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ORIGINAL ARTICLE

Association of travel time, patient characteristics, and hospital quality with patient mobility for breast cancer surgery: A national population-based study

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Abstract

Background: This national study investigated hospital quality and patient factors associated with treatment location for breast cancer surgery.

Methods: By using linked administrative data sets from the English National Health Service, the authors identified all women diagnosed between January 2, 2016, and December 31, 2018, who underwent breast-conserving surgery (BCS) or a mastectomy with or without immediate breast reconstruction. The extent to which patients bypassed their nearest hospital was investigated using a geographic information system (ArcGIS). Conditional logistic regressions were used to estimate the impact of travel time, hospital quality, and patient characteristics.

Results: 22,622 Of 69,153 patients undergoing BCS, 22,622 (32.7%) bypassed their nearest hospital; and, of 23,536 patients undergoing mastectomy, 7179 (30.5%) bypassed their nearest hospital. Women who were younger, without comorbidities, or from rural areas were more likely to travel to more distant hospitals ($p < .05$). Patients undergoing BCS (odds ratio [OR], 1.85; 95% confidence interval [CI], 1.36–2.50) or mastectomy (OR, 1.52; 95% CI, 1.14–2.02) were more likely to be treated at specialist breast reconstruction centers despite not undergoing the procedure. Patients receiving mastectomy and immediate breast reconstruction were more likely to travel to hospitals employing surgeons who had a media reputation (OR, 2.41; 95% CI, 1.28–4.52). Patients undergoing BCS were less likely to travel to hospitals with shorter surgical waiting times (OR, 0.65; 95% CI, 0.46–0.92). The authors did not observe a significant impact for research activity, hospital quality rating, breast re-excision rates, or the status as a multidisciplinary cancer center.

Ajay Aggarwal and Lu Han contributed equally to this article as joint first authors.

Arnie Purushotham and Jan van der Meulen contributed equally to this article are as joint final authors.

Jeanette Costigan and Joanne Taylor participated in this research as patient representatives.

Conclusions: Patient choice policies may drive inequalities in the health care system without improving patient outcomes.

KEYWORDS
breast cancer, geographic information systems, mastectomy, patient choice, quality indicators, waiting times

INTRODUCTION

Several countries have introduced policies that enable patients to choose a hospital where they will have their treatment with the aim of building a more patient-centered and efficient health system and to drive improvements in quality.[1–3]

To date, studies in bowel and prostate cancer have demonstrated that, in the English National Health Service (NHS), up to one in three patients bypass their nearest surgical center for treatment.[4–6] Patients who bypass their nearest hospital are typically younger, fitter, and more affluent. Patients are more likely to travel to hospitals offering advanced technologies, such as robotic surgery,[7] but not necessarily hospitals with the best disease-specific outcomes.[8]

Understanding patient mobility for cancer services is important. First, new policies are being developed that aim to use patient choice to better match demand (patients experiencing long waiting times) to supply (hospitals with shorter waiting times), especially in the context of the postpandemic cancer backlogs.[9] Second, there is emerging evidence that hospitals located in competitive areas where patients have the opportunity to select from a wider range of providers offer better quality care, which suggests that there is a trade-off between centralizing health services and using competition to incentivize quality improvement.[10,11] Third, when more affluent and younger patients are able to travel to hospitals that provide better quality, this may widen inequalities in access and outcomes for marginalized groups.[12]

Breast cancer is an important cancer type in which to investigate patterns of patient mobility because the care for patients with breast cancer is rapidly evolving; for example, the diffusion of oncoplastic techniques for breast-conserving surgery (BCS) and breast reconstruction.[13] In many countries, there is also a wide range of patient forums and cancer charities helping them to make decisions about the hospitals in which they receive treatment.[14,15]

The NHS in the United Kingdom is an ideal health system in which to understand the impact of patient choice policies in cancer care.[16] It is a publicly funded, single-payer system in which, in principle, patients have the opportunity to select any hospital providing cancer treatment.[17] Over 95% of all cancer care is delivered in the NHS, and national administrative data sets are available that capture the care they receive.[18] In addition, it is one of the few countries to publicly report information on the quality of cancer care.[19]

In this national population-based study, we investigate how many patients with breast cancer who had a major primary surgical resection in the English NHS *bypassed* their nearest surgical center for treatment. We then present these mobility patterns according to patient characteristics as well as the extent to which certain characteristics make hospitals more attractive to patients. Finally, we discuss the implications of our results for designing national health policies and provider incentives to ensure effective, efficient, and fair functioning of health care systems.

MATERIALS AND METHODS

Data sources

We used data from the National Cancer Registration and Analysis Service[20] linked to the NHS Hospital Episode Statistics (HES) database.[18] HES data provided information on patient-level characteristics, including the patient's residence, age, sex, the number of comorbidities according to the Royal College of Surgeons' Charlson comorbidity index,[21] ethnicity, and socioeconomic deprivation expressed in terms of quintiles of the national distribution of the Index of Multiple Deprivation (IMD) in 2015.[22] HES data also provided information regarding the treating hospital, the date of surgery, and the type of breast cancer surgery; for example, mastectomy, autologous reconstruction, and the occurrence of breast re-excisions after BCS. Breast cancer surgery procedure information was coded according to the Office of Population Censuses and Surveys Classification of Surgical Operations and Procedures, 4th Revision.[23] The rurality of the area of residence was captured as rural, urban (non-London), or London.[24] The National Cancer Registry data provided information on cancer stage.

Population

We obtained individual patient-level data for all patients who had been diagnosed with breast cancer between January 1, 2016, and December 31, 2018, and who subsequently underwent either BCS or a mastectomy with or without reconstruction in the NHS in England.

Patients with breast cancer were identified in the National Cancer Registry data using the International Classification of Disease, 10th Revision[25] code C50. Patients with these breast cancer codes were included if their sex was recorded as *female* and if there was no other cancer diagnosis 1 month before and 1 month after the breast cancer diagnosis. For patients who had multiple diagnoses of breast cancer in the National Cancer Registry data, we used information on the earliest diagnosis record.

Patients were included in our analysis if they had undergone elective resection and if they were treated in one of the 166 English NHS hospitals routinely performing breast cancer surgery (hospitals that perform at least 10 procedures per year). Patients with metastatic disease as well as patients who underwent surgery in a private sector hospital were excluded.

Variables

Patient characteristics

Six patient characteristics were included in our analysis: age, socioeconomic deprivation,[22] the number of comorbidities,[21] ethnicity, cancer stage, and residential area classified as *rural*', *urban (outside London)*, or *London*.[26]

Hospital characteristics

We used seven hospital characteristics that that may make a hospital more attractive to patients and their primary or secondary care physicians when considering where to have surgical treatment. These variables were informed by the peer-reviewed literature,[7] the national breast cancer organizational survey undertaken by the UK National Breast Cancer Audit,[27] and the study's patient and public involvement group and Steering Committee.

- *Treatment availability*: We identified 49 *multidisciplinary cancer centers* as those hospitals that offer both breast cancer surgery and radiotherapy on the same site and all provide neoadjuvant chemotherapy and adjuvant radiotherapy for breast cancer.
- *Specialist breast reconstruction center*: We identified 45 hospitals that performed at least 20 breast reconstructions after mastectomy using autologous non-implant or expander-based techniques per year.
- *Media reputation*: We identified 11 hospitals with a strong media reputation based on employing breast cancer surgeons who were listed in 2018 as the best breast cancer surgeons in the United Kingdom according to *The Daily Mail*, a leading national paper in the United Kindom.[28]
- *Overall hospital performance rating*: We identified 12 hospitals as providing *inadequate care* according to the performance rating system of the UK Care Quality Commission, which provides a composite metric for hospital quality and is published online.[29]
- *Research activity*: We defined 31 *high-research activity* hospitals using an established method based on trial recruitment[30] that considered research activity at a hospital according to the number of participants recruited at each hospital per year to studies funded by the National Institute for Health Research in 2018–2019.[6]
- *Cancer waiting times*: We identified hospitals that met cancer waiting time targets (i.e., to start treatment within 31 days from the decision to treat date) between January 2016 and during the 36-month period from 2016 to 2018.
- *Re-excision rates*: We identified 33 centers with the *highest re-excision rates* (greater than 20% re-excision rates) after elective BCS.

Travel time

Patients' residential locations were represented by the population-weighted centroids of their Lower-Layer Super Output Areas (LSOAs). There are 32,844 LSOAs in England, defined as small areas that typically include 1500 residents or 650 households.[24] A geographic information system (ESRI ArcGIS) was used to determine average daytime travel times by car by inputting the population-weighted centroids of the patients' LSOAs and full postal codes of the 166 hospitals performing breast cancer surgery by using the Ordnance Survey Master Map Highways Network. Travel time was included in the model as the additional travel time patients had to travel beyond their nearest hospital to reach an alternative hospital providing breast cancer surgery.

Statistical analyses

Bypassing hospitals

Patients who were not treated in the hospital nearest to them, were classified as *bypassers*.

The association of travel time, hospital, and patient characteristics with treatment location

We applied conditional logistic regression models to estimate the association between travel time and hospital and patient characteristics and where patients received surgery.[5,6] For each of the 166 hospitals providing breast cancer surgery, a binary dependent variable was created to indicate the hospital that provided the surgery. Travel time was included in the model as the additional travel time relative to the nearest hospital and was grouped into four categories: ≤10, 11–30, 31–60, and >60 minutes.

Univariable and multivariable conditional logistic regression models were estimated to assess the impact of travel time and hospital characteristics with and without adjustment of confounders. Patient characteristics were then included in the adjusted model as interactions with travel time to investigate the extent to which the associations with travel time were modified by the six patient variables: age (patients older than 70 years vs. patients aged 70 years or younger), ethnicity (patient from ethnic minority groups vs. White ethnic groups), comorbidity (patients with one or more comorbidity as defined by the Charlson comorbidity index vs. patients with no comorbidity), socioeconomic status (patients from more deprived

backgrounds [IMD, 3–5] vs, patients from less deprived backgrounds [IMD, 1–2]), rural–urban classification (patient living in non-London urban areas or in London vs. patients living in rural areas), and cancer stage (patients with stage II or III cancers vs. patients with stage I cancer). We obtained robust standard errors to take into account potential clustering around the 42 regional Integrated Care Systems, which are responsible for the coordination of services provided by the English NHS.[31]

Multiple imputations using chained equations were applied to create 10 imputations for the missing values in stage (2.4% for patients who underwent BCS, 5.0% for patients who underwent mastectomy) and ethnicity (4.3% for patients who underwent BSC, 3.2% for patients who underwent mastectomy). Of note, the proportion of ethnic groups identified in the NHS HES data has been shown to correlate with National Census results, which are considered a gold standard.[32] Multiply imputed data sets were used for the regressions, including patient characteristics, as well as case-mix adjustment in hospital-level reoperation rates. Regression results were combined using Rubin rules. All analyses were conducted using Stata 17 (Stata Corporation).

Ethics

Ethics approval for use of secondary, anonymized, patient-level data sets for these analyses was received from the NHS Research Ethics Committee on January 6, 2020 (reference: 20/WA/0161). Informed consent was not required for use of this information.

Patient partners have co-designed this research study, including defining the primary research objectives and design of the study as part of the patient and public involvement committee. Three of the authors have lived experience of breast cancer, and they have actively contributed to the writing of this article.

RESULTS

We identified 101,750 patients who were diagnosed between January 2, 2016, and December 31, 2018, and who underwent breast cancer surgery with curative intent. Of these patients, 69,153 received underwent an elective BCS, and 33,686 underwent an elective mastectomy (see Figure S1). Of the 23,536 patients undergoing mastectomy without reconstruction; 9055 had an immediate reconstruction and 1095 had a delayed reconstruction. Patient characteristics are described in Table 1. Of the 69,153 women undergoing BCS, 38,696 (56.0%) were aged 60 years or older, and 11,848 (17.13%) were younger than 50 years. In total, 39,070 patients (56.5%) had stage I disease, and 7220 (10.4%) had at least one comorbidity. Of the 23,536 patients who underwent a mastectomy alone, 15,269 (64.9%) were older than 60 years, 4015 (17.1%) were younger than 50 years, 5177 (22.0%) had stage I disease, and 3387 (14.4%) had at least one comorbidity. Of the 9055 patients undergoing mastectomy with immediate breast reconstruction (IBR), 1085 (19.9%) were older than 60 years, 4513 (49.8%) were younger than 50 years, 3157 (34.9%) had stage I disease, and 491 (5.4%) had at least one comorbidity.

Hospital bypassing

Of the 69,153 patients undergoing BCS, 22,622 (32.7%) bypassed their nearest hospital providing breast cancer surgery; and, of the 23,536 patients undergoing a mastectomy without reconstruction, 7179 (30.5%) bypassed their nearest hospital providing breast cancer surgery (see Table S1). The proportion was higher among patients living in rural areas (36.3% for BCS and 34.1% for mastectomy without reconstruction) compared with patients living in urban non-London areas (29.1% for BCS and 27.3% for mastectomy without reconstruction; see Table S2). Figure 1 illustrates the area of residence for patients who had their BCS at a surgical center in North West England. This included patients who lived within the local area of the hospital as well the those who traveled from outside of the local area to receive care there (*bypassers*). Table S1 highlights the median travel time for *nonbypassers* and *bypassers* according to the number of hospitals bypassed.

Determinants of treatment location

For both BCS and mastectomy, the univariable and multivariable analyses demonstrated that travel time was strongly associated with the hospital where the patients underwent their surgery (see Table S3 and Table 2). The odds of a patient traveling to another hospital than the nearest rapidly decreased with the additional travel time. For example, the odds of patients undergoing mastectomy (without reconstruction) traveling to a hospital that was up to 10 minutes farther away than their nearest hospital was considerably lower (adjusted odds ratio [OR], 0.27; 95% confidence interval [CI], 0.22–0.33), which is in keeping with most patients receiving care at their nearest hospital.

For women receiving BCS, we found that patients were more likely to undergo surgery at a specialist breast reconstruction center (adjusted OR, 1.85; 95% CI, 1.36–2.50) and less likely to undergo treatment at hospitals with the shortest waiting times (adjusted OR, 0.65; 95% CI, 0.46–0.92). We did not identify a statistically significant association between hospital-level re-excision rates and the hospital where patients received their surgical treatment. For women undergoing a mastectomy alone, we observed that patients were more likely to travel to a specialist breast reconstruction center (adjusted OR, 1.52; 95% CI, 1.14–2.02). Women who underwent a mastectomy and IBR were five times more likely to receive this at one of the 45 specialist breast reconstruction centers (adjusted OR, 5.53; 95% CI, 3.65–8.37) although all 166 centers offered breast reconstruction. Women were also more likely to have this procedure at hospitals that employed surgeons with a strong media reputation for breast cancer

TABLE 1 Characteristics of patients diagnosed with breast cancer between 2016 and 2018 who underwent breast-conserving surgery or mastectomy in English National Health Service hospitals.

	Breast-conserving surgery, *N* = 69,153		Mastectomy without reconstruction, *N* = 23,536		Mastectomy with immediate reconstruction, *N* = 9055	
	No.	%	No.	%	No.	%
Patient characteristics						
Age, years						
18–49	11,848	17.13	4015	17.06	4513	49.84
50–59	18,609	26.91	4252	18.07	2737	30.23
60–69	21,356	30.88	5297	22.51	1364	15.06
70 and older	17,340	25.07	9972	42.37	441	4.87
Ethnicity						
White	60,814	87.94	20,661	87.78	7819	86.35
Asian	2304	3.33	996	4.23	358	3.95
Black	1362	1.97	488	2.07	271	2.99
Mixed[a]	373	0.54	139	0.59	80	0.88
Other[b]	1312	1.90	470	2.00	258	2.85
Not stated	2599	3.76	696	2.96	232	2.56
Not known/missing	389	0.56	86	0.37	37	0.41
Index of multiple deprivation (IMD)						
First quintile (least deprived)	15,893	22.98	4892	20.79	2167	23.93
Second quintile	16,166	23.38	5219	22.17	2095	23.14
Third quintile	14,570	21.07	4977	21.15	1885	20.82
Fourth quintile	12,320	17.82	4375	18.59	1602	17.69
Fifth quintile (most deprived)	10,204	14.76	4073	17.31	1306	14.42
No. of Charlson comorbidities						
0	61,933	89.56	20,149	85.61	8564	94.58
1	4516	6.53	1906	8.10	378	4.17
>2	2704	3.91	1481	6.29	113	1.25
Rural/urban classification						
Rural	15,336	22.18	5138	21.83	1740	19.22
Urban	45,980	66.49	16,029	68.10	5836	64.45
London	7837	11.33	2369	10.07	1479	16.33
Cancer stage (American Joint Committee on Cancer TNM system)						
I	39,070	56.5	5177	22.00	3157	34.86
II	25,767	37.26	11,832	50.27	4353	48.07
III	2638	3.81	5380	22.86	1076	11.88
Missing	1678	2.43	1147	4.87	469	5.18
Hospital characteristics (166 sites)						
Multidisciplinary cancer center (49 sites)	25,953	37.53	7996	33.97	3982	43.98
Specialist breast reconstruction center (45 sites)	28,317	40.95	8731	37.10	5675	62.67
Hospitals with a strong media reputation (11 sites)	6907	9.99	2381	10.12	1944	21.47
Hospitals meeting 31-day cancer waiting-time target (130 sites)	50,448	72.95	17,774	75.52	6671	73.67

(Continues)

TABLE 1 (Continued)

	Breast-conserving surgery, N = 69,153		Mastectomy without reconstruction, N = 23,536		Mastectomy with immediate reconstruction, N = 9055	
	No.	%	No.	%	No.	%
Overall Care Quality Commission hospital rating						
Outstanding (12 sites)	5664	8.19	1212	5.15	876	9.67
Good (48 sites)	20,122	29.1	7297	31.00	2603	28.75
Requires improvement (90 sites)	37,873	54.77	13,192	56.05	4882	53.91
Inadequate (16 sites)	5494	7.94	1835	7.80	694	7.66
Research activity						
First to fourth quintiles (135 sites)	51,959	75.14	17,925	76.16	5949	65.70
Fifth quintile (highest research activity, 31 sites)	17,194	24.86	5611	23.84	3106	34.30
Reoperation rate following breast conserving surgeries						
First to fourth quintile (133 sites)	57,006	82.43	19,458	82.67	7683	84.85
Fifth quintile (highest reoperation rates; 33 sites)	12,147	17.57	4078	17.33	1372	15.15

[a]Includes patients recorded as *mixed White and Asian*, *mixed White and Black African*, *mixed White and Black Caribbean*, and *any other mixed background* according to linked National Health Service Hospital Episode Statistics data.

[b]Includes patients recorded as *Chinese*, *other*, and *any other ethnic group* according to linked National Health Service Hospital Episode Statistics data.

surgery (adjusted OR, 2.41; 95% CI, 1.28–4.52). In addition, patients undergoing IBR were less likely to travel to hospitals with the shortest waiting times (adjusted OR, 0.60; 95% CI, 0.40–0.90). For all three types of procedures, we did not find any association between the odds of patients traveling to a particular hospital and the overall UK Care Quality Commission hospital performance ratings, the research activity of the hospital, or whether the hospital was a multidisciplinary cancer center.

The interaction terms presented in Table 3 and Table S4) establish the variation in the association between travel time and treatment location according to six patient characteristics. We observed that older patients ($p < .01$ for BCS and mastectomy alone), ethnic minority patients ($p < .01$ for BCS), patients with comorbidity ($p = .01$ for mastectomy alone), and patients with more advanced disease (stage II vs. I; $p < .01$ for BCS and mastectomy with or without IBR; $p = .01$) were less likely to travel to a hospital other than their nearest for treatment. Conversely, rural patients were more likely to travel to a hospital other than their nearest for treatment ($p < .001$ for BCS and mastectomy with and without reconstruction). For example, patients aged 70 years or older were less likely to travel to a hospital up to an additional 30 minutes away from nearest hospital for either BCS (adjusted OR, 0.76; 95% CI, 0.69–0.84) or mastectomy alone (adjusted OR, 0.64; 95% CI, 0.56–0.73). Conversely, additional travel time was less strongly associated with the odds of traveling to a particular hospital for patients who lived in rural areas (OR for interaction term always > 1.00) compared with patients living in urban areas, which demonstrates that patients living in rural areas had a greater willingness to travel.

DISCUSSION

This national, population-based study demonstrated that up to one in three patients who have breast cancer are bypassing their nearest hospital offering cancer surgery. Travel time is the most important determinant of where patients receive their breast cancer treatment. However, patients who were younger, those who had fewer comorbidities, those who were of a White ethnic background, and those who lived in rural areas were more likely to travel to alternative hospitals farther away for treatment. Patients undergoing any type of breast cancer surgery were more likely to be treated at hospitals classified as specialist breast reconstruction centers irrespective of travel time or whether or not they were undergoing a mastectomy. Patients receiving a mastectomy with IBR were more likely to travel to hospitals that employed surgeons who had a strong media reputation for breast cancer surgery. For both BCS and mastectomy with IBR, we observed that women were less likely to travel to hospitals with the shortest surgical waiting times for treatment.

The findings of this work have several policy implications. First, the finding that elderly patients, those with comorbidities, as well as those from ethnic minority backgrounds were more likely to receive care at their local hospital suggests that the increasing centralization of services (e.g., for complex breast reconstruction) could result in inequalities in access to recommended treatments or hospitals that provide better quality care.[13,33,34] Marginalized groups already face barriers to receiving high-quality care.[35–37] Therefore, it is important that policies that allow patients to choose where they receive their care include measures that mitigate against the risks that they increase inequalities in access and outcomes. This can include provision

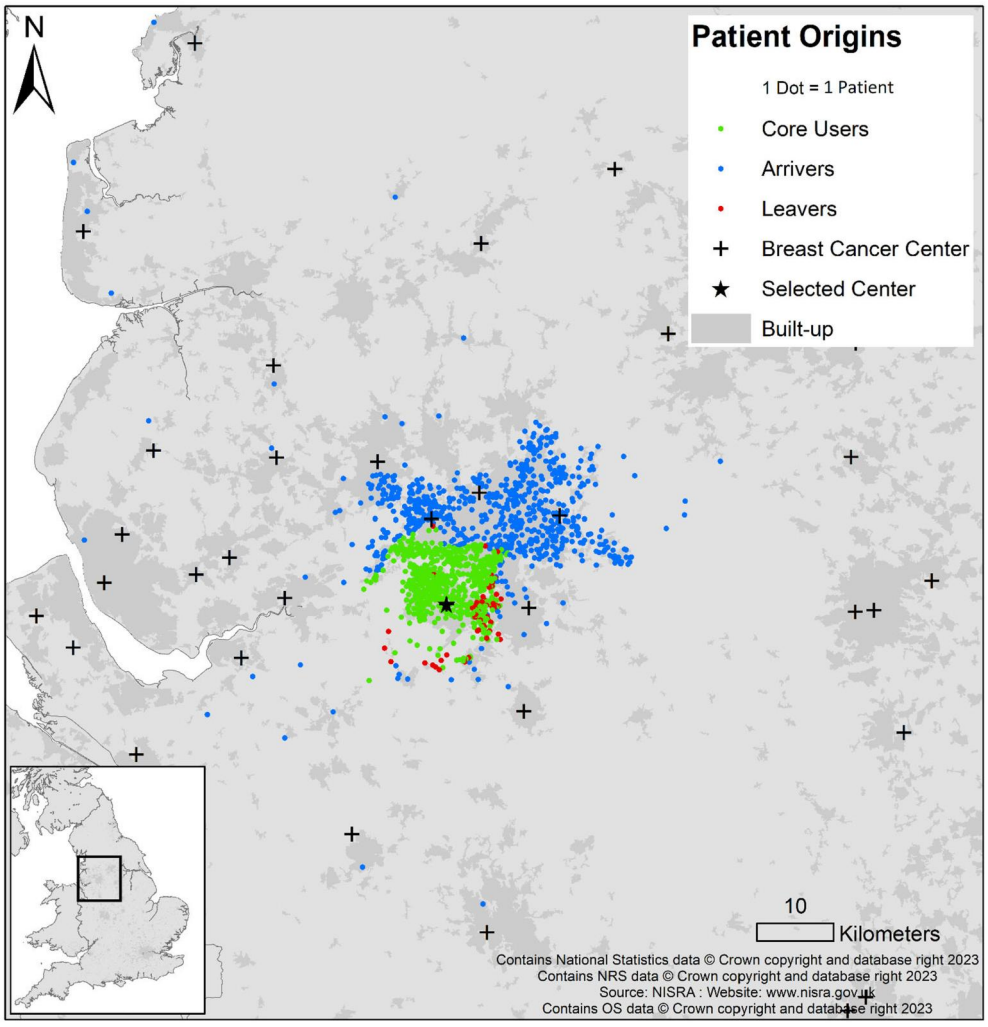

FIGURE 1 Map of the Northwest region of England (UK) illustrating the mobility patterns of patients who received breast conserving surgery (BCS) at a selected NHS hospital (indicated with a star symbol). The crosses represent other hospitals providing BCS in the region, and the colored dots represent individual patients who underwent BCS. Patients treated at the hospital (star symbol) who traveled from outside the local area (*arrivers*) are represented as blue dots. Patients from the hospital's local area who received treatment there are represented as green dots, and patients from the hospital's local area who traveled to other hospitals for surgery are represented as red dots (*leavers*). The map includes a scaled magnification of the region (*inset*) and a national overview. Contains National Statistics and National Records of Scotland data (source: Northern Ireland Statistics and Research Agency) as well as Ordnance Survey data. ©Crown copyright and database right 2022.

of free transport, accommodation, or even protection against loss of salary or income. In addition, given the association of travel time on the likelihood of bypassing, this is more likely to occur in larger urban conurbations, such as London, where there is a higher density of provision from which patients can select compared with rural areas.

Second, patients undergoing BCS or mastectomy were more likely to travel to hospitals that were known specialist breast reconstruction centers irrespective of whether they required a reconstruction.[38] Although not standardized, there is evidence that oncoplastic techniques, such as therapeutic mammoplasty and autologous reconstructions, are associated with better patient outcomes. Therefore, it is likely that this knowledge is being informally disseminated through primary care networks and patient groups, and the availability of these oncoplastic techniques in hospitals could confer a competitive advantage increasing market share.[10,35,39,40] Patients undergoing BCS were not more likely to receive care at multidisciplinary cancer centers, where they would be able to have all their care (surgery and radiotherapy) at one location.

Third, we observed that the reputation of individual surgeons was associated with the hospitals where patients who received immediate reconstruction were treated. The impact of *The Daily Mail* on health-seeking behaviors—the newspaper with the largest circulation in the United Kingdom—has also been similarly demonstrated in prostate cancer for men receiving radical prostatectomies.[4]

Critically, for the above two points, we do not know whether the clinical outcomes for patients treated at these hospitals are better. It is important to improve this disconnect between perceived and actual cancer treatment quality because, otherwise, it has the potential create perverse incentives (e.g., technology adoption) without necessarily affecting patient outcomes.[41] Conversely, with adequate

TABLE 2 Adjusted impact of travel time and hospital characteristics for 69,153 patients who underwent breast-conserving surgery and 32,591 patients who underwent mastectomy in English National Health Service hospitals.

	Breast-conserving surgery			Mastectomy without reconstruction			Mastectomy with immediate reconstruction		
	Adjusted OR	95% CI[a]	*p*	Adjusted OR	95% CI[a]	*p*	Adjusted OR	95% CI[a]	*p*
Impact of additional travel time									
0 minutes (nearest hospital)	1			1			1		
1–10 minutes	0.30	0.25–0.36	< .001	0.27	0.22–0.33	< .001	0.28	0.23–0.35	< .001
11–30 minutes	0.02	0.02–0.03		0.02	0.01–0.03		0.03	0.02–0.04	
31–60 minutes	0.00	0.00–0.00		0.00	0.00–0.00		0.00	0.00–0.01	
>60 minutes	0.00	0.00–0.00		0.00	0.00–0.00		0.00	0.00–0.00	
Impact of hospital characteristics									
Multidisciplinary cancer center	1.02	0.80–1.29	.895	0.82	0.61–1.11	.195	0.87	0.58–1.30	.505
Specialist reconstruction center	1.85	1.36–2.50	< .001	1.52	1.14–2.02	.004	5.53	3.65–8.37	< .001
Hospitals with a strong media reputation	1.04	0.64–1.71	.863	1.25	0.79–1.97	.349	2.41	1.28–4.52	.006
Inadequate CQC hospital rating	0.75	0.44–1.28	.292	0.65	0.38–1.12	.122	0.98	0.52–1.87	.960
Hospitals with highest research activity	1.08	0.77–1.51	.666	1.19	0.85–1.67	.314	0.92	0.56–1.52	.753
Hospitals meeting cancer waiting time target	0.65	0.46––0.92	.014	0.72	0.50–1.05	.085	0.60	0.40–0.90	.014
Hospitals with highest re-excision rates	0.86	0.57–1.29	.469						
No. of observations	11,402,139			3,879,358			1,492,291		
Pseudo R^2 (McFadden)	0.759			0.765			0.709		

Abbreviations: CI, confidence interval; CQC, the UK Care Quality Commission; OR, odds ratio.

[a]The 95% CI accounting for clustering around Integrated Care Systems.

incentives, patient choice and hospital competition could support improved outcomes of care.[42]

Several recent studies have highlighted that patients wish to have information on the quality of breast cancer care at the hospitals in their region and that this information should be available at the start of the management pathway when a diagnosis is sought.[43–45] However, currently, a lot of this information comes through media channels, and it is widely recognized that the quality and validity of this information is often questionable.[15,46–48]

Three co-authors, including those with lived experience of breast cancer, have provided recommendations based on their own experiences and the findings from this study (Table 4). These recommendations demonstrate that initiatives that aim to improve information about where patients can have their treatment should not only focus on making this information more readily available but they should also ensure that this information is easy to understand and presented in a format that can support the trade-offs that patients have to make.

Our fourth major finding is that patients undergoing BCS were less likely to travel to hospitals with shorter waiting times because patients have a preference for other aspects of health care quality, which means the patient mobility that we observed in the study may lead to a lengthening rather than a shortening of waiting times. These findings go against policy initiatives that enable patients to select health care providers with shorter waiting times to manage treatment backlogs after the coronavirus disease 2019 pandemic.[49,50]

Our modelling of patient mobility does highlight several conceptual and methodological challenges. In this report, we have studied where patients receive their treatment in relation to where they live. Decisions are made by patients together with primary or secondary care physicians (at the diagnosing hospital) and are influenced by pre-existing referral patterns. However, distinguishing between the preferences of the patient and their primary and secondary care physicians is beyond the scope of this analysis and requires further qualitative investigation.[45,51,52] The data presented are from 2016–2018, which was the time frame available within our data set. Although activity levels have now returned to prepandemic levels, we do acknowledge that patterns of referral may have changed.

The study used centroids of small geographical areas, typically representing 650 households, to represent the location of patients' residence, and this could have masked variations in travel times, thus attenuating rather than enhancing the observed associations between travel time and patient mobility.[53] We also acknowledge

TABLE 3 Adjusted impact of travel time, patient characteristics, and hospital characteristics for 69,153 patients who underwent breast-conserving surgery and 32,591 patients who underwent mastectomy in English National Health Service hospitals.

	Breast-conserving surgery			Mastectomy without reconstruction			Mastectomy with immediate reconstruction		
	Adjusted OR	95% CI[a]	*p*	Adjusted OR	95% CI[a]	*p*	Adjusted OR	95% CI[a]	*p*
Impact of additional travel time									
0 minutes (nearest hospital)	1.00			1.00			1.00		
1–10 minutes	0.32	0.27–0.39	< .001	0.33	0.26–0.42	< .001	0.28	0.21–0.37	< .001
11–30 minutes	0.03	0.02–0.04		0.02	0.02–0.04		0.03	0.02–0.05	
31–60 minutes	0.00	0.00–0.00		0.00	0.00–0.00		0.00	0.00–0.01	
>60 minutes	0.00	0.00–0.00		0.00	0.00–0.00		0.00	0.00–0.00	
Impact of patient characteristics on travel time									
Aged 70 years or older (vs. younger than 70 years)									
1–10 minutes	0.94	0.87–1.01	< .001	0.86	0.78–0.96	< .001	1.17	0.73–1.86	.561
11–30 minutes	0.76	0.69–0.84		0.64	0.56–0.73		0.84	0.56–1.27	
31–60 minutes	0.81	0.68–0.96		0.71	0.52–0.98		1.13	0.69–1.84	
>60 minutes	0.74	0.57–0.96		0.89	0.70–1.15		1.21	0.63–2.32	
Non-White ethnicity (vs. White ethnicity)									
1–10 minutes	0.85	0.71–1.02	.014	0.84	0.63–1.13	.687	1.01	0.73–1.40	.497
11–30 minutes	0.78	0.61–1.00		0.77	0.49–1.19		0.80	0.60–1.07	
31–60 minutes	0.66	0.45–0.98		0.73	0.34–1.56		0.86	0.52–1.40	
>60 minutes	0.57	0.34–0.96		0.97	0.30–3.15		1.11	0.56–2.19	
Less deprived neighborhoods (vs. more deprived neighborhoods)									
1–10 minutes	1.08	0.95–1.22	.022	0.99	0.83–1.17	.662	1.04	0.86–1.25	.296
11–30 minutes	0.99	0.83–1.19		1.02	0.83–1.25		1.01	0.75–1.37	
31–60 minutes	0.77	0.49–1.21		0.84	0.58–1.20		0.71	0.52–0.98	
>60 minutes	0.69	0.54–0.88		0.88	0.65–1.18		0.93	0.68–1.28	
Rural residence (vs. urban)									
1–10 minutes	1.63	1.30–2.06	< .001	1.62	1.24–2.12	< .001	1.84	1.25–2.70	< .001
11–30 minutes	2.44	1.75–3.41		2.66	1.89–3.74		1.86	1.15–2.99	
31–60 minutes	3.68	2.10–6.45		2.49	1.50–4.14		2.35	1.46–3.79	
>60 minutes	2.72	2.02–3.66		2.80	2.09–3.75		2.65	1.82–3.85	
London residence (vs. urban)									
1–10 minutes	0.47	0.36–0.61	< .001	0.46	0.31–0.67	< .001	0.69	0.45–1.04	.117
11–30 minutes	0.25	0.15–0.43		0.25	0.14–0.46		0.56	0.35–0.91	
31–60 minutes	0.04	0.02–0.10		0.14	0.05–0.43		0.43	0.10–1.91	
>60 minutes	0.41	0.14–1.22		0.34	0.08–1.39		0.50	0.21–1.21	
At least one comorbidity (vs. no comorbidity)									
1–10 minutes	0.97	0.88–1.07	.823	0.90	0.81–1.00	.010	1.44	1.04–2.00	.102
11–30 minutes	0.97	0.89–1.06		1.03	0.87–1.22		1.11	0.82–1.51	
31–60 minutes	0.97	0.79–1.18		0.76	0.59–0.98		1.00	0.65–1.53	
>60 minutes	0.92	0.79–1.09		0.85	0.64–1.12		0.95	0.54–1.66	

(Continues)

TABLE 3 (Continued)

	Breast-conserving surgery			Mastectomy without reconstruction			Mastectomy with immediate reconstruction		
	Adjusted OR	95% CI[a]	*p*	Adjusted OR	95% CI[a]	*p*	Adjusted OR	95% CI[a]	*p*
Stage II (vs. stage I)									
1–10 minutes	0.87	0.80–0.95	.005	0.92	0.83–1.02	.013	0.88	0.72–1.07	.007
11–30 minutes	0.96	0.85–1.07		0.96	0.84–1.08		0.73	0.57–0.94	
31–60 minutes	0.82	0.70–0.96		0.65	0.44–0.94		0.79	0.60–1.03	
>60 minutes	1.16	0.90–1.49		0.99	0.67–1.47		0.64	0.49–0.84	
Stage III (vs. stage I)									
1–10 minutes	0.79	0.65–0.95	.084	0.88	0.77–1.02	.202	1.00	0.73–1.37	.986
11–30 minutes	0.84	0.65–1.10		0.89	0.73–1.08		1.00	0.70–1.43	
31–60 minutes	0.98	0.71–1.35		0.84	0.55–1.28		1.08	0.76–1.54	
>60 minutes	1.76	1.02–3.05		1.15	0.79–1.68		0.96	0.66–1.40	
Impact of hospital characteristics									
Multidisciplinary cancer center	1.02	0.82–1.28	.843	0.84	0.63–1.11	.220	0.88	0.60–1.29	.523
Specialist reconstruction center	1.84	1.36–2.49	< .001	1.51	1.14–2.00	.004	5.51	3.66–8.31	< .001
Hospitals with a strong media reputation	1.08	0.68–1.74	.738	1.29	0.82–2.00	.269	2.42	1.31–4.48	.005
Inadequate CQC hospital rating	0.77	0.47–1.25	.287	0.65	0.40–1.07	.093	1.01	0.56–1.81	.976
Hospitals with highest research activity	1.08	0.76–1.54	.652	1.18	0.83–1.67	.349	0.92	0.56–1.51	.745
Hospitals meeting cancer waiting-time target	0.61	0.44–0.85	.004	0.67	0.47–0.96	.028	0.58	0.39–0.86	.007
Hospitals with highest re-excision rates	0.91	0.61–1.35	.635						
Total no. of observations	11,402,139			3,879,358			1,492,291		

Abbreviations: CI, confidence interval; CQC, the UK Care Quality Commission; OR, odds ratio.

[a]The 95% CI accounting for clustering around Integrated Care Systems.

TABLE 4 Recommendations from the authors with lived experience of breast cancer for supporting patient choices regarding treatment location.

1. Ensure each patient has access to a named breast clinical nurse specialist to help guide them through their options.
2. Provide greater clarity on the types of available breast procedures and the skills and training breast cancer surgeons require to perform these.
3. Highlight the availability of information on the different types of breast cancer surgery available to them in their diagnosing hospital and wider region.
4. Support greater standardization of the diagnostic pathway to ensure the correct surgical options are made available.
5. Support patients to make choices that work for them, which may include the provision of accommodation and transport to receive the care they require.
6. Provide more transparent information on care quality, including re-excision rates for the hospitals and individual surgeons, as well as measures of patient experience.
7. Give patients an explicit option to request a second opinion.

that, given the large national sample size in our data set, although most bypassing occurred for patients who had alternative hospitals within 10 minutes' drive time away, this may also represent difficulty in accessing their nearest hospital rather than an actual choice to bypass. In addition, we only considered the women's residential address and not that of their place of work or care givers.

Finally, we did not consider hospital-procedure volume as a hospital characteristic because of the issue of *reverse causality*. It can be expected that patients will prefer to undergo procedures in hospitals delivering high-quality care. However, a high-volume hospital may also have a high volume because of patient mobility patterns.

In conclusion, approximately one in three women are willing to bypass the nearest hospitals that provide breast cancer surgery, especially women who are relatively young, have no comorbidities, and from a White ethnic background. Patients seem to be influenced by the reputation of hospitals and their surgeons, particularly those performing advanced breast-reconstruction techniques. This highlights that policies offering patients with breast cancer the opportunity to choose where they have their treatment may

drive inequalities in the health care system without necessarily improving patient outcomes. We suggest that information about the care quality of the individual hospitals providing breast cancer surgery should be more readily available to patients in a format that makes it easy to understand and relevant for the choices they face.

AUTHOR CONTRIBUTIONS

Ajay Aggarwal: Methodology; conceptualization; data analysis, acquisition, or interpretation; supervision; funding acquisition; writing–original draft; writing–review and editing; and had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. **Lu Han**: Data curation; data analysis, acquisition, or interpretation; statistical analysis; formal analysis; writing–original draft; writing–review and editing; and had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. **Daniel Lewis**: Visualization. **Jeanette Costigan**: Writing–review and editing. **Alison Hubbard**: Writing–review and editing. **Joanne Taylor**: Writing–review and editing. **Anne Rigg**: Writing–review and editing. **Arnie Purushotham**: Writing–review and editing. **Jan van der Meulen**: Conceptualization; methodology; statistical analysis; acquisition, or interpretation; supervision; and writing–review and editing.

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CONFLICT OF INTEREST STATEMENT

Ajay Aggarwal reports grants/contracts from the National Cancer Institute outside the submitted work. Joanne Taylor reports honoraria and/or support for travel to attend meetings for patient and public involvement activities from Novartis, Gilead, Veracyte, and Greater Manchester Breast Pathway Board outside the submitted work. The remaining authors declared no conflicts of interest.

DATA AVAILABILITY STATEMENT

This study was based on English national cancer registry data. We do not own these data and hence are not permitted to share them in the original form. The data are available from the Office for Data Release at Public Health England. For access please email odr@phe.gov.uk. The underlying code for this study is not publicly available but may be made available to qualified researchers on reasonable request from the corresponding author.

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REFERENCES

1. Siciliani L, Chalkley M, Gravelle H. Policies towards hospital and GP competition in five European countries. *Health Policy*. 2017;121(2):103-110. doi:10.1016/j.healthpol.2016.11.011
2. Le Grand J. *The Other Invisible Hand: Delivering Public Services Through Choice and Competition*. Princeton University Press; 2009.
3. Gaynor M, Ho K, Town RJ. The industrial organization of health-care markets. *J Econ Lit*. 2015;53(2):235-284. doi:10.1257/jel.53.2.235
4. Aggarwal A, Lewis D, Charman SC, et al. Determinants of patient mobility for prostate cancer surgery: a population-based study of choice and competition. *Eur Urol*. 2018;73(6):822-825. doi:10.1016/eururo.2017.07.016
5. Aggarwal A, Lewis D, Sujenthiran A, et al. Hospital quality factors influencing the mobility of patients for radical prostate cancer radiotherapy: a national population based study. *Int J Radiat Oncol Biol Phys*. 2017;99(5):1261-1270. doi:10.1016/j.ijrobp.2017.08.018
6. Aggarwal A, Han L, Boyle LM, et al. Association of quality and technology on patient mobility for colorectal cancer surgery. *JAMA Surg*. 2022;158(1):e225461. doi:10.1001/jamasurg.2022.5461
7. Aggarwal A, Lewis D, Mason M, Sullivan R, van der Meulen J. Patient mobility for elective secondary health care services in response to patient choice policies: a systematic review. *Med Care Res Rev*. 2016;74(4):379-403. doi:10.1177/1077558716654631
8. Metcalfe D, Rios Diaz AJ, Olufajo OA, et al. Impact of public release of performance data on the behaviour of healthcare consumers and providers. *Cochrane Database Syst Rev*. 2018;9:CD004538. doi:10.1002/14651858.cd004538.pub3
9. National Health Service (NHS) England. *My Planned Care*. NHS; 2022. Accessed April 22, 2023. https://www.myplannedcare.nhs.uk/
10. Wright JD, Chen L, Accordino M, et al. Regional market competition and the use of immediate breast reconstruction after mastectomy. *Ann Surg Oncol*. 2019;26(1):62-70. doi:10.1245/s10434-018-6825-7
11. Aggarwal AK, Sujenthiran A, Lewis D, et al. Impact of patient choice and hospital competition on patient outcomes after prostate cancer surgery: a national population-based study. *Cancer*. 2019;125(11):1898-1907. doi:10.1002/cncr31987
12. Gorin SS. Multilevel approaches to reducing diagnostic and treatment delay in colorectal cancer. *Ann Fam Med*. 2019;17(5):386-389. doi:10.1370/afm.2454
13. Potter S, Mills N, Cawthorn S, Wilson S, Blazeby J. Exploring inequalities in access to care and the provision of choice to women seeking breast reconstruction surgery: a qualitative study. *Br J Cancer*. 2013;109(5):1181-1191. doi:10.1038/bjc.2013.461
14. Lewison G, Tootell S, Roe P, Sullivan R. How do the media report cancer research? A study of the UK's BBC website. *Br J Cancer*. 2008;99(4):569-576. doi:10.1038/sj.bjc.6604531
15. Sabel MS, Dal Cin S. Trends in media reports of celebrities' breast cancer treatment decisions. *Ann Surg Oncol*. 2016;23(9):2795-2801. doi:10.1245/s10434-016-5202-7
16. Department of Health. *The NHS Choice Framework: what choices are available to me in the NHS?* National Health Service; 2016.
17. Department of Health and Social Care. NHS Constitution for England. National Health Service; 2021.
18. NHS Digital. *Hospital Episode Statistics (HES)*. NHS Digital; 2016. Accessed April 22, 2023. https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/hospital-episode-statistics
19. Rechel B, McKee M, Haas M, et al. Public reporting on quality, waiting times and patient experience in 11 high-income countries. *Health Policy*. 2016;120(4):377-383. doi:10.1016/j.healthpol.2016.02.008

20. National Cancer Registration and Analysis Service. *National Cancer Registration for England*. Public Health England; 2016. Accessed April 22, 2023. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/cancerregistrationstatisticsengland/2016
21. Armitage JN, van der Meulen JH. Royal College of Surgeons Co-morbidity Consensus Group. Identifying co-morbidity in surgical patients using administrative data with the Royal College of Surgeons Charlson score. *Br J Surg*. 2010;97(5):772-781. doi:10.1002/bjs.6930
22. Ministry of Housing, Communities & Local Government. *National Statistics; English indices of deprivation 2015*. GOV.UK; 2015. Accessed April 22, 2023. https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015
23. NHS Digital. *Hospital Episode Statistics. The Office of Population, Censuses and Surveys (OPCS) Classification of Interventions and Procedures, 4th Revision (OPCS-4)*. NHS Digital; 2022. Accessed April 22, 2023. https://digital.nhs.uk/data-and-information/publications/statistical/hospital-admitted-patient-care-activity/supporting-information#hospital-episode-statistics
24. Office for National Statistics. *Census Geography*. UK Statistics Authority; 2017. Accessed April 22, 2023. https://www.ons.gov.uk/aboutus/transparencyandgovernance/freedomofinformationfoi/ukpopulation2017
25. World Health Organisation (WHO). *International Statistical Classification of Disease and Related Health Problems 10th Revision (ICD-10)*. WHO; 2016.
26. Bibby P, Brindley P; Office for National Statistics. *Urban and Rural Area Definitions for Policy Purposes in England and Wales. Methodology*. UK Statistics Authority; 2013. Accessed April 22, 2023. https://assets.publishing.service.gov.uk/media/5a7c136e40f0b645ba3c68b0/RUC11methodologypaperaug_28_Aug.pdf
27. National Audit of Breast Cancer in Older Patients (NABCOP). *2018 Annual Report*. NABCOP Project Team, Clinical Effectiveness Unit; 2018. Accessed April 22, 2023. https://www.nabcop.org.uk/content/uploads/2018/10/NABCOP-2018-Public-and-Patients-Annual-Report.pdf
28. Daily Mail Reporter. *The good doctors guide: Meet the best breast surgeons for breast cancer*. The Daily Mail; June 5, 2018. Accessed April 22, 2023. https://www.dailymail.co.uk/health/article-5810027/Meet-best-surgeons-breast-cancer.html
29. Care Quality Commission. Information to check hospitals in England and the quality of their care. Care Quality Commission; 2022. Accessed May 10, 2023. https://www.cqc.org.uk/care-services/find-hospital
30. Ozdemir BA, Karthikesalingam A, Sinha S, et al. Research activity and the association with mortality. *PLoS One*. 2015;10(2):e0118253. doi:10.1371/journal.pone.0118253
31. NHS England. Working together at scale: guidance on provider collaboratives. Publication PAR754. NHS England and NHS Improvement; 2021.
32. Office for National Statistics. Understanding consistency of ethnicity data recorded in health-related administrative datasets in England: 2011 to 2021. UK Statistics Authority; 2021.
33. Lee CN, Deal AM, Huh R, et al. Quality of patient decisions about breast reconstruction after mastectomy. *JAMA Surg*. 2017;152(8):741-748. doi:10.1001/jamasurg.2017.0977
34. Keating NL, Kouri EM, He Y, Freedman RA, Volya R, Zaslavsky AM. Location isn't everything: proximity, hospital characteristics, choice of hospital, and disparities for breast cancer surgery patients. *Health Serv Res*. 2016;51(4):1561-1583. doi:10.1111/1475-6773.12443
35. Freedman RA, Kouri EM, West DW, Keating NL. Racial/ethnic differences in patients' selection of surgeons and hospitals for breast cancer surgery. *JAMA Oncol*. 2015;1(2):222-230. doi:10.1001/jamaoncol.2015.20
36. Gorin SS, Heck JE, Cheng B, et al. Delays in breast cancer diagnosis and treatment by racial/ethnic group. *Arch Intern Med*. 2006;166(20):2244-2252. doi:10.1001/archinte.166.20.2244
37. Stitzenberg KB, Sigurdson ER, Egleston BL, Starkey RB, Meropol NJ. Centralization of cancer surgery: implications for patient access to optimal care. *J Clin Oncol*. 2009;27(28):4671-4678. doi:10.1200/jco.2008.20.1715
38. Johnson L, Holcombe C, O'Donoghue JM, et al. Protocol for a national cohort study to explore the long-term clinical and patient-reported outcomes and cost-effectiveness of implant-based and autologous breast reconstruction after mastectomy for breast cancer: the Brighter Study. *BMJ Open*. 2021;11(8):e054055. doi:10.1136/bmjopen-2021-054055
39. Toyserkani NM, Jørgensen MG, Tabatabaeifar S, Damsgaard T, Sørensen JA. Autologous versus implant-based breast reconstruction: a systematic review and meta-analysis of Breast-Q patient-reported outcomes. *J Plast Reconstr Aesthetic Surg*. 2020;73(2):278-285. doi:10.1016/j.bjps.2019.09.040
40. Lee A, Kwasnicki RM, Khan H, et al. Outcome reporting in therapeutic mammaplasty: a systematic review. *BJS Open*. 2021;5(6):zrab126. doi:10.1093/bjsopen/zrab126
41. Aggarwal A, Lewis D, Mason M, Purushotham A, Sullivan R, van der Meulen J. Effect of patient choice and hospital competition on service configuration and technology adoption within cancer surgery: a national, population-based study. *Lancet Oncol*. 2017;18(11):1445-1453. doi:10.1016/s1470-2045(17)30572-7
42. Han L, Boyle JM, Walker K, et al. Impact of patient choice and hospital competition on patient outcomes after rectal cancer surgery: a national population-based study. *Cancer*. 2023;129(1):130-141. doi:10.1002/cncr.34504
43. Powell LE, Andersen ES, Pozez AL. Assessing readability of patient education materials on breast reconstruction by major US academic hospitals as compared with nonacademic sites. *Ann Plast Surg*. 2021;86(6):610-614. doi:10.1097/sap.0000000000002575
44. Corter AL, Speller B, Sequeira S, Campbell C, Facey M, Baxter NN. What young women with breast cancer get versus what they want in online information and social media supports. *J Adolesc Young Adult Oncol*. 2019;8(3):320-328. doi:10.1089/jayao.2018.0125
45. Salampessy BH, Bijlsma WR, van der Hijden E, Koolman X, Portrait FRM. On selecting quality indicators: preferences of patients with breast and colon cancers regarding hospital quality indicators. *BMJ Qual Saf*. 2020;29(7):576-585. doi:10.1136/bmjqs-2019-009818
46. Kamenova K, Reshef A, Caulfield T. Angelina Jolie's faulty gene: newspaper coverage of a celebrity's preventive bilateral mastectomy in Canada, the United States, and the United Kingdom. *Genet Med*. 2014;16(7):522-528. doi:10.1038/gim.2013.199
47. Konfortion J, Jack RH, Davies EA. Coverage of common cancer types in UK national newspapers: a content analysis. *BMJ Open*. 2014;4(7):e004677. doi:10.1136/bmjopen-2013-004677
48. Biancovilli P, Makszin L, Csongor A. Breast cancer on social media: a quali-quantitative study on the credibility and content type of the most shared news stories. *BMC Womens Health*. 2021;21(1):202. doi:10.1186/s12905-021-01352-y
49. Aggarwal A, Walter FM, Sullivan R, van der Meulen J. "Shopping around" for treatment is not a solution to cancer backlog. *BMJ*. 2022;379:e071967. doi:10.1136/bmj-2022-071967
50. National Health Service (NHS). *The NHS Long Term Plan*. NHS; 2019.
51. Tessier G, Contandriopoulos AP, Dionne G. Patient mobility for elective surgical interventions. *Soc Sci Med*. 1985;20(12):1307-1312. doi:10.1016/0277-9536(85)90385-5
52. Aggarwal A, Bernays S, Payne H, van der Meulen J, Davis C. Hospital choice in cancer care: a qualitative study. *Clin Oncol (R Coll Radiol)*. 2018;30(7):e67-e73. doi:10.1016/j.clon.2018.03.009
53. Varkevisser M, van der Geest SA, Schut FT. Do patients choose hospitals with high quality ratings? Empirical evidence from the market

for angioplasty in the Netherlands. *J Health Econ*. 2012;31(2):371-378. doi:10.1016/j.jhealeco.2012.02.001

SUPPORTING INFORMATION

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