



Private sector expansion and the widening NHS treatment gap between rich and poor in England: Admissions for NHS-funded elective primary hip and knee replacements between 1997/98 and 2018/19

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ABSTRACT

Parliament has imposed duties on the government and NHS in England aimed at reducing health inequalities. *Aim:* to understand the effect on inequalities of government policies, which require the NHS in England to outsource elective surgery to the private sector.

We analysed the numbers of admissions for hip and knee replacement surgery from the least and most deprived population quintiles in three time periods: before the introduction of the policies (1997/98–2002/03); following the implementation of the independent sector treatment centre programme (2003/04–2006/07); and after the extension of ‘choice at referral’ (2007/08–2018/19).

Results: despite admission rates doubling and trebling for hip and knee replacements, respectively, between 1997/98 and 2018/19, inequality grew to the detriment of the most deprived. Inequality grew at the fastest rate during period 3; admission rates to the NHS fell while admissions to the private sector continued to rise. By 2018/19 almost a third of NHS funded procedures were provided privately.

In 1997/98, for every 10 patients admitted for hip and knee surgery from the most deprived quintile, 13 and 9, respectively were admitted from the least deprived, by 2018/19 the gap had widened to 19 and 15, respectively. Socio-economic inequalities for hip and knee replacement have widened as outsourcing of NHS treatment to the private sector has increased. The NHS must rebuild in-house capacity and provision instead of outsourcing care.

1. Introduction

Reducing health inequalities, and treating NHS patients in private hospitals, have become increasingly important objectives for the NHS in England. Statutory duties aimed at reducing inequalities were imposed on NHS bodies in 2012 and 2022 [See supplementary file: “Statutory duties and powers in relation to reducing inequalities”]. Socio-economic deprivation stands outside the Equality Act 2010’s protected characteristics, but fits within the framework provided by the health inequalities duties [1].

The NHS currently faces a huge challenge with 7.58 million patients waiting as of February 2024 and 3.20 million still waiting after 18 weeks from referral to treatment [2]. At the heart of NHS England’s response to reducing the backlog in elective care is a “fair recovery” which will “embed a focus on health inequalities” particularly on “equity of access, experience and outcomes for the most deprived 20 % of the population” [3]. One of the ways it proposes to respond to the critical lack of NHS

bed and service capacity [4] is to “transfer...high volume and low complexity conditions, as well as some cancer pathways and diagnostics, to the independent sector” [3].

The policy of transferring patients with these conditions to the independent sector began about 20 years ago and was introduced in two phases. The first phase launched the independent sector treatment centre (ISTC) programme with contracts signed in September 2003 and the first patients admitted the following month [5]. The objectives of the ISTC programme were to assist the NHS in reducing waiting times, support the shift from primary to secondary care, expand plurality of provision, promote innovation and contribute towards building relationships between the NHS and the private sector [6]. Whilst treatment centres were originally run by the NHS to separate elective from emergency surgery, thus reducing the risk of cancellation, ISTCs were designed in the same way to operate only on elective patients [6]. They were intended to contribute to the overall aims of the NHS Plan 2000 to increase capacity and deliver choice. Prior to the introduction of ISTCs,

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commissioning had been on a locally negotiated ‘spot purchase’ basis [7]. Contracts were such that the company providing the care was guaranteed payment over five years for each patient referred (whether treated or not) at the agreed minimum referral value of the contract, known as ‘Take or Pay’ [6]. Phase one was to provide up to 171,000 first finished consultant episodes annually for five years at a cost of approximately £1.6 billion [5].

In the second phase, from 01 January 2006, patients were provided with a ‘national menu’ of services provided by an ‘extended choice network’ including NHS foundation trusts, ISTCs and other nationally approved private providers [8,9]. Choice for orthopaedic services was further extended on 01 Jul 2007 followed by other treatments in April 2008 where patients could now choose to be treated by any hospital provider that met NHS standards and costs [10]. All treatments provided were to be paid for by the NHS at a pre-agreed tariff adjusted for market forces depending on the provider’s location. The aims of extending choice were that patients would be able to ‘access shorter waiting times, better quality, or have their treatment closer to family and friends’ [11]. Phase two was to deliver an additional 150,000 procedures a year at an overall cost of £3 billion over 5 years with a further £1 billion for diagnostics [5].

Hip and knee replacements are examples of high volume elective surgical procedures. Since 2003 these have increasingly been performed in ISTCs and other private hospitals [7,12,13]. However, the complexity of cases is affected by the lack of intensive care units in these settings [14]. Studies show that during the period 2006–2016 patients living in the most deprived quintiles of the population of England were more than twice as likely to need a hip replacement than those in the middle quintile of the population, but only four fifths as likely to receive one funded by the NHS [15]. Research in Scotland has shown outsourcing to be associated with a significant fall in in-house NHS provision and increasing inequality in treatment rates for both patients aged 85 years and over and those living in the more socio-economically deprived areas [16]. A study of hip replacements in England between 2003/4 and 2012/3 highlighted how those living in the least deprived areas of England were benefiting most from NHS funded private provision [17]. Patients cite hospital location and availability of transport as being important when making a choice of provider [18] as well as quality of treatment as measured by lower emergency readmission rates [12] and lower mortality rates [19]. In 2002/03, 70 % of patients chose their nearest provider for their hip or knee placement but in 2010/11 only 46 % of patients did [12,20]. Referral management centres and exclusion criteria may also override patient choice decisions and act as drivers for referral to the private sector [21].

The NHS Increasing Capacity Framework 2020 plans to double annual spend on elective activity in private providers to £2.5 billion annually over four years to November 2024 [22,23]. Between May 2020 and April 2022, £2.66 billion of contracts were awarded by NHS England to companies which include CHG Management Services Ltd (formerly Circle, £530.6 million), Spire Healthcare Limited (£528.9 million) and Ramsey Health Care UK Operations Limited (£467.1 million) [24]. Labour policy is to support outsourcing having criticised the UK government for underuse of the private sector to tackle the NHS backlog in May 2023 [25].

The aim of this study is to understand the effect on inequalities of government policy in England to outsource elective surgery to the private sector for hip and knee replacements, as measured by admission to treatment (‘utilisation’) for the most deprived fifth of the population of England between 1997/98 and 2018/19.

2. Materials and methods

2.1. Data

Extracts of secondary care admissions data for NHS-funded elective primary hip and knee replacements were purchased as Hospital Episode

Statistics data from NHS Digital at a cost of £11,964. Data were also obtained for cataract surgery, arthroscopies, inguinal hernias and cholecystectomies, these procedures are not analysed here.

Hip replacements and knee replacements were requested on the basis of OPCS Classification of Interventions and Procedures (4th edition), OPCS-4, and International Statistical Classification of Diseases and Related Health Problems version 10 (ICD-10) codes in line with the guidance of the Scottish Arthroplasty Project [26].

Admissions to private providers were identified as those where provider type (PROTYPE) was set to: IND = Independent sector provider; INDSITE = Independent sector provider site; INDSITETC = Treatment centre at independent sector provider site; INSITE (unclassified); and OTHERPROV = Other provider organization; with all others classified as NHS: CARETRUST = Care trust; FOUNDATION = NHS foundation trust; PCT = Primary care trust; TRUST = NHS trust; and TRUSTSITETC = Treatment centre at NHS trust site.

Exclusion criteria: All admissions were included where the date of admission was between 01 April 1997 and 31 March 2019. Those with missing Lower Super Output Area (LSOA), LSOA2001 were unable to be apportioned a deprivation quintile.

All calculations were by financial year, 01 April to 31 March the following year. Data were analysed using SAS version 9.4 and Excel.

2.2. Measuring deprivation

NHS Digital guidelines were followed which state that for Index of Multiple Deprivation (IMD) measures, researchers should use ‘IMD version 2004 on activity up to and including 2006–07; IMD version 2007 on activity between 2007–08 and 2009–10; IMD version 2010 on activity from 2010–11 and M10 2022–23; IMD version 2019 from M11 2022–23.’ [27]

IMD measures by LSOA2001, for 2004, 2007 and 2010 with populations for 2001, 2005 and 2008, were sourced from the Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government [28] (see supplementary details Table S1). These were used to derive population weighted deprivation measures by quintile for England by LSOA01 with quintile 1 = most deprived and quintile 5 = least deprived. These quintiles provide approximately equal numbers of population in each such that equality implies an equal number of admissions in each quintile for each financial year. As these are population quintilised, such that denominators are the same between quintiles within the limits of the methodology outlined by NHS Digital, we have used numbers in each quintile as a proxy for raw rates. Mid-year populations by LSOA01 from 1997 to 2018 are not available to allow the calculation of rates by deprivation quintile, only mid-year populations by LSOA11 from 2002 to 2020 from the Office for National Statistics (ONS) [29].

2.3. Time frame

The study period, 1997/98 – 2018/19, was split into three periods: period 1 (1997/98 – 2002/03) from the election of the New Labour government on 01 May 1997 until the introduction of ISTCs; period 2: (2003/04 – 2006/07) from the end of period 1 to the further extension of choice at referral for orthopaedics; and period 3: (2007/08 – 2018/19) from the end of period 2 until the final year not impacted by the covid-19 pandemic (supplementary Fig. SF1).

2.4. Measuring admissions and inequality

Admission numbers and rates were calculated for all NHS funded admissions, and for the NHS (in-house) and private providers for all ages, as age at admission data were only available from 2007/08 (and only complete from 2009/10). For denominators, the mid-year population for 1997 was used for financial year 1997/98 and so on. Linear trends in admission rates are shown for each of the three periods.

The absolute difference is the number of admissions in the least deprived quintile of patients minus the number in the most deprived quintile (IMD5 – IMD1) and the relative difference is the number of admissions in the least deprived quintile divided by the number in the most deprived quintile (IMD5 / IMD1) [13,30].

The slope index of inequality (SII) is measured as the trend gradient using simple linear regression between the number of admissions and deprivation categories, ranked in decreasing levels of socio-economic deprivation. The x axis is created such that IMD1 = 0.1, IMD2 = 0.3, ..., IMD5 = 0.9; thus dividing the trend gradient by five gives the inequality in admissions per deprivation category. The SII gives an additional perspective to that available via the absolute and relative difference by taking into account the number of admissions in each of the deprivation quintiles rather than just the most and least deprived quintiles [30].

3. Results

There were 1,243,578 NHS funded elective primary hip replacement admissions between 01 April 1997 and 31 March 2019 with 16,688 (1.3 %) missing LSOA2001 (Table S2). There were 1,056,525 hip replacement admissions to the NHS between 01 April 1997 and 31 March 2019 and 187,023 to private providers between 01 April 2003 and 31 March 2019 (in addition to 30 admissions to private providers in 2002/03).

There were 1,326,991 NHS funded elective primary knee replacement admissions between 01 April 1997 and 31 March 2019 with 14,951 (1.1 %) missing LSOA2001 (Table S5). There were 1,120,289 knee replacement admissions to the NHS between 01 April 1997 and 31 March 2019 and 206,656 to private providers between 01 April 2003 and 31 March 2019 (in addition to 46 admissions to private providers in 2002/03).

4. NHS England funded elective primary hip replacements

4.1. Trends in numbers and rates of admissions, per 100,000 population, to NHS (in-house) and private providers

Over the whole study period, admissions to all providers increased by 142 % from 31,942 to 77,245 amounting to 110 % increase in the overall admission rate from 65.6 to 138.0 (Table 1, Fig. 1).

The overall admission rate increased at the fastest rate in period 1 (1997/98 – 2002/03), 3.74 admissions per 100,000 per year compared with 3.36 and 2.13 admissions per 100,000 per year, respectively for period 2 (2003/04 – 2006/07) and 3 (2007/08 – 2018/19) (Fig. 1). The admission rate to the NHS increased by 33.7 % and 6.6 % during period 1 and 2, respectively and decreased by –10.1 % in period 3. The admission rate to the private sector increased by 480 % and 375 %, respectively for period 2 and 3.

4.2. Trends in numbers of admissions to NHS (in-house) and private providers for most and least deprived socio-economic quintile

Admissions to all providers increased in IMD1 and IMD5 by 99.9 % from 4774 to 9541 and by 191 % from 6226 to 18,088, respectively over the whole period (Table S2). In period 1, admissions in IMD1 and IMD 5 increased by 35.5 % from 4774 to 6468 and by 43.1 % from 6226 to 8911, respectively. In period 2 and period 3 admissions between IMD1 and IMD5 widened markedly; in period 2, they increased by 4.5 % from 6802 to 7110 and by 20.5 % from 9790 to 11,793, respectively; and in period 3, they increased by 18.3 % from 8064 to 9541 and 40.2 % from 12,903 to 18,088, respectively (Table S2).

In period 1, inequality grew in the NHS where admissions in IMD1 and IMD5, respectively increased by 35.4 % from 4774 to 6465 and by 43.0 % from 6226 to 8903 (Table S3).

In period 2, inequality grew in the NHS where admissions in IMD1 and IMD5, respectively increased by 1.6 % from 6766 to 6874 and by 15.6 % from 9689 to 11,201 (Table S3). Admissions to private providers increased by 556 % from 36 to 236 and by 486 % from 101 to 592 (Table S4).

In period 3 the widening gap in admissions between IMD1 and IMD 5 was driven by admissions to the private sector and a fall in admissions to the NHS. Admissions to the NHS in IMD1 and IMD5 decreased by –0.7 % from 7544 to 7494 and by –1.9 % from 11,856 to 11,632, respectively (Table S3), while admissions to private providers increased by 294 % from 520 to 2047 and by 517 % from 1047 to 6456, respectively (Table S4).

Table 1

NHS England Funded Elective Primary Hip Replacement Number of Admissions and Admission Rates for the NHS and Private Providers by Financial Year 01 April 1997 to 31 March 2019.

Financial Year of Admission	Population (all ages)	Number of Admissions			Admission Rate per 100,000 population		
		NHS	Private Providers	All Providers	NHS	Private Providers	All Providers
1997/98	48,664,800	31,942 (100 %)	(0 %)	31,942	65.6		65.6
1998/99	48,820,600	35,271 (100 %)	(0 %)	35,271	72.2		72.2
1999/00	49,032,900	35,722 (100 %)	(0 %)	35,722	72.9		72.9
2000/01	49,233,300	37,200 (100 %)	(0 %)	37,200	75.6		75.6
2001/02	49,449,746	38,583 (100 %)	(0 %)	38,583	78.0		78.0
2002/03	49,679,267	43,585 (99.9 %)	30 (0.1 %)	43,615	87.7	0.1	87.8
2003/04	49,925,517	46,988 (99.2 %)	395 (0.8 %)	47,383	94.1	0.8	94.9
2004/05	50,194,600	46,465 (97.4 %)	1262 (2.6 %)	47,727	92.6	2.5	95.1
2005/06	50,606,034	48,577 (97.4 %)	1312 (2.6 %)	49,889	96.0	2.6	98.6
2006/07	50,965,186	51,140 (95.6 %)	2337 (4.4 %)	53,477	100.3	4.6	104.9
2007/08	51,381,093	54,863 (92.3 %)	4552 (7.7 %)	59,415	106.8	8.9	115.6
2008/09	51,815,853	54,279 (88.6 %)	6984 (11.4 %)	61,263	104.8	13.5	118.2
2009/10	52,196,381	53,039 (87.3 %)	7706 (12.7 %)	60,745	101.6	14.8	116.4
2010/11	52,642,452	52,641 (81.7 %)	11,812 (18.3 %)	64,453	100.0	22.4	122.4
2011/12	53,107,169	53,579 (80.4 %)	13,061 (19.6 %)	66,640	100.9	24.6	125.5
2012/13	53,493,729	52,156 (78.9 %)	13,931 (21.1 %)	66,087	97.5	26.0	123.5
2013/14	53,865,817	54,586 (76.8 %)	16,452 (23.2 %)	71,038	101.3	30.5	131.9
2014/15	54,316,618	55,049 (74.9 %)	18,408 (25.1 %)	73,457	101.3	33.9	135.2
2015/16	54,786,327	53,036 (72.7 %)	19,869 (27.3 %)	72,905	96.8	36.3	133.1
2016/17	55,268,067	53,969 (70.5 %)	22,532 (29.5 %)	76,501	97.6	40.8	138.4
2017/18	55,619,430	50,148 (68.7 %)	22,872 (31.3 %)	73,020	90.2	41.1	131.3
2018/19	55,977,178	53,707 (69.5 %)	23,538 (30.5 %)	77,245	95.9	42.0	138.0

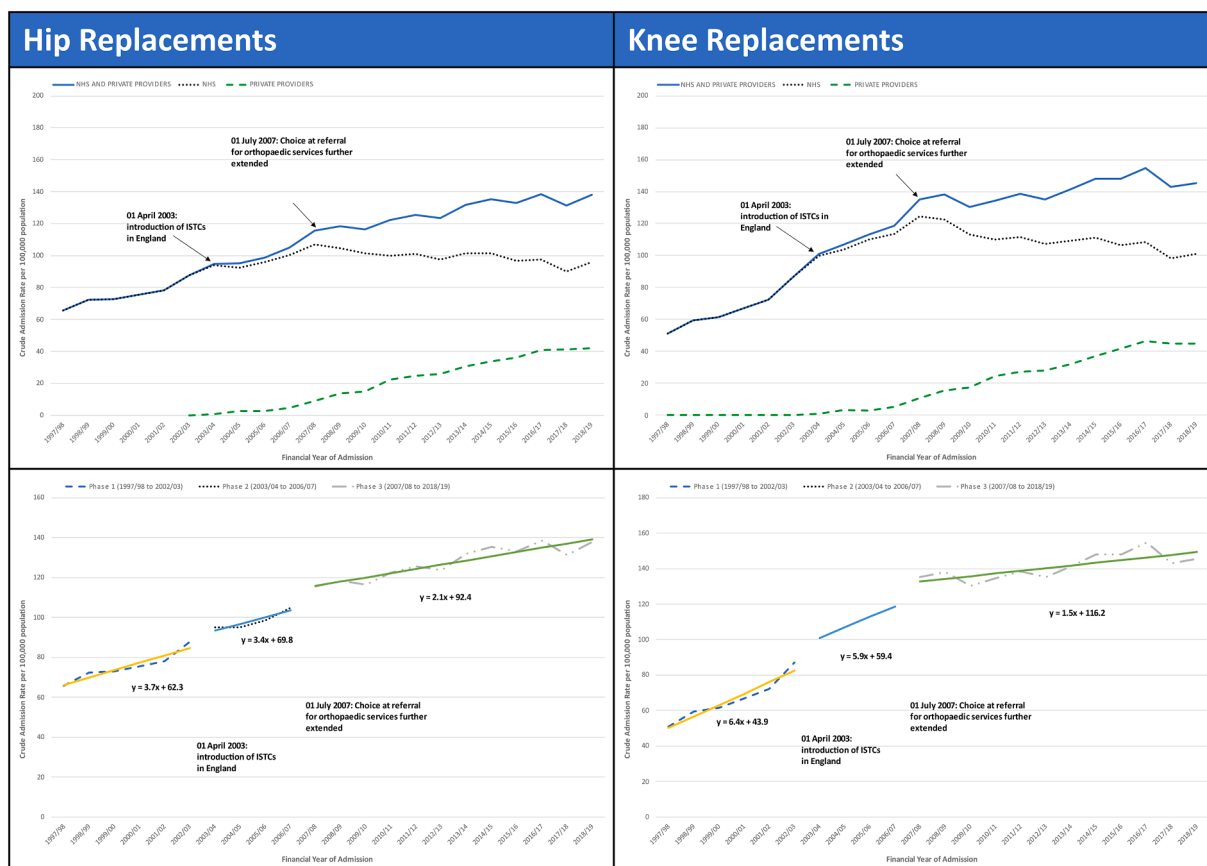


Fig. 1. NHS England Funded Elective Primary Hip and Knee Replacement Admission Rates (all ages) per 100,000 population by Financial Year, Direct NHS Provision and Private Providers, and Trends by Period for All Providers 01 April 1997 to 31 March 2019.

4.3. Inequalities in numbers of admissions to NHS (in-house) and private providers between most and least deprived socio-economic quintiles

Over the whole study period the absolute difference in number of admissions to all providers between IMD5 and IMD1, respectively increased from 1452 to 8547 (Table S2, Fig. 2a) and to the NHS from 1452 to 4138 (Table S3, Fig. 2a). For private providers it increased from 65 in 2003/04 to 4409 in 2018/19 (Table S4, Fig. 2a).

Over the whole study period the relative difference in number of admissions to all providers between IMD5 and IMD1, respectively increased from 1.30 to 1.90 (Table S2, Fig. 2b). To the NHS alone the relative difference increased from 1.30 to 1.55 over the whole study period (Table S3, Fig. 2b) while for private providers it fluctuated, decreasing from 2.81 in 2003/04 to 2.51 in 2006/07 before increasing to 3.15 in 2018/19 (Table S4, Fig. 2b).

Table S2 and Fig. 2d show the trend gradients for the slope index of inequality (SII) for all providers increased sharply from 2143 to 11,494 at a rate of increase of 519 per year over the whole study period (a rate of increase of inequality equivalent to 104 admissions per deprivation category per year).

During period 1 when all admissions were going to the NHS, the SII trend gradient increased at a rate of increase of 222 per year (Table S8, Fig. SF2). During period 2 the SII trend gradient for all providers increased at 711 per year (Table S8, Fig. SF2), for the NHS at 442 per year and for the private sector at 164 per year (Table S9, Fig. SF3). In period 3 when admissions to the NHS were falling, the sharp increase in inequality was driven by the private sector alone. The SII trend gradient for all providers increased at a rate of 478 (Table S8, Fig. SF2) while in the NHS it decreased at a rate of -34 per year while it increased in the private sector at 481 per year (Table S9, Fig. SF3).

The strong correlation between the SII and absolute ($p = 0.9997$) and

relative ($p = 0.9917$) differences for all providers is due to the inverse relationship between deprivation and number of admissions.

5. NHS England funded elective primary knee replacements

5.1. Trends in numbers and rates of admissions, per 100,000 population, to NHS (in-house) and private providers

Over the whole study period, admissions to all providers increased by 228 % from 24,849 to 81,431 amounting to 185 % increase in the overall admission rate from 51.1 to 145.5 (Table 2, Fig. 1).

The overall admission rate increased at the fastest rate in period 1 (1997/98 – 2002/03), 6.39 admissions per 100,000 per year compared with 5.93 and 1.50 admissions per 100,000 per year, respectively for period 2 (2003/04 – 2006/07) and 3 (2007/08 – 2018/19) (Fig. 1). The admission rate to the NHS increased by 70.2 % and 13.7 % during periods 1 and 2, respectively and decreased by -19.1 % in period 3. The admission rate to the private sector increased by 400 % and 319 %, respectively for period 2 and 3.

5.2. Trends in numbers of admissions to NHS (in-house) and private providers for most and least deprived socio-economic quintile

Admissions to all providers increased in IMD1 and IMD5 by 162 % from 4478 to 11,715 and by 320 % from 4176 to 17,536, respectively over the whole period (Table S5). In period 1, admissions in IMD1 and IMD 5 increased by 58.7 % from 4478 to 7107 and by 101.0 % from 4176 to 8395, respectively. In period 2 and period 3 admissions between IMD 1 and IMD5 widened markedly; in period 2, they increased by 17.0 % from 8021 to 9383 and by 24.2 % from 9862 to 12,253, respectively; and in period 3, they increased by 6.7 % from 10,975 to 11,715 and 26.9

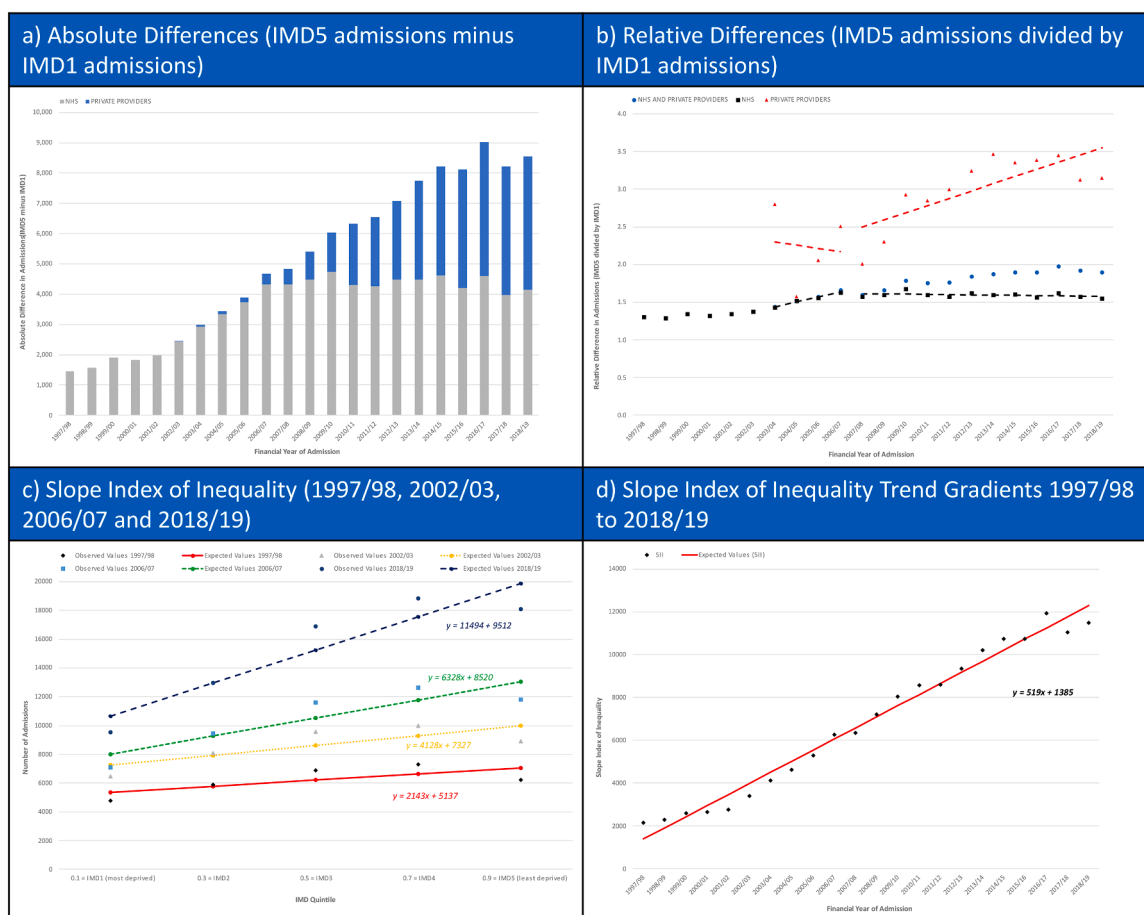


Fig. 2. NHS England Funded Elective Primary Hip Replacement Admissions, Absolute and Relative Difference in Admissions between Index of Multiple Deprivation Quintiles IMD5 (least deprived) and IMD1 (most deprived) and Slope Index of Inequality by Financial Year 01 April 1997 to 31 March 2019.

Table 2

NHS England Funded Elective Primary Knee Replacement Number of Admissions and Admission Rates for the NHS and Private Providers by Financial Year 01 April 1997 to 31 March 2019.

Financial Year of Admission	Population (all ages)	Number of Admissions			Admission Rate per 100,000 population		
		NHS	Private Providers	All Providers	NHS	Private Providers	All Providers
1997/98	48,664,800	24,849 (100 %)	(0 %)	24,849	51.1	0.0	51.1
1998/99	48,820,600	28,946 (100 %)	(0 %)	28,946	59.3	0.0	59.3
1999/00	49,032,900	30,129 (100 %)	(0 %)	30,129	61.4	0.0	61.4
2000/01	49,233,300	32,897 (100 %)	(0 %)	32,897	66.8	0.0	66.8
2001/02	49,449,746	35,717 (100 %)	(0 %)	35,717	72.2	0.0	72.2
2002/03	49,679,267	46 (0.1 %)	46 (0.1 %)	43,210	86.9	0.1	87.0
2003/04	49,925,517	49,826 (99 %)	504 (1 %)	50,330	99.8	1.0	100.8
2004/05	50,194,600	51,989 (97 %)	1626 (3 %)	53,615	103.6	3.2	106.8
2005/06	50,606,034	55,689 (97.3 %)	1518 (2.7 %)	57,207	110.0	3.0	113.0
2006/07	50,965,186	57,829 (95.7 %)	2573 (4.3 %)	60,402	113.5	5.0	118.5
2007/08	51,381,093	63,971 (92.1 %)	5480 (7.9 %)	69,451	124.5	10.7	135.2
2008/09	51,815,853	63,532 (88.7 %)	8065 (11.3 %)	71,597	122.6	15.6	138.2
2009/10	52,196,381	59,050 (86.8 %)	8981 (13.2 %)	68,031	113.1	17.2	130.3
2010/11	52,642,452	57,838 (81.8 %)	12,899 (18.2 %)	70,737	109.9	24.5	134.4
2011/12	53,107,169	59,156 (80.5 %)	14,366 (19.5 %)	73,522	111.4	27.1	138.4
2012/13	53,493,729	57,354 (79.3 %)	14,932 (20.7 %)	72,286	107.2	27.9	135.1
2013/14	53,865,817	58,869 (77.3 %)	17,262 (22.7 %)	76,131	109.3	32.0	141.3
2014/15	54,316,618	60,332 (75.1 %)	20,021 (24.9 %)	80,353	111.1	36.9	147.9
2015/16	54,786,327	58,254 (71.8 %)	22,891 (28.2 %)	81,145	106.3	41.8	148.1
2016/17	55,268,067	59,899 (70 %)	25,642 (30 %)	85,541	108.4	46.4	154.8
2017/18	55,619,430	54,589 (68.7 %)	24,875 (31.3 %)	79,464	98.1	44.7	142.9
2018/19	55,977,178	56,410 (69.3 %)	25,021 (30.7 %)	81,431	100.8	44.7	145.5

% from 13,821 to 17,536, respectively (Table S5).

In period 1, inequality grew in the NHS where admissions in IMD1 and IMD5, respectively increased by 58.6 % from 4478 to 7102 and by

100.8 % from 4176 to 8385 (Table S6).

In period 2, inequality grew in the NHS where admissions in IMD1 and IMD5, respectively increased by 13.7 % from 7975 to 9070 and by

19.3 % from 9734 to 11,615 (Table S6). Admissions to private providers increased by 580 % from 46 to 313 and by 398 % from 128 to 638 (Table S7).

In period 3 the widening gap in admissions between IMD1 and IMD5 was driven by admissions to the private sector and a fall in admissions to the NHS. Admissions to the NHS in IMD1 and IMD5 decreased by -10.8 % from 10,199 to 9093 and by -12.4 % from 12,755 to 11,177, respectively (Table S6), while admissions to private providers increased by 238 % from 776 to 2622 and by 496 % from 1066 to 6359, respectively (Table S7).

5.3. Inequalities in numbers of admissions to NHS (in-house) and private providers between most and least deprived socio-economic quintiles

Over the whole study period the absolute difference in number of admissions to all providers between IMD5 and IMD1, respectively increased from -302 to 5821 (Table S5, Fig. SF4a) and to the NHS from -302 to 2084 (Table S6, Fig. SF4a). For private providers it increased from 82 in 2003/04 to 3737 in 2018/19 (Table S7, Fig. SF4a).

Over the whole study period the relative difference in number of admissions to all providers between IMD5 and IMD1, respectively increased from 0.93 to 1.50 (Table S5, Fig. SF4b). To the NHS alone the relative difference increased from 0.93 to 1.23 over the whole study period (Table S6, Fig. SF4b) while for private providers it fluctuated, decreasing from 2.78 in 2003/04 to 2.04 in 2006/07 before increasing to 2.43 in 2018/19 (Table S7, Fig. SF4b).

Table S5 and Fig. SF4d shows the trend gradients for the slope index of inequality (SII) for all providers increased sharply from -292 to 7916 at a rate of increase of 397 per year over the whole study period (a rate of increase of inequality equivalent to 79 admissions per deprivation category per year).

During period 1 when all admissions were going to the NHS, the SII trend gradient increased at a rate of increase of 380 per year (Table S9, Fig. SF2). During period 2 the SII trend gradient for all providers increased at 457 per year (Table S9, Fig. SF2), for the NHS at 293 per year and for the private sector at 111 per year (Table S9, Fig. SF3). In period 3 when admissions to the NHS were falling, the sharp increase in inequality was driven mainly by the private sector. The SII trend gradient for all providers increased at a rate of 436 (Table S9, Fig. SF2) while in the NHS it increased at 51 per year while it increased in the private sector at 418 per year (Table S9, Fig. SF3).

The strong correlation between the SII and absolute ($p = 0.9991$) and relative ($p = 0.9756$) differences for all providers is due to the inverse relationship between deprivation and number of admissions.

6. Discussion

A widening treatment gap between the most and least deprived 20 % of the population in England occurred over the two decades to 2018/19 whilst hip and knee replacement rates doubled and trebled, respectively. In 2018/19, for every ten patients admitted for hip and knee surgery from the most deprived quintile, 19 and 15 were admitted from the least deprived, respectively, compared with 13 and 9 in 1997/98. Inequality increased in each of the three periods, accelerated from 2003/04 (period 2), and increased fastest between 2007/08 and 2018/19 (period 3) in the private sector when admissions to the NHS were falling.

Inequality in admissions for hip surgery in England has been documented previously between 2001/02 and 2008/09 [13]. Our findings of increasing use of the private sector resulting in a pro-rich bias confirm earlier research findings of the least deprived patients having a substantially higher level of use of private providers between 2003/04 and 2012/13 and benefiting most from increasing private provision [17]. They also mirror findings from Scotland where outsourcing NHS funded hip replacements was associated with increasing age and socio-economic inequalities [16].

These inequalities are unlikely to be occurring before, or at the

earlier parts of, the patient pathway. Socio-economic deprivation does not appear to influence willingness of patients to undergo treatment. A survey of 3307 people in Ontario, Canada, published in 2002, found that people with lower socio-economic status measured using income and education, had a greater need for hip and knee replacement but were equally willing to undergo an operation as those with higher socio-economic status [31]. The Midlands Decision Support Network (MDSN) using data from 2018/19 and 2019/20 has shown inequalities are not due to patient referrals from GPs and physiotherapists, rather they are occurring when decisions to treat are made following the first outpatients' appointment [32].

The reasons for the overall increase in inequality in period 1, when the NHS was the sole provider, are unclear. Following its election in 1997, the Labour government introduced a policy of "War on Waiting" aimed at reducing the number of people waiting rather than reducing the time of waiting [33]. Given the initial constraint on public spending allocations, NHS hospitals may have been incentivised to admit "easier" patients, i.e. those with fewer comorbidities from less deprived areas. Together with the abolition of personal and employee tax relief for private medical insurance in 1997, this may have resulted in some patients in less deprived quintiles switching from private funding to the NHS [34,35].

It is government policy that the private sector treat high volume, low complexity cases [3]. Thus locally negotiated ISTC contracts where ITU facilities are not available exclude patients with multiple complex clinical conditions who may be at risk of requiring ITU, in addition to those with social issues such as lack of support on discharge [7]. It is likely that the extended choice network of providers excludes patients on similar grounds. Given the higher levels of comorbidities and general ill health among the most deprived sections of the population these decisions will impact directly on socio-economic inequality. Mason et al. found that patients treated by NHS hospitals were more likely to come from deprived areas than those treated by treatment centres [7].

One of the claims made by government is that the use of the private sector increases NHS capacity. While admission rates continued to increase after private sector contracts were introduced, the rates increased more during period 1 (1997/98 to 2002/03) when the NHS was the sole provider, slowed in period 2 (despite major increases in overall levels of health spending) and fell further in period 3. Since 2007/08 there has been a decrease in hip and knee admission rates to the NHS such that the private sector is now substituting for the NHS. A Scottish study also showed the private sector substituting for NHS hip replacement provision [16].

The private sector has now overtaken the NHS as the main provider of hip and knee replacement for all sources of funding, NHS and private [36]. The finding that after 2007, inequalities were driven by the private sector suggests that the policy of outsourcing NHS care and expanding the number of private providers operates in favour of the rich to the detriment of the poor. It is also resulting in substitution. NHS England's policy of continued and increased transfer of patients needing hip and knee replacements to the private sector conflicts with its objective to reduce inequalities in access to these procedures for the most deprived 20 % of the population and makes it extremely difficult, if not impossible, to achieve.

7. Limitations

This study has some limitations. Numbers of admissions are used as a proxy for rates by socio-economic deprivation quintile. Given, that the population in each of the quintiles is approximately the same these numbers should be as interpretable as rates. It was not possible to undertake age and sex adjustment due to the unavailability of age at admission until 2007/08 (data are only complete from 2009/10), nor was it possible to adjust for need. There is evidence that the population of the least deprived quintiles were ageing over time compared with the most deprived quintiles. However, research has shown that in England

the need for hip and knee replacement is over four and over five times greater, respectively in the most deprived quintile than the least deprived quintile for people aged between 50 and 69 years of age with no evidence of a deprivation effect for those aged 80 years and over [37].

Recording of private providers separate from the NHS only began in April 2003. We analysed by financial year so period 3 (2007/08 to 2018/19) will contain data for the three months prior to the extension of choice to orthopaedic services on 01 July 2007 [10]. Data on privately funded patients are not available and if included would increase the inequalities observed here.

8. Conclusions

Julian Tudor Hart's inverse care law states that the "availability of good medical care tends to vary inversely with the need for it in the population served" and "operates more completely where medical care is most exposed to market forces, and less so where such exposure is reduced." [38]. The study's findings support this and highlight the need for NHS England to revisit its policy of further outsourcing elective hip and knee replacements in the context of its inequality duties, and to rebuild in-house provision and capacity. Where contracts for these procedures have already been awarded or sub-contracted to the private sector, ICBs, NHS trusts and foundation trusts should assess, monitor and publish the impact of the contracts on admission inequalities.

Data sharing

The datasets used for this study were made available to the researchers under strict licence from NHS Digital England and are not permitted to be made publicly available.

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CRediT authorship contribution statement

Graham Kirkwood: Writing – review & editing, Writing – original draft, Validation, Software, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Allyson M Pollock:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Conceptualization. **Peter Roderick:** Writing – review & editing, Writing – original draft.

Declaration of competing interest

None.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.healthpol.2024.105118](https://doi.org/10.1016/j.healthpol.2024.105118).

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