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RESEARCH ARTICLE

Surgeon preference for treatment allocation in older people facing major gastrointestinal surgery: an application of the discrete choice experiment methodology

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Abstract

Aim: Variation in major gastrointestinal surgery rates in the older population suggests heterogeneity in surgical management. A higher prevalence of comorbidities, frailty and cognitive impairments in the older population may account for some variation. The aim of this study was to determine surgeon preference for major surgery versus conservative management in hypothetical patient scenarios based on key attributes.

Method: A survey was designed according to the discrete choice methodology guided by a separate qualitative study. Questions were designed to test for associations between key attributes (age, comorbidity, urgency of presentation, pathology, functional and cognitive status) and treatment preference for major gastrointestinal surgery versus conservative management. The survey consisting of 18 hypothetical scenarios was disseminated electronically to UK gastrointestinal surgeons. Binomial logistic regression was used to identify associations between the attributes and treatment preference.

Results: In total, 103 responses were received after 256 visits to the questionnaire site (response rate 40.2%). Participants answered 1847 out of the 1854 scenarios (99.6%). There was a preference for major surgery in 1112/1847 (60.2%) of all scenarios. Severe comorbidities (OR 0.001, 95% CI 0.000–0.030; $P = 0.000$), severe cognitive impairment (OR 0.001, 95% CI 0.000–0.033; $P = 0.000$) and age 85 years and above (OR 0.028, 95% CI 0.005–0.168; $P = 0.000$) were all significant in the decision not to offer major gastrointestinal surgery.

Conclusion: This study has demonstrated variation in surgical treatment preference according to key attributes in hypothetical scenarios. The development of fitness-stratified guidelines may help to reduce variation in surgical practice in the older population.

KEYWORDS
clinical practice variation, gastrointestinal surgery, older adults, surgery

INTRODUCTION

Population ageing, coupled with a higher prevalence of the majority of gastrointestinal (GI) conditions with age, has resulted in an ageing surgical population. Despite this, national cancer registration data for England demonstrate that GI cancer resection rates decline with age and this is most pronounced for patients aged 80 years or above [1]. The National Emergency Laparotomy Audit and Royal College of Surgeons of England reports also demonstrate declining rates of major emergency GI surgery (laparotomy) with increasing age, despite higher prevalence of emergency GI surgical conditions [2–4]. This suggests that age may be taken into account in surgical decision-making.

Many factors associated with ageing, such as comorbidity, frailty, and functional and cognitive impairment, increase perioperative risk [5–8]. Healthcare professionals take these factors into account to varying degrees when deciding treatment options for older patients. Available guidelines state that age should not influence surgical management options and all treatment options should be offered if the patient is 'fit' [9–12]. However, there is a paucity of evidence-based surgical guidelines on how patients should be assessed for 'fitness' or how surgical treatments should be stratified. Variation in major GI surgery rates between surgical units that cannot be explained by case-mix variation suggests that surgeon preference may be a factor in this variation.

Major GI surgery is associated with significant postoperative adverse events, even in the fittest of patients [13]. This risk is amplified in the older population, particularly in the emergency setting [13, 14]. Older patients are at risk of delirium, prolonged hospital stay and loss of functional independence [15]. Studies suggest preserving quality of life and independence may be of greater importance than length of life to many older adults [16]; this may be achieved by avoiding major surgery in some cases or pursuing less invasive management options.

The aim of this study was to determine the impact of key attributes on treatment allocation by GI surgeons using the discrete choice experiment (DCE) methodology and to explore variation between subspecialties.

What does this paper add to the literature?

This is the first study to address the impact of surgeon preference on treatment variation in the older surgical population with gastrointestinal disease using the discrete choice methodology. It suggests that attributes such as age, comorbidity and cognitive impairment are highly significant in treatment decision-making.

METHODS

The DCE methodology was chosen as a robust survey methodology that allows examination of the trade-offs participants are willing to make between different key attributes in decision-making, under experimental conditions [17, 18]. Discrete choice was originally conceived as a method to elicit health utility values in health economic modelling; however, it has since been implemented in a wide variety of healthcare studies, such as patient preferences for interventions such as screening programmes [19, 20] and early cancer treatments [21]. There are also a small number of studies where it has been used to elicit surgeon preferences for treatment allocation, for example in early prostate cancer [21] and breast cancer [22, 23]. DCE is felt to be particularly useful when there is uncertainty about best practice and where individual preference is likely to be important in decision-making. We are not aware of any previous application of the DCE methodology in major GI surgery.

Discrete choice experiment requires raters to select an outcome (e.g., treatment preference) based on a small number of attributes (e.g., patient characteristics). The attributes may have up to five predefined levels which address disease severity or impact of a treatment or condition, for example. These items can be combined with various levels to explore which attributes are the most influential on decisions.

In this study, five key attributes were identified from the literature and qualitative semi-structured healthcare professional interviews [22, 24]. Attributes were subdivided into mutually exclusive levels of severity (Table 1) based on previous work by members of the study team [22]. Twenty-five scenarios were randomly generated out of the 1024 potential scenarios using IBM SPSS version 21 Orthoplan software to ensure an orthogonal design with minimal overlap [22, 23]. This number of scenarios was selected based on the literature which suggests that more than 25 leads to respondent fatigue and drop-out [25, 26]. Scenarios were checked for plausibility, leading to the exclusion of seven scenarios (e.g., a patient with severe cognitive impairment cannot be functionally independent).

For each included scenario, respondents were asked whether they would recommend major GI surgery or conservative management (e.g., palliative surgical intervention, antibiotics or best supportive care). This single profile design (with no neutral option) is well established in the DCE literature [27]. Piloting was carried out on seven surgeons outside of the study team to ensure face and content validity, usability and comprehension with adjustments made before the final version was deployed. A screenshot of a sample DCE scenario in Google Forms format is shown in Figure 1. See Appendix S1 for the full questionnaire.

The 18 scenarios were converted into a web-based questionnaire for dissemination. The questionnaire was sent electronically to members of the Association for Upper GI Surgeons and the British Association for Surgical Oncology, subscribers to the Centre for Perioperative Care mailing list, personal contacts of the study team and via Twitter. A click counting URL was used to determine a proxy response rate. Consent was implied by completion

TABLE 1 Discrete choice attributes and levels

Attribute	Levels
Patient age (years)	65–74
	75–79
	80–84
	85+
Comorbidity	No comorbidity
	Mild comorbidity, e.g., arthritis, visual impairment, hypertension (with or without regular treatment)
	Moderate comorbidity, e.g., diabetes, coronary heart disease, moderate COPD (symptomatically controlled with regular medication)
	Severe comorbidity, e.g., disabling stroke, congestive cardiac failure, severe COPD
Pathology and presentation	Elective, non-malignant pathology, e.g., diverticular stricture, incisional hernia
	Elective malignancy amenable to resection
	Emergency non-malignant pathology, e.g., small bowel obstruction
	Emergency malignancy, e.g., obstructing cancer amenable to resection with no distant spread
Functional status	Fully independent
	Mild dependence, e.g., requires help approximately once a week for domestic activities of daily living (shopping, cleaning, laundry)
	Moderate dependence, e.g., requires help at least once a day for personal activities of daily living (washing, dressing, continence management)
	Severe dependence, e.g., requires 24-h care (resides in a residential or nursing home)
Cognition	Normal cognitive function
	Mild cognitive impairment, e.g., slight memory loss but able to function normally in society
	Moderate cognitive impairment, e.g., poor memory, unable to cope without help from either family or carers
	Severe cognitive impairment, e.g., requires 24-h care in own home or a skilled facility

Abbreviations: COPD, chronic obstructive pulmonary disease.

FIGURE 1 Screenshot of question 1 of the discrete choice experiment (DCE) in Google Forms

of the questionnaire. Ethical approval was in place (REC ref. 19/HRA/5964).

Demographics of respondents (sex, subspecialty, region of practice and years from certification of completion of training) were collected and summarized using simple statistics. Binomial logistic regression was performed to test for associations between the dependent variable (treatment preference 'major GI surgery' or 'conservative management') and the independent attributes given in the scenarios. 'Major GI surgery' was set as the reference category. Odds ratios with 95% confidence intervals and *P* values were determined for each attribute subdivision. Participant responses were further divided into subgroups by subspecialty (colorectal vs. upper GI/hepatopancreatobiliary surgery [HPB]) and analysed by logistic regression. Differences between subgroups and the whole group were tested using the chi-squared test. Analyses were performed using Stata (StataCorp 2021, Stata statistical software: release 17, StataCorp LLC). A sample size of 100 was set based on the DCE literature [26, 28].

RESULTS

In total, 103 responses were obtained after 246 visits to the questionnaire site giving an estimated response rate of 40.2%. All major subspecialities of GI surgery were represented with 57/103 (55.3%) colorectal and 46/103 (44.7%) upper GI or HPB. Three-quarters of respondents were men (77/103, 75.0%). Responses were gathered from across the UK, with the largest proportions working in the Yorkshire and Humber 32/103 (31%) and East Midlands 15/103 (15%) deaneries. The median duration of consultant practice was 8 years (range 0–39 years). Participants answered 1847 out of the 1854 scenarios (103 × 18) indicating that 99.6% of questions were completed.

There was a preference for major surgery in 60.2% (1112/1847) of all scenarios. There was variation in how often major surgery was selected by each surgeon, median 11 (range 1–18) with three outliers (Figure 2). There was no relationship between surgeon sex and number of times major GI surgery was selected. There was treatment uncertainty (defined as less than 85% respondents selecting the same management) for scenarios 1, 2, 5, 10, 15 and 16 (Table 2). These included 5/12 (41.7%) non-malignant scenarios compared to 1/6 (16.7%) malignant scenarios.

On binomial logistic regression analysis for the entire group, severe comorbidity (OR 0.001, 95% CI 0.000–0.030; $P = 0.000$), severe cognitive impairment (OR 0.001, 95% CI 0.000–0.033; $P = 0.000$) and age greater than or equal to 85 years (OR 0.028, 95% CI 0.005–0.168; $P = 0.000$) were all highly significant in the decision not to offer major GI surgery (Table 3 and Figure 3). There was a trend for decreasing odds ratios with increasing levels of cognitive impairment and functional impairment. All age groups less than 85 years had non-significant odds ratios. Emergency presentation with malignant pathology was the only attribute from this group that reached statistical significance over the reference category (elective surgery for non-malignant pathology) (OR 7.918, 95% CI 2.594–24.169; $P = 0.000$), indicating that surgeons were more likely to offer major GI surgery.

When the results for the colorectal surgeons were analysed separately, age greater than or equal to 85 years remained significant (OR 0.086, 95% CI 0.018–0.413; $P = 0.002$) and severe functional impairments became significant (OR 0.023, 95% CI 0.001–0.548; $P = 0.020$) with severe cognitive impairments and comorbidity no longer reaching significance. In contrast, when the results for the upper GI and HPB surgeons were analysed separately, all attributes significant for the entire group remained significant. The chi-squared test revealed that only mild comorbidities for colorectal surgeons compared to the whole group reached statistical significance ($\chi^2 = 4.11$, $P = 0.043$).

DISCUSSION

This study has established the importance of different attributes in GI surgeons' treatment decision-making under experimental conditions for hypothetical clinical scenarios. Lack of consensus on treatment preference was observed for six out of 18 scenarios. These scenarios were more likely to include patients with non-malignant pathology. This is concordant with our previous mixed methods study where healthcare professionals said that symptom burden and quality of life are important in their decision-making in patients with non-malignant pathology [24]. There was variation in

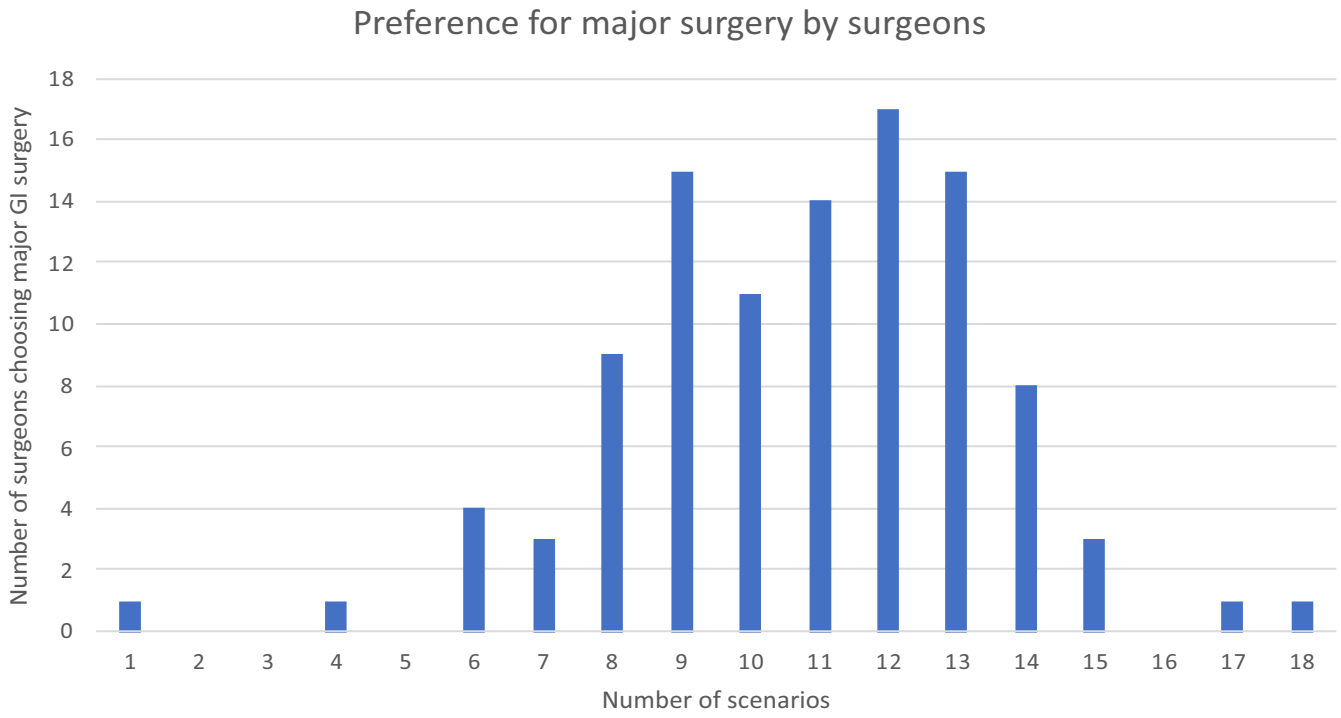

FIGURE 2 Number of times major gastrointestinal surgery was chosen by surgeons

TABLE 2 Results by scenario for the discrete choice experiment with number of respondents and percentage of total reported

Scenario	Patient age	Comorbidity	Pathology and presentation	Functional impairment	Cognitive impairment	Preference for surgery, *n* (%)
1 *	75–79	Mild	Elective, non- malignant	Moderate	Mild	71 (68.9)
2 *	85+	None	Elective, malignant	Moderate	Moderate	46 (44.7)
3	85+	Moderate	Elective, non-malignant	Severe	Mild	6 (5.8)
4	65–74	None	Emergency, malignant	Mild	Mild	101 (98.1)
5 *	65–74	None	Emergency, malignant	Moderate	Severe	40 (38.8)
6	65–74	Moderate	Elective, non-malignant	Mild	None	92 (89.3)
7	75–79	Severe	Emergency, malignant	Severe	None	12 (11.7)
8	65–74	Moderate	Emergency, non-malignant	Moderate	None	92 (89.3)
9	80–84	Severe	Elective, non-malignant	Moderate	None	10 (9.7)
10 *	85+	None	Elective, non-malignant	Independent	None	80 (77.7)
11	75–79	None	Emergency, non-malignant	Independent	None	101 (98.1)
12	80–84	None	Emergency, non-malignant	Independent	Mild	96 (93.2)
13	65–74	None	Elective, non-malignant	Independent	None	101 (98.1)
14	80–84	None	Elective, non-malignant	Severe	Severe	8 (7.8)
15 *	75–79	None	Elective, non-malignant	Mild	Moderate	55 (53.4)
16 *	65–74	Mild	Emergency, non-malignant	Severe	Moderate	23 (22.3)
17	80–84	Mild	Elective, malignant	Mild	None	87 (84.5)
18	85+	Mild	Emergency, malignant	Independent	None	91 (88.3)

Note: Scenarios marked with an asterisk were associated with treatment uncertainty with less than 85% of respondents in agreement.

how many times individual surgeons recommended major GI surgery with three obvious outliers. These outliers are potentially due to participants 'straight-lining' whilst completing the questionnaire rather than recording their true practice [29]. Differences observed on logistic regression between subspecialists suggest that colorectal surgeons place more value on functional status whereas HPB/upper GI surgeons place more value on comorbidities and cognitive impairment. These differences require further study.

Available guidelines for GI surgery suggest that 'fit' older adults should be offered the same treatments as younger individuals [9–12, 30]. However, in this study, age greater than 85 years was highly significant on logistic regression analysis, which is concordant with a previous survey of surgeons [31]. It is likely that surgeons use age as a surrogate for fitness, frailty and life expectancy, particularly in the absence of objective assessments [32]. This underscores the need for incorporation of objective fitness-based thresholds specific to older patients into clinical practice guidelines.

The prevalence of comorbidities increases with age and is an important factor in the higher incidence of postoperative complications in the older surgical population [4]. Available guidelines do not state which comorbidities would be contraindications to major GI surgery or suggest how patients with these comorbidities should be optimized prior to surgery [9–12, 33, 34]. It is therefore the surgeon's responsibility to decide which comorbidities and what severity of comorbidities preclude major surgery. This study suggests that severe comorbidity is a significant contributor to surgeon treatment decision-making in older patients.

Multiple studies have emphasized the negative impact of major GI surgery on functional independence [15, 35, 36]; therefore it is not surprising that surgeons in this study were less likely to suggest major surgery with increasing levels of functional impairment. Functional impairment also correlates with physical inactivity, another predictor of poor outcomes in older patients [37].

Lack of research and guidelines regarding the surgical treatment of individuals with cognitive impairment contributes to the higher observed use of alternative treatments (such as palliative stenting) and non-operative management strategies in colorectal cancer patients [38]. Whilst patients with severe dementia frequently have limited life expectancies, patients with mild dementia often have life expectancies that exceed their surgical pathology and the life expectancy of many other comorbidities [39]. In addition, symptom burden may be significant in surgical GI pathologies and thus the benefits of operative intervention for someone who cannot retain why they are having troubling

TABLE 3 Binomial logistic regression analysis of the influence of DCE attributes on treatment choice

		All				Colorectal				HPB and upper GI			
			95% CI				95% CI				95% CI		
Attribute	Level	OR	Lower	Upper	Sig.	OR	Lower	Upper	Sig.	OR	Lower	Upper	Sig.
Age	65–74	Ref				Ref				Ref			
	75–79	0.613	0.325	1.161	$P = 0.133$	0.759	0.321	1.798	$P = 0.531$	0.219	0.064	0.742	$P = 0.015$
	80–84	1.391	0.356	5.428	$P = 0.635$	0.332	0.024	4.610	$P = 0.412$	1.954	0.306	12.48	$P = 0.479$
	85+	0.028	0.005	0.168	$P = 0.000$	0.086	0.018	0.413	$P = 0.002$	0.002	0.000	0.104	$P = 0.002$
Comorbidities	None	Ref				Ref				Ref			
	Mild	0.204	0.078	0.535	$P = 0.001$	0.655	0.146	2.934	$P = 0.580$	0.064	0.011	0.353	$P = 0.002$
	Moderate	0.496	0.147	1.672	$P = 0.258$	1.375	0.252	7.517	$P = 0.713$	0.251	0.027	2.364	$P = 0.227$
	Severe	0.001	0.000	0.030	$P = 0.000$	0.041	0.000	8.824	$P = 0.243$	0.000	0.000	0.015	$P = 0.001$
Presentation and pathology	Elective non-malignant	Ref				Ref				Ref			
	Elective malignant	2.390	0.837	6.824	$P = 0.104$	6.168	1.065	35.73	$P = 0.042$	1.826	0.356	9.375	$P = 0.471$
	Emergency non-malignant	0.329	0.057	1.887	$P = 0.212$	1.512	0.220	10.38	$P = 0.674$	0.034	0.001	1.219	$P = 0.064$
	Emergency malignant	7.918	2.594	24.169	$P = 0.000$	5.038	0.955	26.57	$P = 0.057$	12.21	1.890	78.99	$P = 0.009$
Functional status	None	Ref				Ref				Ref			
	Mild functional dependence	0.085	0.010	0.691	$P = 0.021$	0.175	0.023	1.315	$P = 0.090$	0.077	0.000	0.765	$P = 0.038$
	Moderate functional dependence	0.433	0.084	2.242	$P = 0.318$	0.210	0.015	2.863	$P = 0.241$	0.211	0.012	3.653	$P = 0.285$
	Severe functional dependence	0.172	0.029	1.020	$P = 0.053$	0.023	0.001	0.548	$P = 0.020$	0.271	0.015	4.941	$P = 0.378$
Cognitive impairment	None	Ref				Ref				Ref			
	Mild	0.267	0.086	0.825	$P = 0.022$	0.767	0.111	5.272	$P = 0.787$	0.162	0.029	0.914	$P = 0.039$
	Moderate	0.172	0.060	0.495	$P = 0.001$	0.347	0.081	1.479	$P = 0.152$	0.150	0.022	1.020	$P = 0.052$
	Severe	0.001	0.000	0.033	$P = 0.000$	0.017	0.000	1.533	$P = 0.076$	0.000	0.000	0.022	$P = 0.001$

Notes: Odds ratios, 95% confidence intervals and significance (sig) are shown. Results are displayed for all participants, colorectal surgeons and HPB/upper GI surgeons. Odds ratios greater than 1 indicate that surgeons are more likely to suggest major GI surgery, whereas odds ratios less than 1 suggest that they are more likely to recommend conservative management compared to the reference category.Abbreviations: GI, gastrointestinal; HPB, hepatopancreatobiliary surgery.

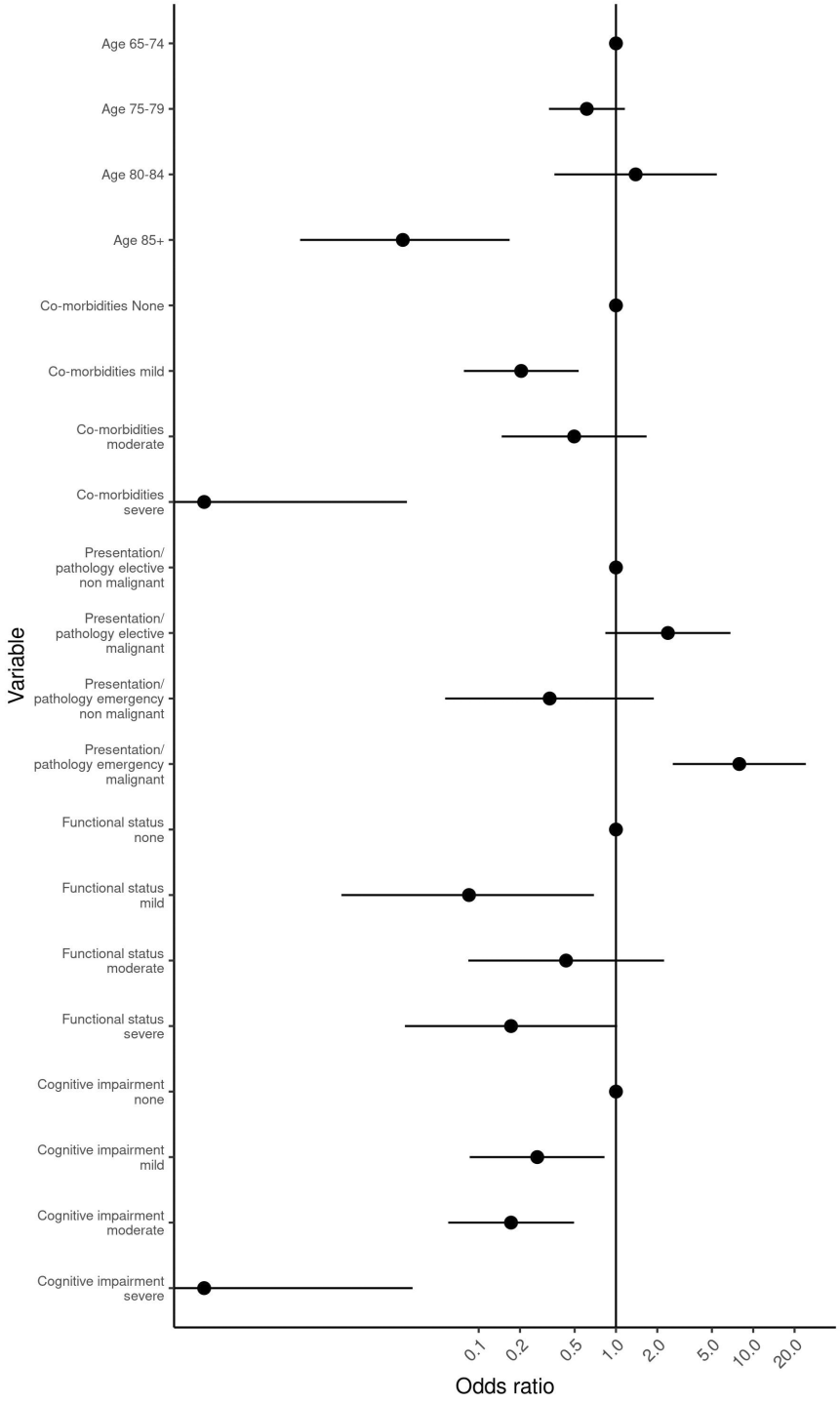

FIGURE 3 Forest plot of odds ratios with 95% confidence intervals for each of the different attributes in the logistic regression analysis of the whole group. The solid line demonstrates the reference value

symptoms may outweigh the risk of intervention. This study has confirmed that severe cognitive impairment impacts surgical treatment decision-making significantly. The reasons for this require further study.

The study was adequately powered according to the literature for DCE [26]. However, due to an estimated response rate of only 40%, the generalizability of these results may be limited. The dissemination of the survey to a wide range of GI surgeons may also have increased heterogeneity in the results. Grade or stage of malignant pathology was not included in the scenarios but obviously would affect treatment decisions depending on the subspeciality of GI surgery. Equally, some non-malignant pathologies may be successfully treated with conservative measures and this was not captured in the scenarios. The exclusion of implausible scenarios resulted in more scenarios for non-malignant than malignant pathology being included in the final model. This may have affected the orthogonal design of the study and introduced bias. Our study design did oblige surgeons to make decisions based on hypothetical scenarios with limited data. However, this is not dissimilar to the real world where information from a general practitioner referral letter or multidisciplinary team referral may be limited.

It is important that policy makers acknowledge that surgeon preference influences treatment allocation and take steps to reduce variation between surgeons. This may include local and national guidelines, audit of practice, standardized perioperative assessment processes prior to surgical decision-making, as well as training of surgeons in perioperative and geriatric assessment. There is wide scope for further research in this field; in particular, a DCE in older patients contemplating major GI surgery would complement this work. A large programme of work funded by the National Institute for Health and Care Research is already under way looking at optimizing shared decision-making for high risk major surgery (www.osiris-programme.org) and is another important area of study in the older population. The presence of cognitive impairment clearly influences surgical management and further research is urgently needed involving patients and their carers to guide practice.

CONCLUSION

This study suggests that severe comorbidities, severe cognitive impairment and advanced age have the greatest impact on surgeon decision-making in the older population. Further work is needed to standardize practice and reduce variation.

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AUTHOR CONTRIBUTIONS

SLD and LW conceived the project. SLD, JM, MJL, SM, TRW, SRB and LW initiated the study design. SLD, JM, MJL and TW were responsible for data analysis. All authors contributed towards and approved the final manuscript.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request." cd_value_code="text

ETHICS APPROVAL

This study has ethical approval (IRAS ID 272619, REC ref. 19/HRA/5964). Local research and development approval was obtained.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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