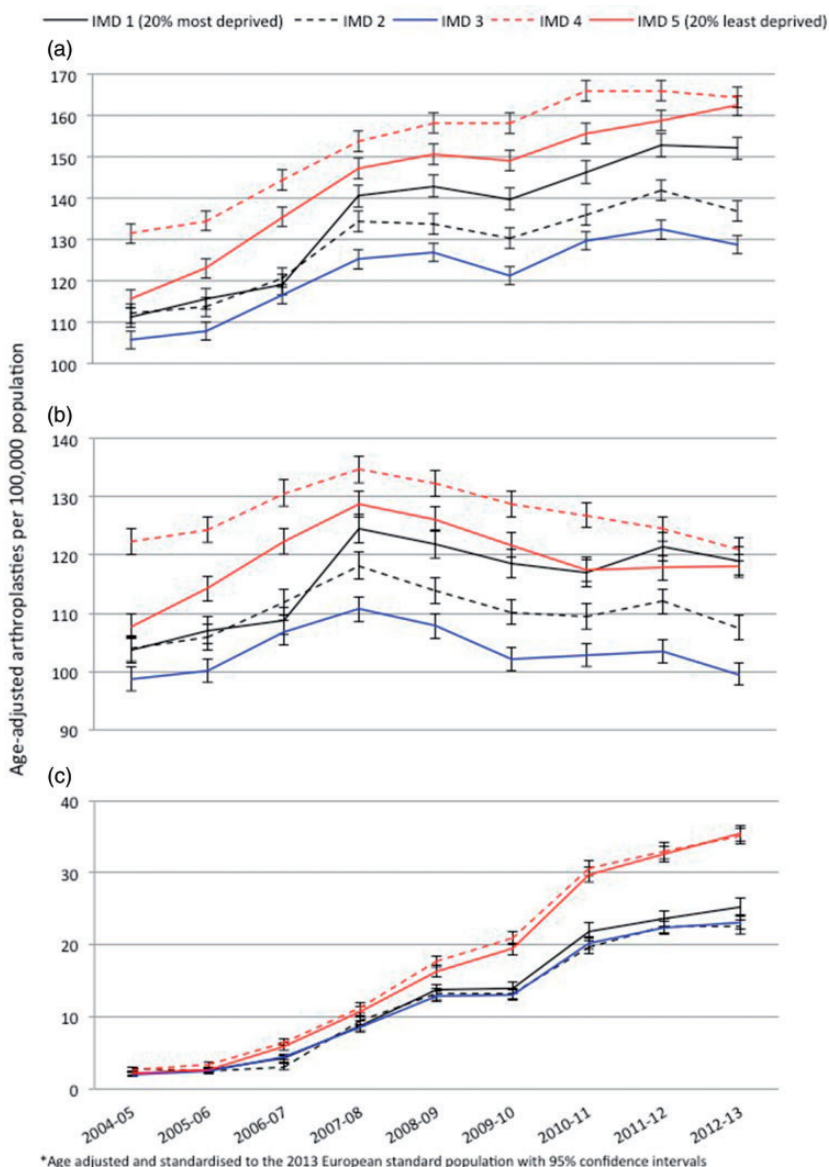
No patients or public were involved in the design of this study.

Results

General trends in NHS-funded elective and emergency hip arthroplasties between 1997/1998 and 2012/2013

Between 1997/1998 and 2012/2013, the number of NHS-funded elective primary hip arthroplasties increased by 122% from 32,226 in 1997/1998 to 71,492 in 2012/2013, and emergency arthroplasties

Figure 3. Rates of NHS-funded hip arthroplasties performed in England by IMD quintile 2004–2013. Rates indicate age-adjusted rates, directly standardised to 2013 European population with 95% confidence intervals. (a) NHS-funded – NHS and privately performed (total). (b) NHS funded – NHS performed. (c) NHS-funded – privately performed.



increased by 46% from 21,336 to 31,136 (Figure 1, Table 1). Over the same time period, the age-standardised rate for elective hip arthroplasties increased from 77.3 (95%CI 76.5–78.2) to 148.7 (95%CI 147.6–149.8) per 100,000 population and for emergency hip arthroplasties the rate increased from 54.4 (95%CI 53.7–55.1) in 1997/1998 to 65 (95%CI 64.2–65.7) per 100,000 population in 2012/2013.

Age–sex distribution of individuals undergoing NHS-funded elective hip arthroplasties from 2004/2005 to 2012/2013 by provider type

The age–sex distribution of those undergoing elective arthroplasties differed by provider (Figure 2, Table 2). Overall, the proportions of younger boys/men (0–59 years) and older women (>75 years) were higher among NHS providers compared with private

Table 3. Number, crude and adjusted rates of NHS-funded elective arthroplasties in England by provider type between 2003/2004 and 2012/2013.

Financial Year	Population (England)	NHS provided elective arthroplasties			Private provided elective arthroplasties		
		No. of arthroplasties (% of total performed)	CR	AR (95% CI)	No. of arthroplasties (% of total performed)	CR	AR (95% CI)
2003–2004	49,925,517	49,016 (100%)	98.2	114.5 (113.5–115.6)	0 (0%)	–	–
2004–2005	50,194,600	49,029 (98%)	97.6	113.5 (112.5–114.5)	1,050 (2%)	2.1	2.5 (2.3–2.6)
2005–2006	50,606,034	50,647 (98%)	100.1	116.1 (115.1–117.1)	1,231 (2%)	2.4	2.9 (2.7–3.1)
2006–2007	50,965,186	53,761 (96%)	105.5	122.4 (121.4–123.5)	2,275 (4%)	4.5	5.3 (5.1–5.5)
2007–2008	51,381,093	58,062 (93%)	112.9	130 (129–131.1)	4,578 (7%)	8.9	10.4 (10.1–10.7)
2008–2009	51,815,853	57,651 (89%)	111.1	127.1 (126–128.1)	7,056 (11%)	13.6	15.7 (15.4–16.1)
2009–2010	52,196,381	56,377 (88%)	107.9	122.6 (121.5–123.6)	7,847 (12%)	15	17.2 (16.9–17.6)
2010–2011	52,642,452	56,397 (82%)	107	120.7 (119.7–121.7)	12,011 (18%)	22.8	25.9 (25.5–26.4)
2011–2012	53,107,169	57,645 (81%)	108.4	121.8 (120.8–122.8)	13,329 (19%)	25.1	28.4 (28–28.9)
2012–2013	53,493,729	57,166 (80%)	106.7	118.8 (117.8–119.7)	14,326 (20%)	26.8	29.9 (29.4–30.4)

CR: crude rate; AR: adjusted rates standardised by age and population to 2013 European standard population; 95% CI: 95% confidence interval.

providers, 25% versus 15% and 35% versus 23%, respectively.

Trends in NHS-funded elective hip arthroplasties by provider type from 2004/2005 to 2012/2013

The total number of NHS-funded elective primary hip arthroplasties performed by the NHS and private providers increased by 44.6% between 2004/2005 and 2012/2013 from 49,434 to 71,492 (Figure 3, Table 3). In 2004/2005, 2% of NHS-funded arthroplasties were performed by the private sector; this increased to 20% in 2012/2013.

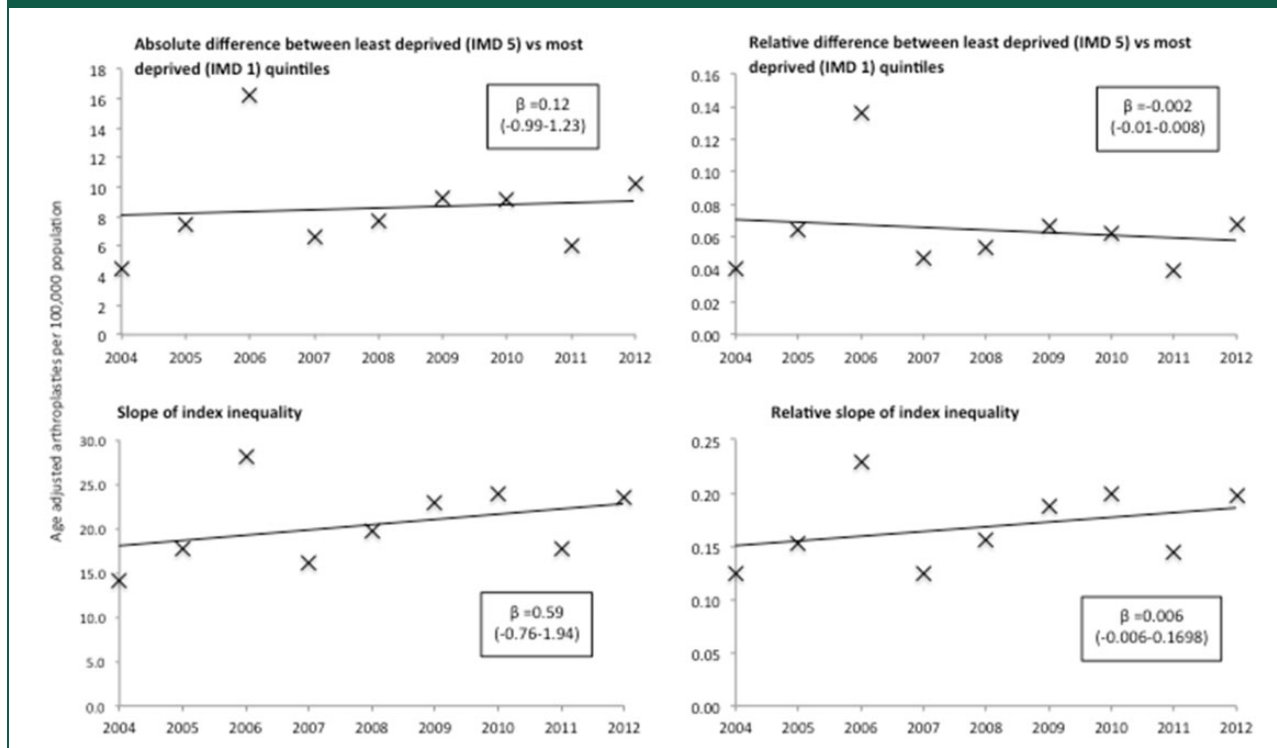
Age-standardised NHS performed arthroplasty rates increased from 113.5 (112.5–114.5) in 2004/2005 to 130.0 (95%CI 129.0–131.1) arthroplasties per 100,000 population in 2007/2008 before falling back to 118.8 (95%CI 117.8–119.7) arthroplasties per 100,000 population in 2012/2013. Age-standardised privately performed arthroplasty rates increased significantly year on year from 2.5 (95%CI 2.3–2.6) in 2004/2005 to 29.9 (95%CI 29.4–30.4) per 100,000 population in 2012/2013.

Trends in NHS-funded elective hip arthroplasties by IMD quintile from 2004/2005 to 2012/2013

Overall trends (Figure 4, Panel 1). The age-standardised rate of all NHS-funded elective primary hip arthroplasties increased from 2004/2005 to 2012/2013 in all IMD quintiles (Figure 3, Panel 1) with the largest (40%) increase occurring in the least deprived quintile (IMD 5), 115.8 (95%CI 113.6–118) to 162.5 (95%CI 160–164.9) arthroplasties per 100,000 population between 2004/2005 and 2012/2013. The smallest increases occurred in IMD 2, 3 and 4, which increased by 22%, 22% and 25%, respectively, during the same time period. The treatment rate in the most deprived quintile (IMD 1) increased significantly by 37% from 111.3 (95%CI 108.9–113.7) in 2004/2005 to 152.2 (95%CI 149.4–154.9) arthroplasties per 100,000 population in 2012/2013.

Age-standardised rates were significantly higher in IMD 4 compared to IMD 1, 2, 3 and 5 for all years except 2012/2013, when adjusted rates for both IMD 4 and 5 were similar 164.6 (95%CI 162.1–167) and 162.5 (95% CI 160–164.9) and both significantly higher than IMD 1, 2 and 3.

Figure 4. Trends in absolute, relative, slope and relative slope of index inequality in NHS-funded elective hip arthroplasties in England 2004–2012. Lines of best fit with beta coefficient and 95% confidence interval are also shown.



IMD 3 had significantly lower adjusted rates of arthroplasties compared to all other quintiles for all years except 2006/2007, when IMD 1, 2 and 3 were all similar, and significantly lower than IMD 4 and 5.

NHS-provided arthroplasty trends (Figure 4, Panel 2). There was no significant change in standardised rates for NHS-provided arthroplasties from 2004/2005 to 2012/2013 in IMD2, 3 or 4.

IMD 1 rates increased significantly from 103.7 (95%CI 101.5–106) arthroplasties per 100,000 population in 2004/2005 to 124.5 (95%CI 122.1–127.0) in 2007/2008 before falling significantly to 119.0 (116.6–121.4) in 2012/2013.

IMD 5 rates increased significantly from 107.7 (95%CI 105.6–109.8) in 2004/2005 to 128.7 (95%CI 126.5–131) in 2007/2008 before falling significantly to 118.2 (116.2–120.2) in 2012/2013.

The lowest rates were in patients in IMD 3, where from 2007/2008 arthroplasty rates were significantly lower than any other quintile.

Arthroplasties rates were significantly higher in IMD 4 than all the other quintiles except from 2010/2011, when rates were similar to IMD 1 and 5.

Privately provided arthroplasty trends (Figure 4, Panel 3). Age-standardised privately provided elective primary hip arthroplasty rates increased significantly for all IMD quintiles with rates increasing in the least deprived quintile from 2.2 (95%CI 1.9–2.5) in 2004/2005 to 35.4 (95%CI 34.3–36.5) arthroplasties per 100,000 population in 2012/2013.

The highest rates year on year occurred in IMD 4 and IMD 5, significantly higher than the more deprived quintiles (IMD 1, 2 and 3).

In 2004/2005, there was no significant difference in adjusted treatment rates between IMD 1 (2.1 per 100,000; 95%CI 1.8–2.5) and IMD 5 (2.2 per 100,000; 95%CI 1.9–2.5); this widened yearly and by 2012/2013, the rate for IMD 5 (35.4 per 100,000; 95%CI 34.3–36.5) was significantly higher than that for IMD 1 (25.2 per 100,000; 95%CI 24.1–26.4).

Trends in inequality in hip arthroplasty rates between 2004/2005 and 2012/2013

Trends gradients were positive for all measures of inequality (except relative difference), suggesting a widening of inequalities over time; however,

Table 4. Crude and adjusted rates of NHS-funded elective arthroplasties in England by deprivation quintile and provider type between 2003/2004 and 2012/2013 per 100,000 population.

Year	Provider type	IMD 1 (20% most deprived)		IMD 2		IMD 3		IMD 4		IMD 5 (20% least deprived)	
		CR	AR (95% CI)	CR	AR (95% CI)	CR	AR (95% CI)	CR	AR (95% CI)	CR	AR (95% CI)
2004-2005	All	90.1	111.3 (108.9-113.7)	97.3	112.2 (109.8-114.5)	100.1	105.9 (103.7-108)	126.2	131.6 (129.2-134)	110.3	115.8 (113.6-118)
	NHS	88.3	103.7 (101.5-106)	94.8	104 (101.8-106.2)	98.1	98.7 (96.7-100.7)	123.5	122.3 (120-124.5)	108.1	107.7 (105.6-109.8)
	Private	1.8	2.1 (1.8-2.5)	2.4	2.8 (2.4-3.1)	2	2 (1.7-2.3)	2.7	2.6 (2.3-3)	2.2	2.2 (1.9-2.5)
2005-2006	All	92.1	115.6 (113.2-118.1)	97.8	113.9 (111.5-116.2)	102.1	108 (105.8-110.1)	129.9	134.6 (132.2-136.9)	118.4	123.1 (120.8-125.4)
	NHS	89.9	107.1 (104.8-109.4)	95.6	105.9 (103.7-108.1)	99.6	100.2 (98.2-102.2)	126.5	124.4 (122.2-126.6)	115.7	114.3 (112.1-116.4)
	Private	2.2	2.6 (2.3-3)	2.2	2.5 (2.1-2.8)	2.5	2.5 (2.2-2.8)	3.5	3.4 (3-3.8)	2.6	2.6 (2.3-2.9)
2006-2007	All	93.6	119.2 (116.7-121.7)	103.2	120.9 (118.5-123.3)	110.5	116.8 (114.6-119.1)	140.1	144.6 (142.1-147)	131.3	135.5 (133.1-137.8)
	NHS	90.2	108.7 (106.4-111)	100.5	112 (109.7-114.2)	106.1	106.7 (104.6-108.7)	133.5	130.6 (128.4-132.9)	125.3	122.4 (120.2-124.6)
	Private	3.4	4.2 (3.7-4.6)	2.7	3.1 (2.7-3.5)	4.4	4.5 (4.1-4.9)	6.6	6.5 (6-7)	6	5.9 (5.4-6.4)
2007-2008	All	109.7	140.6 (137.9-143.3)	114.5	134.4 (131.9-136.9)	119	125.3 (123-127.6)	150.7	153.9 (151.4-156.5)	144.9	147.2 (144.7-149.7)
	NHS	102.6	124.5 (122.1-127)	106.3	118.2 (115.9-120.5)	110.6	110.7 (108.6-112.8)	139	134.7 (132.4-137)	133.6	128.7 (126.5-131)
	Private	7.1	8.8 (8.1-9.4)	8.3	9.4 (8.7-10)	8.4	8.5 (7.9-9)	11.7	11.2 (10.6-11.9)	11.2	10.8 (10.2-11.5)
2008-2009	All	110.9	143 (140.3-145.7)	113.8	133.9 (131.4-136.4)	121.5	127 (124.8-129.3)	157.1	158.4 (155.9-160.9)	150.4	150.7 (148.2-153.1)
	NHS	99.9	121.9 (119.5-124.4)	102.2	113.8 (111.6-116.1)	108.6	107.8 (105.7-109.8)	138.5	132.4 (130.1-134.6)	133.2	126.2 (124-128.3)
	Private	11	13.7 (12.9-14.5)	11.6	13.2 (12.4-14)	12.9	12.9 (12.1-13.6)	18.6	17.7 (16.9-18.5)	17.2	16.3 (15.5-17.1)
2009-2010	All	107.7	139.9 (137.2-142.5)	111	130.4 (127.9-132.8)	116.7	121.3 (119.1-123.5)	158.6	158.2 (155.7-160.7)	151.6	149.2 (146.8-151.6)
	NHS	96.4	118.5 (116.1-120.9)	99.3	110.2 (108.1-112.4)	103.5	102.1 (100.1-104.1)	136.4	128.7 (126.5-130.9)	130.5	121.7 (119.6-123.9)
	Private	11.2	14 (13.2-14.9)	11.8	13.2 (12.5-14)	13.2	13 (12.3-13.7)	22.2	20.9 (20-21.8)	21.1	19.5 (18.6-20.3)
2010-2011	All	112.1	146.5 (143.7-149.2)	115.5	136.1 (133.6-138.6)	125.7	129.8 (127.5-132.1)	168.5	166.2 (163.6-168.7)	160.7	155.7 (153.3-158.2)
	NHS	94.7	116.9 (114.5-119.3)	98.2	109.4 (107.3-111.6)	105	102.9 (100.9-104.9)	135.6	126.8 (124.7-129)	128.1	117.5 (115.5-119.6)
	Private	17.5	21.9 (20.9-23)	17.4	19.6 (18.7-20.6)	20.7	20.3 (19.4-21.2)	32.9	30.6 (29.6-31.7)	32.6	29.7 (28.7-30.8)

(continued)

Table 4. Continued.

Year	Provider type	IMD 1 (20% most deprived)			IMD 2			IMD 3			IMD 4			IMD 5 (20% least deprived)								
		CR	AR (95% CI)	AR (95% CI)	CR	AR (95% CI)	AR (95% CI)	CR	AR (95% CI)	AR (95% CI)	CR	AR (95% CI)	AR (95% CI)	CR	AR (95% CI)	AR (95% CI)						
2011–2012	All	116.2	152.9 (150.1–155.7)	120.4	142.1 (139.6–144.6)	128.8	132.5 (130.2–134.8)	170.1	166.2 (163.7–168.7)	166.1	158.9 (156.5–161.4)	20NHS	97.6	121.4 (118.9–123.8)	100.4	112.1 (109.9–114.2)	105.9	103.5 (101.5–105.4)	134.4	124.5 (122.4–126.6)	129.9	117.8 (115.7–119.8)
	Private	18.5	23.6 (22.5–24.7)	19.9	22.6 (21.6–23.6)	22.8	22.3 (21.4–23.2)	35.6	33 (31.9–34.1)	36.2	32.6 (31.5–33.7)		2012–2013	115.8	152.2 (149.4–154.9)	116.8	137 (134.6–139.5)	126.6	129 (126.7–131.2)	171	164.6 (162.1–167)	172.8
All	95.8	119 (116.6–121.4)	96.7	107.5 (105.4–109.6)	102.7	99.5 (97.6–101.4)	132.4	120.9 (118.9–123)	132.9	118.2 (116.2–120.2)	NHS	20.1		25.2 (24.1–26.4)	20.1	22.5 (21.5–23.5)	23.9	23.1 (22.1–24)	38.6	35.1 (34–36.2)	39.9	35.4 (34.3–36.5)
Private	20.1	25.2 (24.1–26.4)	20.1	22.5 (21.5–23.5)	23.9	23.1 (22.1–24)	38.6	35.1 (34–36.2)	39.9	35.4 (34.3–36.5)	Private	20.1	25.2 (24.1–26.4)	20.1	22.5 (21.5–23.5)	23.9	23.1 (22.1–24)	38.6	35.1 (34–36.2)	39.9	35.4 (34.3–36.5)	

CR: crude rate; AR: adjusted rates standardised by age and population to 2013 European standard population; 95% CI: 95% confidence interval.

none were statistically significant ($p > 0.05$) in any measure of inequality (absolute, relative difference, and slope and relative slope of index inequality) (Figure 5, Table 5).

Discussion

Main findings

From 1997/1998 to 2003/2004, there was a 50% increase in numbers and rates of NHS-funded elective hip arthroplasties, delivered by NHS providers. From 2003/2004, rates and numbers of NHS-funded elective hip arthroplasties continued to increase being delivered by both increasing NHS and private provision. From 2007/2008, overall provision continued to increase but was driven by increasing private sector provision as NHS provision decreased. The most affluent groups benefited the greatest from increasing private provision; however, we found no statistically significant widening in inequalities in overall NHS-funded hip arthroplasties between 2004/2005 and 2012/2013. This was due to the protective and buffering effects of NHS provision which still remained the predominant provider of elective hip arthroplasties during the study period.

Our findings are similar to the findings of a Scottish study where increasing private sector provision was associated with a fall in NHS provision.¹⁹ Since 2015, the Scottish government policy has been to ‘effectively eliminate use of the private sector for planned care’²⁴ in England the Department of Health continues to adopt policies of outsourcing of health-care provision.²⁵

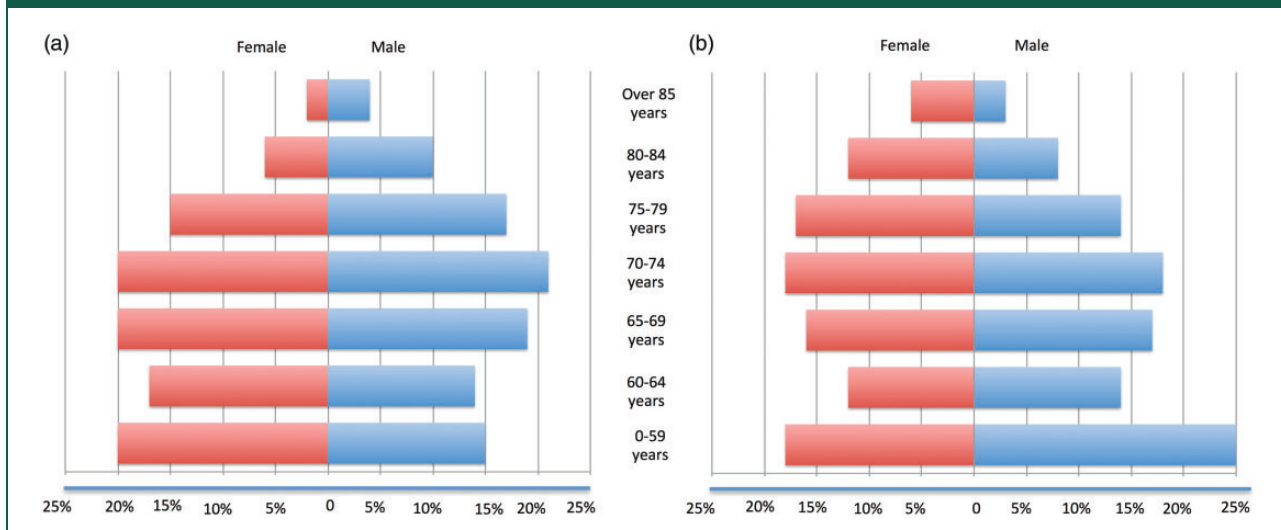
Strengths and limitations of study

This is the first study in England examining the effects of NHS funding of private provision on NHS direct provision and inequalities in access, using treatment rates by provider type.

Limitations include lack of adjustment for need which is highest among more deprived groups¹⁶; thus, differences observed between socioeconomic groups will underestimate true inequities in treatment provision.

Second, the extent to which privately funded patients are receiving hip arthroplasty is unknown as Hospital Episode Statistics data do not capture data on privately funded and performed hip arthroplasties; it is difficult to estimate the impact on inequalities. Derived estimates from private providers who perform only privately funded hip arthroplasties suggest the number of privately funded hip

Figure 5. Age–sex distribution of individuals undergoing NHS-funded elective hip arthroplasties from 2004/2005 to 2012/2013 by provider type. (a) Private providers and (b) NHS providers.



arthroplasties fell by 25.5%, between 2004/2005 and 2010/2011.²⁶ This contrasts with the rising trends in numbers of NHS-funded hip arthroplasties performed. Rates of private insurance have remained relatively static in the UK.

There is evidence that individuals who would have undergone privately funded hip arthroplasty transferred to NHS funding, as waiting times reduced.²⁶

Despite this substitution between private and NHS-funded joint replacements, we still found rates of NHS-funded hip arthroplasties were consistently highest among the second most affluent quintile. The size of any substitution effect on inequality is difficult to quantify. Research by Mindell et al. found private-funded coronary intervention was inversely related to need and exacerbated inequalities.²⁷

Third, we were not able to examine where in the care pathway inequity occurs; GPs may be less likely to refer older, ethnic minorities and less-educated patients; or geographic location of private providers combined with risk selection may result in some individuals being less likely to be treated by private providers.^{2,4,28–31} We found private providers favoured less extremes of ages compared to NHS providers. Those individuals aged <59 years for boys/men and >75 years for women requiring elective hip arthroplasty may represent more complex arthroplasties or associated co-morbidities that are excluded by private providers.

Implication of findings

The large and sustained increases in NHS-funded elective hip arthroplasties between 1997/1998 and 2007/2008 was delivered using NHS providers. This period coincides with large increases in NHS funding, from £59 billion in 1997/1998 to £110 billion in 2007/2008 (at 2010/2011 prices)³² demonstrating the NHS ability to increase capacity when supported by sufficient funding.

Previous analysis by Cooper et al. found no substantial widening of inequalities in waiting times by socioeconomic group during this period.¹⁸ This is likely due to outsourcing still being in its infancy, contributing to < 5% of NHS-funded elective arthroplasties and large increases in NHS funding and provision.

In 2017, one in three of all NHS-funded elective hip arthroplasties are performed in the private sector.¹⁴ If the trends shown here continue, whereby private provision substitutes for NHS direct provision with risk selection favouring less deprived patients, then widening inequalities are likely.


The Health and Social Care Act 2012 places a duty on Clinical Commissioning Groups to ‘reduce inequalities between patients with respect to their ability to access health services’. Our findings suggest Clinical Commissioning Groups should immediately reassess private sector contracting, undertake further research on its impact from 2012/2013 onwards on inequalities and consider and monitor the impact both on direct NHS provision and inequalities.

Table 5. Indices of inequalities.

Measure of inequality	2004	2005	2006	2007	2008	2009	2010	2011	2012
Absolute difference in age standardised arthroplasty rates IMD 5 vs. IMD 1	4.5	7.5	16.3	6.6	7.7	9.3	9.2	6	10.3
Relative difference in age standardised arthroplasty rates IMD 5 vs. IMD 1	0.040	0.065	0.137	0.047	0.054	0.066	0.063	0.039	0.068
Slope of index inequality ^a	14.2 (18.1–102)	17.8 (21.7–138)	28.1 (31.9–20.4)	16.2 (11.9–20.4)	19.7 (24.2–15.3)	22.9 (27.8–18.1)	24.0 (28.8–19.2)	17.7 (22.4–13.0)	23.5 (28.5–18.5)
Relative slope of index inequality	0.12	0.15	0.23	0.12	0.16	0.19	0.20	0.15	0.20

^a95% Confidence interval.

Declarations

Competing Interests: None declared.**Funding:** None declared.**Ethics approval:** Ethical approval was not required as data was anonymised and published in aggregate form.**Guarantor:** SS.**Contributors:** AMP, GK and SS were all involved in the design of the study. SS performed statistical analysis with assistance from GK. All authors contributed to data interpretation and revising and editing drafts produced by SS. All authors had full access to the data and have checked for accuracy and have approved the final version of this manuscript.**Acknowledgements:** None.**Provenance:** Not commissioned; peer-reviewed by Julie Morris and Martin McKee.**ORCID iD:** Shailen Sutaria  <https://orcid.org/0000-0002-9455-3751>Allyson M Pollock  <https://orcid.org/0000-0002-7388-3110>

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