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What influences clinicians' operative preferences for women with breast cancer? An application of the discrete choice experiment

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ABSTRACT

Introduction: Little is known regarding cancer clinicians' treatment preferences.

Aim: Determine the impact of pre-operative variables over specialist breast clinicians' operative preferences using discrete choice experiment methodology.

Methods: Cross-sectional survey of operative preferences to hypothetical scenarios based on: patient age, bra cup size, cancer size, site and focality.

Results: 73% response rate (68/93). Multinomial logistic regression across scenarios ($n = 1695$) with allowance for response clustering, comparing equal preference for mastectomy and breast conservation surgery (BCS) with preference for mastectomy or BCS. Increasing patient age, cancer size, central site, multi-focality and reducing cup size, all associated with preference for mastectomy, over equal preference, over BCS ($p < 0.001$). Doctors preferred specific treatments, females and nurses avoided mastectomy ($p = 0.015$ and $p < 0.001$ respectively).

Conclusions: Clinician preferences were predominantly treatment guideline congruent, but significantly influenced by patient age, clinician gender and occupation. This methodology is capable of elucidating treatment preferences and could be applied elsewhere where treatment options and practice variability exist.

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1. Introduction

Breast cancer is common, affecting one in nine UK women. Mastectomy (Mx) and breast conservation surgery (BCS) with ipsilateral radiotherapy remain the most common initial treatments for operable breast cancer. There is often a position of equipoise between these due to the demonstration of survival equivalence in cancers up to 40 and 50mm in diameter^{1,2} and enhanced psychological recovery in patients

treated by clinicians who provide information and choices, rather than treatment direction.^{3–7}

Worldwide, significant geographic variation in hospital breast units' treatment of operable breast cancer exists.^{8–15} A recent study confirmed case-mix (cancer size, site and grade) does not explain statistically significant variation in breast unit practice.¹⁰ The UK Department of Health expresses concern regarding treatment variation, describing it as a 'post code lottery' of treatment. In the context of breast

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units it proposes to adopt breast unit mastectomy to BCS ratios as performance indicators.¹⁶ Other cancer specialties have contentious areas where treatment options exist and best practice is unclear. Where present, these are often associated with practice variation which are equally vulnerable to similar concerns; for example, rates of de-functioning ileostomy formation and reversal in colorectal cancer,¹⁷ the management of localised prostate cancer¹⁸ and referral for radiotherapy.^{19,20}

In the UK, patients diagnosed with breast cancer are routinely discussed within Multi-Disciplinary Team (MDT) meetings, to decide the appropriateness of therapeutic options at individual case level, based on cancer characteristics, patient co-morbidity and evidence-based treatment guidelines. In addition to cancer variables known to influence survival, i.e. cancer size,^{1,2} the anticipated aesthetic outcome of the options is also considered: For instance, BCS for a 40 mm diameter cancer might be anticipated aesthetically unfavourable in a small breast, which could influence the team/clinician's operative preference or recommendation. Guidelines are designed flexibly to optimise patient involvement in decision-making. If presented with options, patients' decisions are based on their personal preferences and knowledge; much of which arises from discussion with the treating team's clinicians (doctors and nurses).

Numerous internal and external factors are known to influence patient decision-making; prior information and experience of breast cancer,²¹ body image,²² balance of fears (the trade off between fear of breast loss and fear of cancer recurrence and death)^{23,24} and information portrayal by the media.²⁵ However, the influence of the treating clinician cannot be overlooked. The stated or perceived treatment preference or recommendation of clinicians has been demonstrated to exert one of the most potent influences over patients' treatment choices.^{21,26,27} However, limited information is available on clinicians' preferences. Studies based on clinicians' stated preferences to clinical vignettes note variability, but deduce little else.^{28,29}

The Discrete Choice Experiment (DCE) is a survey methodology capable of establishing preferences in controlled experimental conditions, through responses to hypothetical scenarios. The vast majority of DCE applications in health care to date have focused upon developing techniques to elicit the preferences of consumers in relation to alternative treatments and service configurations (e.g. Seston and colleagues 2007 and Lancsar and colleagues 2007).^{30,31} Examples of the application of DCEs to elicit the preferences of clinicians remain relatively rare and, to our knowledge this is the first study to use the technique to assess the preferences of cancer clinicians for alternative treatment regimens.

To effectively capture preferences, the DCE design and scenario content must be plausible to potential respondents; containing realistic hypothetical scenarios comprised of variables that individuals are willing to trade between to arrive at decisions. The majority of health care DCEs to date have effectively forced respondents to choose between two or more options. However, it is recognised that such a design does not reflect all decision-making in health care. An opt-out response is sometimes necessary to improve realism and response rates. The opt-out response commonly employed is

a non-participation (prefers 'neither') response,^{32,33} but equally could include an equivalent preference (prefers both equally) option.

The aim of this study was to employ a cross-sectional postal questionnaire survey designed using DCE methodology, to determine the impact of key variables available pre-operatively, over specialist breast clinicians' (nurses and doctors) therapeutic operative preferences, for the management of primary breast cancer.

The study is a component of a Multi-centre Research Ethics Committee approved research project conducted in the UK's Trent region, investigating variation in the therapeutic surgical treatment of breast cancer.¹⁰ The region's specialist breast service comprises 14 hospital-based breast units, encompassing 11 breast screening units, serving a population of approximately 2,500,000 females.

2. Sample

All 14 hospitals' specialist breast teams comprising the Trent breast service were recruited to the study. Ninety-seven eligible specialist clinicians (48 doctors and 49 nurses), were identified, 93 were invited to participate, as four were on long term sick leave during study recruitment. Eligibility was defined as a permanent specialist member of the breast team (nurse or doctor), routinely discussing surgical treatment options with patients diagnosed with breast cancer. Surgical trainees were ineligible due to their transitory role within teams.

3. Methods

3.1. Instrument

The questionnaire comprised two sections: the DCE (25 hypothetical case scenarios) and background information (age, sex, occupation, experience etc.).

3.2. DCE scenario development

The chosen DCE design comprised the presentation of single scenarios and the incorporation of an opt-out or equivalent preference option.³¹ This less commonly adopted design was used in preference to the more conventionally applied pair-wise choice design,³² to more closely reflect the clinical decision-making context of interest, and therefore enhance response rates and elucidate clinicians' treatment preferences.

The crucial stage of DCE design is the identification of key variables capable of defining the subject of interest. By peer consensus, five variables routinely available pre-operatively were selected for inclusion and subdivided into plausible levels. Table 1 illustrates the variables and levels of the applied DCE. The questionnaire's 25 scenarios were randomly generated from the reduction of all possible combinations of the five variable levels generated by SPSS 'Orthoplan' software (1700 potential scenarios), by fractional factorial design (Speed).³⁴ The DCE questionnaire design considered the properties of orthogonality, and was balanced in terms of the number of times each level of an attribute was represented in a scenario.

Table 1 – Discrete choice experiment variables and levels

Variable	Levels				
Patient age (years)	<40	40 – <60	60 – <70	70 – <80	≥ 80
Total cancer size (mm)	<20	20 – <30	30 – <40	40 – <50	≥ 50
Bra cup size	A	B	C	≥ D	
Cancer site	Upper Inner (UI)	Upper Outer (UO)	Lower Outer (LO)	Lower Inner (LI)	Central
Focality	Uni-focal	Multi-focal within a single-quadrant			

A pilot study with a group of experienced surgical trainees with a declared interest in breast surgery, and breast care nurses employed outside the regional breast service, exposed the presence of a dominant variable level (multi-focal, multi-quadrant cancer focality), skewing results, making it impossible to interpret the influence of the other variables. This was excluded from the final instrument.

3.3. Establishment of preferences

Clinicians were asked to indicate their operative preferences to hypothetical scenarios. Fig. 1 illustrates a scenario example. It was emphasised that clinicians should respond with their individual preferences, rather than with those of their breast team, and to base decisions purely on presented information, as other aspects of the cases were equal or insignificant. Three treatment options were presented: mastectomy, BCS, or equal preference for both mastectomy and BCS; equal preference representing providing patients with open choices. Extended treatment options (neo-adjuvant chemotherapy, primary breast reconstruction etc.) were excluded from the exercise.

Since the outcome, preferred choice of surgery, was a 3-level nominal categorical variable (mastectomy, BCS, prefers both options equally), multinomial (polytomous) logistic regression (MLR) was used to look for associations between the outcome variable and the various clinical characteristics given in the scenarios (age, bra cup size, cancer size, cancer site and focality). A multinomial logistic model in STATA ver-

sion 8 was fitted using the mlogit procedure, with 'prefers both options equally' as the reference or base category.³⁵

With a 3-level nominal categorical outcome, the multinomial logistic model will estimate, using maximum likelihood, two sets of regression coefficients for the explanatory variables: One for the effect of choosing mastectomy versus prefers both options equally, and a second set for BCS versus prefers both options equally. The regression coefficients, from the MLR model, correspond to the probability of each outcome category (mastectomy versus both options equally; BCS versus both options equally) relative to the base category. The exponentiated value of a regression coefficient, from this model, is the relative risk ratio (RRR) for a one unit change in the corresponding explanatory variable, where risk is measured as the risk of the category relative to the base category. The cluster option was used to take into consideration the lack of response independence (each responder valued up to 25 scenarios). This alters regression coefficient's estimated standard errors, *p*-values and confidences intervals, but not coefficient values themselves.

4. Results

Sixty-eight of the 93 clinicians approached returned completed questionnaires (73% response rate): 34% male, 66% female, 48% nurses, 52% doctors (25 consultants, three Associate Specialists, one Staff Grade and four Clinical Assistants), mode age 41–50 (range 26 to 65), with a median 22 years post qualification experience (range 5 to 39 years) and 7 years specialist experience (range 0 to 26 years). Table 2 presents the characteristics of the 68 responders to the survey.

The 68 responders answered 1695 of 1700 (68 × 25) scenarios. In 890 (53%) scenarios responders preferred mastectomy, 397 (23%) BCS, and 408 (24%) preferred both equally. Overall 56/68 (82%) of responders demonstrated a preference for mastectomy in the majority of the scenarios they rated, seven (10%) a preference for BCS and five (8%) an equal preference for mastectomy and BCS.

Table 3 summarises the results by scenario. Scenarios are displayed as individual rows. This form of data presentation highlights a lack of consensus in clinicians' preferences: for example, in scenario 19, in a woman over 80 with a single 30 to <40 mm diameter focus of cancer in the upper out quadrant of her B cup breast, 32% of clinicians would prefer she had a mastectomy, 28% prefer she had BCS and 40% would leave the choice to her. The table also illustrates that some clinicians adhere rigidly to their preferences despite potentially consequent compromised recurrence and survival rates; for example, clinicians retain-

Patient Age (years)	60 – <70
Total cancer size (mm)	<20
Bra cup size	C
Site	LI
Focality	Unifocal

Please indicate your preferred choice of surgery in this case by ticking the relevant box below. If you prefer both equally, please tick both boxes.

Mastectomy ☐
 Breast Conservation Surgery ☐

Fig. 1 – Scenario example.

Table 2 – Demographic data of clinician responders

		n	%				
Clinician age	26–30	2	(3.0%)				
	31–35	5	(7.6%)				
	36–40	13	(19.7%)				
	41–45	14	(21.2%)				
	46–50	14	(21.2%)				
	51–55	8	(12.1%)				
	56–60	9	(13.6%)				
	61–65	1	(1.5%)				
Total		66	(100.0%)				
Clinician gender	Male	23	(33.8%)				
	Female	45	(66.2%)				
Total		68	(100.0%)				
Clinician occupation	Doctor	33	(48.5%)				
	Nurse	35	(51.5%)				
Total		68	(100.0%)				
		n	Mean	SD	Median	Min	Max
Year of qualification		64	1982	(8.4)	1982.5	1965	1999
Year commenced as a specialist		65	1995	(6.6)	1996.0	1977	2003
No. of years as specialist		65	8	(6.6)	7.0	0	26
No. of years experience (since qualification)		63	22	(8.4)	22.0	5	39

ing their preference for BCS in scenarios 13 and 25, where cancers are over 50mm diameter and in scenario 25, the cancer is also multi-focal.

Responses were analysed across scenarios, to establish the impact of individual variables over clinicians' operative preferences. Equal preference, representing the provision of an open choice of surgery to the patient, was treated as the reference therapeutic option, and compared with preference for mastectomy and preference for BCS using univariate (variables analysed as independent of the other variables) and multivariate analysis.

All five variables independently demonstrated statistically significant association with preference both on their own and when combined together ($p < 0.001$). The results of multivariate analysis are summarised in Tables 4 and 5. The RRR for the regression coefficients in Tables 4 and 5 are from the same model, but shown in separate tables for ease of understanding. Preference for mastectomy over choice, and choice over BCS, correlated positively with increasing patient age and cancer size, central cancer site, multi rather than uni-focal cancer, and reducing bra cup size. For example, other factors being equal, clinicians are over three times more likely to prefer mastectomy rather than choice, if a woman is aged between 60 and 70, than if she is under 40 ($p = < 0.001$). Consistent with evidence-based treatment guidelines, cancer size appears to exert the greatest influence over preferences: Clinicians are nearly 36 times more likely to prefer mastectomy rather than choice if a cancer is greater than 50 mm in diameter, than if it is less than 20 mm ($p = < 0.001$), and likewise, they are 92% less likely to prefer BCS over choice, if a cancer is over 50 mm in diameter, than if it is less than 20 mm ($p = < 0.001$). The goodness of fit of the model in Tables 4 and 5 was assessed by the pseudo R². The pseudo R² value of 0.29 suggests the model with five covariates is about 29% better than the model with no covariates (the "constant-only"

model), but is about 71% worse than the theoretical perfect fitting or predicting model (with a pseudo R² value of 1.0).

The DCE technique confirmed most clinicians' operative preferences are consistent with evidence-based treatment guidelines. But in addition it permitted the discovery of several nuances; in particular, how patient age and cancer size impact on clinicians' preferences. Clinicians increasingly prefer mastectomy with increasing patient age, but the impact is less marked in patients over 80. Those with preferences for BCS were less influenced by patient age; preference for choice rather than BCS was only statistically significant in the 70–80 year old group. The DCE also highlights that choice dominates over Mx and BCS at different cancer size levels: Clinicians prefer choice over BCS for cancers over 20 mm (cancer size <20 versus 20–30 mm, RRR equal preference versus BCS preference 0.70, 95% CI 0.51–0.98, $p = 0.035$), and start to prefer mastectomy over choice in cancers over 30 mm (Cancer size <20 versus 20–30 mm, RRR equal preference versus mastectomy preference 1.10, 95% CI 0.69–1.77, $p = 0.680$).

When clinician factors were incorporated into multivariate analysis alongside the other variables, clinician gender and occupation demonstrated independent association with surgical preferences. Other factors being equal, female responders were twice as likely as male responders to prefer choice than mastectomy (female versus male clinician gender, RRR equal preference versus mastectomy preference 0.51, 95% CI 0.29–0.87, $p = 0.015$), and nurses were more likely to prefer choice than mastectomy or BCS (nurse versus doctor, RRR equal preference versus Mx preference 0.37, 95% CI 0.21–0.64, $p < 0.001$, nurse versus doctor, RRR equal preference versus BCS preference 0.52, 95% CI 0.26–1.03, $p = 0.06$). In contrast, doctors were more directive; they tended to prefer specific operations (BCS or Mx) over more open choices. Clinicians' preferences were not influenced by their age or years of experience.

Table 3 – Results by scenario

Scenario	Age (years)	Total cancer size (mm)	Bra cup size	Cancer site	Focality	Preference for Mx %	Preference for BCS %	Equal Preference (Mx & BCS) %
1	<40	40– to <50	D	LI	Unifocal	45.59	19.12	35.29
2	60– to <70	≥50	B	LI	Multi-focal, single quadrant	95.59	0.00	4.41
3	≥80	≥50	D	LO	Unifocal	70.59	7.35	22.06
4	≥80	40– to <50	C	UI	Multi-focal, single quadrant	80.88	2.94	16.18
5	70– to <80	40– to <50	B	Central	Unifocal	94.12	0.00	5.88
6	40– to <60	20– to <30	C	LI	Unifocal	1.49	71.64	26.87
7	40– to <60	<20	B	LO	Multi-focal, single quadrant	22.39	40.30	37.31
8	<40	20– to <30	B	UI	Unifocal	5.97	64.18	29.85
9	40– to <60	40– to <50	A	UO	Multi-focal, single quadrant	91.04	0.00	8.96
10	60– to <70	20– to <30	D	UO	Multi-focal, single quadrant	19.4	46.27	34.33
11	40– to <60	≥50	A	UI	Unifocal	92.65	0.00	7.35
12	40– to <60	30– to <40	D	Central	Unifocal	44.12	17.65	38.24
13	70– to <80	≥50	C	UO	Unifocal	83.82	4.41	11.76
14	70– to <80	30– to <40	A	LI	Multi-focal, single quadrant	89.71	1.47	8.82
15	<40	<20	A	UO	Unifocal	1.47	66.18	32.35
16	<40	30– to <40	C	LO	Multi-focal, single quadrant	41.18	25.00	33.82
17	60– to <70	40– to <50	A	LO	Unifocal	86.76	2.94	10.29
18	≥80	20– to <30	A	Central	Multi-focal, single quadrant	79.41	1.47	19.12
19	≥80	30– to <40	B	UO	Unifocal	32.35	27.94	39.71
20	60– to <70	<20	C	Central	Unifocal	27.94	42.65	29.41
21	70– to <80	<20	D	UI	Multi-focal, single quadrant	17.65	45.59	36.76
22	≥80	<20	A	LI	Unifocal	11.76	50.00	38.24
23	70– to <80	20– to <30	A	LO	Unifocal	13.23	39.71	47.06
24	60– to <70	30– to <40	A	UI	Unifocal	67.65	8.82	23.53
25	<40	≥50	A	Central	Multi-focal, single quadrant	94.12	1.47	4.41

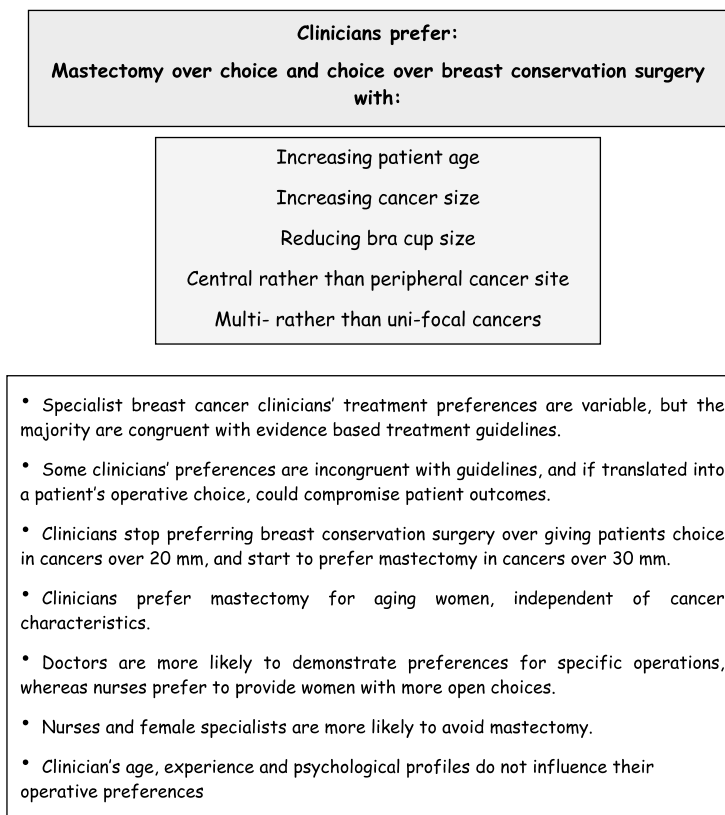
Table 4 – Influence of DCE variable over operative preferences: Relative risk ratio (RRR) equal preference for both BCS and mastectomy versus mastectomy preference

Variable		Relative risk ratio (RRR) equal preference versus Mx preference	[95% CI]	p=
Patient age (years)	<40 versus 40–60	1.42	0.91–2.22	0.121
	<40 versus 60–70	3.26	2.03–5.24	<0.001
	<40 versus 70–80	2.47	1.58–3.86	<0.001
	<40 versus >80	1.64	0.93–2.89	0.088
Total cancer size (mm)	<20 versus 20–30	1.10	0.69–1.77	0.680
	<20 versus 30–40	4.92	3.17–7.65	<0.001
	<20 versus 40–50	15.55	8.85–27.33	<0.001
	<20 versus >50	35.61	13.01–97.41	<0.001
Bra cup size	A versus B	0.76	0.48–1.22	0.225
	A versus C	0.46	0.29–0.73	0.001
	A versus ≥ D	0.35	0.22–0.57	<0.001
Cancer site	Central versus UO	0.25	0.14–0.44	<0.001
	Central versus LO	0.28	0.15–0.50	<0.001
	Central versus LI	0.37	0.23–0.61	<0.001
	Central versus UI	0.33	0.19–0.56	<0.001
Focality	Uni versus Multifocal single quadrant	3.22	1.98–5.26	<0.001

Table 5 – Influence of DCE variable over operative preferences: Relative risk ratio (RRR) equal preference for both BCS and mastectomy versus BCS preference

Variable		Relative risk ratio (RRR) equal preference versus BCS preference	[95% CI]	p =
Patient age (years)	<40 versus 40–60	0.77	0.49–1.22	0.272
	<40 versus 60–70	0.73	0.44–1.22	0.233
	<40 versus 70–80	0.60	0.38–0.93	0.022
	<40 versus >80	0.70	0.40–1.23	0.215
Total cancer size (mm)	<20 versus 20–30	0.70	0.51–0.98	0.035
	<20 versus 30–40	0.30	0.19–0.47	<0.001
	<20 versus 40–50	0.10	0.04–0.26	<0.001
	<20 versus >50	0.08	0.02–0.25	<0.001
Bra cup size	A versus B	1.55	1.04–2.32	0.033
	A versus C	2.86	1.63–5.03	<0.001
	A versus ≥ D	2.95	1.55–5.62	0.001
Cancer site	Central versus UO	3.30	1.42–7.68	0.006
	Central versus LO	3.28	1.23–8.74	0.018
	Central versus LI	2.72	1.50–4.93	0.001
	Central versus UI	2.73	1.07–6.97	0.036
Focality	Uni versus Multifocal single quadrant	0.39	0.21–0.71	0.002

All 5 DCE variables significantly associated with clinicians' preferences ($p < 0.001$)

**Fig. 2 – Summary of specialist breast clinician DCE survey.**

In summary, the study demonstrates clinician preferences to individual scenarios are variable, but largely consistent with evidence-based guidelines. Preference for mastectomy rather than choice, and choice rather than BCS, correlating with increasing cancer size, central cancer site, multi rather

than uni-focal cancer, and reducing bra cup size. We also demonstrated clinician preferences are significantly influenced by patient age, and the clinician's gender and occupation, and established several nuances of preference drivers. Fig. 2 summarises the findings.

5. Discussion

To the authors knowledge this is the first study to use the DCE technique to assess the preferences of cancer clinicians for alternative treatment regimens. To optimise the realism of the clinical decision-making exercise, the DCE design utilised a less commonly adopted single scenario design and incorporated an equivalent preference (prefers both equally) option to determine the impact of key variables available pre-operatively, over specialist breast clinicians' therapeutic operative preferences for the management of primary breast cancer. It could be argued that respondents should be forced to make specific choices rather than defer to the perhaps easier decision of selecting the equivalent preference option. However, a number of clinical situations exist, e.g. breast cancers up to 4 and 5 cm in diameter, where no clearly superior surgical treatment has been established in terms of its impact on mortality rates,^{1,2} or physical and psychological morbidity,^{7,36,37} while evidence exists that providing patients with treatment choices confers psychological benefit.^{3–7} Therefore, failing to provide respondents with the option to select the equivalent preference option and defer decision-making to the patient, would be inappropriate. The methodology however does not permit elicitation of respondents' motives for selecting the equivalent preference option, i.e. an easier decision or a belief in the provision of choice to patients. Nor does it necessarily mean the clinician views the two treatments as exactly equal. Future research utilising the DCE technique in similar clinical contexts should include the elicitation of respondent's motives for their responses to DCE scenarios; which could be achieved through the addition of a qualitative element to the study.

The DCE technique is capable of elucidating clinicians' preferences. It confirmed the influence of several predictable influencers of clinician's decision-making in the therapeutic surgical management of primary breast cancer (i.e. cancer size and focality), and the congruence of the majority of clinicians' preferences with evidence-based guidelines. However, at individual respondent level, clinician preferences varied and some outlying responses were identified.

The technique also uncovered several novel insights into specialist breast clinicians' operative preferences: For example, preferences are significantly influenced by patient age, but less so in the very old; and clinicians who prefer mastectomy or BCS have different cancer size thresholds for their preferences. Such detail is unlikely to have been detected with other methodologies used to establish preferences in health care decision-making.

The explanation for clinicians' purely age-based preference for mastectomy in older patients is not obvious. Whilst age may influence some treatment recommendations, such as chemotherapy, it should not independently influence their surgical treatment. This may reflect clinicians assuming increasing age equates to greater co-morbidity, despite instructions that other aspects of the cases were equal or insignificant. Alternatively, it could indicate a conditioned impression of patient preferences, or a belief among clinicians that older patients are best treated with mastectomy.

The different stance of the two professional groups was interesting, but perhaps not unexpected. In most areas of

clinical practice, doctors are frequently asked to assume roles requiring them to make specific recommendations, while nurses tend to provide more supportive roles.

Despite the national establishment of the Multi-Disciplinary Team (MDT) in the breast service, and discussion of all patients diagnosed with cancer in regular MDT meetings, variation in the surgical management of breast cancer persists. MDTs decide which options are available to individual patients, but communication of options is at individual clinician level, and it has been demonstrated that clinicians' treatment recommendations and preferences, whether overtly stated or perceived by a patient, exert one of the most powerful influences over patients' decisions.^{21,26,27} We have clearly demonstrated clinicians' preferences are not uniform and have also illustrated that some clinicians adhere rigidly to their personal treatment preferences, which may lie outside evidence of best practice and safety.

The employment of the DCE technique in the described study has substantially increased our understanding of specialists' treatment preferences in breast cancer surgery. To resolve why women with breast cancer treated by different breast units chose such different options, it is important we achieve greater understanding of clinicians' preferences and study how, and to what extent, these influence individual consultations and patients' decisions.

Discrete choice experiment methodology has a promising potential role in aiding the elucidation of practice variation in the wider cancer context, in areas where contention regarding best practice or the presence of treatment options exists.

Conflict of interest statement

None declared.

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