Divided by Choice? Private Providers, Patient Choice and Hospital Sorting in the English National Health Service*

[PRELIMINARY - PLEASE DO NOT CITE]

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Abstract

A common reform used to increase consumer choice and competition in public services has been to allow private providers to compete with publicly run incumbents. However, there remains a concern that not all consumers are able to equally benefit from choice. We study mechanisms of patient sorting between private and public providers of publicly funded elective medical procedures, using recent reforms to the English National Health Service (NHS). We show that differential health care services usage is not only driven by local hospital provision and patients' underlying health, but also by patients' socio-demographic characteristics and the advice given by general practitioners in the choice process. Simulations suggest that up to half of the difference in the use of private providers by patient income and ethnicity could be eliminated if all patients were given the choices offered by general practitioners in their area who refer the most widely.

JEL classification: I11, I18, L1, L44, D12

Keywords: hospital choice, demand for healthcare, preference heterogeneity, inequality

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1 Introduction

Recent reforms in many countries have sought to increase the role of consumer choice in public services such as education and health care. At a time when government finances are severely constrained, choice is viewed as a mechanism for driving competition between providers and thereby, in a system with fixed prices, delivering improvements in quality and efficiency. One type of reform employed to promote choice has been to increase the options available to consumers by allowing entry from private sector or not-for-profit providers [Besley and Ghatak, 2003, Blöchliger, 2008, Hoxby, 2003]. Examples include Charter schools in the US and Sweden [Asth et al., 2013, Böhlmark and Lindahl, 2015, Ladd, 2002] and the recent free school programme in England[1]; and publicly funded health care systems, like the English National Health Service (NHS) studied in this paper[2].

Policies to increase choice have proved controversial, however, because of concerns that not all consumers are equally able to exercise choice. Unequal engagement in choice may prove problematic in a publicly funded system when some types of providers deliver higher quality of service and only benefit those who get to choose them. And it may defeat the objective of enhancing competitive constraints, to the extent that it insulates providers from competitive pressure that is otherwise induced by the threat of their users switching to competitors.

This paper examines how patients sort across hospitals following reforms to the NHS in England, which increased choice by allowing privately-owned hospitals, or Independent Sector Providers (ISPs), to enter the market for publicly funded health care. Private providers have shorter waiting times, higher patient satisfaction and arguably higher clinical quality[3]. We address two primary research questions. First, are certain types of patients less likely to choose a privately owned hospital? Second, are there frictions that diminish the access of certain patient groups to the new providers and the potential competitive pressure that private providers could exert on public providers for them to improve their performance? Specifically, we ask whether sorting is driven by differences in patient need or variation in local hospital provision, or influenced by frictions in the market, such as the referral practices of general practitioners (GPs, primary care doctors).

We estimate a mixed multinomial logit (MMNL) model of hospital choice, where patients are able to choose from a set of both, public NHS and privately owned hospitals. The model

[1] See, for example, the introduction of education vouchers and charter schools in the US and Sweden, and **?** for discussion of the introduction of private providers in England.

[2] In the US system, except for the elderly and those on social benefits, provision is provided by private managed care organizations, comprising health insurance and health care delivery. In that system, the "public option", blocked by Congress in 2010, was intended as a constraint on the private market place.

[3] See, for example, [NHS Partners Network, 2015].

is estimated using NHS administrative records data on elective hip replacement procedures for the year 2012/13. Hip replacements are well suited to address our question, as the procedure is conducted in large volumes and ISPs have gained a substantial presence in the market, treating 20% of patients and accounting for 38% of hospitals that treated publicly funded patients in 2012/13.

We begin by providing descriptive evidence on the sorting present in our sample. We show that patients who choose ISPs are richer, healthier, and less likely to belong to an ethnic minority than public hospital patients[4]. It is these patterns that we seek to understand using the model.

We then estimate mixed logit models of hospital choice using different assumptions on the composition of choice sets that patients get to consider when making their choice.

The first and more standard approach allows patients to choose between their nearest 10 hospitals, which we term the "distance choice set". Consistent with the findings in the hospital choice literature [Beckert et al., 2012, Capps et al., 2003, Gaynor et al., 2016, Ho, 2006], the model estimates show that distance, waiting times and quality emerge as significant determinants of choice. The observable patterns of heterogeneity present in our descriptive evidence remain, with poorer, less healthy and ethnic minority patients less likely to choose an ISP. Controlling for local access and patient health, our estimates suggest that patients in the most deprived areas are up to 25 per cent less likely to choose ISPs than those from the least deprived areas. Our parameter estimates also highlight the strong influence of the prior referral patterns of the patient's GP on patient choice. Patients registered with GPs with more concentrated patterns of prior referrals are less likely to choose an ISP, more sensitive to distance, and less sensitive to quality. Alongside the observable heterogeneity, we also identify significant unobserved heterogeneity across patients with regard to their sensitivity to distance and their preferences for ISPs, relative to NHS hospitals. Perhaps surprisingly, however, there does not appear to be any significant unobserved heterogeneity in terms of valuation of hospital quality attributes.

We also explore a second approach where we redefine patient choice sets based on the prior referrals of their GP's. Restricting the choice set in this way both reflects the role the GP plays as a gatekeeper to secondary care within the NHS system, and the finding in the standard model that GP referrals have an important affect on hospitals that patients choose. The "GP choice sets" we construct using referral data exhibit a large variation in the number and composition of included hospitals. We provide evidence that this choice set formation is in part governed by market frictions, such as administrative boundaries and ISP contract

[4] This is consistent with existing descriptive evidence from the first ISPs that opened in the mid 2000s [Bardsley and Dixon, 2011, Chard et al., 2011]

types, with hospital quality and GP patient characteristics playing only a very limited role.

Our qualitative findings from the estimated model are the same with regard to drivers of patient choice. Conditional on GP choice sets, sorting by patient income is eliminated and sorting by ethnic minority status is reduced. There are no changes in sorting with respect to underlying health. Comparing these findings with those of the standard 'distance choice set' specification, leads us to conclude that the sorting effects are strongly influenced by the choice set that GPs are likely to present to their patients.

Finally, we use our estimates from the model based on GP choice sets to simulate counterfactual choices under two scenarios: (patient focussed) patients are re-assigned to local GPs that are prone to including ISPs; and (GP focussed) patients' current GPs are forced to include the same number of ISPs as the most inclusive local GP. Our simulations show that up to half of the difference in ISP use - and hence of the forgone welfare gains, e.g. with regard to waiting time - by local deprivation and ethnicity could be eliminated in the GP focussed scenario; the effect under the patient focussed scenario is only slightly more muted. These results are important for policy makers: While the GP focussed scenario is predicted to be more effective, it may be less easy to implement, given the constraints GPs operate under[5]; and therefore the second-best, patient focussed strategy may be an attractive, more feasible alternative policy option.

Our work contributes to several existing literatures. First, we add to the hospital choice literature [Beckert et al., 2012, Capps et al., 2003, Gaynor et al., 2012, Ho, 2006, Kessler and McClellan, 2000]. We build on the existing literature in two respects. First, our focus is on how patients sort across hospitals, and on the distribution of welfare changes, rather than on aggregate changes. Second, we incorporate the introduction of private providers, which are not included in other models of hospital choice in England [Gaynor et al., 2016][6].

Our results provide two important insights relevant to this literature. First, differences in the use of ISP by ethnic minorities and income are only partially explained by patient health and the characteristics of local hospitals. Such sorting indicates that responses to reforms or changes in market structure may have heterogeneous impacts upon patients, on welfare and on competition. Second, there are restrictions on choice that arise from frictions in the market and therefore distort consumer welfare and limit competition[7].

[5]For example, The Telegraph, 27 October 2016; the article quotes physicians' concerns about the extra time cost per patient required by discussing their choice options in more detail.

[6]Gaynor et al. [2016] consider CABG surgery and this is not a market where ISPs operate.

[7]While our study focusses on the choices made by patients, given the institutional, socio-demographic and choice protocol setting they find themselves in, we note that an emerging literature is concerned with structurally modelling choice protocols in which choice sets are restricted or heterogeneous, often in ways that are only partially observed by the econometrician. In the area of choices in health care, see for example Beckert [2015] and Gaynor et al. [2016].

In many countries with publicly funded health systems, the existence and source of inequalities in access to health services, are an subject of public and political concern. For example, in England, the NHS and supporting bodies have statutory duties to address inequalities in health under the Health and Social Care Act (2012). Understanding the mechanisms that drive inequalities is therefore vital for policy design. This includes strategies for the implementation of competition policy, to the extent that unequal engagement in choice induces impediments to switching and thereby shields providers from competitive pressure, resulting in diminished incentives to improve quality, efficiency and value for money.

Beyond healthcare, we contribute to the literature that considers the relationship between choice and sorting in other services, such as school choice [Altonji et al., 2015, Böhlmark et al., 2016, Burgess et al., 2015, Edmark et al., 2014, Hastings and Weinstein, 2008, Hastings et al., 2010, Urquiola, 2005]. As in health care, reforms to increase school choice have included offering parents more formal choice, providing information on school quality to aid choice [Hastings and Weinstein, 2008], and introducing charter schools and school vouchers in countries such as the US, Norway and Sweden [Ladd, 2002]. The choice of school does differ from the choice of hospital in a number of respects, including the period covered by choice - years for schooling verses a limited course of treatments at a hospital. However, our results do show that inequalities in use of new providers does exist even when controlling for the characteristics of consumers and providers, and that information frictions and the choices consumers are presented with may explain some of the observed patterns of consumer choices.

Finally, we add to the extensive literature on socioeconomic inequalities in health care utilisation. In general, this literature finds pro-poor inequalities in the use of primary care and community health services and pro-rich inequalities in the use of hospital care [Cookson et al., 2012, Doorslaer et al., 2004, Morris et al., 2005, O'Donnell and Propper, 1991]. However, the extent and the direction of these inequalities typically vary by country, year and condition and are hard to generalize[8]. The literature on variation in the *quality* and *types* of care received by different types of patients is smaller, but typically shows that treatment is on average less intensive and of a lower quality for disadvantaged socioeconomic and racial minority groups [Fiscella et al., 2000, Moscelli et al., 2015].

The rest of the paper is organized as follows. Section 2 provides some background on the NHS and the relevant policy reforms. Section 3 describes the data. Section 4 outlines the model and empirical strategy. And Section 5 presents the results and a discussion of their

[8]For example, Cookson et al. [2012] find no change in the inequality in the provision of hip replacements between 2001 and 2008 in England, but Kelly and Stoye [2016] find uneven growth in the number of hip replacements by local area deprivation from 2002 to 2011, largely explained by changes between 2008 and 2011.

robustness. Section 6 provides counterfactual simulations. And Section 7 concludes.

2 Background

2.1 NHS Policy Reforms and Patient Choice

The majority of health care in England is provided through the taxpayer funded National Health Service (NHS), free at the point of use. In this paper, we study the market for NHS funded elective secondary care.

On the demand side, patients access secondary care via a referral from their primary care doctor or General Practitioner (GP), and hospital consultants then decide whether the patient requires surgery. GPs act as "gatekeepers" to hospital-based or secondary care. They decide whether patients require further treatments and make referrals to a specific hospital. GPs therefore act both as agents for their patients while also helping to control demand for elective hospital care. Since the "patient choice" reforms of 2006 and 2008, GPs have been required to offer patients a choice of hospital when making a referral[9]. GPs may influence where patients are treated either by pre-selecting the options that are presented to patients to choose from, or by directly providing advice. The role of GPs in determining how patients sort across hospitals is returned to in more detail in Sections 3 and 4.

On the supply side, NHS funded hospital care has historically been delivered by state owned and run NHS Acute Trusts, or hospitals[10]. This paper focuses on a set of reforms introduced alongside the patient choice reforms that further extended choice by increasing the number of providers or hospitals available to NHS funded patients. The NHS had purchased small volumes of care from private sector on an ad hoc basis for many years, but two waves of reforms introduced between 2003 and 2008 formalized and greatly increased the access of private providers to markets for NHS funded care.[11]

During the period we study, both GPs and hospitals received NHS payments through 152 "Primary Care Trusts" (PCTs). These PCTs were publicly funded bodies who had the responsibility of paying for the healthcare of all patients living within their designated geographic area [12]. Payments to GPs are based on a capitation fee, plus a payment for

[9]These reforms were motivated by both, the belief that patients valued the choice over their care, and evidence that health care competition when prices were fixed could improve quality [Gaynor, 2006]. A series of work has found that this reform led to improvements in quality [Cooper et al., 2011, Gaynor et al., 2012].

[10]A NHS Acute Trust may be comprised of a single hospital or multiple hospitals within the same geographic area.

[11]For hip replacements there also exists a small private pay sector, which accounted for a fifth of hip replacements in 2002 [Arora et al., 2013]; it is excluded from all analyses in this paper.

[12]These organisations were established in 2002 to deliver a purchaser-provider split necessary to sustain a market for healthcare.

performance supplement. The payments received by GPs are not dependent on referrals. Hospitals receive payments based on activity, on a per patient per treatment basis at rates which were fixed at a national level.[13].

The ISPs reforms that form the context for this study were introduced in several stages, and track changing priorities of NHS reforms over the 2000s. Understanding the motivation behind these reforms and the contracts offered to providers is important for understanding the incentives GPs have to promote ISPs and the profile of patients that ISPs treat.

The reforms introduced three types of ISPs across two waves. The characteristics of each are summarized in Table 1. The first wave of the reforms introduced Wave 1 Independent Sector Treatment Centres (ISTCs). These ISTCs began to open in 2003, and were privately owned providers under contract to provide diagnostic tests and elective procedures only to NHS patients. The contracts were awarded to help address local capacity constraints and meet waiting time targets. ISTCs were typically newly created health care facilities, often located on existing private or NHS hospital sites. The intention was that ISTCs would treat routine patients, allowing NHS trusts to focus on emergencies and patients with more complex needs. As expected, this meant patients treated by ISTCs were on average younger and richer than those treated by NHS providers [Bardsley and Dixon, 2011, Chard et al., 2011]. These ISTCs were contracted for a certain number of procedures to the NHS, and providers were paid irrespective of whether the procedures were carried out. PCTs therefore had an incentive to encourage GPs to refer to these providers. The last of these contracts expired in 2011, after which payment reverted to the same per patient payments as NHS hospitals.

A second wave of reforms was launched in 2006, with objectives expanding to include increasing competition for NHS providers and fostering innovation [Naylor and Gregory, 2009], reflecting the shift in policy focus towards using choice to drive increases in competition and quality. During this second wave, there were some additional Wave 2 ISTCs, but most new ISPs were existing private hospitals, which treated NHS and private patients alongside each other. Both Wave 2 ISTCs and private hospitals were paid on a per procedure basis similar to the payments for NHS providers [14]. As with Wave 1 ISTCs, there were restrictions on who was able to use ISPs based on underlying health. However, as most ISPs in the second wave were existing private hospitals, most were located in richer areas than NHS hospital

[13]So called “Payment by Results” was phased in after 2005/06. Hospital care is grouped into Healthcare Resource Groups (HRGs), which are similar to Diagnostic Resource Groups in the US. Prices or Tariffs are then set at a national level based on the average cost of providing the associated care.

[14]Wave 2 ISTCs were not guaranteed the full contracted value, as in Wave 1 (they were not paid for procedures that did not take place) but were guaranteed a payment to cover their fixed costs [Naylor and Gregory, 2009]

or ISTCs, and therefore served populations that are relatively advantaged. For GPs, the incentives to refer to the second wave of ISPs were much weaker, as ISPs only received payments for procedures that took place.

Figure 1 shows how ISPs spread across England between 2006/7 and 2012/13. In 2006/7 there were just 9 ISPs conducting at least 20 NHS funded procedures. By 2012/12 this had risen to over 119, spread from Newcastle in the North East to Cornwall in the South West. The number of NHS hospitals remained roughly stable at 200 throughout the period. The reforms therefore increased the hospitals available to patients by more than half, and by 2012/13 a fifth of NHS funded hip replacements were conducted by ISPs.

2.2 Mechanisms of Patient Sorting by Provider Type

The structure of the reforms points towards three mechanisms that might generate differences in the characteristics of patients by provider type. First, differences in health based on the eligibility requirements for ISPs. In particular, ISPs do not treat patients with complex health conditions who are at risk of requiring emergency intensive care. Some differences in ISP use by underlying health are therefore to be expected, and the outcome of government regulations rather than 'cherry picking' by ISPs[15]. This will generate sorting by ill-health and any other characteristics correlated with ill-health, such as poverty or old age. However, this sorting may well be appropriate and represent an efficient allocation of resources across hospitals.

Second, the geographic distribution of ISPs is non-random and is likely to result in differential access to ISPs. In particular, during the second wave of the reforms, most new ISPs were existing private hospitals. These were typically located in richer areas, close to the private-pay patients they serve. Again, given that patients always show a preference for shorter distances any resulting sorting may be efficient, taking the geographic distribution of ISPs as given. Whether the geographic distribution is itself efficient is a separate question.

Finally, there may be frictions in advice given by GPs to patients for reasons unrelated to patient health. As ISPs were new and introduced very quickly, it is likely that GPs may lack information about the additional providers, at least in the short run. The structure of the first wave of ISTC contracts also provided an incentive for PCTs to encourage GPs to refer to ISTCs, to avoid paying for procedures that did not take place. These types of frictions are at least potentially inefficient, both in terms of restricting access of patients to ISPs and limiting competition between providers. We will return to the issue of the options presented to patients in Section 4.2.

[15] Whether ISPs then imposed additional eligibility requirements that did amount to 'cherry picking' or 'cream skimming' remains open to debate.

In addition to concerns about potential welfare losses resulting from market frictions, there are at least two further reasons why policy makers may be concerned about the sorting of patients across providers.

First, even if ISP use were based on complete information and absent administrative constraints, policy makers may be concerned if choice leads to too much segmentation, or indeed segregation, in public service utilization, given it is paid for by, and designed to serve, all. Moreover, this segmentation may limit the extent of competition between NHS hospitals and ISP, reducing the pressure on NHS hospitals to improve quality.

Second, the characteristics of patients carry implications for hospital costs. NHS hospitals and ISPs are paid on a per patient basis. These payments are based on a clinical grouping system. They are set nationally and vary very little across providers[16]. For elective hip replacements, there is a slightly higher rate of payment if patients have comorbidities or suffer from more complex health issues, but for the most part there is a flat fee paid[17]. However, the costs of treating patients are likely to vary more continuously with underlying health. Low cost patients moving from NHS hospitals to ISPs may be regarded as an adverse selection issue. It entails external effects, to the extent that it reduces the ability of NHS hospitals to cross-subsidize: average costs for NHS hospitals would rise, whereas ISPs would receive a surplus.

All these concerns depend upon the extent and type of sorting that takes places. Existing evidence from the first wave of ISTCs points towards ISPs treating younger, healthier patients. The next section details our data and describes the patterns of sorting in 2012/13, when almost all ISPs had been introduced.

3 Data

We use data on NHS-funded elective hip replacements. The data come from the NHS inpatient Hospital Episode Statistics (HES). They provide an administrative record of all NHS-funded inpatient treatments in England, including treatments provided by both NHS hospitals and ISPs. Each patient record contains information on where the patients were admitted, the dates of admission and discharge, up to 20 ICD-10 diagnoses, and information on any procedures that took place. For each patient record, HES data also identify the referring GP practice, albeit not the individual GP. We extract hip replacements using the

[16] These are known as Diagnosis Related Groups (DRGs) in the US and Healthcare Resource Groups (HRGs) in England. Small adjustments are made to the payments received, based on length of stay and local costs of living.

[17] In our sample, 75% of patients fall under HRG HB12C "Major Hip Procedures for non Trauma Category 1 without CC".

relevant orthopaedic procedure codes, and obtain a sample of 68,769 patients.[18]

3.1 Patient Characteristics

In the MMNL models we estimate, heterogeneity in patients' preferences is captured by interactions of hospital attributes with patient characteristics. Table 3 summarizes patient characteristics used for estimation by hospital type chosen, grouped into three categories: patient demographics and health; local area characteristics; and characteristics of the patients' GP practice.

The first panel shows mean demographic and health characteristics by chosen provider type. The average age of patients treated by both NHS hospitals and ISPs is 68. The share of ethnic minority patients, which has not been examined by existing studies, is much lower in ISPs (1.3%) than for NHS patients (3.9%)[19]. This is consistent with a report on Patient Choice from 2010, where GPs voiced concerns that language barriers may limit the ability of minority ethnic populations from exercising choice [Dixon et al., 2010a].

Two sets of measures are used to capture underlying health of the patient. First, we consider the Charlson Index of comorbidities[20] We group patients into three categories: no comorbidities; a score of 1, which we term mild comorbidities; and a score of more than one, which we class as severe comorbidities.

Second, we extract all prior admissions for patients in our estimation sample, and create indicators for whether the patient had at least one (NHS funded) elective or emergency admission in the three years (1095 days) prior to the hip replacement admission, for any cause. All our measures confirm that ISP patients are on average less complex and have better underlying health than NHS patients[21]. It is however important to note that the

[18] Hip replacements include those operations with Office of Population Censuses and Surveys (OPCS) Classification of Interventions and Procedures Codes (4th Edition) beginning W37, W38, W39, W93, W94 and W95. Each operation code defines a different type of hip replacement. For a full list of OPCS codes see here: http://www.surginet.org.uk/informatics/opcs.php.

[19] These shares are much lower than the share of people of an ethnic minority patients in the population, due to the age structure of the ethnic minority population in England

[20] This is calculated using It is calculated using the comorbidities recorded at the point of the hip replacement admission. The Charlson Index predicts ten-year mortality using 22 comorbidity conditions. Each condition is scored a 1, 2, 3 or 6, depending on the severity of the condition, and is calculated on the basis of all diagnoses recorded in hip replacement admission. See Sundararajan et al. [2004] for more details on the Charlson Index.

[21] Comparing these measures with the reported underlying health recorded for the 60% of the sample that responded the Patient Recorded Outcome Measures survey illustrates that the health measures we use pick up different elements of ill health. Of those that report ever having cancer in PROMs, 79% have had an elective admission to hospital over the previous 3 years, compared to 53% for all other patients, emergency admissions were 10 percentage points higher (29% verses 19%), and cancer patients were twice as likely to have a Charlson index score of 2 or more (15% verses 7%). By contrast, for those reporting high blood pressure, the shares with prior emergency and elective admissions are both only 2 percentage points higher

market is not completely segmented by underlying health: a substantial fraction of ISP patients do have comorbidities or prior admissions.[22].

HES data do not contain any patient level socioeconomic information, but we are able to embed characteristics at the neighborhood level via the patient's postcode district and LSOA.[23] Socioeconomic status is measured using the neighborhood level Index of Multiple Deprivation (IMD) as compiled by the Office for National Statistics.[24] This measure allows us to rank neighborhoods from the least to the most deprived. We rescale the IMD to lie between zero and one. Higher values imply higher deprivation. Henceforth, we will refer to this IMD measure as 'deprivation'. As documented by Chard et al. [2011] and elsewhere, ISP patients are on average less deprived than patients that are treated by NHS hospitals. In our sample, the average NHS patient lived in an area with a deprivation rank of 0.45, compared to 0.39 for the average ISP patient.

The final set of characteristics is the historic referral patterns of the patient's GP. This reflects the likely importance of the GP in the referral decision. From HES outpatient records detailing GP practice referrals in 2011/12 in the Orthopaedics and Trauma specialty, which is the largest specialty by volume in the NHS and contains consultants who would see joint replacement patients, we calculate a Herfindahl-Hirschman Index (HHI) of the concentration of referrals across providers for each GP practice.[25] We also use all referrals from 2009/10 to 2011/12 to calculate the share of referrals to ISPs over those three years. Table 3 shows that patients who choose ISPs are registered at GP practices with lower concentrations of referrals. The average patient treated by an ISP was registered with a GP practice that referred 13.2% of patients to ISPs, compared to an average of 7.6% for those treated by an NHS hospital. Only 1% of ISP patients were registered with GP practices that were unamenable to private providers in the previous three years, relative to 11% of patients that chose an NHS hospital.

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than the rest of the sample, whereas the share of those with a Charlson Index of 2 or more is 6 percentage points higher

[22] This is also true when we use the more detailed Patient Reported Outcome Questionnaire available for two thirds of the sample. Even for those who report having a previous stroke or heart attack, 10% have a hip replacement conducted by an ISP.

[23] Lower Super Output Areas are statistical geographical aggregation units with no administrative jurisdiction, similar to a census tract, and are designed to be as homogeneous as possible with respect to population composition. They contain an average of 1,500 individuals. There are approximately 32,500 LSOAs in England.

[24] The Index of Multiple Deprivation (IMD) is an local area based measure of deprivation produced by the UK government that includes measures of income, employment, health deprivation and disability, education skills and training, barriers to housing and services, crime and the living environment. We use the version produced in 2010. Please see https://www.gov.uk/government/statistics/english-indices-of-deprivation-2010 for more details.

[25] This is given by the sum of squared referral shares of each hospital that the GP practice refers to.

3.2 Hospital Characteristics

We construct hospital attributes for 314 hospitals in our sample. Of these, 119 (or 38%) are ISPs. In terms of treatments, ISPs have a market share of just 20%, however, because they treat fewer patients per hospital (103 on average, compared to an average of 253 for NHS hospitals).

Previous analyses of hospital choice in England and elsewhere have shown that distance is the principal hospital attribute driving patient decisions [Beckert et al., 2012, Gaynor et al., 2012, Kessler and McClellan, 2000].[26] Figure 5 shows the distribution of patient choices, with hospitals ordered by distance.[27] The black bars indicate that 45% of patients chose their closest hospital and 82% chose amongst their closest three. When we exclude ISPs - which in some cases are the nearest provider - and just look at patients that chose NHS hospitals, shown in the grey bars, 66% chose their closest NHS hospital and 91% chose from among their three closest. The closest NHS hospital and ISP are on average 8.9km (s.d. 7.3km) and 12.7km (s.d. 10.8km) away, respectively.

Given the PCT centered healthcare funding architecture in England during the period we consider, we also expect that where patients are treated will depend upon Primary Care Trust areas. In our sample 64% of patients choose hospitals in the same PCT that they reside in. This includes 64% of patients who choose NHS hospitals and 62% of patients that choose ISPs.

Further hospital attributes driving patients' decisions are summarized in Table 2. A large range of quality measures is recorded for NHS hospitals, but very few of these are available for ISPs.[28] All the quality measures we use are therefore constructed using the information available in HES. We control for hospitals' clinical quality using the ratio of 30-day all-cause emergency readmissions for hip replacement relative to expected readmissions at the hospital level, given the hospital's case mix.[29] A ratio of unity indicates that the rate of readmissions is as expected, higher ratios imply higher than expected readmissions, i.e. lower clinical quality. The mean readmission ratio is higher for NHS hospitals than ISPs. However, there is substantial overlap in the distributions of readmission ratios across hospital types.

We also control for hospital quality more summarily, in terms of broad hospital type

[26]The same pattern exists for education choices and other public services [Burgess et al., 2015].

[27]Distance is measured in a straight line from the centroid of the patient's Lower Super Output Area to the hospital postal code.

[28]For example, while PROMS data are relatively abundant for treatments at NHS hospitals, they are sparse for treatments at ISPs. We therefore decided not to construct quality measures from PROMS data.

[29]Readmissions include any emergency readmission to any hospital for any cause within 30 days. Expected admissions are constructed by regressing readmissions on age, sex, and prior admissions, and underlying co-morbidities of hospital patients. We calculate average predicted readmission rates for each hospital and then divide by the observed readmission rate.

categorisations. The first category comprises "early FTs", i.e. NHS hospitals that became a "Foundation Trust" (FT) up to and including 2006. Foundation Trust status allows hospitals a degree of independence from the Department of Health. The first hospitals were granted Foundation Trust status in 2004. These hospitals were typically of higher quality in terms of both, management and clinical outcomes. In subsequent years, the majority of hospitals have become Foundation Trusts, but as a consequence the average quality of FT hospitals has declined. We use the cut-off of 2006 in our definition of early FTs as a measure of the highest quality hospitals. 16% of NHS hospitals are classified as early FTs.

The second category comprises Specialist Orthopaedic hospitals. There are five in total, four NHS hospitals and one ISP. Specialist orthopaedic hospitals treat a larger number of orthopaedic patients, and they may be a particularly relevant alternative, not only for patients living nearby.

3.3 Descriptive Evidence on Sorting

Table 3 reveals that ISP patients are on average healthier, richer, and registered with GP practices that refer more widely. Hospital sorting according to patient health may reflect an efficient allocation, and is a natural consequence of the government regulations on who could be treated by ISPs.[30] In this section we provide some descriptive evidence on the mechanisms driving sorting by local area deprivation and GP referral patterns. The mechanisms are consistent with frictions in the market which may be regarded as undesirable or inefficient.

Figure 6 shows the distribution of local area deprivation of hip replacement patients, by hospital type, in 2006/07, 2009/10 and 2012/13. For patients treated by NHS hospitals, shown in the top panel, the density of patients by deprivation is flat for values of deprivation between 0 and 0.4 and downward sloping thereafter. This pattern remained stable over time. The bottom panel shows the distribution of local area deprivation for patients treated by ISPs. There are two points of note. First, the distribution of hip replacement patients is much more strongly skewed towards less deprived patients. Second, the skew towards the least deprived areas increases over time. This is most apparent between 2006/07 and 2009/10, but the shift towards patients from less deprived areas increases further between 2009/10 and 2012/13. By 2012/13, patients in the least deprived 40% of local areas were twice as likely to be treated by ISPs as those in the most deprived 10%.

A primary aim our analysis is to understand the extent to which the pattern observed in Figure 6 reflects differences in the distribution of hospital attributes and patient characteris-

[30]In this case, the key policy question is how to remunerate hospitals. The payments made to hospitals for treating NHS-funded patients show very limited variation and do not fully capture the variation in costs of treating patients with different needs.

tics other than deprivation, such as health, that will influence choice. Given the importance of distance in determining choice, the geographical distribution of ISPs is one factor that may be important in explaining the socioeconomic gradient in ISP use. Figure 7 shows the distribution of deprivation for areas where the closest hospital is an ISP by year. In all years, ISPs are more likely to be the nearest provider in less deprived areas, although this distribution has somewhat evened out over time. Nonetheless, this suggests that location and supply side considerations do have a role to play in access. However, it is interesting to note that, over the same time horizon, the distribution of ISP patients became more concentrated around the least deprived. Moreover, the slope of the deprivation density function for ISP patients in Figure 6 is steepest between 0.4 and 1 of local area deprivation, but the slope of the deprivation density function of areas where an ISP is the closest provider in Figure 7 is relatively stable throughout. Figure 6 shows the order of the nearest ISP by local area deprivation decile. This again shows that ISPs are located closer to patients in less deprived areas. However, it is important to note that even for those in the most deprived quintile, 80% have at least one ISP among their closest 3 providers.

There is a similar pattern in how ISPs are distributed across England with respect to ethnicity. In 2009/10, 15.2% of white hip replacement patients have an ISP as their nearest hospital, compared to 9.4% of ethnic minority patients. By 2012/13, this had increased to 31.9% of white patients and 25.1% of ethnic minority patients. On the one hand, these figures suggests that proximity may explain a portion of the difference in ISP use by ethnicity. On the other, the differences in proximity are relatively small, compared to the very low share of ethnic minority patients who use ISPs.

Figure 8 shows the share of patients that had a previous emergency admission, mild co-morbidities and severe comorbidities, by deprivation quintile.[31] As expected, underlying health declines with local area deprivation. For previous emergency admissions and mild comorbidities, the declines in health are largely confined to the most deprived half of the distribution. There is a small difference in the underlying health by ethnicity, with share of ethnic minority patients with prior emergency admissions 2 percentage points higher than for the white population, and slightly more comorbidities.

These descriptives results suggest that differences in patient health could explain part of the observed sorting patterns, but some sorting by local area deprivation and to a lesser extent ethnicity appears unexplained. For example, the share of ethnic minorities that choose an ISP (7.5%) is approximately equal to share of patients with both low income (living in the poorest fifth of local areas) and poor underlying health (have a prior emergency admission) who choose an ISP.

[31] Here, the value 1 represents the least deprived quintile.

4 Econometric Choice Model

4.1 Patient Level Choice Model

We use a random utility model (RUM) to describe the patient's discrete hospital choice problem. We consider a mixed multinomial logit (MMNL) model that allows us to capture a wide spectrum of patient level heterogeneity, exhibits unrestricted substitution patterns and does not impose a correlation structure across choice alternatives. More tightly specified alternatives in the logit family, such a conditional or nested logit models, while yielding more efficient estimates, embed the risk of being misspecified and consequently yielding inconsistent estimators. As demonstrated by [McFadden and Train, 2000], an appropriately rich MMNL specification can arbitrarily closely approximate any RUM for discrete choice. This flexibility renders it an attractive econometric framework for analysis.

Consider hip replacement patient i. Let $g(i)$ denote i's GP (practice).[32] And suppose that $g(i)$ offers i to choose among a set of NHS hospitals $\mathcal{N}_{g(i)}$ and a set of ISPs $\mathcal{I}_{g(i)}$. Then, patient i's choice set is given by $J_{g(i)} = \mathcal{N}_{g(i)} \cup \mathcal{I}_{g(i)}$. Let U_{ij} denote i's indirect conditional utility from having the procedure carried out at hospital j, $j \in \mathcal{J}_{g(i)}$, and consider the specification

$$U_{ij} = \mathbf{x}_{ij}'\beta_i + \epsilon_{ij},$$

where $\mathbf{x}_{ij}$ is a K-vector of hospital attributes that may vary across patients, such as distance between patient and hospital. The vector β_i is a vector of possibly random coefficients,

$$\beta_{ik} = \beta_k + \mathbf{z}_i'\theta_k + \sigma_k \nu_{ik}, \quad k = 1, \cdots, K,$$

where $\mathbf{z}_i$ is a vector of patient level characteristics, $\sigma_{ik} > 0$ for random coefficient and zero otherwise, and ν_{ik} is an independent standard normally distributed random variable. In this model, $\beta_k + \mathbf{z}_i'\theta_k$ captures the conditional mean of the random coefficient β_{ik} on hospital attribute k, given patient characteristics $\mathbf{z}_i$, or the observed heterogeneity in i's valuation of attribute k. The contribution $\sigma_k \nu_{ik}$ to β_{ik}, in turn, captures unobserved heterogeneity in i's valuation of attribute k. The term ϵ_{ij} captures unobserved taste variation across hospitals that is not quantified by hospital attributes $\mathbf{x}_{ij}$. The collection $\{\epsilon_{ij}, j \in \mathcal{J}_{g(i)}\}$ is assumed to be i.i.d. $EV(0,1)$. Patient i chooses the hospital associated with the highest indirect conditional utility. Let $D_{ij} = 1$ if patient i is observed to choose alternative j, and $D_{ij} = 0$ otherwise. Then,

$$D_{ij} = 1 \quad \Leftrightarrow \quad U_{ij} = \max\{U_{in}, n \in \mathcal{J}_{g(i)}\}.$$

[32] In line with the informational content of our data, which identify a patient's GP practice, but not the individual GP, in much of our discussion we refer to GP and GP practice synonymously.

This model can be estimated by Maximum Simulated Likelihood [Hajivassiliou, 2000].

We include an ISP dummy among those attributes in $\mathbf{x}_{ij}$ that carry a random coefficient, i.e. $x_{ijk} = 1_{\{j \in \mathcal{I}_{g(i)}\}}$ and $\sigma_k \geq 0$. Heterogeneity in sorting into ISPs then operates through the interactions of x_{ijk} with $\mathbf{z}_i$. By controlling for i's health and GP $g(i)$'s referral pattern among $\mathbf{z}_i$, the model allows us to identify differential sorting, conditional on access and health, with respect to other patient socio-demographics, e.g. deprivation of the area the patient lives in. Our MMNL model endows two other hospital attributes with random coefficients: distance, and the 30-day emergency readmissions ratio.

4.2 Choice Sets

The model, as specified, assumes that choice sets $\mathcal{J}_{g(i)}$ may vary across GP practices, but do not vary across patients within GP practice. We consider two definitions of the choice sets $\mathcal{J}_{g(i)}$. In line with standard practice [Beckert et al., 2012, Ho, 2006], the first approach defines $\mathcal{J}_{g(i)}$ by distance to the GP practice, as the ten nearest hospitals conducting at least 20 procedures, plus all specialist hospitals within 50km; we refer to choice sets according to this definition as "distance choice sets"[33]. Among the 63.120 patients in our sample, the average number of ISPs in their distance choice sets is 3.9, and 80 per cent of them have between 3 and 5 ISPs.

The second approach defines $\mathcal{J}_{g(i)}$ as the set of hospital alternatives that the GP referred patients to over the last three years; we refer to choice sets according to this definition as "GP choice sets". We do so to reflect both the role of the GP as the gatekeeper and patient advisor when making referrals in the English NHS and the relationship between ISP use and previous GP referrals described in Table 3. These choice sets are constructed by proxying the alternatives offered to the patient by the set of hospitals that the GP practice has referred to in the previous three years within the Orthopaedics and Trauma specialty.[34] This approach

[33]Distances are measured in a straight line from the centroid or central point of the patient's Lower Super Output Area to the post code of the hospital. We include only hospitals that perform at least 20 hip operations in 2012/13, as hospitals that perform very low volumes may not be in patient choice sets. This is a particular problem for ISPs where a relatively large fraction of sites perform very few procedures. For example, reducing the minimum threshold from 20 to 5 procedures increases the number of relevant ISPs by 22%, but these smaller sites accounted for just 2.7% of ISP patients in 2010/11 and 0.5% of all NHS funded patients. We include additional Specialist Orthopaedic hospitals within 50km, as these are hospitals that patient predominately choose when not picking one of their nearest 10. Patients that chose a hospital outside their nearest 10, plus nearby specialist hospitals, are dropped, which removes 7% of the patient sample.

[34]To construct these choices, we take all referrals by that GP within Orthopaedics and Trauma over the period 2009 to 2012 (with an average of 420 referrals), and include hospitals where the GP referred more than 0.5% of patients, plus any sites where any hip replacement patients were referred to in our hip replacement sample. This is reasonable approximation of the alternatives that may have been considered, and avoids any restrictions on the size of the choice set from using only hip replacement patients. Again, we restrict to hospitals that conducted 20 or more hip replacements in 2012/12

generates variation in the size and composition of the choice set size at the GP level. We believe that this approach is a strong proxy for the choices offered to patients, as referral to a provider indicates either pre-existing knowledge or subsequent knowledge obtained following feedback from patients [Dixon et al., 2010a] [35]

Figure 2 shows the composition of distance and GP choice sets and demonstrates that the GP choice set typically contains fewer alternatives than the distance choice set. The number of alternatives in the GP choice has an approximately normal distribution, with most practices offering between 2 and 12 alternatives.

Figure 3 and 4 split alternatives into NHS hospitals and ISPs, and show that the number of alternatives offered in the GP choice set is lower for both types of provider. The median number of ISP alternatives is 4 in the distance choice set but only 1 in the GP choice set.

Comparing the size of the choice sets in Figures 2 - 4 highlights both the large variation in the number of choices that are offered across GP practices and that the majority of GP practices refer to far fewer than the 10 hospitals we consider in the distance choice set model. The sets of hospitals presented to patients by their GP can be thought of as outcome of at least three different competing processes. First, GPs may act as a patient surrogate, i.e. as an altruistic agent who presents patients only with the highest ranked alternatives. A GP might therefore exclude hospitals that are far away and of low quality. In a full information setting, in principle the GP could choose on behalf of the patient, and a mandate to offer choice would be unnecessary.

Second, information on providers is often costly to acquire and to disseminate. The costs of information acquisition mean that the patient is likely to defer to the GP in terms of choice alternatives to consider, but also imply that GPs may not acquire knowledge about all providers. This is supported by results from GP surveys which indicate that GPs rely on "soft" knowledge from previous experience and referrals, rather than comparing clinical indicators [Dixon et al., 2010a]. Incomplete information on the part of the GP may be particularly relevant for the inclusion of ISPs, as the providers are new and GPs will have less information based on previous referrals. The cost of communicating and disseminating information about choice options to patients is costly both to GPs themselves and for patients, where large choice sets may complicate the choice problem (see, for example, Kamenica [2008] on the tyranny of choice and choice overload). As a result, GPs may limit the number hospital alternatives they present to patients to a small number, either because (i) GPs do not have an incentive to acquire information about further hospitals or (ii)

[35] One possibility is that this approach falsely excludes providers that are never chosen, but given the costs of transmitting information about additional providers to patients, it seems unlikely that GPs would continue to offer providers that patients never chose.

some hospitals that the GP does have information about are withheld [36]. The resulting narrow choice set may exclude hospital alternatives that patients would rank highly if they had perfect information. This pre-selection is potentially efficient, conditional the costs of information acquisition and dissemination, because it saves patients the cost of collecting the necessary information themselves. The question is then whether there is a way of reducing these information costs to overcome the market friction. Efficiency also hinges on the incentives of GP and patient being aligned.

Finally, if GPs face incentives that are not aligned with those of the patient, then such pre-selection on the part of the GP may be distortive. It comprises situations in which GPs are uninformed about, or unresponsive to, evaluation criteria relevant to patients; and situations in which GPs face idiosyncratic incentives that patients are unaware of. For example, the contracts granted to Wave 1 ISTCs, which compensate providers for a fixed number of procedures, irrespective of whether those procedures were conducted, provided GPs with an incentive to refer to those providers; patients would not know or care about the underlying financial arrangements.

Any difference in choice sets resulting from the first mechanism, where GPs act as altruistic agents, do not limit competition or affect consumer welfare. The second and third mechanism, imperfect information and differential incentives, imply frictions in the market for choice which may be ameliorated with policy reforms.

While a formally incorporating the GP level choice set formation process into our model is beyond the scope of this paper, Appendix A presents estimates from a model that examines the determinants of the GP's binary decision whether or not to include the hospital in the GP choice set[37]. The model examines the relative importance of the three aforementioned scenarios: the fully informed GP, informational asymmetries, and GPs' idiosyncratic incentives. Our estimates conform to all three mechanisms we highlight and the findings from the GP survey summarized in Dixon et al. [2010a]. Higher quality hospitals are more likely to be included in GP choice sets, but the magnitude of the quality effect is small. By contrast, the inclusion of a hospital in a GP choice set is strongly associated with features of local health care organisation unrelated to patient health. And these determinants dominate the hospital quality effects or population health characteristics. In particular, GPs are much

[36]These assumptions are consistent with evidence [Dixon et al., 2010b, Monitor, 2015] that, the choice mandate notwithstanding, the majority of patients gets to discuss no more than five options with the GP and that GPs feel that they operate under resource constraints that do not permit them to discuss more options while seeing the same number of patients. Such resource constraints suggest that GPs decide on a relatively tightly delineated, standardized set of alternatives that they discuss with their patients

[37]See Beckert and Collyer [2016], Goeree [2008] and Gaynor et al. [2016] for examples; Crawford et al. [2016] study demand estimation in the absence of accurate and quantifiable information on the true choice sets

more likely to refer to NHS hospitals within the same PCT. This may reflect some inertia in referral practices dating back to block contracting in the early 2000s, or a desire to maintain the revenues of hospitals that provide emergency care for their patients. For ISPs, the odds of a Wave 1 ISTC being included in a GP choice set are nine times that of a pre-existing private hospital. This is consistent with the incentives to refer to these providers until the initial contracts ended (typically 2010 or 2011). By contrast, for Wave 2 ISTCs, where the incentive to refer was much weaker, the odds of inclusion in GP choice sets were double that of a private hospital.

5 Results

5.1 Baseline Results

Tables 4 and 5 show the parameter estimates from the mixed logit models based on the distance and GP choice sets[38]

The parameter estimates for the mean valuations of hospital attributes are presented in Table 4. The parameter estimates from the "distance choice set" model on the right hand side of the Table provide similar results to existing work on patient choice. Patients have a preference for shorter travel distances, shorter waiting times and higher quality. We find that specialist hospitals are more likely to be chosen and ISPs less likely to be chosen. Patients are more likely to choose hospitals within the same PCT, holding all other hospital characteristics constant. The random coefficient parameters indicate significant heterogeneity in valuations of distance and ISPs, but no unobserved variations in the emergency readmission rate. This finding might be explained by patients deferring to their GP with regard to quality assessments [Dixon and Robertson, 2009, Monitor, 2015]. In an incomplete information setting like the one considered here, quality is likely assessed via the patients' GPs who possess superior information. GPs, in turn, may have relatively homogeneous information on hospital quality and thus are unlikely to vary significantly in their quality assessments.

The GP choice set model produces a similar pattern of estimates. Responses to quality, as measured by emergency readmissions and early FT status are slightly smaller (relative to other attributes such as distance). This is perhaps explained by GP pre-selection eliminating lower quality hospitals. Specialist hospitals are also valued more highly under the GP choice set model.

Table 5 presents parameter estimates for interactions between hospital type and patient and GP characteristics. Starting again with the distance choice set parameter estimates, we

[38]The remaining parameters estimated by the models are available on request

find that as with the raw data, patients from deprived areas, ethnic minorities and those with underlying ill-health are less likely to seek treatment at an ISP. This suggests that the hypothesis that the differences in use by income and ethnic minority status are explained by different distributions of underlying health is not supported. Patients who are registered with GP practices with high referral concentrations or low prior referral shares to ISPs are less likely to choose an ISP, which is consistent with an important role played by GPs in the choice making process.

The parameter estimates of the GP choice set model produce a similar pattern of results with respect to ethnicity and health, albeit with slighter smaller magnitudes. In both models, the magnitude of the interaction between ISP and ethnic minority is approximately equal to the interaction between ISP and having a previous emergency hospital admission. These parameters indicate that ISP patients are healthier even accounting for distance and the hospital choices that are available, which is unsurprising given the eligibility criteria for ISPs. Ethnic minorities are less likely to use ISPs, even when controlling for distance to ISPs, differences in deprivation, or observable measures of health.

In contrast, how the choice set is specified does affect the parameter estimates for variation in ISP use by local area deprivation. While the estimated parameter is statistically significant in the distance choice set model, the parameter in the GP choice set model is small and not statistically significant. We therefore conclude that any sorting by local area deprivation can be explained by a combination of patient health characteristics and the hospital choices patients were offered, and that a share of the sorting by local area deprivation that is observed is related to the restrictions placed on the choice sets of more deprived patients. GP prior referral characteristics continue to play a strong role in the GP choice set model, although the magnitude of the importance of prior ISP referrals relative to overall referral concentration is reduced.

The final three parameter estimates presented in Table 5 consider heterogeneity in Specialist Orthopaedic hospital use by ethnic minority status, local area deprivation and previous emergency hospital admission (to proxy for underlying ill health). Parameter estimates from the distance choice set model suggest that ethnic minorities are more likely to choose a specialist hospital. However, in the GP choice set model the parameter estimate is negative and not statistically significant. This suggests that ethnic minorities are more likely to use a specialist hospital due to the geographic distribution of specialist hospitals in urban centres. When the choice set that patients are presented with by the GP is controlled for in the GP choice set model, they are no longer more likely to choose a specialist hospital.

The pattern is similar for deprivation. In the distance choice set model, more deprived patients are equally likely to choose a specialist hospital, whereas under the GP choice set deprived patients are less likely to choose specialist hospitals.

Finally, the estimates also show that patients with previous admissions are less likely to choose specialist hospital, irrespective of the choice set definition that is used.

5.2 GP Level Random Coefficients

The estimated models using the distance and GP choice set definitions have both assumed that random coefficients operate at the patient level. Given the likely role of the GP in forming choice sets and offering advice, it is possible that unobserved variation in preferences is not attributable to the patient, but instead to the GP. We therefore re-estimate the GP choice set model with random coefficients at the GP level. This amounts to re-interpreting the choice outcomes as those that a GP might arrive at when deciding on behalf of each of the GP's patients. This model serves as a robustness check on our preferred specifications, although the results are difficult to interpret.

For mean valuations of hospital attributes, this model entails the largest effect, relative to our baseline specifications, on estimates for the ISP attribute and emergency readmission. The negative parameter estimate for ISP use is smaller in absolute value than for the patient level model, as is the extent of the observed variation. This suggests that GPs experience less heterogeneity in valuations of ISPs. For emergency readmissions, the estimated parameter remains negative and statistically significant, but the random coefficient goes from very small and not statistically significant in the distance and GP choice set model to sizeable and statistically significant when random coefficients are estimated at the GP level.

While the estimates of the remaining coefficients, notably on the various interactions, are broadly similar to those of our preferred specifications, the aforementioned discrepancies are difficult to interpret. The GP model can be thought of as a version of a choice model that in a somewhat opaque manner blends the patient's and GP's contributions to the choice outcome. For example, the randomness in valuation of quality could arise from the GP observing patient characteristics that the econometrician does not observe and that lead the GP to choose a hospital for the patient that excels along other dimensions relative to quality.

We include the results from this model because they demonstrate the robustness of our headline results to modelling assumptions, while cautioning against attempts to directly interpret the results from this model.

6 Counterfactual Simulations

6.1 Underlying Assumptions

The model estimates indicate that after conditioning on GP choice sets the difference by deprivation is removed, and the ethnic minority and health parameter estimates shrink towards zero. In this section we consider two counterfactual simulations that examine the extent to which the patients' GP contributes to how patients with different characteristics sort into ISPs.

To do so we construct two simulations using, for each patient, choice sets of feasible GP practice, where feasible practices are defined as those where at least 10 patients from the same MSOA are registered as the patient whose choices are simulated[39]. The first, "patient focussed" simulation moves patients to local GP practices that have the largest number of ISPs in their GP choice set. The second, "GP focussed" simulation adds alternatives to the patient's current GP practice choice set, based on the GP choice set of the GP practice with the most referrals to ISPs.

Our assumptions for these simulations are as follows. For simulation 1, we assume that the reallocated patients do not alter the choice set provided by the GP. For simulation 2, we assume that the costs to the GP of providing more choice are minimal, so that there is no capacity constraint. Finally, for both simulations, we assume that there is no capacity constraint at the hospital level, so that additional patients to do not change the attributes of alternatives. Given that characteristics such as waiting times may change, the predicted demand shift is an upper bound of the expected effects.

Figure 9 shows the mean number of ISPs in the choice set by local area deprivation quintile, for the status quo – i.e. the observed GP choice set – and each of the two simulation scenarios. For all quintiles, the mean number of ISPs in the choice sets under the simulation scenarios increases relative to the status quo. The absolute increases are similar across quintiles but the proportionate increases are greatest at the bottom. This is despite the simulations not taking local area deprivation into account. The pattern is similar for ethnicity. Ethnic minority patients have an average of 1 ISP in their choice set, compared to 1.5 for White British/Irish patients. The simulated choice sets both increase the mean by 0.5 ISPs, thus the absolute difference remains unchanged but the relative difference falls.

The pattern by ill-health is quite different, as shown by Figure **??**, which gives the mean number of ISPs in the GP choice sets conditional on previous admissions. Patients with a previous emergency admission have on average 0.022 fewer ISPs in their choice set than

[39] We have conducted the same simulation using a 2.5km radius and obtained similar results

other patients. The simulated choice sets do not change this pattern. This suggests that underlying health of patients, at least to the extent it is visible by the econometrician, is not what is driving choice set formation.

6.2 Simulation Results

Table 7 shows the estimated probability of choosing an ISP under the model and the simulated probability of choosing an ISP under the two simulation scenarios for all patients, and by three sets of patient characteristics: local area deprivation, ethnicity, and underlying health (previous emergency admission). The simulated ISP probabilities are obtained by summing up the predicted probabilities for the ISP alternatives for all patients.

Relative to the data, the GP choice set model predicts a higher share of ISP use overall (19.2 vs 25.9), but the gradient by local area deprivation quintile is similar. Both simulations increase the share of ISPs, by construction. However, the gradient is reduced. In simulation 1, where patients are reallocated to different practices, the difference between ISP use for the richest and poorest quintile falls from 7.9 percentage points on the basis of the model to 4.1 percentage points in the first simulation. In the second simulation, where additional alternatives are added to the choice set of the patient's own GP practice, the difference falls to 3.8 percentage points.

The second panel of Table 7 presents the simulations for ethnicity. Here, the data shows a 12.2 percentage point difference in the share of patients who use ISPs, this compares to an 11.5 percentage point difference using model estimates. These differences are large relative to income, where moving from the richest to the poorest richest quintiles of areas only reduces ISP use by 7.9 percentage points. As with deprivation, the simulations result reduce the difference between White British/Irish and ethnic minorities to 7.6 percentage points in simulation 1 and 6.7 percentage points in simulation 2.

The final panel considers the impact of the simulations on the expected ISP shares by whether the patient has had an emergency admission in the previous three years. Here there are two points to note. First, the model over-predicts the share of patients with previous emergency admissions that choose ISPs and under-predicts the difference, with a 1.8 percentage point difference in the expected share of ISP patients, relative to 9.7 percentage points in the data. Second, in contrast to the results for ethnicity and local area deprivation, the simulations increase, rather than decrease, the differences in ISP use by underlying health. The absence of a change in expected ISP share as a result of the simulation is unsurprising, as Figure **??**, ill-health was not associated with a significant reduction in the number of ISPs that were included in GP hospital choice sets. This also suggests that much of the sorting by health appears related to restrictions in who can be treated by ISPs, rather than the geographic distribution of ISPs, or frictions in the choices that are offered.

7 Conclusions

In this paper, we study mechanisms of patient sorting between private and public providers of publicly funded elective medical treatments in the English National Health Service. Understanding these mechanisms is important for at least three reasons. First, inequality in access to, and uptake of, private provision is potentially important for welfare, especially when private providers are able to deliver care much faster than public providers, and where patient satisfaction and quality are arguably superior NHS Partners Network [2015]. Second, in a system of national prices that do not necessarily fully compensate for differences in the severity of patient illness, different patient types entail different cost implications for providers, and these differences matter acutely when budgets and capacity are constrained. Finally, policies to expand market access to private providers are often introduced to generate competitive pressure on public incumbents, with the aim of improving efficiency, quality and innovation. Unequal access implies the threat of patients switching provider is below its full potential, and hence public providers may be expected to experience less competitive pressure than intended by the policy reform.

Our results for hip replacements reveal inequality in patient sorting into private provision along several dimensions. In particular, we find that patients with worse underlying health, those living in deprived areas and those that belong to an ethnic minority are less likely to choose an ISP. Differences in ISP usage by health are to be expected, given that there are health related eligibility criteria for ISP treatment. Reasons for variation in use by local area deprivation and ethnicity are more subtle. The comparison of our estimates from the distance and the GP choice set specifications reveals that differences in ISP use by local area deprivation that are not accounted for by geography, local hospital provision or patient health, can be explained by differences in the choice set that the patients' GP is likely to present to them. Differences in ISP by ethnicity and underlying health remain but are muted somewhat.

The influence that the GP exerts on patients' choice outcomes via the choice set offered to choose from is further illustrated in our counterfactual simulations. In a GP focussed simulation, where we force GPs to include additional local choice alternatives into the choice set offered to patients, we show that the difference in predicted ISP choice probabilities between the richest and poorest quintile of patients decreases by close to 50 percent. This equalizing effect is slightly more muted in our patient focussed simulation, where we re-assign patients to nearby GPs that are the most amenable to including ISPs in the offered choice set. We find similar effects for the predicted ISP choice differences between white British patients and those from ethnic minorities. The simulations do not affect the share of patients with previous emergency admissions who are predicted to choose an ISP.

The simulations are insightful for policy makers. While initiatives aiming to replicate the GP focussed scenario may be expected to induce more equality, they are likely to face more resistance, given the known constraints GPs operate under. The patient focussed scenario offers a potentially attractive alternative. It suggests a similar equalizing effect by empowering patients: While patients choose their GP on the basis of many criteria, offering them information on how amenable GPs are to facilitating choice may allow more patients to benefit from choice and strengthen the competitive pressure on providers generated by choice policies.

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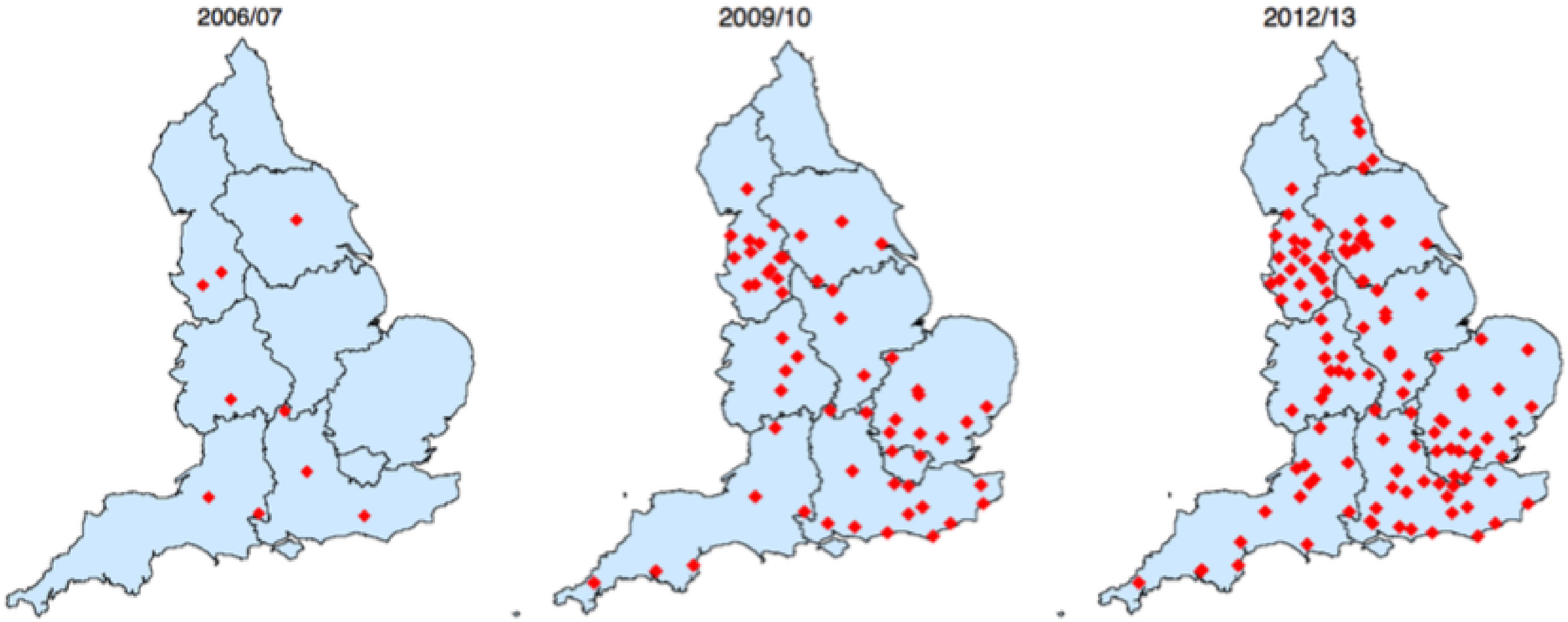
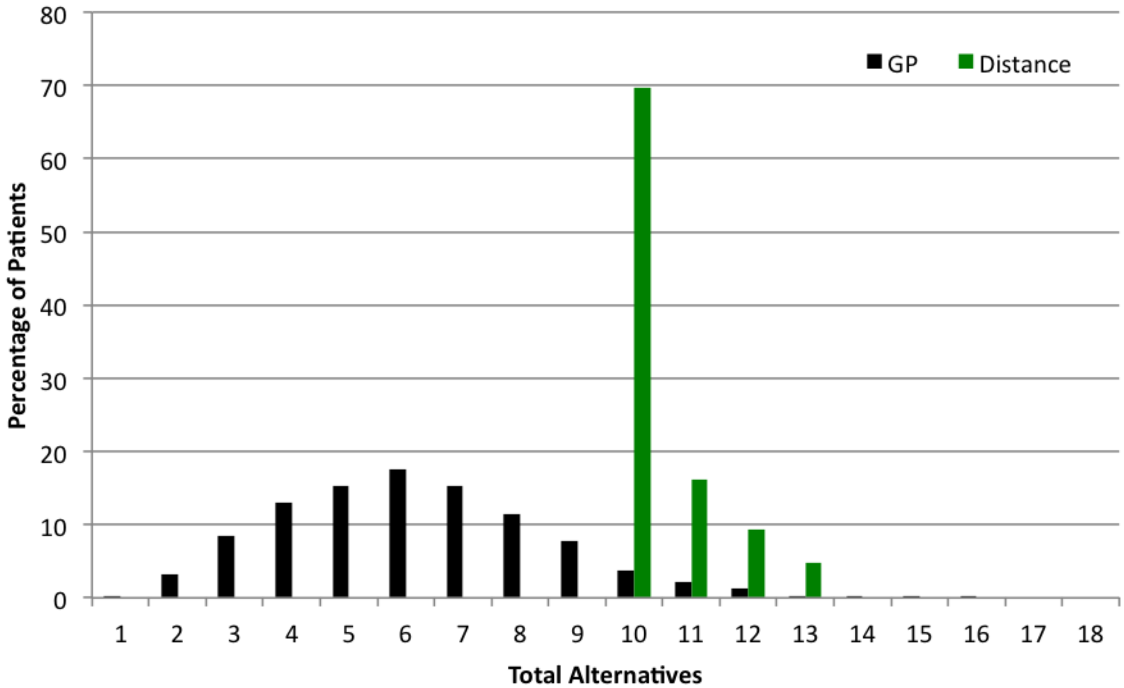
Figure 1: **The spread of ISPs across England (2006/07, 2008/09 and 2010/11)**



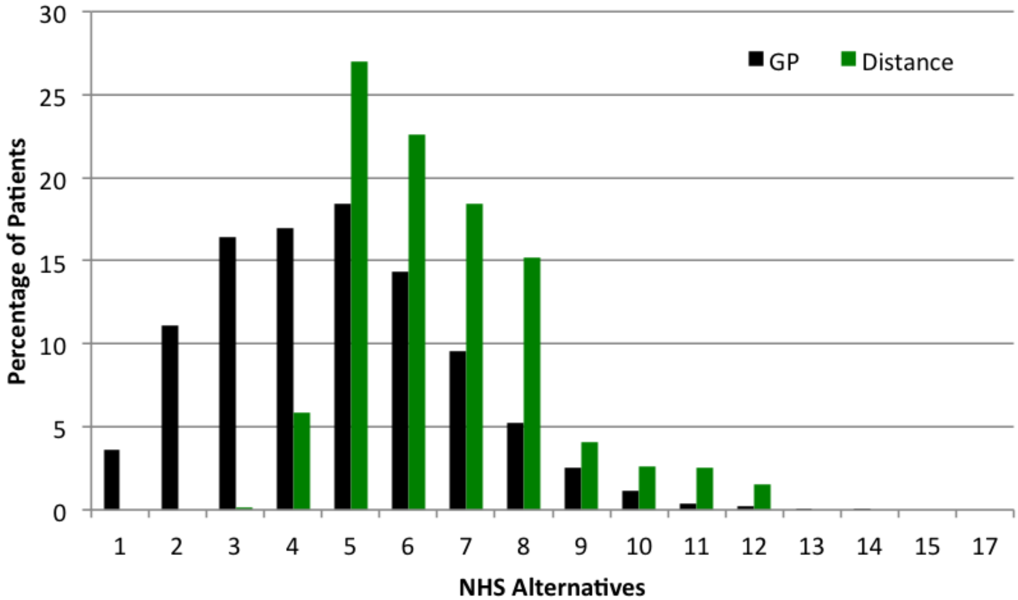
Notes Sample is restricted to those Independent Sector Providers that are recorded as conducting at least 20 NHS-funded elective hip replacements in the NHS Hospital Episode Statistics in the given

Figure 2: **The distribution of the number alternatives in patient choice sets**



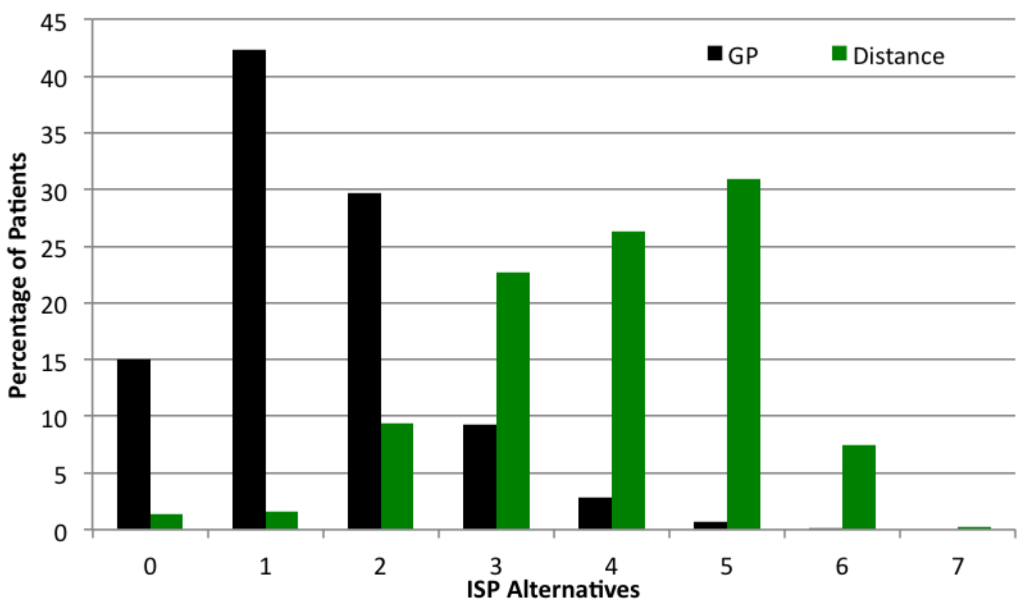
Notes Sample is restricted to those hospitals that are recorded as conducting at least 20 NHS-funded elective hip replacements in the NHS Hospital Episode Statistics in the given

Figure 3: **The distribution of the number NHS alternatives in patient choice sets**



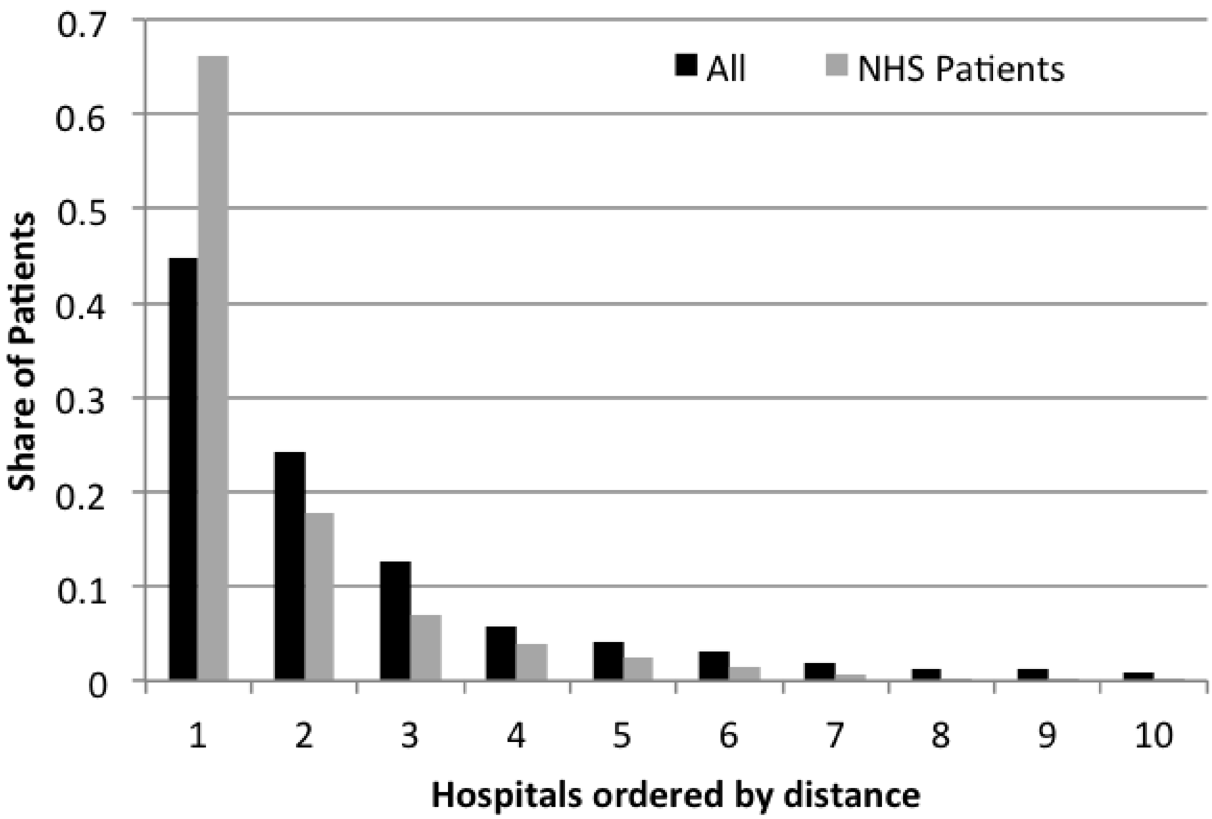
Notes Sample is restricted to those NHS hospitals that are recorded as conducting at least 20 NHS-funded elective hip replacements in the NHS Hospital Episode Statistics in the given

Figure 4: **The distribution of the number ISP alternatives in patient choice sets**



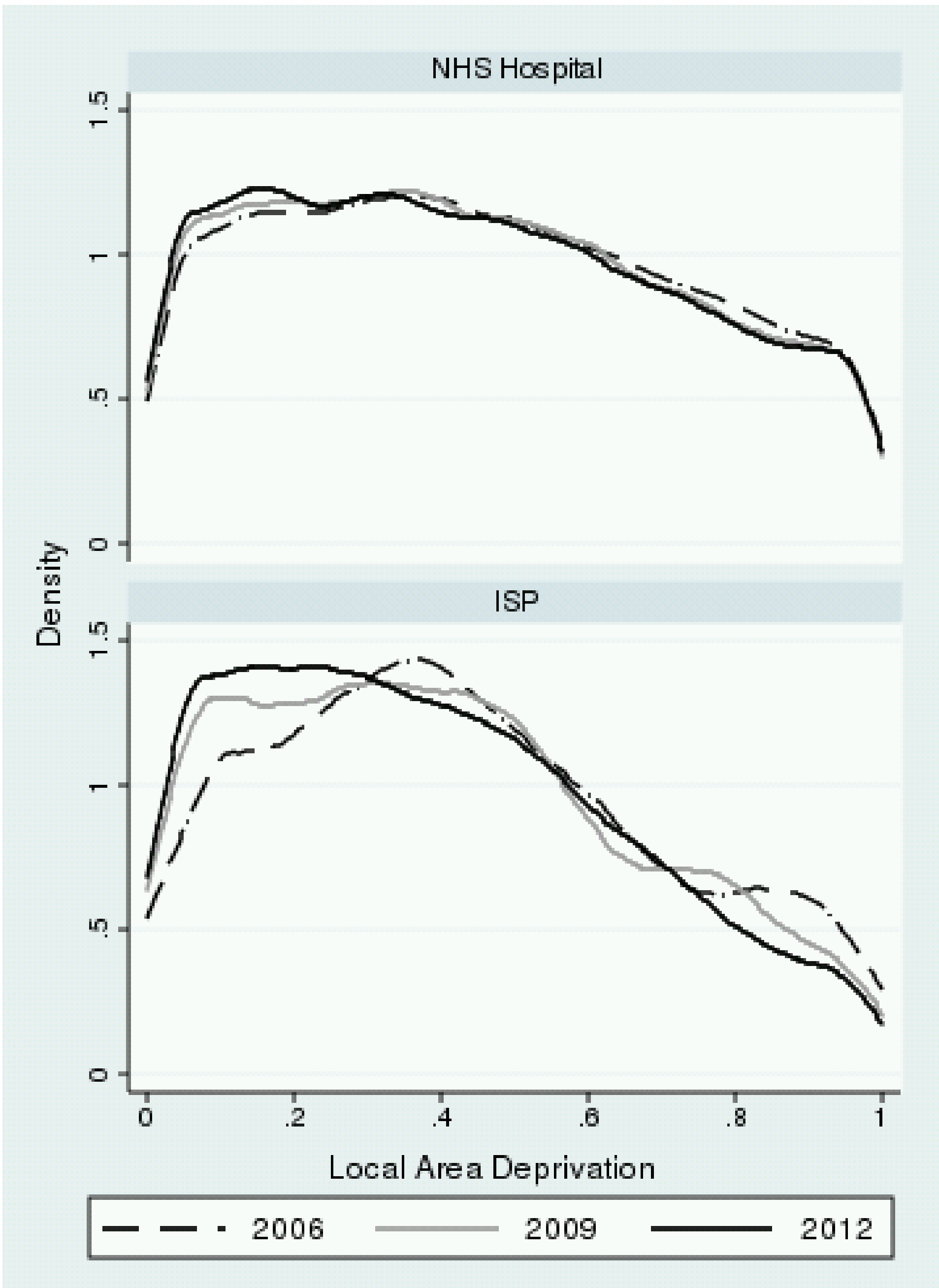
Notes Sample is restricted to those Independent Sector Providers that are recorded as conducting at least 20 NHS-funded elective hip replacements in the NHS Hospital Episode Statistics in the given

Figure 5: **Distribution of Patient Choices, Hospitals Ordered by Distance**



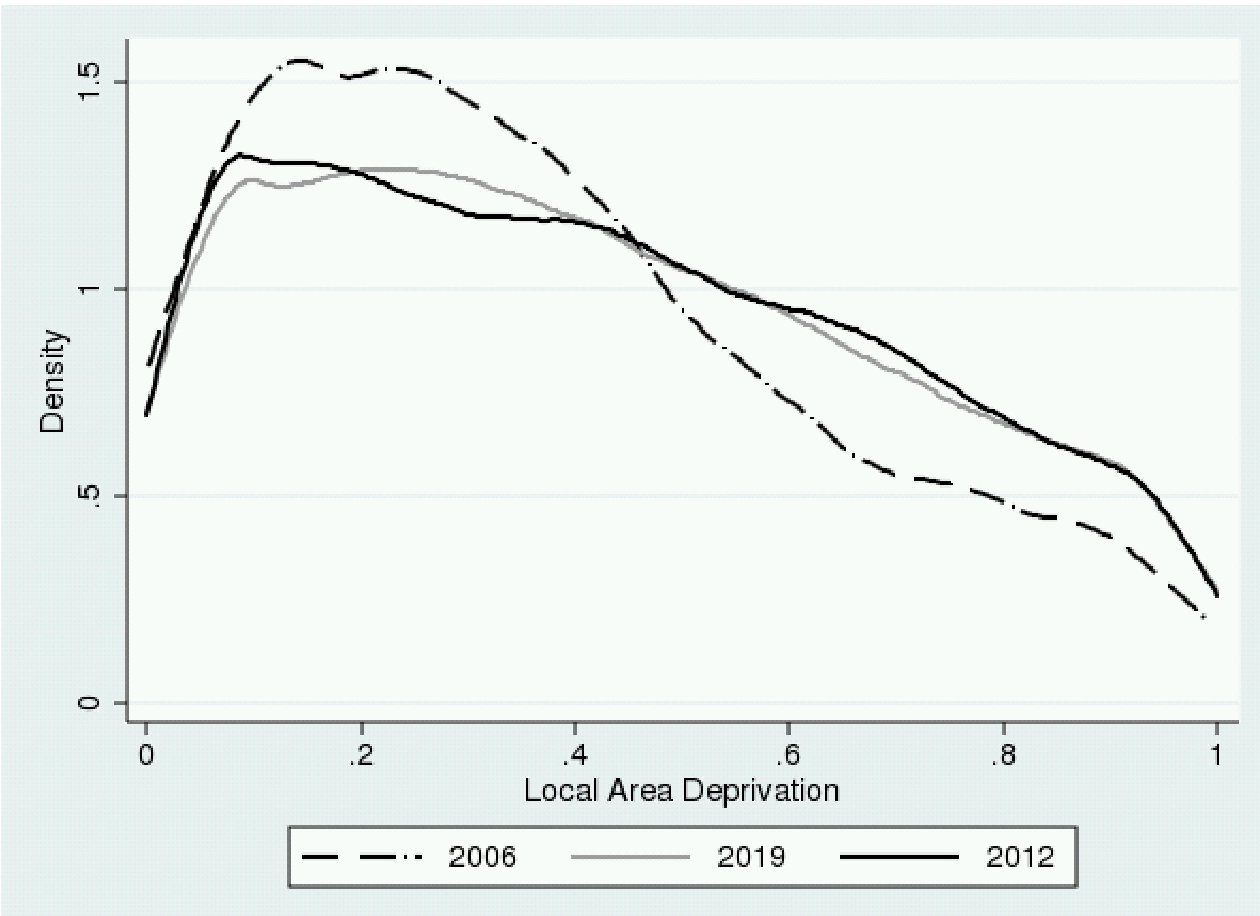
Notes: Distances are calculated in a straight line between the centroid of the patient's local area (LSOA) and the postcode of the hospital. The grey bars exclude patients that chose treatment at ISPs.

Figure 6: **Local Area Deprivation of Hip Replacement Patients, by Provider Type (2006/07, 2009/10 and 2012/13)**



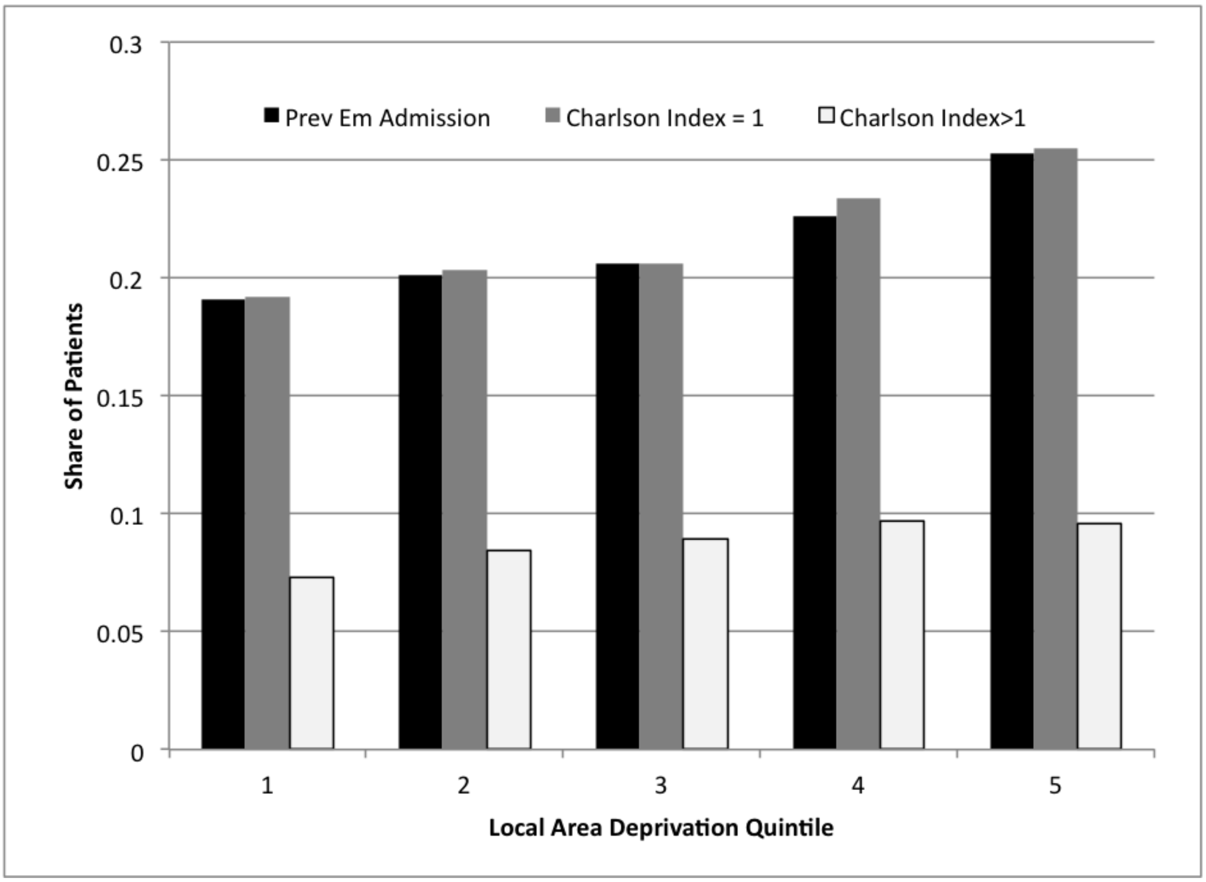
Notes: Local area deprivation takes values between zero and one, with zero representing the least deprived local area (LSOA) and one the most deprived local area in England.

Figure 7: **Distribution of Deprivation of Local Areas where ISPs are the Closest Hip Replacement Provider (2006/07, 2009/10 and 2012/13)**



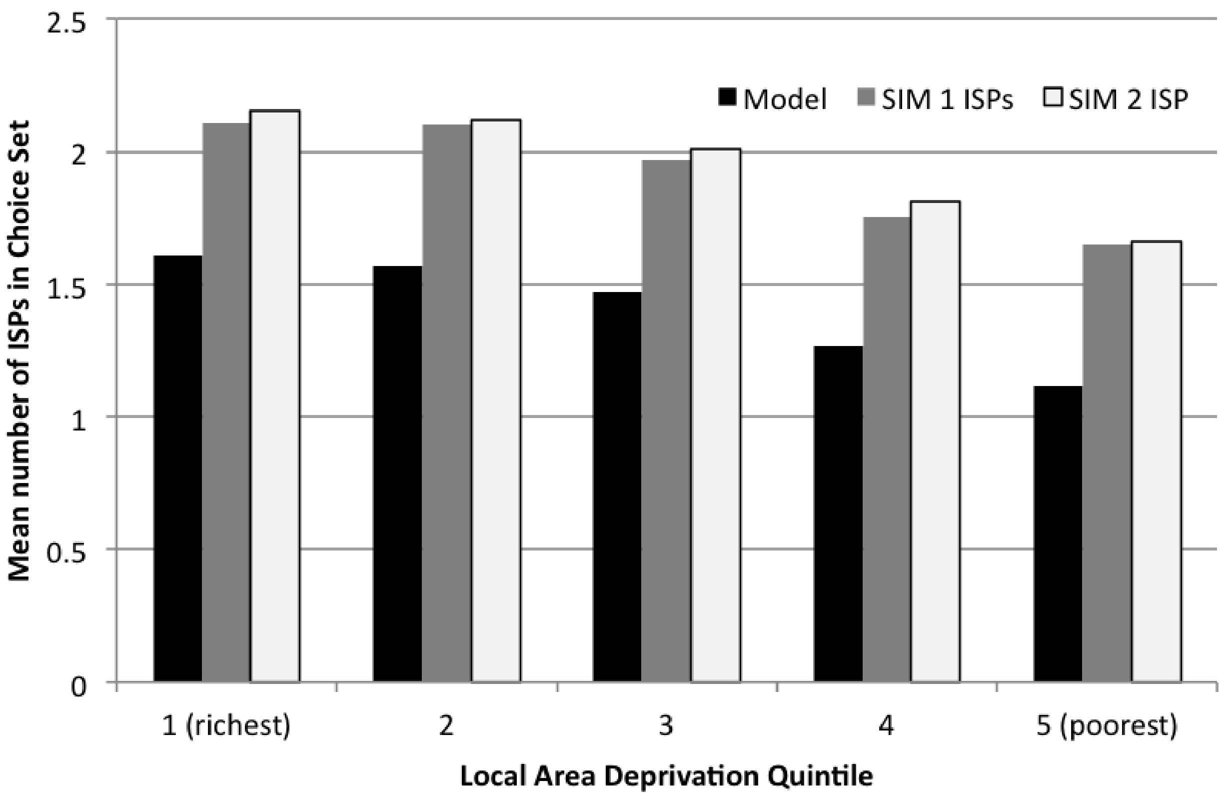
Notes: This Figure plots the distribution of the deprivation (IMD) rank of LSOAs that have an ISP as their nearest provider. The local area with the lowest deprivation in England takes the value zero; the local area with the highest level of deprivation take the value 1. There are 32,500 LSOAs in total in England. In 2006/07 there were 500 that had an ISP as the closest provider; in 2009/10 3545 and in 2012/13, 8012.

Figure 8: **Share of Patients with Underlying Health Problems by Local Area Deprivation Quintiles.)**



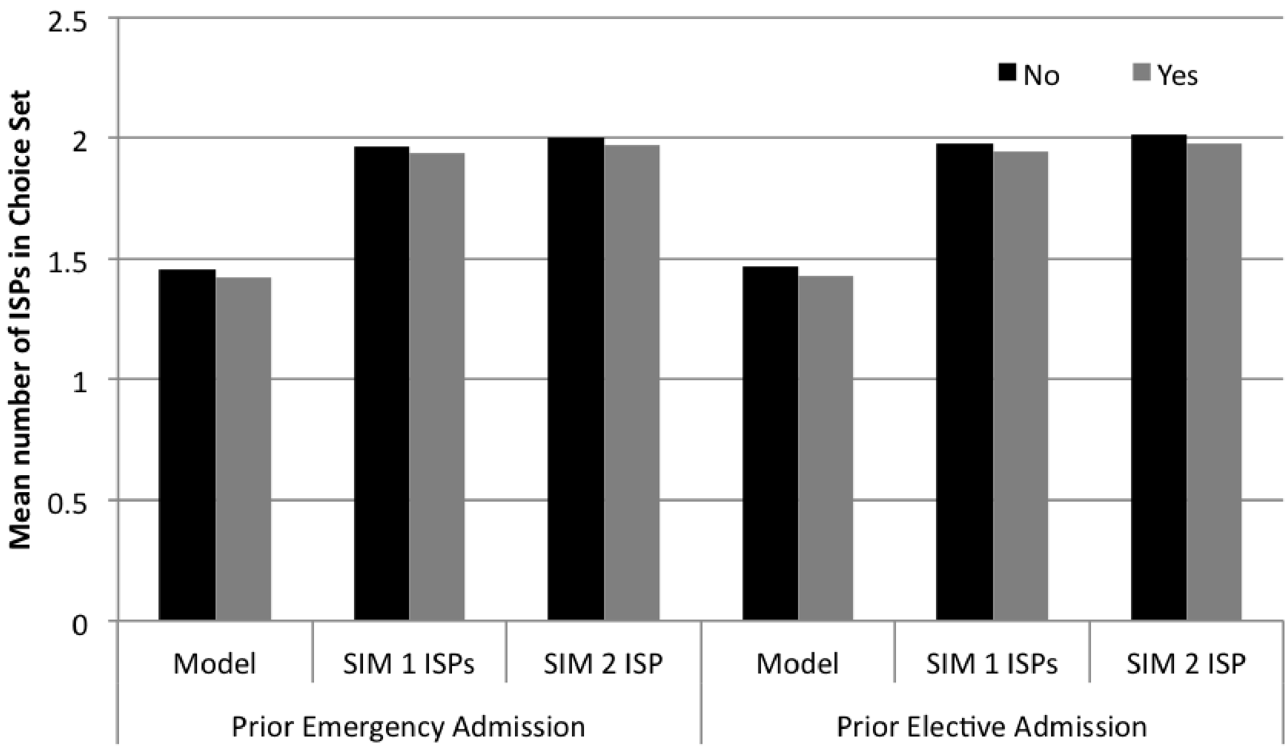
Notes: Quintile 1 corresponds the least deprived fifth of areas on the basis of IMD. Quintile 5 corresponds the most deprived quintile of areas. Local area deprivation measures by Index of Multiple Deprivation rank of the patient's lower super output area

Figure 9: **Number of ISPs by model and simulation choice sets and deprivation quintile**



Notes: Simulation 1 moves patients to GP practices which have choice sets with the most ISPs in the patient's local area. Simulation 2 expands GP choice sets to add the alternatives that are referred to by GP practices in the local area that referred to the most ISPs.

Figure 10: **Number of ISPs by choice set and prior admissions**



Notes: Simulation 1 moves patients to GP practices which have choice sets with the most ISPs in the patient's local area. Simulation 2 expands GP choice sets to add the alternatives that are referred to by GP practices in the local area that referred to the most ISPs. Admissions in the previous three years (1095 days).

Table 1: **ISP Types**

	Wave 1	Wave 2	
	Wave 1 ISTC	Wave 2 ISTC	AQP
Year commenced	2003	2006	2006
Year last contract ended	2011	2015	-
Payment	Contracted procedure numbers, full payment guaranteed	Payments for fixed costs guaranteed, per procedure thereafter.	Per procedure
Patients	NHS patients only	NHS patients only	NHS patients and private pay patients

Table 2: **Means of Hospital Attributes, by Provider Type**

	NHS	ISP	All
Attributes with RC			
30 Day Em Readmit Ratio (2012)	0.91	1.09	1.02
(1=expected)	(0.42)	(0.64)	(0.53)
Attributes without RC			
Median Waiting Time)	87	45.3	71.2
(days, 2012/13	(23.3)	(33.2)	(34.1)
Share Early Found Trusts	0.160	N/A	0.10
	(0.37)	N/A	(0.30)
Share Specialist Hosps	0.0205	0.008	0.016
	(0.142)	(0.091)	(0.125)
Patients	253.3	103.4	196.5
	(174.0)	(96.0)	(166.0)
Hospitals	195	119	314

Notes: The sample includes hospitals that treated at least 20 patients in 2012/13. Waiting times are measured from the date of the decision to admit for a procedure and the date of the admission for the procedure. The 30 day emergency admission rate is given by predicting readmissions based on a regression of readmissions on the age, sex and underlying health of patients and dividing the actual readmissions, by the expected number. An ISP is defined as a hospital site that has a code in HES that begins with an ”N”.

Table 3: **Mean patient characteristics by chosen provider type**

	ISP	**NHS**	**Difference**
Age	68.2	68.6	-0.4***
	(10.0)	(11.6)	(0.1)
Ethnic Minority	0.013	0.039	-0.025***
	(0.115)	(0.193)	(0.002)
Female	0.598	0.601	-0.002
	(0.49)	(0.49)	(0.005)
Local Area Deprivation	0.391	0.45	-0.058***
(Scaled 0-1)	(0.253)	(0.275)	(0.003)
Moderate Comorbidity	0.167	0.225	-0.058***
(CI=1)	(0.373)	(0.418)	(0.004)
Severe Comorbidity	0.044	0.096	-0.052***
(CI>1)	(0.205)	(0.295)	(0.003)
Prev Emergency Admission	0.132	0.230	-0.098***
	(0.338)	(0.421)	(0.004)
Prev Elective Admission	0.481	0.568	-0.088***
	(0.500)	(0.495)	(0.005)
GP ref HHI (2011)	0.548	0.607	-0.059***
	(0.178)	(0.197)	(0.002)
GP 3 year ISP ref share	0.13	0.077	0.054***
(2009/10-2011/12)	(0.106)	(0.086)	(0.001)
N	50,525	12,357	

Notes: Ethnic minority are those not classed as White British or Irish. Comorbidities measured using the Charlson Index. Previous admissions in the previous 3 years (1095 days) for any cause.

Table 4: **Mixed Logit Results: Hospital Attributes**

	Distance Choice Set			GP Choice Set		
	Coeff	SE	p-value	Coeff	SE	p-value
Attributes with RC						
Distance						
Mean	-0.0854	0.0076	0.000	-0.0753	0.0060	0.000
SD	0.1041	0.0017	0.000	0.0450	0.0014	0.000
ISP						
Mean	-1.9011	0.2106	0.000	-1.6493	0.1984	0.000
SD	3.1474	0.0975	0.000	2.6472	0.0866	0.000
Emergency Readmissions						
Mean	-1.1737	0.1209	0.001	-1.0235	0.1288	0.000
SD	0.0019	0.0417	0.480	0.0180	0.1116	0.436
Attributes w/out RC						
Early Foundation Trust	0.8261	0.1498	0.000	0.4358	0.1492	0.000
Waiting times (weeks)	-0.0985	0.0142	0.000	-0.1083	0.0144	0.000
Specialist Orthopedic Hosp	1.4729	0.2011	0.000	3.1278	0.1655	0.000
Same PCT	-0.3577	0.1075	0.000	-0.3965	0.1029	0.000

Notes: The sample includes all patients who had an elective hip replacement in financial year 2012/13 and chose one of the ten closest hospitals to the centroid of their LSOA. The model also includes interactions between all hospital characteristics and age, ethnic minority status, underlying health, and prior GP referral patterns.

Table 5: **Mixed Logit Results: Heterogeneity by patient characteristics**

	Distance Choice Set			GP Choice Set		
	Coeff	SE	p-value	Coeff	SE	p-value
	Coeff	SE	p-value	Coeff	SE	p-value
ISPs ISP x Age	0.0026	0.0024	0.131	0.0004	0.0022	0.4280
ISP x Eth Min	-1.3286	0.1777	0.000	-1.0496	0.1732	0.000
ISP x Deprivation	-0.3598	0.1039	0.000	-0.0725	0.0958	0.224
ISP x Prev Em Admit	-1.2158	0.0739	0.000	-1.0008	0.0674	0.000
ISP x Prev El Admit	-0.5151	0.0531	0.000	-0.5611	0.0503	0.000
ISP x CI of 1	-0.7291	0.0670	0.000	-0.6258	0.0616	0.000
ISP x CI of 2+	-1.5998	0.1121	0.000	-1.3218	0.1015	0.000
ISP x GP HHI	-1.5917	0.1588	0.000	-0.4582	0.1433	0.001
ISP x GP refs to ISPs	3.8879	0.3476	0.000	3.1966	0.3131	0.000
Specialist Hospitals Spec Hosp x Ethnic Minority	0.5021	0.1294	0.000	0.0837	0.1117	0.227
Spec Hosp x Deprivation	0.0214	0.1022	0.417	-0.2537	0.0848	0.001
Spec Hosp x Pre Em Admit	-0.1955	0.0678	0.002	-0.1359	0.0558	0.008

Notes: The sample includes all patients who had an elective hip replacement in financial year 2012/13 and chose one of the ten closest hospitals to the centroid of their LSOA. The model also includes interactions all hospital characteristics in Table 4 and age, ethnic minority status, underlying health, and prior GP referral patterns. Random coefficients are estimated at the patient level.

Table 6: **Mixed Logit Results: GP level model**

	Coeff	SE	p-value
Attributes with RC			
Distance			
Mean	-0.0699	0.0067	0.000
SD	0.0616	0.0016	0.000
ISP			
Mean	-1.1008	0.1736	0.000
SD	1.0180	0.0242	0.000
Emergency Readmissions			
Mean	-0.8762	0.1603	0.000
SD	-1.4226	0.0345	0.000
Attributes w/out RC			
Early Foundation Trust	0.3338	0.1527	0.015
Waiting times (weeks)	-0.1208	0.0145	0.000
Specialist Orthopedic Hosp	3.0329	0.1650	0.000
Same PCT	-0.0740	0.1062	0.243
Observable Heterogeneity			
ISP x Age	0.0042	0.0015	0.003
ISP x Ethnic Minority	-0.7147	0.1210	0.000
ISP x Deprivation	-0.0321	0.0756	0.336
ISP x Prev Em Admit	-0.6169	0.0444	0.000
ISP x Prev El Admit	-0.3155	0.0339	0.000
ISP x CI of 1	-0.3722	0.0418	0.000
ISP x CI of 2+	-0.8859	0.0689	0.000
ISP x GP HHI	-0.3495	0.1577	0.014
ISP x GP refs to ISPs	1.1941	0.3181	0.000
Spec Hosp x Ethnic Minority	-0.0501	0.1091	0.323
Spec Hosp x Deprivation	-0.3905	0.0874	0.000
Spec Hosp x Pre Em Admit	-0.1141	0.0534	0.016

Notes: The sample includes all patients who had an elective hip replacement in financial year 2012/13 and chose one of the ten closest hospitals to the centroid of their LSOA. The full model also includes interactions between all patient characteristics and all hospital attributes. Random coefficients are estimated at the GP Practice level.

Table 7: **Simulation Results: Expected ISP Share by Patient Characteristics**

	Data	GPCS Model	Sim 1 Moving pats	Sim 2 Adding Alts
All	19.2	25.9	28.7	27.6
Local Area Deprivation Quintile				
1 (richest)	22.1	27.1	30.2	28.6
2	21.3	26.2	30.2	29.1
3	20.3	24.9	29.5	28.6
4	15.9	21.1	27.5	26.1
5 (poorest)	12.1	19.2	26.1	24.8
Difference Quintile 1-5	10.0	7.9	4.1	3.8
Ethnicity				
White British/Irish	19.6	27.0	29.2	27.8
Ethnic Minority	7.4	15.5	21.6	21.1
Difference	12.2	11.5	7.6	6.7
Previous Emergency Admission				
No	22.9	24.9	26.3	25.4
Yes	13.2	26.7	29.2	28.4
Difference	9.7	1.8	2.9	2.9

Calculated by summing the predicted probabilities for ISP alternatives for all patients

A GP Choice Set Determinants

The GP choice sets used to estimate the GP choice set model are determined by referral patterns over the previous three years (2009/10 - 2011/12). We include hospitals where GP practices referred more than 0.5% of patients. the mean number of referrals was 420 per GP practice. We then add any hospital that a GP referred a hip replacement patient to in that year, if these are no already included in the sample.

This section estimates a logit model for whether each of the 313 hospitals that conducted at least 20 procedures were included in choice set. Results are presented in Table A1. Column 1 shows the odds that an NHS hospital is in a GP choice set given the characteristics of the hospital. As expected, the odds of inclusion decline with distance, increase in hospital quality and decline in waiting times. This fits with the model of GPs acting as altruistic agents for their patients. However, the role of quality is relatively weak. This is consistent with responses to a survey of Providers in 2008 and 2009, where it was perceived that GP referral patterns paid little attention to quality [Dixon et al., 2010a]. Specialist Orthopedic hospitals are 78 times more likely to be included in GP choice sets, holding other characteristics constant, and hospitals located in the same Primary Care Trust (PCT) are 22 times more likely to be included. NHS acute hospitals are separate from PCTs, however this within PCT effect may be explained by differences in information on GPs wishing to ensure that hospitals where their patients receive emergency treatment continue to receive a stream of funding.

The factors that determine whether an ISP is included in a GP choice set are similar to those for an NHS hospital. Factors of importance to patients, such as distance, waiting times, and clinical do affect referrals, although the effect of quality is relatively small. The type of ISP is a very strong determinant. The odds of including an ISP are 13 times higher for Wave 1 ISTCs and 3 times higher for Wave 2 ISTCs, relative to hospitals that also treat private patients. As all ISPs place similar restrictions on the types of patients that are eligible for ISP treatment, this must operate either through differences in information on incentives to refer. In particular, Wave 1 ISTCs received payments for contracted procedures whether or not undertaken. Primary Care Trusts therefore had an incentive to ask GPs to refer. In common with NHS hospitals, ISPs are more likely to be included in choice sets if they are located in the same PCT, although the magnitude of this difference is lower (with odds six times higher for ISPs, relative to 22 times higher for NHS hospitals). There are no clear incentives for GPs or Primary Care Trusts for favouring ISPs within the same PCT, suggesting that this is likely to reflect imperfect information rather than incentives.

Columns 3 and 4 add the characteristics of the local area including the share of the

MSOA population that is non white, the share over 65 and local area deprivation. These coefficients capture whether these characteristics affect the average number of alternatives of each provider type are included. For both types of provider, areas with high ethnic minority populations attend GP practices that refer to fewer hospitals. The magnitude is greater for ISPs. This is consistent with results of the **?** survey, where GPs noted that language difficulties may limit the extent to which ethnic minority patients can participate in choice. The share of those over 75 also has a small positive association with the number of hospitals in the choice set. The relationship between consideration set size and local area deprivation is not statistically significant.

Columns 5 and 6 include characteristics of the GP practice. Number of hospitals in GP consideration sets increase with the practice list size and the number of GPs in the practice. Consideration sets are small in GP practices with higher shares of GPs from outside the UK and EEA and the share of younger GPs under the age of 40.

Finally, columns 7 and 8 include characteristics of the nearest hospital. Consideration sets are larger when there are fewer hospitals in each GP practice. ISP alternatives are increasing in the waiting times of the nearest NHS hospital.

Table A1: **The odds that a hospital is included in a GP choice set**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Hosp chars		+ loc area		+GP practice		+ local healthcare	
	NHS	ISP	NHS	ISP	NHS	ISP	NHS	ISP
Log Distance	0.0892***	0.0641***	0.0696***	0.0506***	0.0676***	0.0479***	0.0448***	0.0301***
	(0.00607)	(0.00823)	(0.00449)	(0.00641)	(0.00438)	(0.00610)	(0.00269)	(0.00398)
Emergency Readmissions	0.545***	0.914	0.600***	0.966	0.596***	0.967	0.677***	1.014
	(0.0572)	(0.135)	(0.0595)	(0.141)	(0.0596)	(0.142)	(0.0618)	(0.136)
Wait Times	0.996**	1.000	0.998	0.998	0.998	0.997	0.999	0.994**
	(0.00151)	(0.00249)	(0.00158)	(0.00248)	(0.00158)	(0.00247)	(0.00153)	(0.00228)
Early FT	1.069		0.998		0.999		0.992	
	(0.120)		(0.112)		(0.114)		(0.110)	
spec_ortho	77.95***	85.80***	92.80***	137.3***	95.01***	151.5***	124.2***	321.7***
	(8.308)	(29.68)	(9.940)	(47.81)	(10.31)	(53.58)	(12.79)	(118.1)
Same PCT	21.77***	6.203***	14.40***	4.076***	13.92***	3.927***	8.810***	2.513***
	(6.660)	(1.514)	(3.922)	(0.942)	(3.817)	(0.902)	(1.842)	(0.456)
Phase 1 ISTC		13.01***		11.36***		10.88***		9.413***
		(3.343)		(2.854)		(2.737)		(2.342)
Phase 2 ISTC		2.896***		2.121***		2.185***		2.718***
		(0.785)		(0.616)		(0.625)		(0.710)
Local Area Deprivation			1.050	0.647	1.205	0.818	1.308*	1.033
			(0.197)	(0.184)	(0.225)	(0.235)	(0.207)	(0.227)
Share of population non white			0.0597***	0.0107***	0.0614***	0.0120***	0.292***	0.0849***
			(0.0246)	(0.00862)	(0.0255)	(0.00949)	(0.0978)	(0.0436)
Share of Population over 75			1.066***	1.088***	1.066***	1.088***	1.056***	1.097***
			(0.0231)	(0.0272)	(0.0220)	(0.0249)	(0.0163)	(0.0200)
List Size					1.035***	1.024**	1.029***	1.019**
					(0.00802)	(0.0110)	(0.00684)	(0.00956)
GP practice GPs (rel to single practitioner)								
2-3					1.150**	1.471***	1.055	1.364***
					(0.0694)	(0.170)	(0.0602)	(0.145)
4-6					1.204**	1.837***	1.075	1.581***
					(0.104)	(0.284)	(0.0831)	(0.221)
7+					1.309**	2.096***	1.116	1.678***
					(0.155)	(0.428)	(0.114)	(0.304)
PCT GP non EEA					0.822**	0.599***	0.925	0.800**
					(0.0689)	(0.0729)	(0.0609)	(0.0808)
PCT GP under 40					0.777***	0.569***	0.913	0.765**
					(0.0636)	(0.0783)	(0.0675)	(0.0903)
Number of NHS Hospitals ¡ 15km (rel to 0)								
1							0.501***	0.343***
							(0.0616)	(0.0499)
2							0.295***	0.137***
							(0.0432)	(0.0261)
3							0.201***	0.0827***
							(0.0320)	(0.0206)
4							0.161***	0.0815***
							(0.0332)	(0.0227)
5+							0.0877***	0.0483***
							(0.0160)	(0.0122)
Nearest NHS hospital wait times							1.000	1.003***
							(0.000709)	(0.00134)
Nearest NHS hospital early FT							0.816*	0.940
							(0.0885)	(0.147)
Observations	1,353,213	711,847	1,353,213	711,847	1,353,213	711,847	1,353,213	711,847

Notes: *** denotes significance at 1%, ** at 5%, and * at 10% level. Observations are at the GP-hospital level. The dependent variable takes the value 1 if the hospital is in the GP's choice set. Estimates are odds ratios