Determinants of patient mobility for prostate cancer surgery: a population-based study of choice and competition

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ABSTRACT

Many countries have introduced policies that enable patients to select a health care provider of their choice with the aim of improving the quality of care. However, there is little information about the drivers or the impact of patient mobility. Using administrative hospital data (*n*=19,256) we analysed the mobility of prostate cancer patients who had radical surgery in England between 2010 and 2014. Our analysis, using geographic information systems and multivariable choice modelling, found that 33·5% (*n*= 6,465) of men bypassed their nearest prostate cancer surgical centre. Travel time had a strong impact on where patients moved to but was less of a factor for men who were younger, fitter, and more affluent (p always <0·001). Men were more likely to move to hospitals that provided robotic prostate cancer surgery (odds ratio 1·42, p<0·001) and to hospitals that employed surgeons with a strong media reputation (odds ratio 2·18, p<0·001). Patient mobility occurred in the absence of validated measures of the quality of care, instead influenced by the adoption of robotic surgery and the reputation of individual clinicians. National policy based on patient choice and provider competition may have had a negative impact on equality of access, service capacity, and health system efficiency.

Patient summary

In this study we assessed the reasons why men would choose to have prostate cancer surgery at a centre other than their nearest. We found that in England men were attracted to centres that carried out robotic surgery and employed surgeons with a national reputation.

Many high-income countries have introduced policies that aim to improve the quality of care by stimulating competition between hospital providers and allowing patients to choose the hospital where they have treatment.[1] In publicly funded health care markets such as the UK, funding follows the patient, creating quite powerful incentives for hospitals to attract new patients by demonstrating superior quality.[2]

To date, our understanding of the extent and determinants of patient mobility across health services remains limited, due to a paucity of available research and heterogeneity in the design of empirical studies.[3] The aim of the present study is to undertake the first-ever national analysis assessing the impact of choice and competition policies within cancer care. Our aim was to investigate whether prostate cancer patients, who had a radical prostatectomy (RP) in the English NHS, travelled beyond ("bypassed") their nearest hospital, and the hospital and patient characteristics associated with that mobility.

We obtained individual patient-level data on all men (n=19, 256) who were diagnosed with prostate cancer and underwent RP in the English NHS between 1st January 2010 and 31st December 2014 from the National Cancer Registration and Analysis Service (NCRAS) and linked at patient level to Hospital Episode Statistics (HES). Patient characteristics of the study cohort are presented in Supplementary Table 1.

The population weighted centroids of the patients' Lower Super Output Areas (geographic areas defined by the Office for National Statistics that typically includes 1,500 residents or

650 households) and the full postcodes for the hospitals where the surgery was undertaken were inputted into a geographical information system (ESRI ArcGIS 10.3) to calculate travel times according to the fastest route by car (using Ordnance Survey MasterMap Integrated Transport Network). For each patient, the travel time to all prostate cancer surgical centres (n=65) was calculated. The proportion of patients not receiving care at their nearest centre were considered to be "bypassers".

We determined three hospital-level characteristics. These were informed by a systematic review of the literature and qualitative interviews with both men previously treated for prostate cancer and uro-oncology specialists currently practicing in the UK.

We labelled the 12 hospitals that carried out robotic prostatectomies at the start of the study period as "established robotic centres". We identified the 31 "university teaching hospitals", based on their membership of the Association of UK University Hospitals. We also defined the 12 hospitals with a "strong media reputation", based on whether or not they employed urologists that were listed in 2010 as the "best" prostate cancer surgeons in the UK by the "Daily Mail",[4] which is the only nationally published source recognising expert prostate cancer surgeons. Further details on selection of hospital characteristics is available in the supplemental content.

Conditional logit regression was used to model the odds that a patient moved to a particular hospital as a function of travel time and hospital and patient characteristics.[5] For each patient, we created a data set that included for each patient a row for each hospital providing prostate cancer surgery at the time of treatment (number of hospitals varied between 57 and 65 as eight hospitals closed during the study period). The dependent variable of the conditional logit model was a dummy variable with a value of 1 for the hospital where a patient had his treatment and a value of 0 otherwise. Patient characteristics were included as interaction terms with travel time in the model and included age, number of comorbidities, socioeconomic status (based on national quintiles of the Index of Multiple Deprivation)[6],and urban or rural residence.[7] Further detail on patient characteristics and the statistical methods is available in the supplemental content.

Our analysis demonstrated that 6,465 men (33·5%) “bypassed” the nearest centre that carried out prostate cancer surgery. 2386 men (12·4%) bypassed at least three hospitals for their treatment and 1,258 men (6·5%) at least five hospitals (Supplementary Table 2). There were clear differences in bypass rates between the nine English regions. In London, 50·9% of men had their prostate cancer surgery at the nearest centre whilst corresponding percentages were 86·5% in the North East and 80·6% in Yorkshire and Humberside (Supplementary Table 3).

Travel time had a strong impact on the odds that a patient chose a particular hospital to receive surgery. The odds of a patient choosing a hospital that was up to 10 minutes further away than the patient’s nearest hospital that carried out prostate cancer surgery was found to be on average 78% smaller (OR of 0.22). The odds decreased markedly as the additional travel time increased (Table 1).

The addition of patient characteristics as interaction terms into our model demonstrated that the impact of travel time was smaller for men who were younger, for those who were fitter (no recorded comorbidities), and for those who lived in more affluent or rural areas (odds ratios larger than “1” (Table 1)). For example, again compared to having the surgery at the nearest hospital, for men in rural areas, the likelihood of moving to a hospital that was up to 10 minutes further away was estimated to be 2·5 times smaller (= 1 / (0·22 x 1·79)) whereas the corresponding figure for men from urban areas is 4.8 (= 1 / 0·22).

Patients were 1·42 times more likely to move to one of the 12 hospitals that were established robotic centres compared to those that were not and 2·18 times more likely to move to the 12 hospitals that employed surgeons who had a strong media reputation (Table 1). University teaching hospital status had a small but statistically significant impact (OR 1·09, p<0·001) on attracting patients.

These findings have a number of policy implications that are relevant across a range of elective secondary care services in countries that have introduced patient choice of provider policies.[3] A substantial number of patients, well above the 5% to 10% thought to be necessary to incentivise improvements in quality,[8] were prepared to move to hospitals further away for radical prostatectomy. This occurred in the absence of evidence that these hospitals achieved better outcomes. Instead, they responded to the availability of more advanced surgical technology and the perceived reputation of the hospitals’ surgeons.

The provision of robotic surgery has been noted to attract patients to providers in health care markets across Europe and North America,[9] resulting in a rapid growth in the number of providers offering this technology. Our own data supports this: men were more likely to choose one of the 12 established robotic centres in the NHS. It is likely that this competitive advantage has contributed to the large-scale investment in equipment for robotic surgery across the NHS.[10] There has been a more than threefold increase in the number of centres offering this modality between 2010 and 2016 (from 12 to 42 centres).

Hospital and clinician reputation have also been identified in other studies as important factors influencing decision making for cancer surgery.[11] This suggests that patients, with or without guidance from their primary care physician, social and medical networks or clinician who diagnosed the cancer, respond to indicators that in their view reflect differences in treatment quality.[12]

The list of prostate cancer surgeons with a national reputation was compiled by the Daily Mail following a survey of urologists working in the UK. Much of the intelligence is therefore likely to be representative of the discussions that are ongoing within particular regions both amongst clinicians as well as patient and carer support groups. It can therefore be considered as a proxy for the wider reputation of hospitals.

The patterns of mobility observed in England has resulted in large and unexpected shifts in market share for hospitals carrying out prostate cancer surgery. For some hospitals, nearly

80% of patients for whom that hospital was the nearest provider chose to have their treatment elsewhere. Conversely, other hospitals were performing up to 200% more operations than expected because patients from elsewhere travelled to these hospitals for their surgery. Such extremes of mobility are likely to have a negative impact on health system efficiency (due to lengthening waiting lists for some and unused capacity for others) with some surgical units facing the threat of closure given that funding is contingent on the number of procedures performed.[2,10] Equally, surgical unit closures and the greater regionalization that results may serve to improve efficiency.

Our modelling of patient mobility had a number of limitations. First, we used administrative dataset and it is likely that we have missed less severe comorbid conditions. Second, the study used centroids of small geographical areas to represent the location of the patients' residence. This will have added "noise" to the determination of travel times.

In conclusion, men are willing to travel for prostate cancer surgery, especially those that are relatively young, fit and affluent. The study highlights that without appropriate quality information to guide patients' choices, patients are influenced by the reputation of hospitals and their surgeons and the availability of innovative technologies. National policy based on patient choice and provider competition may have a negative impact on service capacity, equality of access, and health system efficiency.

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Table 1 – Impact of travel time and hospital and patient characteristics on patient mobility in 19,256 men undergoing radical prostatectomy between 2010-2014 in the English National Health Service.[1]

	Adjusted odds ratio	95% CI	p value[2]
Impact of additional travel time (mins)[3]			
	1		<0.001
<10	0.22	0.18-0.27	
11-30	0.03	0.03-0.04	
31-60	0.004	0.003-0.006	
>60	0.0005	0.0003-0.0006	
Difference in impact of additional travel time for selected patient characteristics[4]			
Younger patients (< 65 years)			<0.001
<10	1.11	1.01-1.23	
11-30	1.14	1.02-1.28	
31-60	1.40	1.20-1.64	
>60	1.37	1.18-1.59	
Patients without comorbidities			<0.001
<10	1.16	0.97-0.98	
11-30	1.12	0.90-1.39	
31-60	1.78	1.23-2.58	
>60	1.32	0.97-1.81	
Patients from more affluent areas (IMD 1 or 2)			<0.001
<10	1.08	0.98-1.23	
11-30	1.36	1.21-1.52	
31-60	1.35	1.15-1.59	
>60	1.12	0.97-1.29	
Patients from rural areas			<0.001
<10	1.79	1.57-2.04	
11-30	2.19	1.93-2.48	
31-60	2.61	2.23-3.05	
>60	2.14	1.84-2.47	
Impact of hospital characteristics			
University hospital	1.09	1.05-1.15	<0.001
Established robotic centre	1.42	1.33-1.52	<0.001
Strong media reputation	2.18	2.05-2.31	<0.001
McFadden's pseudo R^2		0.70	

Notes:

1. Odds ratio represent differences in the odds that a patient moves to a particular hospital as a function of travel time and hospital and patient characteristics.
2. P value based on likelihood ratio test
3. Note that the adjusted odds ratios for additional travel time relates to older men (≥ 65 years), with comorbidity (Charlson ≥ 1), from less affluent (IMD 3-5), and living in an urban area.
4. Impact of patient characteristics on the odds ratio representing the impact of additional travel time (see results section for interpretation).