Relational value creation: exploring the impact of patient-doctor communication on patient outcomes

Creazione di valore relazionale: esplorare l'impatto della comunicazione medico - paziente sugli esiti percepiti dai pazienti

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Lo studio presenta un'indagine empirica sull'impatto della comunicazione medico-paziente nella cura del tumore al seno. Sottolinea la co-creazione di valore relazionale attraverso una comunicazione efficace, affrontando specificamente la relazione tra le informazioni cognitive ed emotive ricevute prima dell'intervento e gli esiti riportati dai pazienti. La relazione diadica è studiata attraverso un'indagine longitudinale su 421 donne trattate per il tumore al seno in un'azienda ospedaliera universitaria in Italia tra il 2018 e il 2022. I risultati mostrano come le informazioni cognitive ricevute prima dell'intervento prevedono significativamente gli esiti, e le competenze interpersonali e comunicative del chirurgo svolgono un ruolo di mediazione. Gli esiti risultano più positivi in particolare per le pazienti ad alto rischio. L'approccio evidenzia l'importanza di spostare l'attenzione dalla condivisione delle informazioni alla condivisione del valore, per promuovere la co-creazione di valore nella sanità. Questo richiede un maggiore coinvolgimento dei pazienti e una maggiore esposizione dei professionisti sanitari a strategie che favoriscano la cura centrata sul paziente.

This study presents an empirical investigation into the impact of doctor-patient communication in breast cancer care. It emphasizes the co-creation of relational value through effective communication, specifically addressing the relationship between cognitive and emotional information received before surgery and patient outcome. The dyadic relationship is studied using a longitudinal survey targeting 421 women treated for breast cancer at a teaching hospital in Italy between 2018 and 2022. The findings reveal that cognitive information received before surgery significantly predicts post-surgical outcome, mediated by the surgeon's interpersonal and communication skills. The results are enhanced, particularly for high-risk patients. The approach highlights the importance of shifting the focus from information sharing to value sharing, to promote value co-creation in healthcare. This requires increased patient involvement and greater exposure of healthcare professionals to strategies that foster patient-centered care.

Cette étude présente une enquête empirique sur l'impact de la communication médecin-patient dans la prise en charge du cancer du sein. Elle met en évidence la co-création de valeur rela-

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tionnelle à travers une communication efficace, en abordant spécifiquement la relation entre les informations cognitives et émotionnelles reçues avant la chirurgie et les résultats pour le patient. La relation diadique est étudiée à l'aide d'une enquête longitudinale auprès de 421 femmes traitées pour un cancer du sein dans un hôpital universitaire en Italie entre 2018 et 2022. Les résultats montrent que les informations cognitives reçues avant l'intervention prédisent de manière significative les résultats post-chirurgicaux, médiées par les compétences interpersonnelles et de communication du chirurgien. Les résultats sont particulièrement améliorés pour les patientes à haut risque. L'approche souligne l'importance de déplacer l'attention de la simple transmission d'informations vers le partage de valeur, afin de promouvoir la co-création de valeur dans les soins de santé. Cela nécessite un plus grand engagement des patients et une exposition accrue des professionnels de santé à des stratégies favorisant des soins centrés sur le patient.

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1. Introduction

The unequal distribution of information between healthcare professionals and patients is a key feature that characterizes transactions in health care, where service users often lack the expert medical knowledge that professionals have causing information asymmetry (Arrow 1978; Haas-Wilson 2001). This asymmetry leads to the delegation of decision-making authority from the patient to the professional experts on the basis of mutual trust (Hall 2005; Bloom et al. 2008). The communication between doctors, patients, and other healthcare providers is essential to help patients make decisions regarding their medical condition. Typically, the formal way of obtaining information and explanations is through informed consent. Nonetheless, as described by Di Blasi and colleagues (Di Blasi et al. 2001), doctor-patient communication is not limited to information sharing (cognitive care), it also involves a deeper human interaction focused on reciprocal understanding (emotional care). The clinician-patient relationship is considered a fundamental principle of patient-centredness: it is a partnership characterized by trust and caring (Scholl et al. 2014). The literature highlights the importance of this reciprocal relationship marked by constancy, trust, connection, empathy, mutual caring, mutual knowledge, positive rapport building, guidance as well as mutual understanding of roles and responsibilities (Ong et al. 1995).

The objective of any doctor-patient communication is about creating inter-personal relationships to exchange information aimed at improving patients' health and medical care, supporting the patient-centred care view. The knowledge and preferences that patients could (should) share with clinicians can rebalance the information asymmetry leading to better treatment-related decisions, positively affecting outcomes and enhancing value creation for the patient. Indeed, evidence reports that communication and agreement between doctor and patient is a potential key variable that influences clinical and patient outcomes (Kaplan et al. 1989; Ha, Longnecker 2010 Riedl, Schüßler 2017; Kelley et al. 2014), espe-

cially in life-threatening diseases such as cancer (Husson et al. 2011; Lamers et al. 2016; Rogge et al. 2021). Following the public service literature, the information exchange moment can be viewed as a dyadic relation (Osborne et al. 2021) where the patient (as individual) can extract value from the service provided in terms of information received from the professional, and the service provider (the doctor) can support the patient in both the emotional and cognitive care component to achieve greater outcomes. Through these rich interactions, the patient gains significant value by receiving crucial information and guidance from healthcare professionals, which is vital for enhancing their understanding, decision-making, and overall health management. At the same time, the role of the healthcare provider extends beyond merely delivering accurate and relevant medical information; it involves fostering an environment conducive to informed patient choices. This includes not only facilitating clinical decision-making but also supporting emotional care through the cultivation of mutual trust, empathy, respect, genuineness, acceptance, and warmth. By addressing both informational and emotional needs, the healthcare professional significantly improves the effectiveness of care and the patient's experience, ultimately contributing to better health outcomes.

In this perspective, the doctor-patient relation can be seen as an exchange and value-sharing moment considering the human side of service interaction (Barile et al. 2014), suggesting a shift in focus from information sharing to value sharing, offering new insights for co-creation in healthcare.

The paper aims to assess the impact of doctor-patient communication on patient outcomes, considering what the patient has gained in terms of perceived health improvement considering different satisfaction levels of information received. The hypothesis is that value for the patient can be enhanced by the emotional care expressed by the doctor and results in a co-creation partnership. In the study, the impact of information asymmetries on health outcomes is assessed using Patient-Reported Outcome (PRO) information that provides information about wellbeing, quality of life, and experience measures directly reported by the patient as a unique person (Jayakumar et al. 2019). Moreover, PROs allow clinicians to consider the patients' perspectives to realize whether such asymmetries exist and to address them properly so to provide care that is tailored to each specific patient. Given the rich informative nature of PROs, we investigate when and how a closer patient-doctor relationship in terms of information-communication exchange in pre-surgical intervention in breast cancer care can affect patient outcomes also considering physician emotional care, building on the relational nature of value creation (Cui, Aulton 2023) and co-creation.

2. Study relevance

The relevance behind the information-communication process that takes place between breast surgeons and women who undergo breast cancer surgery is confirmed by the problems that can arise when the professio-

nals fail in effectively dealing with patients' information needs (e.g., Carr et al. 2019; Jacox et al. 2020; Li et al. 2011; Spector et al. 2010); a situation of unmet needs, either in terms of quantity or quality of the information provided, can constitute a relevant barrier that does not resolve the asymmetric information condition existing between patients and surgeons (Azuma et al. 2021; Glassey et al. 2018; Kugbey et al. 2019). Failure in successfully communicating all the relevant information (both verbally and nonverbally) may lead to important undesired outcomes, such as a discrepancy between women pre-surgery expectations and post-operation outcomes (Flitcroft et al. 2017; Fuzesi et al. 2019; Heisig et al. 2016; Waljee et al. 2014) and a decrease in trust towards the breast surgeon, which could also lead to a second opinion request (Fuchs et al. 2017; Mellink et al. 2003).

While current literature on PROs mainly focused on the relevance of women socio-demographic and surgery characteristics as factors that influence patient-reported clinical outcomes (usually referred to as "Satisfaction with breast"), the impact of doctor-patient communication relation on self-reported outcomes is still under-investigated. Given that the quality of the information provided by the breast surgeon is expected to influence women's expectations and post-surgery outcomes evaluation, the aim of this study is to shed light on this relationship, which is characterized by rich interpersonal interactions. For this purpose, a validated PRO survey (the BREAST-Q©) is used to collect information about women's satisfaction with their breast and with their perception of information received by the breast surgeon about treatment choices, survival, healing and recovery time, pain, complications and aesthetical outcomes. The survey collected information from women in one Breast Centre in Italy in the period 2018-2022. To test the hypothesis, the questionnaire has been delivered before and three months after the surgery. In total, 448 women completed both questionnaires. The results highlight how satisfaction towards the information received by breast surgeons before the surgery positively affects women's overall satisfaction with their breast three months after the surgical intervention, supporting a relational value co-creation. The relationship is mediated by the satisfaction with surgeon, which refers to surgeon's style of consultation (e.g., professional, reassuring, thorough, sensitive, easy to talk to).

3. Theoretical Framework

The doctor-patient relationship has been largely studied in health service research and medical marketing. It is well-known that there is a profound asymmetry of knowledge in the patient-physician relationship, and that certain social behaviours exhibited by the physician (Larson, Yao 2005), as well as their information and communication style (Buller, Buller 1987), can have a significant impact on patient satisfaction, compliance, and outcomes. Developing patient-centred communication is a central

component of high-quality care, requiring the involvement of both physician and patient in a mutual exchange of information to reach a shared understanding of the problem and its treatment. This interaction enables patients to express their concerns, expectations, needs and feelings (including psychosocial condition), and foster patient involvement in decision-making. Numerous are the challenges in defining and measuring patient-centred communication (Epstein et al. 2005). However, it seems appropriate to expand the research ground to include contributions from the public service literature on value and value co-creation (Osborne et al. 2021), which focuses on the interactions between service producer and user – in this case between physicians and patients – during the communication process and the involvement of patients in their treatment decision.

In general, despite some challenges in the conceptualization of "value", public service literature often defines it as the "change in the well-being or viability of a system/actor" (Vargo, Lusch 2018: 740). This refers to factors that generate positive external value, which, in the context of public services, represents a key metric for evaluating desired outcomes (Hodgkinson et al. 2017). Current literature is focused on refining the elements of value for public services (Cui, Aulton 2023; Mussari 2022) and on exploring mechanisms through which public services enhance well-being and contribute to societal development by meeting public needs efficiently and effectively (Meynhardt 2009; Osborne 2018; Osborne et al. 2021; Nasi et al. 2024). In this paper, we refer to value as the generated improved benefits (or outcome) produced by the public organizations for individuals/ beneficiary of the public service (Mussari 2022). As clearly reported by Osborne (Osborne 2018), value creation is enhanced by the sequence of interactions occurring between the public provider and the service user during its wider experience and participating in the process.

In healthcare, value co-creation often occurs by integrating resources in order to improve the average level of quality and outcomes (Palumbo 2016). The patient-doctor relation constitutes a pivotal moment for resource integration aimed at involving and empowering patients to effectively understand their needs and concerns, allowing doctors to personalize healthcare services for better outcomes.

Patient-doctor interactions are central to this study, emphasizing the importance of quality of information exchange between breast surgeon and patient prior to breast surgical treatments. This focus is crucial for understanding how and when information sharing can influence outcomes for breast cancer women expressed in terms of body image. The approach emphasizes the combined action of physician and patient moving to an actor-to-actor approach where multiple actors co-create value by the integration and exchange of resources (Vargo et al. 2015). Although many studies place their attention on how information provided by breast surgeons can affect a wide range of physical and psychosocial outcomes,

there exist some aspects that still need further clarification. For example, there is the necessity of understanding the context of patients, their characteristics, habits, needs, and prior experiences, as value is co-created 'in-context', as well as 'in-use' (Vargo et al. 2017). To this regard, scholars argued that context is a key variable to be taken into consideration in the value creation process (Chandler, Vargo 2011). Value in-context means that value can be co-created within the context – ecosystem – where social, emotional and relational aspects play an important role in framing the exchange through which value is produced and the border of the service perception and evaluation (De Rosis et al. 2023; Megaro et al. 2023).

Considering the role of patient-doctor communication in women's overall satisfaction with their breasts after a breast cancer surgery, the main limitation emerging from the current literature is that the analysis is often limited to pre-surgical and post-surgical scores correlations and comparisons (Brands-Appeldoorn et al. 2019; Herold et al. 2022; Iskandarsyah et al. 2013).

Indeed, studies consider the effect of clinician's information on the overall quality of life (Davies et al. 2008; Herold et al. 2022; Husson et al. 2011; Jackisch et al. 2020), others explored how information affects women's satisfaction with their breasts and with cosmetic outcomes (Brands-Appeldoorn et al. 2019; Herold et al. 2022; Ho et al. 2013; Iskandarsyah et al. 2013). Further contributions focused on psychosocial outcomes like decisions regret (Sheehan et al. 2007; Zhong et al. 2013), psychological distress (Okamura et al. 2003), anxiety (Faller et al. 2017; Meijers et al. 2022; Zissiadis et al. 2010), mental health (Griggs et al. 2007) and emotional well-being (Namkoong et al. 2010).

However, current evidence typically overlooks relational factors present in the doctor-patient encounter, as well as other relevant "in-context" factors, such as socio-demographic characteristics, healthy habits, well-being, and key medical variables. Coherently with the previous literature, we can develop the following hypothesis:

H1: satisfaction with information (before surgery) positively affects PROs, specifically satisfaction with breast.

In addition, we also claim that the relationship between women's satisfaction with the received information and their overall satisfaction with their breast is mediated by the breast surgeon's manner (professional, reassuring, thorough, sensitive), communication skills (easy to talk to) and extent to which the patient was involved in the decision making and understanding of the process: better patient-doctor communication increases women's perception and overall evaluation of the surgeon herself, which in turn increases patients' degree of satisfaction of their body image after the surgery (see Figure 1).

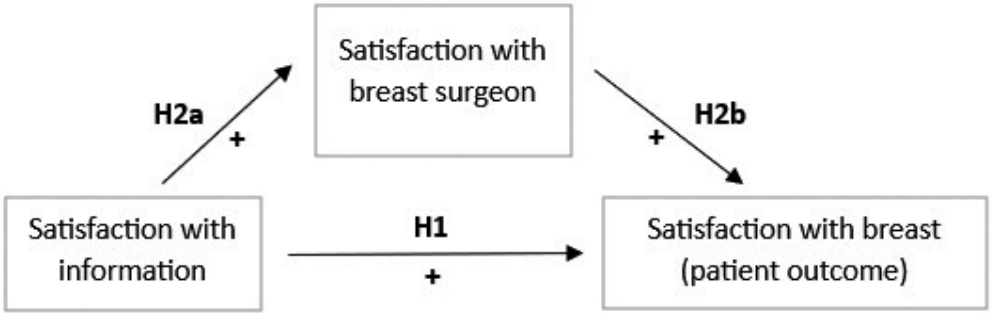
H2: surgeon positively mediates the relationship between satisfaction with information and satisfaction with breast.

Specifically, we claim the following:

H2a: satisfaction with information positively affects women's satisfaction with the breast surgeon.

H2b: satisfaction with the breast surgeon positively affects women's satisfaction with their breast (patient outcome).

Figure 1 – Mediation model and hypotheses



4. Data and methodology

This study considers women diagnosed with breast cancer who underwent breast-conserving therapy (BCT) or one-step breast reconstruction (BR) after mastectomy in the Breast Unit of the Teaching Hospital of Pisa (Tuscany, Italy) between March 2018 and December 2022 (Ghilli et al. 2023). Inclusion criteria regarded participants' age (women over the age of 18 years), the presence of malignant breast cancer (ICD-9-CM diagnosis code 174*) and an adequate knowledge of the Italian language (being the survey delivered only in Italian). Only those participants who provided their informed consent during one of their visits with breast surgeons or/and plastic surgeons preceding the breast surgery have been enrolled for the study, with the possibility to leave the study anytime. The data collection process was developed following a defined protocol (Ferrè et al. 2021).

The survey has been delivered exclusively online, before and 3 months after the surgery; this longitudinal approach allowed us to identify any differences in women perceptions about their own perceived outcomes caused by the breast intervention. For the purposes of this study, we considered the domains of satisfaction with breasts, satisfaction with the information received and satisfaction with surgeon, which have been explored through the BREAST-Q© (Pusic et al. 2009).

To identify the impact of "Satisfaction with information" provided by the breast surgeon and "Satisfaction with the breast surgeon" on women "Satisfaction with breast", multivariate OLS regressions with pre- and post-surgery data have been performed. With respect to t-tests and correlation analyses, this approach allowed us to test the magnitude of this relationship after controlling for other potential confounding factors, like individual sociodemographic characteristics and lifestyles.

The three variables of main interest, satisfaction with the breast, with

the breast surgeon and with the quality of information received, are three scores that range from 0 (very dissatisfied) to 100 (very satisfied). They are built from a BREAST-Q© conversion table that synthesizes a list of items, evaluated through Likert scales ranging from 1 to 4 that explore such dimensions (see Tables 4a-4b in Appendix for more details).

The items included in the scale about satisfaction with information cover complications and risks (e.g., loss of nipple sensation), healing and recovery time, how the surgery would be done and breast appearance (e.g., breast size, scars), implication for future breast screening. The items included in the scale about woman's overall appraisal of the outcome of her breast surgery measures body image in terms of a woman's satisfaction with her breast area. Items cover breast appearance (e.g., size, symmetry, softness), and satisfaction with breasts in relation to how a bra fits and how the breasts look when clothed or unclothed. For BR, there are also implant-specific items (e.g., amount of rippling seen or felt). Finally, the items included in the scale about satisfaction with surgeon ask about the surgeon's manner (e.g., professional, reassuring, thorough, sensitive) and communication skills (e.g., easy to talk to). Items also cover the extent to which the patient was involved in the decision making and understanding of the process. While the first scale is measured both before and after the surgery, the second and third ones are measured only at the post-surgery questionnaire. All the socio-demographic characteristics are provided directly by the patients. Age is a continuous variable, measured as the difference between the year of surgery and year of birth. The presence/absence of a bachelor's degree (education) is a dummy extrapolated from an ordinal variable, which originally ranged from 1 (no education) to 5 (PhD and post-graduate education). The smoking status (smoke) corresponds to 0 for non- and former smokers and 1 for current smokers. The variable that measures the sport activity (sport) is an ordinal that ranges from 1 (no daily activity at all) to 5 (more than 2 hours per day). Information about height, weight (which compose the Body Mass Index - BMI), and menopause status (0: no, 1: yes) is collected in both the pre- and post-surgery questionnaires; BMI is computed as a continuous variable. The information about the presence or absence of other comorbidities (comorbidities) is provided by the breast surgeon before the surgery and is coded as a dummy variable.

In order to explore the impact of the degree of satisfaction with the information received on patients' satisfaction with their breast, as well as the potential mediating role of their overall satisfaction with the breast surgeon, we developed a mediation model as follows: we firstly regressed the independent variable (satisfaction with information) on the dependent one (satisfaction with breast); subsequently, we analysed the impact of the independent variable on the mediator (satisfaction with breast surgeon); finally, we regressed both the mediator and the independent variable on satisfaction with breast. In all cases we also included the main socio-demographic characteristics as covariates. To develop the analysis,

we exploited the STATA *sgmediation* package, which allows to run these regressions and provides additional information about the direct, indirect and total effects, as well as the relevance of the mediation mechanism.

5. Results

Overall, a total of 1,690 patients were eligible for the survey and 1,042 of them have been enrolled for the two surgical paths (647 under BCT and 395 for BR). For the purposes of our study, we considered for the analysis only those patients who participated and completed both the pre- and 3 months post-surgery questionnaires, leading to a final sample of 421 women (191 for the BCT and 230 for the one-step BR). The overall enrolment rate was 61.7%, while the completion rate for those who participated to the survey was 40.4%.

Table 1 presents the main descriptive statistics on the variables included in the analysis and the sample. Table 2 shows the correlation matrix between the dependent variable, the main independent variable, the mediator and the socio-demographic covariates (all measured before the surgery).

Table 1 – Socio-demographic characteristics

Variable	Mean	St. dev.	Min	Max
Satisfaction with breast	60.15	15.17	0	100
Satisfaction with surgeon	90.50	16.14	0	100
Satisfaction with information	65.77	18.68	0	100
Age	54.83	10.76	29	88
Body Mass Index (BMI)	24.56	4.24	15.63	39.56
Education	0.30	0.46	0	1
Sport	2.62	1.54	1	5
Smoke	0.15	0.35	0	1
Menopause	0.78	0.41	0	1
Comorbidities	0.25	0.44	0	1
N=421				

Table 2 – Correlation matrix

Variable	Sat. with breast	Sat. with surgeon	Sat. with info	Age	BMI	Education	Sport	Smoke	Men.
Sat. with breast	-	-	-	-	-	-	-	-	
Sat. with surgeon	0.37***	-	-	-	-	-	-	-	
Sat. with info	0.55***	0.46***	-	-	-	-	-	-	
Age	0.02	0.08	0.02	-	-	-	-	-	
Body Mass Index (BMI)	-0.07	0.02	-0.06	0.26***	-	-	-	-	

►►

Variable	Sat. with breast	Sat. with surgeon	Sat. with info	Age	BMI	Educa-tion	Sport	Smoke	Men.
Education	-0.05	-0.07	-0.03	-0.11**	-0.15***	-	-	-	
Sport	0.11**	0.00	0.03	0.01	-0.17***	0.13***	-	-	
Smoke	-0.09*	-0.07	-0.02	-0.04	-0.14***	-0.05	-0.01	-	
Menopause	-0.04	-0.03	-0.01	0.62**	0.15***	-0.10**	0.01	0.02	
Comorbidities	-0.08*	-0.03	-0.05	0.31***	0.20***	-0.01	-0.12**	-0.05	0.18***
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01									

The statistical significance emerging from the correlation matrix provides some preliminary interesting insights. Referring to the variables that are going to be tested, women's degree of satisfaction with their breast, with the information received and with the breast surgeon are all characterized by strong positive and significant correlation, in line with the hypotheses. Looking at the socio-demographic characteristics, it is interesting to note how BMI correlations with the other covariates are always statistically significant, coherently with the expectations and the evidence already present in the literature (positive correlation with age and menopause status; negative with education, sport activity and smoking habits).

Table 3 presents the baseline model developed to analyse the mediation mechanism: from left to right, Model 1 tests the impact of the main independent variable (satisfaction with information) on the dependent variable (satisfaction with breast); Model 2 regresses satisfaction with information on the mediator (satisfaction with surgeon); Model 3 corresponds to an OLS where both the independent and the mediator are included in the regression. All the models include the socio-demographic characteristics and the surgery path as covariates.

Table 3 – Baseline model

Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/ breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/ breast**	β	**St. err.**
Sat. w/ information	0.424***	0.033	*Sat. w/information*	0.376***	0.038	*Sat. w/information*	0.384***	0.036
-	-	-	-	-	-	*Sat. w/surgeon*	0.107**	0.042
Surgery path	-4.409***	1.266	*Surgery path*	-3.781***	1.465	*Surgery path*	-4.006***	1.268
Age	0.061	0.075	*Age*	0.164*	0.087	*Age*	0.043	0.075
BMI	-0.202	0.155	*BMI*	0.023	0.179	*BMI*	-0.204	0.154
Bachelor's degree	-2.519*	1.337	*Bachelor's degree*	-2.140	1.548	*Bachelor's degree*	-2.291*	1.332
Sport activity	0.880**	0.399	*Sport activity*	-0.193	0.462	*Sport activity*	0.901**	0.397

►►

Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/ breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/ breast**	β	**St. err.**
Smoking habit	-2.975*	1.715	*Smoking habit*	-2.347	1.986	*Smoking habit*	-2.724	1.707
Menopause	-2.347	1.545	*Menopause*	-3.377*	1.789	*Menopause*	-1.987	1.542
Comorbidities	-2.165	1.467	*Comorbidities*	-1.486	1.698	*Comorbidities*	-2.006	1.459
Constant	37.124***	5.718	*Constant*	a68.135***	6.621	*Constant*	30.497***	6.261
	N=421			N=421			N=421	
	R2=0.346			R2=0.226			R2=0.354	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.040** (0.016) Direct effect = 0.384*** (0.036) Total effect = 0.424*** (0.033) Proportion of total effect that is mediated: 9.45%								

The evidence that emerges from the table shows some interesting insights: both types of satisfaction (with information and with breast surgeon) are statistically significant, and the sign of their coefficients are in line with the expectations. Looking at the overall effect and at the separate contributions of the two variables that compose the model, we can state that satisfaction with surgeon works as a mediator in the relationship between satisfaction with information and satisfaction with breast. Although the impact is not particularly strong in terms of magnitude (9.45% of the overall effect is mediated by satisfaction with breast surgeon), its statistical significance is very relevant.

Another interesting consideration relates to the surgery path (equal to 0 for women undergoing BCT and 1 for one-step BR): women undergoing BR on average claim to have a lower satisfaction with their breast (-4 points) compared to women undergoing BCT. In terms of socio-demographic characteristics, higher satisfaction with breast is witnessed by women with healthier habits (in particular for what concerns sport activities) and with lower degrees of education. These results are confirmed considering women's age and BMI as categorical instead of continuous (according to the standard BMI and age categories).

To strengthen the reliability of the results and understand whether the previous evidence is constant across subsamples or is driven by some specific "types" of patients, we developed further mediation analyses focusing on specific subpopulations, taking as reference the care path and women's socio-demographic characteristics. The groups for the sub-group analysis are mutually exclusive. The tables with the results can be found in the Appendix (Tables 5-10).

Focusing on the surgery path (Tables 5a-5b), it is interesting to note how the mediation mechanism loses significance for women undergoing

BCT; conversely, it is confirmed for women undergoing one-step BR after mastectomy in terms of sign and significance, while the impact of the mediator on the total effect is almost doubled with respect to the baseline model (18.29% versus 9.45%). Such effect is in line with the expectations: as the reconstruction surgery is particularly invasive with respect to BCT, the role of the breast surgeon acquires even more importance on the communication flow of the information sharing process.

Moving to the socio-demographic characteristics, we firstly grouped the sample according to the median age (Tables 6a-6b), to explore whether the mediation mechanism is driven particularly by younger or older patients. Women below the median age confirm the impact of satisfaction with surgeon as a mediator of the relationship between satisfaction with information and satisfaction with breast. In this case, not only sign and significance are confirmed, but also the magnitude of the total effect that is mediated is in line with the findings of the overall sample (9.78% versus 9.45%). Instead, the sub-group of women above the median age is characterized by a lack of significance of their satisfaction with the breast surgeon, although the impact of satisfaction with information is confirmed. Such evidence can be interpreted in light of the fact that younger women could have higher expectations and fears about the surgery outcome; then, the role of the breast surgeon in communicating is particularly central.

Looking at patients' educational background (Tables 7a-7b), women without a bachelor's degree value higher the role of the breast surgeon, as the mediation model is present and confirmed from a statistical significance perspective. This result can be justified by the fact that this sub-group might be on average less informed about the surgery itself and about the overall expectations on the outcomes in the short and long term; this explains why the profile of the breast surgeon is particularly impactful on this group of women. Coherently, the absence of breast surgeons' mediating role on the more educated women can be justified by the same explanation provided for the previous subsample.

Discriminating by smoking habits (Tables 8a-8b), non-smoking women confirmed a nuanced and non-significant role of breast surgeons in the mediating mechanism (6.73% impact on the overall effect). Women who smoke, instead, are characterized by a markedly higher impact of the indirect role of breast surgeons, which mediates 21.28% of the total effect. In addition to the relatively smaller direct effect, this evidence can be interpreted by the fact that high-risk patients are those who benefit most from a more effective doctor-patient communication, for what concerns the risks and expectations. For this specific group of women, the particularly small sample (N=62) could have played a role in terms of precision of the estimates.

For women's BMI (Tables 9a-9b), we took as reference the value of 24.99, being the upper limit of "normal weight" (WHO, 2010). Women

with a BMI below 24.99 are not affected by the mediating role of the breast surgeon on the relationship between the degree of satisfaction towards the received information and the satisfaction with their breast while, for the subsample characterized by a BMI above 24.99, the results are more in line with the baseline model (11.59% of the total effect that is mediated). Similarly, to smoking women, also in this case the evidence can be justified by the fact that more high-risk women are those who can take advantage most from an adequate presence of the breast surgeon.

6. Discussion

This study presents how the problem of information asymmetry affects the healthcare provider-user in co-creation relationship; in particular, considering changes in information-communication exchange between doctors and patients. It uses a unique source of data, represented by a continuous and longitudinal web survey on PROs for breast cancer patients in one teaching hospital in Italy. This paper contributes to the public management literature by i) investigating the value co-creation driven by the relational component of provider-user exchange considering data collected from the users, thus enhancing this power relationship, ii) proposing an example to evaluate the outcomes associated with the implementation of healthcare co-production and iii) providing evidence on the importance of considering value in-context to better understand and explain value produced or value-in-use.

The key findings of this study highlight the need to prioritize patient-centered approaches in doctor-patient communication, addressing patients' unmet needs and enabling them to better understand their condition. From this perspective, the study challenges the conflict between the standardization of service provision and customization that still permeates healthcare, advocating for a more balanced approach that considers the value of co-creation in relation to different value configurations (Colldén et al. 2021). Our study highlights the importance of micro-level initiatives to co-create, assuming an interpersonal attachment and attention to the dynamics between patient and doctor. It underscores the significance of building trust and relationships with providers to ensure better PROs. Both cognitive and emotional care are investigated, where cognitive care aims to influence patients' expectations about the illness or the treatment, whereas emotional care refers to the style of the consultation (e.g., warm, empathic), and aims to reduce negative feelings such as anxiety and fear. The relational dimension of co-creation appears to be an interesting starting point for a more detailed and meaningful assessment of value creation (Cui, Aulton 2023).

In terms of approach, the study proposes the use of PROs as a proxy to assess the impact of relational value creation developed between the surgeon and the patient when confronting with the management of a specific health condition (i.e., breast cancer). In light of the scant evidence

about methods and tools to empirically evaluate the impact of co-creation in healthcare (Marsilio et al. 2021), the use of a validated patient-reported scales appears to be a promising strategy to assess the benefit for the lay actor's perspective. However, patient-reported data do not provide a complete picture of the value created for the professional (e.g., behavioral change and trust), indeed, evidence is reported just from one side of the equation – the user – and no triangulation was possible. There is a need for more research on approaches for assessing the impact of co-creation on users, professionals, system and society considering the complexity and the multi-stakeholder and intrinsically multi-level nature of healthcare services. Additionally, our findings suggest that the traditional division between practitioners and users can be reconsidered, as both parties can be the beneficiaries of value. By including the public value dimension in this dyadic relationship, the responsibility for generating value no longer falls exclusively within the pure view of the professionals, as endorsed by the more traditional information asymmetry approach. Instead, such responsibility stems from a mutual collaboration, where the professionals and citizens (patients) co-create value through the integration of their mutual resources.

Moreover, the empirical study highlights how value is in nature a context-specific and evolving concept – its specific content varies with the characteristics, the needs and preferences of users. The perceived successful outcome of a service (i.e., breast satisfaction) appears to be the result of an interactive and dynamic relationship between the professional provider and the patient in the co-creation for value as expressed by the emerging public service logic (Gronroos et al. 2015; Grönroos, Voima 2013; Osborne 2018). Moreover, the study highlights the importance of examining the content of value (what benefits can be achieved) and not just the process of value creation, constituting an enrichment to the current literature.

The main takeaway is the strong and significant impact of satisfaction with information on women's breast satisfaction, confirmed across all specifications and aligned with current literature. The baseline model confirms the importance of the surgeon, while sub-group analysis offers insights into which patients value this role most.

Due to the overwhelming nature of being diagnosed with a major health condition, good communication was thought to be key to providing quality support and reassurance. In particular, the evidence shows that this mediation mechanism is confirmed for the women at high-risk, namely those who are less educated, smoke, have a higher BMI, and do not engage in regular physical activity. These insights can help clinicians improve doctor-patient communication, considering the impact that their time and the information shared with women of specific characteristics. The evidence presented supports the idea that there is a need for stronger patient-doctor engagement in the form of information-communication to reduce the

distance in the doctor-patient interactions and provide a supportive space where the expertise of patients and health professionals can be pooled to arrive at mutually agreed goals, reinforcing the concordance or alliance model between medical and patient (Bissell et al. 2004). This reinforced partnership has positive effects on patients' health and wellbeing, especially to those who are in weaker position considering some socio-demographic characteristics (education) and are at high-risk.

Nevertheless, the results of this study could be further strengthened, through some improvements able to overcome the current limitations. The first one relates to the consideration of only one Breast Unit, which limits the external validity of the results. Linked to that, the possibility to replicate the analyses with a bigger sample would help to provide more robust estimates. Furthermore, the PROs included in the analysis refer to satisfaction with body image, as the health intervention has a prominent impact on women's breast appearance (at least in the short term). Further relevant PROs should be explored, such as psychosocial, physical and sexual well-being. Due to limited data availability, some clinically relevant information was missing (e.g., tumour stage, concurrent therapies, or complications) as well as patient's health knowledge and prior experiences, which can influence PROs. Moreover, the post-operative outcome was measured considering a short time frame, three months. Further research should consider a longer follow-up period to fully appreciate patient outcomes, also including other concerns that might take precedence (disease recurrence, follow-up therapies and complications). Additionally, other significant in-context variables could be investigated, including professional and patient competence and skills to promote value co-creation, such as dialogue, cooperation and reciprocity (Palumbo 2016). Nevertheless, this contribution provides useful insights for practitioners and policymakers, as adequate two-way communication between breast surgeons and patients has been proven fundamental in setting women's expectations and avoiding discrepancies between pre-surgery expectations and post-surgery aesthetic PROs. Furthermore, this study only examined value as a positive change; future research could explore negative value in public providers and citizens, particularly how value destruction occurs as a result of conflicts between different value dimensions (e.g., aesthetic and physical outcome). Finally, the concept of mutual value creation should be better understood, as not all patients want to engage with providers, and vice versa, thus posing questions on how to identify and address these situations, particularly with short-term orientation and resources constraints being key limiting factors.

7. Conclusion and implications for practice

Health services are inherently co-produced, with both providers and patients actively engaged in a co-creating partnership. Despite this, the potential of this relationship remains underdeveloped and often overlo-

oked, largely due to the persistent barriers preventing patients' involvement, alongside the limited exposure of healthcare professionals to strategies that foster patient-centered care (Palumbo 2016). The concept of relational value co-creation is increasingly recognized as a critical factor in improving health outcomes. The findings from this study emphasize the importance of continuously collecting and reporting voices of service users (De Rosis et al. 2023; Ferrè 2024), to ensure that patient experiences and perspectives are effectively integrated into the healthcare process. Indeed, patient engagement is key to design healthcare services that reflect real-life experiences, needs, and expectations, improving their appropriateness and effectiveness. Moreover, it is vital to implement systems that capture patient input but also provide feedback on value creation throughout the patient-provider exchange.

The study further emphasizes the importance of interpersonal training for clinicians, both during initial and ongoing education to improve communication and emotional aspects of care (Kelley et al. 2014). Enhancing interpersonal dynamics is therefore a fundamental aspect of advancing patient-centered care and optimizing the co-creation of value in healthcare settings.

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Appendix

Table 4a – Pre- and post-surgery items of "Satisfaction with breast", "Satisfaction with surgeon" and "Satisfaction with information received by the breast surgeon": BCT

Satisfaction with breast	**Satisfaction with surgeon**	**Satisfaction with information: breast surgeon**
PRE-OP		
Mirror clothed	-	-
Bras fit	-	-
Fitted clothing	-	-
Mirror unclothed	-	-
POST-OP		
Mirror clothed	Professional	Radiation need
Shape	Gave confidence	Surgery options
Feel normal	Involved you	Same survival
Fitted clothing	Reassuring	Healing time
Breast hangs	Answered questions	Treatment plan
Smoothly shaped	Comfortable	Pain expect
Contour	Thorough	Complications
Equal in size	Easy to talk	Cancer come back
Normal look	Understood	Look after surgery
Same	Sensitive	Scars look
Mirror unclothed	Made time	Size expect
	Available	Shape

Table 4b – Pre- and post-surgery items of "Satisfaction with breast", "Satisfaction with surgeon" and "Satisfaction with information received by the breast surgeon": Reconstruction after mastectomy

Satisfaction with breast	**Satisfaction with surgeon**	**Satisfaction with information: breast surgeon**
PRE-OP		
Mirror clothed	-	-
Bras fit	-	-
Fitted clothing	-	-
Mirror unclothed	-	-
POST-OP		
Mirror clothed	Professional	Surgery done
Shape	Gave confidence	Healing time
Normal	Involved you	Complications
Size	Reassuring	Option types

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Satisfaction with breast	**Satisfaction with surgeon**	**Satisfaction with information: breast surgeon**
Fitted clothing	Answered questions	Options timing
Lined up	Comfortable	Timing pros cons
Bras fit	Thorough	How long
Softness	Easy to talk	Size expect
Equal size	Understood	Pain expect
Natural look	Sensitive	Look expect
Natural hang	Made time	Feel self
Feels to touch	Available	Future screen
Feels natural		Sensation
Matched		Others
Mirror unclothed		Scars look

Table 5a – Baseline model with separate subsamples clustered for surgery path (BCT)

Perc = 0 (BCT)								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/ breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.461***	0.055	*Sat. w/ information*	0.260***	0.050	*Sat. w/ information*	0.442***	0.059
-	-	-	-	-	-	*Sat. w/ surgeon*	0.076	0.083
Age	0.196*	0.116	*Age*	0.066	0.104	*Age*	0.191	0.116
BMI	-0.263	0.247	*BMI*	0.089	0.222	*BMI*	-0.270	0.248
Bachelor's degree	-3.011	2.208	*Bachelor's degree*	-1.548	1.985	*Bachelor's degree*	-2.894	2.213
Sport activity	1.651**	0.703	*Sport activity*	-0.233	0.632	*Sport activity*	1.669**	0.704
Smoking habit	-4.882	3.103	*Smoking habit*	-3.427	2.789	*Smoking habit*	-4.622	3.117
Menopause	-3.608	2.682	*Menopause*	-0.624	2.411	*Menopause*	-3.560	2.684
Comorbidities	-4.175*	2.423	*Comorbidities*	-0.465	2.178	*Comorbidities*	-4.140*	2.425
Constant	28.126***	9.326	*Constant*	71.981***	8.383	*Constant*	22.655**	11.060
	N=191			N=191			N=191	
	R2=0.326			R2=0.109			R2=0.326	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.020 (0.022) Direct effect = 0.449*** (0.059) Total effect = 0.469*** (0.055) Proportion of total effect that is mediated: 4.28%								

Table 5b – Baseline model with separate subsamples clustered for surgery path (Reconstruction after mastectomy)

Perc = 1 (Reconstruction)								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.391***	0.039	*Sat. w/ information*	0.479***	0.056	*Sat. w/ information*	0.319***	0.044
-	-	-	-	-	-	*Sat. w/ surgeon*	0.149***	0.046
Age	-0.064	0.097	*Age*	0.262*	0.139	*Age*	-0.103	0.096
BMI	-0.110	0.193	*BMI*	-0.085	0.277	*BMI*	-0.097	0.189
Bachelor's degree	-2.176	1.614	*Bachelor's degree*	-2.790	2.318	*Bachelor's degree*	-1.760	1.585
Sport activity	0.223	0.464	*Sport activity*	-0.220	0.667	*Sport activity*	0.256	0.455
Smoking habit	-2.015	1.951	*Smoking habit*	-0.915	2.803	*Smoking habit*	-1.879	1.911
Menopause	-1.539	1.811	*Menopause*	-5.359**	2.601	*Menopause*	-0.739	1.789
Comorbidities	-0.062	1.779	*Comorbidities*	-2.918	2.556	*Comorbidities*	0.373	1.747
Constant	39.750***	6.508	*Constant*	50.606***	9.348	*Constant*	32.203***	6.781
	N=230			N=230			N=230	
	R2=0.313			R2=0.255			R2=0.342	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.071*** (0.023) Direct effect = 0.319*** (0.044) Total effect = 0.391*** (0.039) Proportion of total effect that is mediated: 18.29%								

Table 6a – Baseline model with separate subsamples clustered for age below the median value

Age <= 53								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.434***	0.049	*Sat. w/ information*	0.395***	0.056	*Sat. w/ information*	0.391***	0.054
-	-	-	-	-	-	*Sat. w/ surgeon*	0.107*	0.060
Surgery path	-3.081*	1.864	*Surgery path*	-3.619*	2.131	*Surgery path*	-2.692	1.867
Age	0.330*	0.194	*Age*	0.180	0.222	*Age*	0.311	0.193
BMI	-0.507**	0.232	*BMI*	0.070	0.266	*BMI*	-0.514**	0.231

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Bachelor's degree	-5.105***	1.921	*Bachelor's degree*	-2.007	2.196	*Bachelor's degree*	-4.890**	1.914
Sport activity	0.492	0.569	*Sport activity*	-0.073	0.650	*Sport activity*	0.500	0.566
Smoking habit	-5.625**	2.432	*Smoking habit*	-3.981	2.780	*Smoking habit*	-5.197**	2.431
Menopause	-3.947**	1.973	*Menopause*	-3.475	2.256	*Menopause*	-3.573*	1.974
Comorbidities	-3.937*	2.385	*Comorbidities*	-6.336**	2.727	*Comorbidities*	-3.256	2.403
Constant	33.043***	10.720	*Constant*	59.707***	12.255	*Constant*	26.627**	11.254
	N=219			N=219			N=219	
	R2=0.344			R2=0.239			R2=0.351	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.042* (0.025) Direct effect = 0.391*** (0.054) Total effect = 0.434*** (0.049) Proportion of total effect that is mediated: 9.78%								

Table 6b – Baseline model with separate subsamples clustered for age above the median value

Age > 53								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.429***	0.044	*Sat. w/ information*	0.350***	0.053	*Sat. w/ information*	0.395***	0.049
-	-	-	-	-	-	*Sat. w/ surgeon*	0.097	0.060
Surgery path	-5.472***	1.723	*Surgery path*	-3.614*	2.066	*Surgery path*	-5.121***	1.729
Age	-0.144	0.117	*Age*	0.132	0.141	*Age*	-0.157	0.117
BMI	-0.030	0.212	*BMI*	-0.020	0.254	*BMI*	-0.028	0.211
Bachelor's degree	-0.261	1.922	*Bachelor's degree*	-2.857	2.305	*Bachelor's degree*	0.016	1.921
Sport activity	1.164**	0.578	*Sport activity*	-0.234	0.694	*Sport activity*	1.187**	0.576
Smoking habit	-1.502	2.533	*Smoking habit*	-0.065	3.038	*Smoking habit*	-1.495	2.522
Menopause	1.541	3.546	*Menopause*	-2.805	4.252	*Menopause*	1.813	3.535
Comorbidities	-0.774	1.822	*Comorbidities*	1.885	2.185	*Comorbidities*	-0.957	1.818
Constant	40.553***	10.375	*Constant*	65.212***	12.442	*Constant*	34.216***	11.046
	N=202			N=202			N=202	
	R2=0.367			R2=0.200			R2=0.372	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.034 (0.022) Direct effect = 0.395*** (0.049) Total effect = 0.429*** (0.044) Proportion of total effect that is mediated: 7.92%								

Table 7a – Baseline model with separate subsamples clustered for levels of education (not graduated)

Not graduated								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.403***	0.039	*Sat. w/ information*	0.341***	0.044	*Sat. w/ information*	0.354***	0.043
-	-	-	-	-	-	*Sat. w/ surgeon*	0.142***	0.058
Surgery path	-5.072***	1.513	*Surgery path*	-3.592**	1.678	*Surgery path*	-4.562***	1.508
Age	-0.018	0.088	*Age*	0.167*	0.098	*Age*	-0.042	0.088
BMI	-0.166	0.180	*BMI*	0.147	0.200	*BMI*	-0.187	0.179
Sport activity	1.164**	0.497	*Sport activity*	0.291	0.552	*Sport activity*	1.122**	0.492
Smoking habit	-2.691	1.996	*Smoking habit*	-1.671	2.214	*Smoking habit*	-2.454	1.976
Menopause	-2.506	1.857	*Menopause*	-3.797*	2.059	*Menopause*	-1.966	1.847
Comorbidities	-1.275	1.778	*Comorbidities*	-2.618	1.972	*Comorbidities*	-0.903	1.764
Constant	41.480***	6.802	*Constant*	60.365***	7.544	*Constant*	32.896***	7.446
	N=294			N=294			N=294	
	R2=0.329			R2=0.211			R2=0.343	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.048** (0.019) Direct effect = 0.354*** (0.043) Total effect = 0.403*** (0.039) Proportion of total effect that is mediated: 12.02%								

Table 7b – Baseline model with separate subsamples clustered for levels of education (graduated)

Graduated								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.480***	0.061	*Sat. w/ information*	0.444***	0.078	*Sat. w/ information*	0.468***	0.070
-	-	-	-	-	-	*Sat. w/ surgeon*	0.026	0.073
Surgery path	-3.109	2.353	*Surgery path*	-4.428	2.989	*Surgery path*	-2.994	2.384
Age	0.286*	0.147	*Age*	0.195	0.187	*Age*	0.281*	0.148
BMI	-0.353	0.319	*BMI*	-0.187	0.405	*BMI*	-0.348	0.321
Sport activity	0.230	0.691	*Sport activity*	-1.228	0.877	*Sport activity*	0.262	0.699

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Smoking habit	-5.193	3.444	*Smoking habit*	-5.487	4.374	*Smoking habit*	-5.050	3.480
Menopause	-1.797	2.886	*Menopause*	-1.531	3.666	*Menopause*	-1.757	2.899
Comorbidities	-4.272	2.668	*Comorbidities*	0.797	3.389	*Comorbidities*	-4.292	2.679
Constant	24.323**	10.347	*Constant*	61.001***	13.143	*Constant*	22.740**	11.294
	N=127			N=127			N=127	
	R2=0.376			R2=0.233			R2=0.372	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.012 (0.032) Direct effect = 0.468*** (0.070) Total effect = 0.480*** (0.061) Proportion of total effect that is mediated: 2.40%								

Table 8a – Baseline model with separate subsamples clustered for smoking status (not smokers)

Not smokers								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.439***	0.038	*Sat. w/ information*	0.359***	0.040	*Sat. w/ information*	0.410***	0.042
-	-	-	-	-	-	*Sat. w/ surgeon*	0.082	0.050
Surgery path	-4.825***	1.381	*Surgery path*	-4.342***	1.466	*Surgery path*	-4.468***	1.395
Age	0.085	0.081	*Age*	0.155*	0.086	*Age*	0.072	0.082
BMI	-0.270	0.167	*BMI*	-0.086	0.177	*BMI*	-0.263	0.166
Bachelor's degree	-2.361	1.465	*Bachelor's degree*	-1.956	1.555	*Bachelor's degree*	-2.200	1.465
Sport activity	0.768*	0.442	*Sport activity*	-0.184	0.469	*Sport activity*	0.783*	0.441
Menopause	-2.743	1.705	*Menopause*	-2.815	1.810	*Menopause*	-2.512	1.707
Comorbidities	-2.570	1.604	*Comorbidities*	-1.330	1.703	*Comorbidities*	-2.460	1.602
Constant	37.256***	6.224	*Constant*	66.272***	6.607	*Constant*	31.802***	7.045
	N=359			N=359			N=359	
	R2=0.343			R2=0.227			R2=0.346	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.030 (0.018) Direct effect = 0.410*** (0.042) Total effect = 0.439*** (0.038) Proportion of total effect that is mediated: 6.73%								

Table 8b – Baseline model with separate subsamples clustered for smoking status (smokers)

Smokers								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.331***	0.071	*Sat. w/ information*	0.416***	0.125	*Sat. w/ information*	0.260***	0.076
-	-	-	-	-	-	*Sat. w/ surgeon*	0.169**	0.076
Surgery path	-3.339	3.363	*Surgery path*	-0.974	5.891	*Surgery path*	-3.174	3.243
Age	-0.059	0.209	*Age*	0.293	0.366	*Age*	-0.109	0.203
BMI	0.675	0.491	*BMI*	0.825	0.861	*BMI*	0.536	0.478
Bachelor's degree	-1.880	3.467	*Bachelor's degree*	-2.227	6.074	*Bachelor's degree*	-1.503	3.347
Sport activity	1.450	0.986	*Sport activity*	-0.264	1.726	*Sport activity*	1.495	0.950
Menopause	0.650	3.760	*Menopause*	-6.771	6.587	*Menopause*	1.797	3.661
Comorbidities	-1.116	3.828	*Comorbidities*	-1.856	6.707	*Comorbidities*	-0.802	3.694
Constant	22.319	15.965	*Constant*	32.500	27.967	*Constant*	16.814	15.587
	N=62			N=62			N=62	
	R2=0.324			R2=0.143			R2=0.371	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.070* (0.038) Direct effect = 0.260*** (0.076) Total effect = 0.331*** (0.071) Proportion of total effect that is mediated: 21.28%								

Table 9a – Baseline model with separate subsamples clustered for BMI values below 24.99

BMI <= 24.99								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.458***	0.042	*Sat. w/ information*	0.407***	0.051	*Sat. w/ information*	0.428***	0.047
-	-	-	-	-	-	*Sat. w/ surgeon*	0.073	0.052
Surgery path	-5.073***	1.652	*Surgery path*	-3.740*	1.997	*Surgery path*	-4.799***	1.660
Age	0.142	0.102	*Age*	0.209	0.123	*Age*	0.128	0.102
BMI	-0.679	0.418	*BMI*	-0.564	0.505	*BMI*	-0.638	0.418
Bachelor's degree	-2.357	1.643	*Bachelor's degree*	-1.771	1.986	*Bachelor's degree*	-2.227	1.642

Sport activity	0.747	0.502	*Sport activity*	-0.503	0.607	*Sport activity*	0.784	0.502
Smoking habit	-5.110**	2.078	*Smoking habit*	-5.407**	2.512	*Smoking habit*	-4.714**	2.093
Menopause	-3.707*	1.936	*Menopause*	-4.313*	2.341	*Menopause*	-3.391*	1.946
Comorbidities	-4.189**	2.062	*Comorbidities*	-2.559	2.493	*Comorbidities*	-4.002*	2.063
Constant	42.713***	9.938	*Constant*	72.297***	12.014	*Constant*	a37.416***	10.613
	N=260			N=260			N=260	
	R2=0.399			R2=0.243			R2=0.401	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.030 (0.022) Direct effect = 0.428*** (0.047) Total effect = 0.458*** (0.042) Proportion of total effect that is mediated: 6.52%								

Table 9b – Baseline model with separate subsamples clustered for BMI values above 24.99

BMI > 24.99								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.360***	0.055	*Sat. w/ information*	0.322***	0.059	*Sat. w/ information*	0.319***	0.060
-	-	-	-	-	-	*Sat. w/ surgeon*	0.129*	0.076
Surgery path	-3.492*	1.996	*Surgery path*	-4.012*	2.129	*Surgery path*	-2.974	2.007
Age	0.001	0.119	*Age*	0.179	0.127	*Age*	-0.022	0.119
BMI	-0.368	0.308	*BMI*	-0.165	0.328	*BMI*	-0.347	0.306
Bachelor's degree	-1.982	2.479	*Bachelor's degree*	-2.343	2.645	*Bachelor's degree*	-1.679	2.470
Sport activity	0.897	0.679	*Sport activity*	0.144	0.724	*Sport activity*	0.878	0.675
Smoking habit	1.264	3.165	*Smoking habit*	4.210	3.377	*Smoking habit*	0.720	3.162
Menopause	-0.739	2.687	*Menopause*	-2.420	2.867	*Menopause*	-0.426	2.677
Comorbidities	-0.873	2.174	*Comorbidities*	-1.299	2.319	*Comorbidities*	-0.705	2.162
Constant	47.359***	11.774	*Constant*	68.878***	12.561	*Constant*	38.459***	12.812
	N=161			N=161			N=161	
	R2=0.232			R2=0.190			R2=0.242	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.042 (0.026) Direct effect = 0.319*** (0.060) Total effect = 0.360*** (0.055) Proportion of total effect that is mediated: 11.57%								

Table 10a – Baseline model with separate subsamples clustered for women practicing sport

Sport < 2.5								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.408***	0.050	*Sat. w/ information*	0.390***	0.055	*Sat. w/ information*	0.354***	0.056
-	-	-	-	-	-	*Sat. w/ surgeon*	0.139**	0.062
Surgery path	-2.147	1.890	*Surgery path*	-3.325	2.065	*Surgery path*	-1.684	1.884
Age	0.050	0.112	*Age*	0.254**	0.122	*Age*	0.014	0.112
BMI	-0.015	0.231	*BMI*	-0.046	0.252	*BMI*	-0.009	0.229
Bachelor's degree	-0.616	2.114	*Bachelor's degree*	-0.051	2.310	*Bachelor's degree*	-0.609	2.094
Sport activity	3.519*	2.012	*Sport activity*	0.925	2.198	*Sport activity*	3.390*	1.994
Smoking habit	-2.869	2.501	*Smoking habit*	-1.272	2.733	*Smoking habit*	-2.692	2.479
Menopause	-2.853	2.346	*Menopause*	-7.178***	2.564	*Menopause*	-1.853	2.367
Comorbidities	-2.059	2.224	*Comorbidities*	-0.169	2.430	*Comorbidities*	-2.035	2.203
Constant	29.349***	8.708	*Constant*	57.175***	9.516	*Constant*	21.386**	9.336
	N=221			N=221			N=221	
	R2=0.266			R2=0.227			R2=0.280	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.054** (0.026) Direct effect = 0.354*** (0.056) Total effect = 0.408*** (0.050) Proportion of total effect that is mediated: 13.31%								

Table 10b – Baseline model with separate subsamples clustered for women not practicing sport

Sport > 2.5								
Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
DV: sat. w/breast	β	**St. err.**	**Mediator: sat. w/ surgeon**	β	**St. err.**	**DV: sat. w/breast**	β	**St. err.**
Sat. w/ information	0.425***	0.044	*Sat. w/ information*	0.366***	0.055	*Sat. w/ information*	0.401***	0.049
-	-	-	-	-	-	*Sat. w/ surgeon*	0.066	0.058
Surgery path	-6.838***	1.701	*Surgery path*	-3.818*	2.118	*Surgery path*	-6.586***	1.714
Age	0.116	0.101	*Age*	0.066	0.126	*Age*	0.112	0.101

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Model 1 with DV regressed on IV			Model 2 with mediator regressed on IV			Model 3 with DV regressed on mediator and IV		
BMI	-0.357*	0.211	*BMI*	0.119	0.263	*BMI*	-0.365*	0.211
Bachelor's degree	-4.097**	1.725	*Bachelor's degree*	-4.033*	2.148	*Bachelor's degree*	-3.831**	1.740
Sport activity	0.931	0.988	*Sport activity*	-1.532	1.230	*Sport activity*	1.032	0.991
Smoking habit	-2.624	2.379	*Smoking habit*	-3.506	2.963	*Smoking habit*	-2.394	2.386
Menopause	-2.786	2.059	*Menopause*	0.119	2.565	*Menopause*	-2.793	2.058
Comorbidities	-2.310	2.035	*Comorbidities*	-1.962	2.535	*Comorbidities*	-2.181	2.037
Constant	39.429***	8.574	*Constant*	70.561***	10.677	*Constant*	34.788***	9.501
	N=200			N=200			N=200	
	R2=0.423			R2=0.223			R2=0.424	
Significance levels: *p≤0.1; **p≤0.05; ***p≤0.01								
Indirect effect = 0.024 (0.022) Direct effect = 0.401*** (0.049) Total effect = 0.425*** (0.044) Proportion of total effect that is mediated: 5.66%								