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Abstract

Objectives: The aim of this study was to identify the socio-professional and behavioral factors influencing decision-making between surgical and non-surgical treatment in Upper AeroDigestive Tract (UADT) oncology among surgeons and oncologists.

Materials and methods: We conducted a nationwide online survey among surgeons and medical or radiation oncologists treating head and neck cancer patients in France. The questionnaire collected physicians' demographics, type of practice, individual behavioral characteristics (attitudes toward risk and uncertainty) and data on decision-making via clinical case scenarios.

Results: In total, 197 questionnaires were usable. Clinical case scenarios were grouped into three categories according to the prognostic and functional impact of the choice between surgical or non-surgical treatment. For clinical case scenarios where evidence-based medicine considered surgery as the best option, surgeons were significantly more likely to offer surgery in multivariable analysis. When surgery and non-surgical treatment were equivalent, multivariable analysis showed that the tendency to offer surgery increased with the physician's age, and decreased as the number of patients treated per year increased. When non-surgical treatment was the best option because of very high surgical morbidity, multivariable analysis showed a higher propensity to opt for surgery for the age group 40 – 59 versus 25 – 39, and a lower likelihood of choosing surgery among oncologists.

Conclusion: This study sheds light on the physicians' socio-professional and behavioral factors influencing decision-making in UADT oncology. These mechanisms, poorly studied and probably underestimated, partly explain the variability of the decisions taken when confronted with clinical situations that are subject to debate.

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Key words: head and neck cancer, multidisciplinary tumor board, practice variation, behavioral factors, socio-professional factors, decision under risk and uncertainty.

Introduction

The treatment of Head and Neck Cancers (HNC) follows recommendations based on evidence-based medicine [1]. However, those guidelines do not address all clinical situations. Some complex cases will be subject to debate because of the lack of recommendation suitable for some patient's clinical characteristics (past medical history and exact location). Several choices are then possible, and physicians are free to propose the treatment they feel is most appropriate for the patient and the pathology. Most of the time, the options are either upfront surgery or non-surgical treatment with radio(chemo)therapy. Undecided cases frequently encountered in clinical practice include early glottic cancers [2,3] or oropharyngeal cancers, particularly those driven by the Human Papilloma Virus (HPV) [4,5]. Some locally advanced tumors may be treated surgically or with radio-chemotherapy, depending on the center [6]. To our knowledge, there is no study on physician-related factors influencing treatment decisions in the field of upper aerodigestive tract (UADT) cancers.

In 1973, Wennberg et al. described variations in health care delivery that could not be explained by variation in patient illness or patient preferences [7]. Besides standard demographics such as age and gender, socio-professional and behavioral characteristics of the physicians may also be associated with variations in medical practice [8–12]. Therefore, we aimed to assess the potential influence of the specialty, type of practice, caseload (number of HNC patients treated per year), position, as well as the access to various facilities and skills. With regard to the physician's behavioral characteristics, we focused on attitudes toward risk and uncertainty measured by Likert scales [13] and choice-based tasks [14]. The latter are related to decision models, that allow us to better describe, understand and assess individual decisions in situations where the consequences of choices are uncertain [15].

Intuitively, risk- or uncertainty-averse individuals will prefer a safer option (high probability or likelihood of gain, but low gain) while risk- or uncertainty-seeking individuals will choose a less safe option (lower probability or likelihood of gain, but higher gain). The difference between risk and uncertainty is that the probability of success is unknown in the uncertain situation, unlike the risky situation [16]. This difference has behavioral consequences and the preference for a risky situation over an uncertain one is called ambiguity aversion [17]. Attitudes toward risk and uncertainty are the behavioral variables derived from the normative model of Expected Utility Theory [18,19]. Using a series of two choices, Allais and Ellsberg paradoxes [14,17] have highlighted systematic deviations from this normative model. In this study, we replicated the choices of these two paradoxes and therefore assessed the potential individual deviations to the Expected Utility Theory model. We also measured individual attitudes toward risk and uncertainty. Given the high degree of uncertainty inherent to decision making in UADT oncology, our hypothesis was that variations in physicians' behavioral characteristics such as attitude toward risk and uncertainty may be associated with the treatment offered to the patient. Such determinants of practice variations have been found in therapeutical decisions for older patients with acute myeloid leukemia [10] and in general practitioner's daily practice concerning vaccination and testing [20]. Identifying new drivers of variations in individual practices could then allow us to undertake corrective measures to minimize these variations and offer the same quality of treatment to each patient. Some authors already suggested target points to reduce practice variations, such as networks to enhance collaboration, feedback and teamwork within and between hospitals [21].

The objective of our study was to identify socio-professional and behavioral factors influencing decision making between surgical and non-surgical treatment in UADT oncology among surgeons and oncologists.

Material and methods

We conducted a nationwide online survey (*clinicaltrials.gov ID: NCT03663985*) among ENT surgeons, maxillofacial surgeons, medical oncologists, and radiation oncologists treating HNC patients in France. Physicians were invited to participate via a link on their professional mailbox, in partnership with the national GETTEC/GORTEC/GERCOR/SFORL/UNICANCER intergroup, during the period from 14/12/2018 to 31/03/2019. The recipients were composed of 71% of surgeons and 29% of oncologists.

The questionnaire was based on a set of clinical case scenarios for which the physicians had to choose a therapeutic proposal among several options (see appendix). The case scenarios were designed by a senior author of this article (ADB) and peer-reviewed for validation by 5 experts (2 surgeons, 3 oncologists, cf. acknowledgements). A total of 36 clinical case scenarios were generated by crossing the 6 clinical cases with 6 patient profiles of different social backgrounds, using a Latin square design to ensure a random but balanced distribution of the variables to all respondents. Social backgrounds were defined by a combination of "profession (white-collar or blue-collar worker) - gender (male or female) - marital status (single or married)". The first clinical case scenario was used as an internal control because the answer was consensual. It allowed us to verify the physicians' compliance with the guidelines; those who proposed an answer other than surgery for this item were excluded from the study. The remaining six clinical case scenarios were then grouped into three categories according to the prognostic and functional impact of the choice between surgical or non-surgical treatment (Figure 1):

- Group E = surgical and non-surgical treatment equivalent (clinical case scenario 4 and 6): Surgical and medical treatment offer the same rate of locoregional control and survival, alongside comparable functional outcomes [5,22].

- Group S = surgical treatment advantageous (clinical case scenario 2 and 7): In the scenario 2, the best treatment option is surgery with adjuvant radiotherapy. Non-surgical options offer poorer survival outcomes i.e., 3-year disease free survival around 69% with surgery followed by adjuvant radiotherapy, against 21% with definitive radiotherapy [23–25]. In the scenario 7, the options are salvage surgery, reirradiation alone or palliative chemotherapy. The 5-year survival is estimated at 39% after surgery while the 2-year survival after reirradiation is around 15% [26].
- Group NS = non-surgical treatment advantageous (clinical case scenario 3 and 5): Surgical and medical treatment offer the same rate of locoregional control and survival [27,28]. However, the surgeries are highly morbid and associated to poorer functional outcomes i.e., total glossectomy (scenario 3) and total pharyngolaryngectomy (scenario 5).

With regard to the physicians' characteristics, we collected the following data: demographics (age and gender), specialty (surgeon, medical or radiation oncologist), type of healthcare facility (private clinic, district general hospital or academic center i.e., teaching hospital or comprehensive cancer center), position (tenured or non-tenured), number of HNC patients treated per year, proportion of public and private practice, access to a multidisciplinary team involving surgeons and oncologists, possibility of microsurgical reconstruction, and access to an intensive care unit.

Finally, the physicians' preferences and attitudes toward risk and uncertainty in both daily life (binary choices for monetary outcomes) and clinical practice (willingness to take risks in the domain of health) were evaluated using 4 tools, previously validated in behavioral science (see appendix).

1- A task composed of a sequence of 4 binary choices between a risky option (lottery) and a certain gain, which allowed to calculate a risk-aversion index for each respondent.

2- A task composed of a sequence of 4 binary choices between an uncertain option (lottery) and a certain gain, which allowed to calculate an uncertainty-aversion index for each respondent. From the difference between these indexes, we defined economic rationality and irrationality according to Ellsberg definition [17].

3- A task composed of 2 binary choices between lotteries corresponding to the Allais paradox [29], which allowed us to classify each physician as rational or not according to the expected utility theory under risk.

4- A Likert scale assessing the willingness to take risks in the field of daily life management, medical practice with regard to patients' health, and their own health [13].

The first item was used to assess the global attitude toward risk, and the difference between the second and third items was used to assess physicians' self-coherence (i.e., consistency between their willingness to take risk for their own health and that of their patients).

The analysis of the response rate in favor of surgery was stratified by the type of clinical case scenario (group E, S and NS as described in Figure 1). For each scenario group, we analyzed the association between the therapeutic proposals (surgical versus nonsurgical treatment) and the demographics, practice characteristics and attitudes toward risk and uncertainty of the physician. In addition, we used a random-intercept logistic model to account for the hierarchical structure of the data. The statistical unit of the models was the clinical case scenario, nested in the higher level i.e., the physician. For each patient profile, the variables to study in multivariable analysis were selected on the basis of the results of the bivariate analysis (alpha risk < 0.20). All models were systematically adjusted for socioeconomic background. The analysis of the impact of patients' characteristics on the decision was the subject of another study [30]. An alpha risk of 0.05 was considered statistically significant in multivariable analysis. Statistical analysis was performed with STATA release 14 software (StataCorp LP, College Station, TX).

Results

Of the 624 e-mails sent, we received 206 completed questionnaires. After inquiry, out of the 624 e-mail addresses, 164 belonged to physicians no longer practicing or not treating HNC patients, and 83 e-mails were not delivered. According to American Association of Public Opinion Reporting (AAPOR) standards, the adjusted response rate was 54.6%. Among the 206 completed questionnaires, eight respondents were excluded i.e., one who consistently answered "patient referred to tertiary hospital" and seven because of missing data on gender (n=1), specialty (n=1), number of HNC cases treated per year (n=1), type of practice (n=4), and answer to clinical case scenario 1 other than surgery (n=1). In total, 197 questionnaires were usable, representing 1178 observations.

Table 1 describes the demographic, behavioral and professional characteristics of the respondents. Most of them were males (65%), under 60 years old (93%), surgeons (66%), working in an academic center (73%), holding a tenured position (85%), treating at least 50 HNC patients per year (66%). The vast majority of respondents worked in multidisciplinary teams involving surgeons and oncologists (83%) and had access to an intensive care unit (81%) or to microsurgical reconstruction (90%). Only 19% had a mixed public and private practice. Most respondents were considered economically irrational according to the Allais (59%) and Ellsberg (54%) models. Finally, respondents were more often risk-averse (37%)

and the majority had a similar willingness to take risks for their health and that of their patients (80%).

Table 2 shows the bivariate associations between the physicians' characteristics and the proportion of cases where the surgical option was chosen in each group of clinical case scenarios. When surgery was the only curative option (group S), respondents were statistically significantly more likely to offer surgery if they were surgeons, treated more than 100 HNC patients per year, had access to an intensive care unit and/or had a mixed public/private practice. When surgical and non-surgical options were equivalent (group E), respondents proposed surgery significantly more often if they were surgeons, aged between 40 and 59, and to a lesser extent if they had access to microsurgical reconstruction, were risk-seeking (or risk-neutral) and/or economically irrational (or undetermined) according to Ellsberg's model. Finally, when surgical and non-surgical options were equivalent with poorer functional outcomes for surgery (group NS), respondents tended to suggest surgery significantly more often if they were older, undetermined according to Ellsberg's paradox, self-coherent (consistent in the relationship to risk for their health and that of their patients), treated fewer HNC patients per year and/or worked in a multidisciplinary team.

The results of the multivariable analysis are presented in tables 3 to 5. Regarding clinical case scenarios from group S, only specialty maintained an independent effect on the propensity to opt for a surgery in multivariable analysis (table 3). Indeed, oncologists proposed surgery almost half as often as surgeons.

Regarding clinical case scenarios from group NS, multivariable analysis showed that the tendency to offer surgery increased with the age of the physician, and conversely, that it decreased as the number of patients treated per year increased (table 4). At the limit of significance (p=0.066), we observed that physicians who were self-coherent (consistent in the relationship to risk for their health and that of their patients) were more likely to offer surgery.

The bivariate association between decision of surgery and rationality was no longer significant in multivariate analysis, probably because that association was due to the "undetermined" category, which impedes interpretation.

Regarding clinical case scenarios from group E, the multivariable analysis showed a higher propensity to opt for surgery for the intermediate age group compared to the youngest (table 5). On the other hand, surgery tended to be chosen less frequently among oncologists and, at the limit of significance ($p<0.063$), among risk-averse compared to risk-neutral and risk-seeking physicians. Finally, ambiguity-neutral physicians (i.e., economically rational) were less likely to choose surgery than ambiguity-sensitive one (i.e., economically irrational).

Discussion

Our results showed that, depending on the type of clinical case scenario, the decision to offer or not surgery may be influenced by the physician's socio-professional and behavioral characteristics. To our knowledge, this is the first demonstration of the influence of attitude toward risk and uncertainty on the therapeutic decision in UADT oncology. We herein exhibited and discussed hypotheses and literature data in order to explain and validate our findings.

Context and limitations of the study

Approximately 30% of the decisions made in the Multidisciplinary Tumor Board (MTB) do not strictly follow the recommendations [31,32]. These are the very situations that we have tried to replicate in our clinical case scenarios. According to Castel et al., the personal experience of the physician has an impact on his or her therapeutic decision in 30% of cases [31]. Some practitioners possess specific competence and experience recognized by the rest of the group. In the end, when a disagreement persists after a discussion and in the absence of literature relevant to the situation, the expert's opinion generally prevails. Moreover, since the opinion of the MTB is only advisory in France, the referring physician can decide whether or not to follow the MTB's proposal. It is certainly in these relatively frequent cases, in which one practitioner makes the final decision, that the results of our study come into play.

One of the main limitations of this study is the fact that each practitioner was questioned individually and not as a team, which was not representative of the MTB. Our study therefore did not take into account the discussion generated during these meetings, which could influence decisions and therefore reduce inter-individual variability. During MTB discussions, shared leadership is usually observed [33,34] but each specialist does not participate equally in the decision making. We chose to interview surgeons and oncologists because they have the greatest impact on the discussions [33,35,36].

Influence of demographic characteristics

In our study, when surgery was not the most consensual approach (NS group), it was more often proposed by practitioners aged 40 to 59 years than by those aged 25 to 39 years. This could mean that greater experience leads to more confidence in complex cases, at the limit of the surgical indication. Conversely, younger surgeons would then opt for a less ambitious but less risky treatment. Similar results have been demonstrated outside the oncological context. In gastrointestinal surgery, surgeons under the age of 50 were more likely to create a stoma rather than perform an anastomosis [37]. In cardiac surgery, the more experienced surgeons were more likely to perform surgical ablation to treat atrial fibrillation concomitantly with another cardiac surgical procedure [38].

Recently, some authors focused on the influence of physician demographics, such as gender and age, on treatment decisions. These features are thought to have an impact on the frequency of screening [39], compliance with recommendations [40], cost of hospital stay [41], type of radiotherapy prescribed [42] or even on the mortality and readmission rates [43]. The physician gender has been reported to influence the decision to perform contralateral prophylactic mastectomy in patients with breast cancer [8].

Influence of professional characteristics

In the case where there was no established consensus (group E), oncologists were more likely to choose a medical treatment, and conversely, surgeons were more likely to opt for surgical management, with statistical significance. In the end, each physician favored the approach in which they had more competence and experience. Similar results were observed in the treatment of early-stage lung cancer, with thoracic surgeons more likely to offer surgery and radiation oncologists more likely to opt for stereotactic radiotherapy [11]. Similarly, for localized prostate cancers, a national survey in the United States (US) noted a significant tendency to prefer radiotherapy for oncologists and surgery for urologists [12]. Outside the oncology setting, similar findings were found in abdominal aortic aneurysm management, in which vascular surgeons were more likely to indicate surgery than geriatricians [44].

Our analysis did not reveal any management disparity according to the type of healthcare facility in which the practitioner worked. In contrast, a large study in the US found that oncologists working in a private practice were more likely to recommend adjuvant treatment after mastectomy. The influence of geography (rural versus metropolitan) has also been proven to influence the type of radiotherapy prescription in the US [42]. Another international study identified large practice variations across regions and hospitals for almost every condition and procedure [45].

Influence of behavioral characteristics

Behavioral characteristics accounted for practice variations only in clinical situations where no therapeutic option prevailed in terms of functional or survival outcomes. On the other hand, when there was a definitely advantageous therapeutic option, socio-professional characteristics alone seemed responsible for practice variations.

A few studies have focused on the relationship between physician's attitude toward risk and variation in professional practice [9,46]. In orthopedics, some authors demonstrated a relationship between the physician's personality and the choice between surgery or non-surgical treatment for the management of a fracture [47]. In emergency medicine, the rate of hospitalization for chest pain was greater in patients under the care of physicians from the most risk-averse subgroup [48]. In onco-hematology, Bories et al. [10] found a significant association between the risk-taking tendency of the hematologist and the prescription of intensive chemotherapy in the treatment of acute myeloid leukemia in the elderly. These factors have also been studied in gastrointestinal surgery, indicating that the physician who does not seek risk in his or her personal life would be more likely to create a stoma than to perform an anastomosis [37]. When referring a patient for a suspicion of cancer, general practitioners who were more tolerant to ambiguity significantly under-estimated the risk of cancer [49]. Finally, Nebout et al. reported an important gap between general practitioners' willingness to take risks in the domain of their own health and in the domain of their patients' health [50]. However, our study is the first to date showing that those behavioral characteristics are particularly relevant in situations where no therapeutic option prevail.

Cognitive biases

Decisions are based on knowledge, rationality, beliefs and intuition [51]. The therapeutic decision may thus be influenced by the physician's beliefs e.g., about the life expectancy of the elderly patient, his or her preference between quality of life and length of life, the chances of survival or response to a treatment [52]. In the setting of advanced laryngeal cancers, the trade-off between survival and laryngeal preservation was not perceived with the same priorities by patients and physicians in a French survey [53]. Indeed, surgeons cared more about survival than laryngeal preservation, when compared to radiation oncologists or patients. Interestingly, the percentage of survival respondents were willing to trade to preserve their larynx ranged from 5% to 100% [53]. A systematic review of elderly patients with gynecological cancers alerted against unjustified undertreatment due to a misjudgment of patients' life expectancy [54].

Finally, one mechanism that might explain physician practice variations is that physicians' personalities might make them more or less sensitive to patient-based implicit biases [55]. Our study minimized this by randomizing patients for gender, profession, and marital status.

In order to avoid these biases, the choice of treatment can sometimes be left to the patient by providing clear and appropriate information. However, the physician's demographics or personality also have a significant impact in this context. A US survey of patients with an optional indication for radioiodine therapy after surgery for papillary thyroid carcinoma found that 56% of patients perceived that they did not have a choice [56]. In order to deliver neutral information and to avoid influencing the patient’s choice, some authors developed a web-based decision aid for oropharyngeal cancers [57].

Conclusion

This study sheds light on the physicians' socio-professional and behavioral factors influencing decision making in UADT oncology. These mechanisms are still understudied and probably underestimated. They may partly explain the variability of the decisions taken in MTB when confronted with clinical situations that are subject to debate because of the lack of recommendation. Further large-scale studies are warranted to better understand this inter-individual variability. Other studies could assess the inter-MTB variability.

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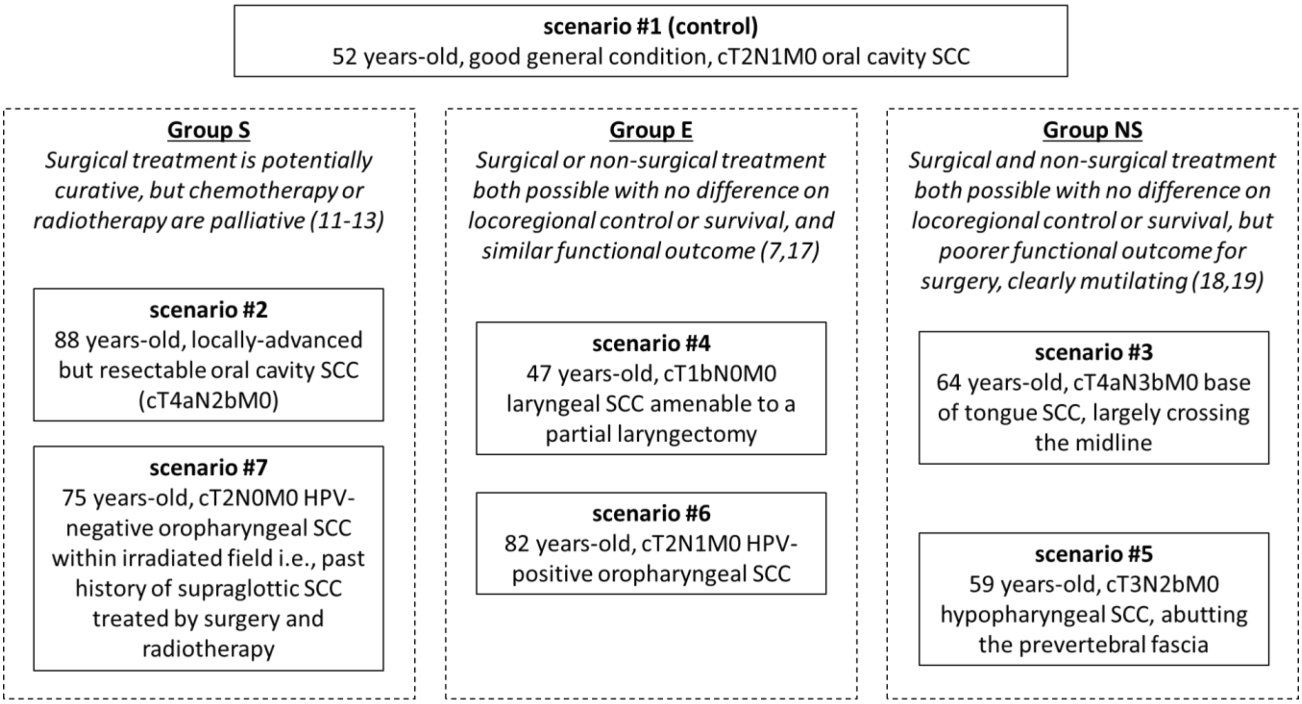

Figure 1. Clinical case scenarios used in the survey, and their distribution into three groups.

Group E=surgical and non-surgical treatment equivalent; Group S=surgical treatment advantageous; Group NS=non-surgical treatment advantageous. All TNM staging correspond to the 8th edition of the American Joint Committee on Cancer. See questionnaire in appendix for detailed clinical case scenarios.

Physician characteristics		n (%)
Demographics		
Sex	Women Men	69 (35%) 128 (65%)
Age (years)	25 to 39 40 to 59 60 and over	93 (47.2%) 90 (45.7%) 14 (7.1%)
Behavioral characteristics		
Allais rationality model	Economically irrational (Non-EU) Economically rational (EU)	116 (58.9%) 81 (41.1%)
Ellsberg rationality model	Economically irrational (Non-EU) Economically rational (EU) Undetermined	106 (53.8%) 62 (31.5%) 29 (14.7%)
Attitude toward risk	Risk-averse Neutral Risk-seeking	72 (36.6%) 69 (35%) 56 (28.4%)
Self-coherence between own health and patients' health	No Yes	39 (19.8%) 158 (80.2%)
Professional characteristics		
Specialty	Surgeon Medical/radiation oncologist	130 (66%) 67 (34%)
Type of healthcare facility	Academic center District general hospital Private clinic	143 (72.6%) 26 (13.2%) 28 (14.2%)
Position	Tenured Non-tenured	167 (84.8%) 30 (15.2%)
Caseload (patients per year)	Fewer than 50 50 to 100 More than 100	66 (33.5%) 54 (27.4%) 77 (39.1%)
Multidisciplinary team (surgeons and oncologists)	No Yes	34 (17.3%) 163 (82.7%)
Access to intensive care unit	No Yes	38 (19.3%) 159 (80.7%)
Access to microsurgical reconstruction	No Yes	20 (10.1%) 177 (89.9%)
Mixed public/private practice	No Yes	160 (81.2%) 37 (18.8%)

Table 1: Characteristics of respondents to the survey (n=197).

EU = expected utility.

Physician characteristics		Proportion of answers in favor of surgery to clinical case scenarios					
		Group S		Group E		Group NS	
			p-value*		p-value*		p-value*
Demographics							
Sex	Women	69%	0.979	47%	0.914	15%	0.729
	Men	69%		47%		16%	
Age (years)	25 to 39	71%	0.717	40%	**0.031**	10%	**0.073**
	40 to 59	67%		54%		19%	
	60 and over	64%		46%		29%	
Behavioral characteristics							
Allais rationality model	Economically irrational (Non-EU)	69%	0.898	47%	0.880	14%	0.429
	Economically rational (EU)	68%		48%		18%	
Ellsberg rationality model	Economically irrational (Non-EU)	68%	0.529	50%	**0.187**	14%	**0.094**
	Economically rational (EU)	72%		40%		13%	
	Undetermined	64%		50%		26%	
Attitude toward risk	Risk-averse	67%	0.916	41%	**0.192**	19%	0.394
	Neutral	70%		50%		12%	
	Risk-seeking	70%		51%		15%	
Self-coherence between own health and patients' health	No	65%	0.509	51%	0.405	6%	**0.012**
	Yes	70%		46%		18%	
Professional characteristics							
Specialty	Surgeon	76%	**<0.001**	54%	**<0.001**	17%	0.291
	Medical/radiation oncologist	55%		34%		13%	
Type of healthcare facility	Academic center	70%	0.432	46%	0.564	16%	0.816
	District general hospital	71%		46%		15%	
	Private clinic	61%		54%		13%	
Position	Tenured	68%	0.947	42%	0.359	15%	0.909
	Non-tenured	69%		48%		16%	
Caseload (patients per year)	Fewer than 50	69%	**0.184**	47%	0.940	22%	**0.057**
	50 to 100	62%		46%		14%	
	More than 100	73%		48%		11%	
Multidisciplinary team (surgeons and oncologists)	No	68%	0.843	50%	0.607	10%	**0.136**
	Yes	69%		46%		17%	
Access to reanimation unit	No	62%	**0.149**	52%	0.334	17%	0.712
	Yes	70%		46%		15%	
Access to microsurgical reconstruction	No	63%	0.409	35%	**0.098**	10%	0.228
	Yes	69%		48%		16%	
Mixed public/private practice	No	67%	**0.077**	46%	0.442	14%	0.356
	Yes	77%		51%		20%	

Table 2: Bivariate associations between the physicians' characteristics and the proportion of answers in favor of surgery in each group of clinical case scenarios.

*Group S = surgical treatment advantageous; Group E = surgical and non-surgical treatment equivalent; Group NS = non-surgical treatment advantageous; EU = expected utility; bold text = p value < 0,20; * = p-value from a Pearson's chi square test using the second-order Rao and Scott correction for complex design.*

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		OR	[95%	CI]	p-value
Specialty	Surgeon *	1			
	Medical/radiation oncologist	0.40	[0.24 ;	0.67]	<0.001
Caseload (patients per year) [a]	Less than 50 *	1			
	50 to 100	0.90	[0.48 ;	1.62]	0.717
	More than 100	1.48	[0.84 ;	2.61]	0.172
Access to intensive care unit	No	1			
	Yes	1.16	[0.65 ;	2.07]	0.623
Mixed public/private practice	No *	1			
	Yes	1.54	[0.80 ;	2.96]	0.337
Model intercept		2.34	[1.22 ;	4.51]	
Model random component: SD (intercept)		0.43	[0.06 ;	3.36]	

Table 3: Multivariable analysis of the relation between physicians' characteristics and answers in favor of surgery to clinical case scenarios from the group S (surgical treatment advantageous): 393 observations over 197 participants.
*Global p-values from Wald test: [a] = 0.192; * = reference category; SD = standard deviation.*

		OR	[95%	CI]	p-value
Age (years) [a]	25 to 39 *	1			
	40 to 59	2.12	[0.95 ;	4.75]	0.067
	60 and over	3.81	[1.00 ;	14.49]	0.049
Ellsberg rationality model [b]	Economically irrational (Non- EU) *	1			
	Economically rational (EU)	0.74	[0.32 ;	1.73]	0.495
	Undetermined	1.90	[0.71 ;	5.06]	0.199
Self-coherence	No *	1			
	Yes	2.95	[0.93 ;	9.36]	0.066
Caseload (patients per year) [c]	Fewer than 50 *	1			
	50 to 100	0.38	[0.15 ;	0.97]	0.044
	More than 100	0.29	[0.12 ;	0.71]	0.007
Multidisciplinary team	No *	1			
	Yes	1.34	[0.47 ;	3.86]	0.582
Model intercept		0.05	[0.01 ;	0.21]	
Model random component: SD (intercept)		1.12	[0.54 ;	2.34]	

Table 4: Multivariable analysis of the relation between physicians' characteristics and answers in favor of surgery to clinical case scenarios from the group NS (non-surgical treatment advantageous): 393 observations over 197 participants.
Global p-values from Wald test: [a] = 0.076, [b] = 0.245, [c] = 0.018; EU = expected utility; SD = standard deviation.

		OR	[95%	CI]	p-value
Age (years) [a]	25 to 39 *	1			
	40 to 59	1.67	[1.07 ;	2.59]	0.023
	60 and over	1.20	[0.52 ;	2.75]	0.672
Ellsberg rationality model [b]	Economically irrational (Non-EU) *	1			
	Economically rational (EU)	0.60	[0.35;	1.04]	0.069
	Undetermined	1.00	[0.55;	1.84]	0.995
Attitude toward risk [c]	Risk-averse*	1			
	Neutral	1.59	[0.97;	2.62]	0.065
	Risk-seeking	1.45	[0.86 ;	2.45]	0.163
Specialty	Surgeon *	1			
	Medical/radiation oncologist	0.45	[0.29 ;	0.72]	0.001
Access to microsurgical reconstruction	No *	1			
	Yes	1.39	[0.66 ;	2.92]	0.380
Model intercept		0.56	0.56	[0.24 ;	1.29]
Model random component: SD (intercept)		null			

Table 5: Multivariable analysis of the relation between physicians' characteristics and answers in favor of surgery to clinical case scenarios from the group E (surgical and non-surgical treatment equivalent): 392 observations over 197 participants.
*Global p-values from Wald test: [a] = 0.070, [b] = 0.165, [c] = 0.153; *reference category; EU = expected utility; SD = standard deviation.*

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