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Association between patient activation and delayed discharge in elective laparoscopic cholecystectomy: A prospective cohort analysis

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ABSTRACT

Background: Improving patient activation may be an effective way to reduce healthcare costs and improve patient outcomes after surgery.
Objective: To determine whether preoperative patient activation is associated with delayed discharge (i.e., length of stay >24 h) after elective laparoscopic cholecystectomy. Postoperative symptoms, unscheduled access to healthcare facilities within seven days of surgery, unplanned hospital readmissions, and postoperative complications were analyzed as secondary outcomes.
Design: This cohort study was a secondary analysis of the DeDiLaCo study (Delayed Discharge after day-surgery Laparoscopic Cholecystectomy) collecting data of patients undergoing elective laparoscopic cholecystectomy during 2021 in Italy. Data was analyzed from June 2022 to April 2023.
Setting: 90 Italian surgical centers participating in the study.
Participants: 4708 adult patients with an instrumental diagnosis of gallbladder disease and undergoing laparoscopic cholecystectomy. Patient activation was assessed using the Italian translation of Patient Activation Measure in the preoperative setting.
Results: Of 4532 cases analyzed the median (IQR) Patient Activation Measure score was 80.3 (71.2–92.3). Participants were on average 55.5 years of age and 58.1 % were female. Two groups based on the activation level were created: 270 (6 %) had low activation, and 4262 had high activation. The low activation level was associated with the likelihood of delayed discharge (odds ratio [OR] 1.47, 95 % CI, 1.11–1.95; P = .008), higher symptom burden (OR 1.99, 95 % CI 1.49–2.66, P < .0001), and unplanned healthcare utilization within seven days after hospital discharge (OR 1.85, 95 % CI, 1.29–2.63; P = .001). There was no difference between the high and low activation groups in the incidence of postoperative complications (OR 1.28, 95 % CI, 0.95–1.73; P = .10) and hospital readmission after discharge (OR 0.95, 95 % CI, 0.30–3.05; P = .93).
Conclusions: Our results suggest that patients with low activation have 1.47 times the risk of delayed discharge compared with patients with higher activation, almost twice the risk of the onset of postoperative symptoms, and 1.85 times the risk of unscheduled use of hospital services. Screening for patient activation in the preoperative setting could not only identify patients not suitable for early discharge, but more importantly, help physicians and nurses develop tailored interventions.

What is already known

- Patient activation is linked to various health-related outcomes, such as healthy living behaviors, higher use of preventive care, better disease management, increased patient and provider satisfaction, and lower resource utilization and care costs.

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- The role of patient activation in improving health outcomes in patients with chronic medical conditions is known; however, the effect of patient activation in the immediate postoperative period remains unclear.

What this paper adds

- Surgical patient populations present remarkable differences in activation from medical patients.
- Patients with low activation have 1.47 times the risk of delayed discharge compared with patients with higher activation, almost twice the risk of the onset of postoperative symptoms, and 1,85 the risk of unscheduled use of hospital.
- Screening for patient activation in the preoperative setting could not only identify patients not suitable for early discharge but, more importantly, can help physicians and nurses to develop tailored interventions for managing postoperative symptoms and project discharge plans based on an individual's activation level to prepare and support patients for a safe discharge and the post-hospital period reducing the risk of unplanned healthcare service utilization.

1. Introduction

The changing healthcare environment requires new roles for both clinicians and patients. Patients have to shed their passive role and play an active part in their health and quality of life, increase autonomy and gaining control over the factors that may affect their health.

The shift from a disease-centered to a patient-centered model of care leads to a wide use (or abuse) of terms such as patient engagement, involvement and empowerment, with overlapping concepts (Castro et al., 2016; Fumagalli et al., 2015; Higgins et al., 2017). The semantic area of each term, their relationships and distinctions between concepts have been clarified by Hickmann et al. (2022).

Patient activation belongs to this wide concept field focused on the more central role of the patient in their healthcare. Patient empowerment generally refers to the process that allows an individual or a community to gain the knowledge, skills, and attitude needed to make choices about their care. Instead, patient activation focuses more on precise disease improvement goals (Fumagalli et al., 2015). As a result, patients who are activated become partners in creating a high-performing and cost-efficient healthcare system.

Emerging evidence has shown that patient activation is linked to various health-related outcomes, such as healthy living behaviors, higher use of preventive care, better disease management, increased patient and provider satisfaction, and lower resource utilization and care costs (Bu and Fancourt, 2021; Greene et al., 2015; Hibbard et al., 2007; Remmers et al., 2009).

The literature has established the role of patient activation in improving health outcomes in patients with chronic medical conditions (Hemming and Munir, n.d.; Kearns et al., 2020; Tusa et al., 2020) and the long-term recovery phase after surgery (Anderson et al., 2022; Harris et al., 2019). However, the effect of patient activation in the immediate postoperative period remains unclear (Law et al., 2022).

It is well-established that the safety of an early discharge after laparoscopic cholecystectomy is similar to that of a conventional hospital stay regarding complications and hospital readmission (Gurusamy et al., 2008; Vaughan et al., 2013).

This study aimed to examine the activation of a population of patients undergoing elective laparoscopic cholecystectomy and determine if an association exists between preoperative patient activation and delayed discharge (i.e., length of stay >24 h).

Secondarily, we explored the association of patient activation with postoperative symptoms, complications and unplanned healthcare utilization in the seven days after the discharge. We hypothesized that patients with higher levels of activation before surgery performed better postoperative surgical results and have reduced hospitalization time and healthcare service utilization.

2. Methods

This cohort study is conducted on a large database proceeding from Italian surgical centers participating in the DeDiLaCo study (Delayed Discharge after day-surgery Laparoscopic Cholecystectomy) (Cillara et al., 2023). In October 20, 2020 the study protocol was approved by the Ethics Committee of the Azienda Tutela Salute (ATS) Sardegna (Italy) with protocol number 271/2020/CE.

An open invitation to participate in the DeDiLaCo study was sent out in November 2020. As a result, 111 Italian surgical units expressed an interest and obtained study approval according to local policies. The centers included academic medical centers, teaching hospitals, tertiary referral centers and community hospitals. The responsibility of the local investigators was to ensure that the local data would be protected and held according to the current privacy policy and in line with what has been approved by the ethics board. Patient data were collected and encoded in an encrypted electronic database (SurveyMonkey©) from January to December 2021 for new cases and, until February 2022, for follow-up data.

2.1. Study population

All patients who underwent elective laparoscopic cholecystectomy in the surgical units participating in the DeDiLaCo study from January 1 to December 31, 2021 were taken into consideration. From a clinical perspective, to be eligible for participation, patients had to be ≥18 years old with an imaging diagnosis of gallbladder disease and indications for laparoscopic cholecystectomy, and ASA (Association of American Anesthesiologists) class I, II or III. In addition, regarding post-discharge conditions, the presence of a caregiver to assist the patient at home for 24 h post-operatively was mandatory, as well as the possibility of reaching the hospital within 1 h in case of need.

Exclusion criteria were: Body Mass Index >40 kg/m^2; acute cholecystitis; acute pancreatitis; concomitant choledocholithiasis; obstructive jaundice; pregnancy or breastfeeding; patient's inability to provide informed consent and history of an adverse drug reaction to analgesic medications included in the analgesic protocols (Ketorolac, Paracetamol, Ketoprofen).

2.2. Study measures

The DeDiLaCo protocol consists of 3 data collection moments: a preoperative phase, an intraoperative and postoperative phase, and a 7-day follow-up after the discharge phase.

In the preoperative phase, demographic data (age, gender, Body Mass Index), comorbidity such as the Charlson Comorbidity Index, and preoperative diagnosis were collected, and patient activation was assessed using the Italian translation of Patient Activation Measure (PAM) (Graffigna et al., 2015).

The survey consists of 13 statements evaluating knowledge, skills, beliefs, and confidence in managing their health care with four-answer options ranging from “strongly disagree” to “strongly agree” and a fifth response option, “not applicable”. Scores were calculated by summing the responses, weighted to a scale of 0 to 100. The overall score categorized patients into four levels: level 1 (score ≤47), level 2 (score ≥47.1 to ≤55.1), level 3 (score ≥55.2 to ≤72.4), and level 4 (score ≥72.5). According to Hibbard et al. (2004), activation is developmental and involves four increasing levels. At level one, adults “tend to be overwhelmed with managing their health and may not feel ready to take an active role”. At level two, patients “realize that they have a role to play in their healthcare, but may lack the knowledge and confidence to manage their health and healthcare”. At level three, patients “are beginning to take action but may still lack some confidence to manage all aspects of their health”. Finally, at level 4, patients can manage their health and care but “struggle to maintain the behaviors they have already adopted”. For the aim of this study, patient activation levels were dichotomized into low activation (levels 1 and 2) and high

activation (levels 3 and 4) groups, according to other studies (Block et al., 2019; Dumitra et al., 2021; Prey et al., 2016).

In the intra-hospital phase, the following data was collected: the presence of intraoperative complications (bleeding, biliary leak, iatrogenic injuries, and complications related to anesthesia), nausea or vomiting, body temperature > 38 °C, pain > 3 on the Numerical Rating Scale (NRS) scale and the presence of postoperative complications stratified according to the Clavien–Dindo classification (Clavien et al., 2009).

During the follow-up, signs or symptoms of surgical wound infection, readmission to the surgical center that performed surgery and unscheduled access to health care in the seven days following discharge were noted. Unscheduled access to health care included a visit to the family doctor, the surgical center or the Emergency Department.

2.3. Study outcomes

The primary outcome measure for this study was the rate of patients with delayed discharge after elective laparoscopic cholecystectomy. In addition, the time to discharge after laparoscopic cholecystectomy and reasons for delayed discharge were collected. Postoperative symptoms were analyzed as secondary outcomes. These included the presence of at least one of the following: pain at discharge, and the presence of nausea or vomiting after surgery. Other secondary outcomes included unscheduled access to healthcare facilities within seven days of surgery, unplanned hospital readmissions, and postoperative complications. Complications were evaluated with the Clavien–Dindo classification and include presence of fever (i.e., body temperature > 38 °C) or any sign of wound infection.

2.4. Statistical analysis

Sample characteristics were summarized by the mean and standard deviation (SD), or median and interquartile range (IQR) for quantitative variables and by absolute and relative (percentage) frequencies for qualitative ones. The normality of the data was assessed by visual inspection and the Shapiro–Wilk test. The Mann–Whitney *U* test evaluated differences in quantitative variables, whereas Pearson Chi-Square or Fisher exact tests were used for qualitative ones. Spearman rank's coefficients were calculated to assess the correlation among PAM score, age, and Charlson Comorbidity Index.

Multivariable logistic regression models were performed to evaluate the independent association of the patient activation level, adjusted for anthropometric and clinical characteristics, and the following study outcomes: delayed discharge, postoperative symptoms, complications, unscheduled access to healthcare facilities, and hospital readmission.

Candidate variables were selected if significant at univariable analysis or by their clinical relevance. The statistical threshold was $P < .05$; data was analyzed using the STATA version 17 software.

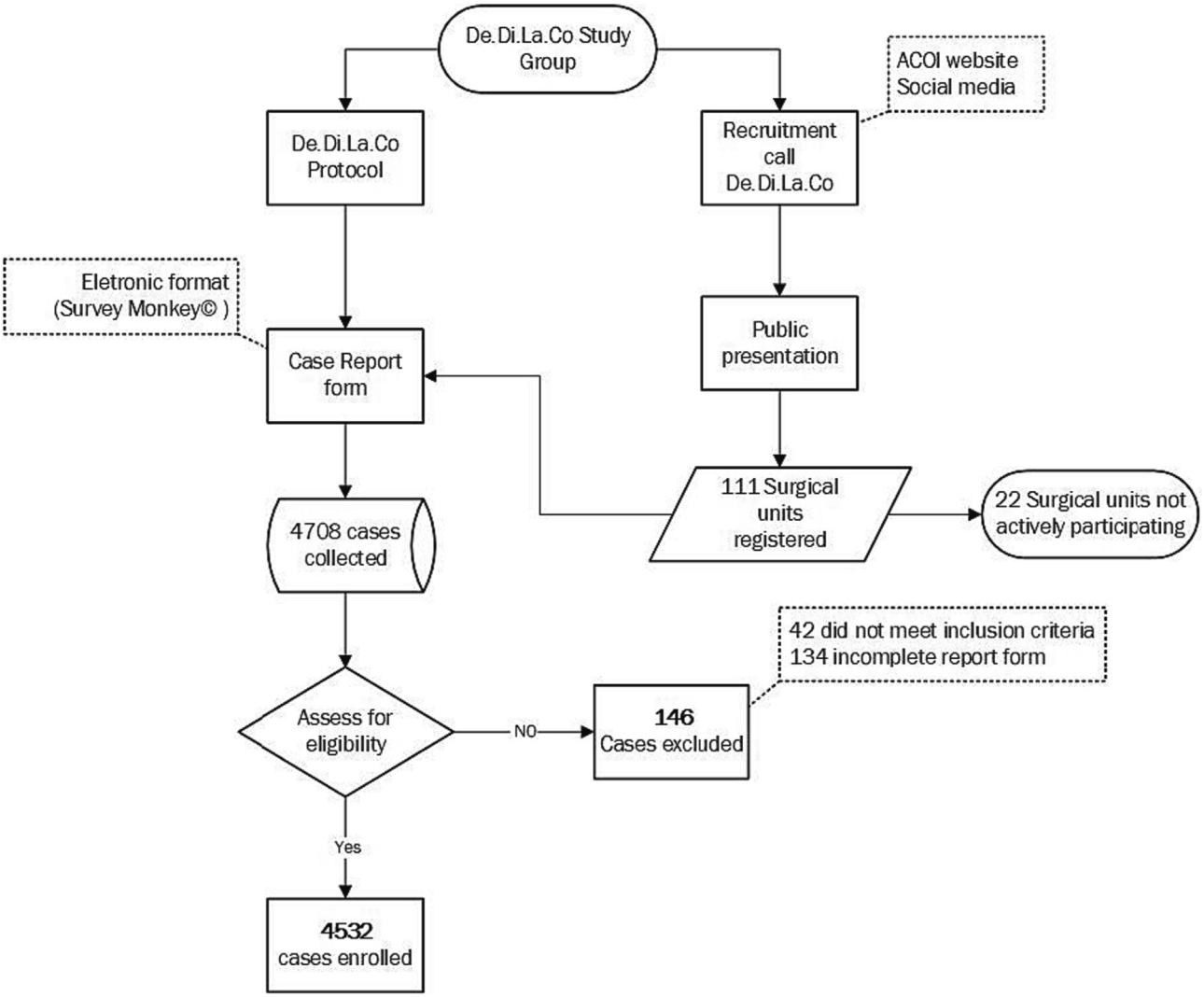

Fig. 1. Patient selection flow chart.

3. Results

Four thousand seven hundred eight cases were registered in the database by 90 surgical units actively participating in the study. Of these, 44 patients were excluded from the database due to failure to comply with the inclusion criteria, and 132 did not contain answers for PAM's questions (Fig. 1, flow diagram). Of 4532 attempted PAM surveys the predominant response category across all responses was "agree," making up 41,3 % (24,349 out of 58,916) of the total. Following closely was the "totally agree" category, accounting for 40,3 % (23,942 out of 59,816) of the responses. The categories of "disagree" and "totally disagree" were notably less common, representing 14 % (8235 out of 58,916) and 2,9 % (98 out of 58,916) of all responses, respectively. The question most commonly responded with N/A was item 9. The "N/A" responses accounted for only 1.2 % (715 out of 58,916) of the total responses. The option "not applicable" was computed as a missing value.

In 4532 cases, the median (IQR) PAM score analyzed was 80.3 (71.2–92.3). Participants were, on average, 55.5 years old, and 58.1 % were female. The baseline demographic and clinical characteristics of patients are reported in Table 1.

Two groups based on the patient activation level were created: 270 had low activation (102 [2.3 %] in level 1 and 168 [3.7 %] in level 2), and 4262 had high activation (866 [19.1 %] in level 3 and 3396 [74.9 %] in level 4).

Based on analysis using the Spearman correlation test, there was a significant negative association between patients' activation score and age (Rho −0.24, P < .0001) and comorbidity index (Rho −0.23, P < .0001). Moreover, results showed a statistically significant difference based on Body Mass Index. Obese patients with Body Mass Index between 30 and 40 kg/m^2 reported lower levels of activation (28.5 % vs. 18.6 %, P < .0001).

In univariable analysis, patients with low activation reported significantly higher postoperative symptoms (30.7 % vs. 18.2 %, P < .0001) and higher unplanned healthcare service utilization (9.6 % vs. 5.4 %, P < .004). However, there was no difference in the incidence of postoperative complications (21.8 % vs. 17.9 %, P = .10). Hospital readmission after discharge was similar between the high and low activation groups (1.1 % vs. 1.2 %, P = .93).

3.1. Patient activation and delayed discharge

For 656 patients, surgical units declared the impossibility of discharging patients on the first postoperative day due to a corporate organizational approach related to hospital reimbursement policies (Table 2). Patients with organizational and economic reasons for delayed discharge were excluded when considering delayed discharge as an outcome. The association between low patient activation and delayed discharge was significant (52.9 % vs. 38.7 %, P < .0001). In univariable analysis, the association between the patient activation level and intraoperative complications due to potential confounders was statistically significant.

A multivariable logistic regression analysis was performed to predict delayed discharge based on the patient activation level and demographic and clinical variables (Table 3) and used to adjust for known predictors of delayed discharge. Independent variables in the regression model included age, gender, Body Mass Index, Charlson Comorbidity Index, intraoperative and postoperative complications, and postoperative symptoms. After adjusting for potential confounding factors, according to the results, the low preoperative level of activation was associated with the likelihood of delayed discharge (OR 1.47, 95 % CI, 1.11–1.95.60; P = .008). The odds of delayed discharge were 1.47 times higher among poorly activated patients compared to highly activated.

Table 2
Reasons for delayed discharge.

Reasons for delayed discharge	Total (N = 2194)	LPA (N = 147)	HPA (N = 2047)
Clinical reason	762	76	678
Postoperative blood tests derangement	257	31	226
Postoperative uncontrolled pain	200	14	186
Open conversion	60	10	50
Postoperative bleeding	54	7	47
Cholangitis	3	0	3
Residual choledocholithiasis	6	1	5
Postoperative abscess	9	0	9
Postoperative fever > 38 °c	49	4	45
Surgical site infection	8	1	7
Biliary leak	21	1	20
Other specified clinical reasons	160	13	147
Economic factors related to hospital refund policies	656	9	647
Medical decisions not supported by clinical reasons	562	29	533
Patient psychosocial reasons	149	27	122

Abbreviations: LPA, low patient activation (levels 1 and 2); HPA, high patient activation (levels 3 and 4).

Table 1
Baseline demographic and clinical characteristics.

Variables	LPA (n = 270)	HPA (n = 4262)	Total (n = 4532)	P-value
Median (IQR) age, years	67 (54–76)	55 (45–66)	55.5 (14.9)	<.0001[a]
Females, n (%)	148 (54.8)	2487 (58.4)	2635 (58.14)	.25
Obesity (BMI 30 to <40 kg/m^2) n (%)	77 (28.5)	794 (18.6)	871 (19.2)	<.0001[a]
Median (IQR) CCI	3 (1–5)	1 (0–3)	1 (0–3)	<.0001[a]
Median (IQR) PAM score	50 (40.4–51.9)	80.8 (75–94.2)	80 (71.2–92.3)	<.0001[a]
Intraoperative complications, n (%)	22 (8.1)	222 (5.2)	244 (5.4)	.04[a]
Postoperative symptoms n (%)	83 (30.7)	776 (18.2)	859 (18.9)	<.0001[a]
NRS > 3, n (%)	36 (13.3)	453 (10.6)	489 (10.8)	.16
Nausea, n (%)	65 (24.1)	410 (9.6)	475 (10.5)	<.0001[a]
Vomit, n (%)	27 (10.0)	139 (3.3)	166 (3.7)	<.0001[a]
Postoperative complication, n (%)	59 (21.8)	763 (17.9)	822 (18.1)	.10
Clavien–Dindo ≥ I, n (%)	51 (18.9)	681 (16.0)	732 (16.1)	.21
Fever (>38 °C), n (%)	12 (4.4)	70 (1.6)	82 (1.8)	.001[a]
Surgical site infection, n (%)	13 (4.8)	168 (3.9)	181 (4.0)	.48
Unplanned healthcare utilization, n (%)	26 (9.6)	232 (5.4)	258	.004[a]
Re-admission post discharge, n (%)	3 (1.1)	50 (1.2)	53 (1.2)	.93

Variables	LPA (n = 261)	HPA (n = 3615)	Total (n = 3876)	P-value
Delayed discharge (>24 h post procedure), n (%)[b]	138 (52.9)	1400 (38.7)	1538 (39.7)	<.0001[a]

Abbreviations: LPA, low patient activation (levels 1 and 2); HPA, high patient activation (levels 3 and 4); IQR, interquartile range; BMI, Body Mass Index; CCI, Charlson Comorbidity Index; PAM, Patient Activation Measure; NRS, Numerical Rating Scale.

[a] P value statistically significant at <.05.

[b] Among patients who do not present "economic factors related to hospital refund policies" as a reason for delayed discharge.

Table 3
Multivariable logistic regression to assess relationship between anthropometric and clinical characteristics and DD (delayed discharge).

Variables		Univariate analysis		Multivariate analysis	
		OR (95 % CI)	P-value	OR (95 % CI)	P-value
Age		1.02 (1.02–1.03)	<.0001	1.01(1.00–1.01)	.14
Females		0.74 (0.65–0.85)	<.0001	0.83 (0.72–0.96)	.01
Obesity (BMI 30 to <40 kg/m^2)		1.22 (1.04–1.42)	.02	1.05 (0.88–1.26)	.60
CCI		1.27 (1.22–1.32)	<.0001	1.15 (1.08–1.23)	<.0001[a]
PAM level	HPA	Ref.	Ref.	Ref.	Ref.
	LPA	1.78 (1.38–2.28)	<.0001	1.47 (1.11–1.95)	.008[a]
Intraoperative complications		1.19 (0.90–1.57)	.23	2.81(2.00–3.95)	<.0001[a]
Postoperative symptoms		1.99 (1.68–2.30)	<.0001	1.18 (0.98–1.43)	.08
Postoperative complications		9.53 (7.83–11.59)	<.0001	7.76 (6.31–9.55)	<.0001[a]

Abbreviations: OR, odds ratio; CI, confidence interval; BMI, Body Mass Index; CCI, Charlson Comorbidity Index; PAM, Patient Activation Measure; HPA, high patient activation (levels 3 and 4); LPA, low patient activation (levels 1 and 2).
[a] P value statistically significant at <.05.

3.2. Patient activation and postoperative symptoms

Regression modeling was implemented to control for the effect of covariates on the relationship between activation and postoperative symptoms. Results showed lower activation levels were associated with higher symptom burden (OR 1.99, 95 % CI, 1.49–2.66; P < .0001). Other independent variables significantly associated with postoperative symptoms were the female gender and intraoperative and postoperative complications.

3.3. Patient activation and unplanned healthcare utilization

The association between patient activation and unplanned healthcare utilization within seven days after hospital discharge remained significant in the multivariable analysis. Compared to patients with higher levels, those with activation level 1 or 2 have 1.68 times the rate of healthcare utilization (OR 1.85, 95 % CI, 1.29–2.63; P = .001). In our study, early discharge (length of hospitalization ≤24 h) was not a predictor of unplanned healthcare utilization.

Multivariable logistic regression was used to assess the association between anthropometric and clinical characteristics and postoperative symptoms and unplanned health care utilizations. Results are reported in Table 4. Variables not significant in the univariable analysis were excluded from multivariable models.

Table 4
Multivariable logistic regression to assess relationship between anthropometric and clinical characteristics and postoperative symptoms and unplanned healthcare utilizations.

Variables		Postoperative symptoms		Unplanned healthcare utilizations	
		OR (95 % CI)	P-value	OR (95 % CI)	P-value
Age		1.00 (0.99–1.01)	.83	0.99 (0.98–1.01)	.88
Females		1.34 (1.14–1.58)	<.0004[a]	1.12 (0.86–1.46)	.40
Obesity (BMI 30 to <40 kg/m^2)		1.21 (1.00–1.46)	.045[a]	–[b]	–[b]
CCI		0.99 (0.92–1.05)	.68	–[b]	–[b]
PAM level	HPA	Ref.	Ref.	Ref.	Ref.
	LPA	1.99 (1.49–2.66)	<.0001[a]	1.85 (1.29–2.63)	.001[a]
Intraoperative complications		1.17 (0.85–1.59)	.32	1.38 (0.95–1.99)	.09
Postoperative complications		4.42 (3.71–5.27)	<.0001[a]	3.07 (2.46–3.83)	<.0001[a]

Abbreviations: OR, odds ratio; CI, confidence interval; BMI, Body Mass Index; CCI, Charlson Comorbidity Index; PAM, Patient Activation Measure; HPA, high patient activation (levels 3 and 4); LPA, low patient activation (levels 1 and 2).
[a] P value statistically significant at <.05.
[b] Variable not significant at the univariable analysis.

4. Discussion

This study aimed to investigate the relationship between patient activation, defined as the patient's knowledge, skills, and confidence to manage their health care, and postoperative outcomes, including delayed discharge, postoperative symptoms, and unplanned healthcare utilization. This study reported a considerably higher mean patient activation score than found in other studies on chronic diseases at baseline (Begum et al., 2011; Humphries et al., 2021; Hussein et al., 2022) but consistent with specific studies on surgical engagement (Andrawis et al., 2015; Sachdev et al., 2023; Yun et al., 2020). This finding indicates that patients generally have a moderate to high level of patient activation, suggesting that our healthcare system is effective in engaging patients in their care. Our study also found a significant negative correlation between the patient activation level and age, Charlson Comorbidity Index, and Body Mass Index. These results are consistent with previous studies that have found that older patients and those with more comorbidities and higher Body Mass Index have lower levels of activation (Blakemore et al., 2016). Moreover, our findings confirm that surgical patient populations present remarkable differences in activation from medical patients (Yun et al., 2020). The type of admission must be considered when analyzing activation levels (Prey et al., 2016). According to Dumitra et al. (2021), the patient activation level is higher in elective surgery; this could explain our patient activation mean score. Patient activation has been shown to improve an individual's health outcome in medical or nonsurgical fields. This study provides strong evidence linking patient activation and surgical outcomes.

Therefore, this study showed that lower patient activation was associated with higher symptom burden and the female gender, and intraoperative and postoperative complications were independent variables associated with postoperative symptoms. Several studies indicated that the female gender was the most reliable independent predictor of postoperative nausea and vomiting (Apfel et al., 2012; Conti et al., 2014).

The association between postoperative complications and the patient activation level in our study was not significant. Also, patients with lower activation levels were not at higher risk of readmission, confirming previous literature (Dumitra et al., 2021). However, our results suggest that patients with low activation have 1.47 times the risk of delayed discharge compared with patients with higher activation, almost twice the risk of the onset of postoperative symptoms, and 1.85 times the risk of unscheduled use of hospital services.

These effects are important findings suggesting new strategies. As not every patient is suitable to be discharged early, the correct selection of patients for day-cases or overnight stay laparoscopic cholecystectomy is important regarding patient scheduling, counseling and allocation of hospital resources. Patient activation is a modifiable risk factor for length of hospital stay. It may be more modifiable than other risk factors such as advanced age, operation time, the gallbladder's wall thickness, diagnosis of acute cholecystitis, biliary pancreatitis, and advanced comorbidity (Richardson et al., 2001; Ripetti et al., 2019; Robinson et al., 2002).

Screening for patient activation in the preoperative setting could not only identify patients not suitable for early discharge but, more importantly, can help physicians and nurses to develop tailored interventions for managing postoperative symptoms and develop discharge plans based on an individual's activation level to prepare and support patients for a safe discharge and the post-hospital period, reducing the risk of unplanned healthcare service utilization (Hunter et al., 2013). This is important from a healthcare provider's perspective, reducing costs related to hospitalization and the possible use of health services, but also it is essential from the patient's experience (Woodfield et al., 2019).

Given the crucial role that nurses play in patient care, the study's results have a strong impact in the nursing practice. Patients with lower activation levels, identified through the PAM questionnaire, may require additional support and resources to effectively manage postoperative symptoms. This need could include educational

materials, support from healthcare professionals, or access to community resources. By targeting support based on patients' activation levels, healthcare providers could address specific needs and concerns more effectively. Tailoring interventions based on patients' activation levels could also improve the effectiveness of postoperative care and enhance patient outcomes. Introducing a personalized discharge intervention based on patient activation in nursing practice can enhance patients' confidence to manage their health after discharge, leading to better adherence to post-discharge instructions and treatment plans. By empowering patients to take an active role in their own care and providing them with the support they need, nurses can help prevent complications and avoid unnecessary use of healthcare services.

Better postoperative outcomes associated with high activation levels are reported particularly after orthopedic surgery: improvement in pain (Gruber et al., 2014), disability (Skolasky et al., 2009), adherence to physical therapy (Skolasky et al., 2008), functional recovery (Skolasky et al., 2011), patient satisfaction (Harris et al., 2020), depression and anxiety (Sachdev et al., 2023). However, this study is the first to demonstrate a relationship between the preoperative patient activation level and better surgical outcomes in the acute phase of the surgical journey.

Therefore, patients with low activation could be strongly supported in managing postoperative symptoms and adequately assisted in the discharge process, trying to avoid distress by unscheduled hospital visits. They are high-risk patients in need of an integrated approach to improve their activation. Furthermore, our study found that patients with Body Mass Index between 30 and 40 kg/m^2 reported lower levels of patient activation, suggesting that interventions to improve patient activation may be particularly beneficial for obese patients.

The strengths of this study include the large sample size, multicenter design, and use of validated instruments to measure patient activation and postoperative outcomes. However, there are some limitations to consider. Our study was observational, and therefore, we cannot establish causality between patient activation and postoperative outcomes; our study relied on self-reported data, which may be subject to recall bias; our study only included patients from surgical units, and therefore, the generalizability of our findings to other patient populations may be limited; finally, we did not administer questionnaires to evaluate the patient's socioeconomic status. Moreover, the patient's social environment was non-quantified through standardized instruments.

Our study suggests that patient activation may play a crucial role in predicting postoperative outcomes, including delayed discharge, postoperative symptoms, and unplanned healthcare utilization. Interventions aimed at improving patient activation may be an effective way to reduce healthcare costs and improve patient outcomes after surgery. Further research is needed to determine the most effective strategies to improve patient activation and its impact on postoperative outcomes. Overall, this study has provided strong empirical evidence linking patient activation with surgical outcomes and risk of unplanned healthcare utilization. Our findings are consistent with the available literature. Considering the emerging differences between patients undergoing surgical treatments and patients with chronic medical diseases, further studies would be needed to confirm the validity and reliability of the questionnaire on this type of patient.

CRediT authorship contribution statement

Maria Provenzano: Writing – original draft, Methodology, Investigation, Conceptualization. **Nicola Cillara:** Supervision, Investigation, Conceptualization. **Mauro Podda:** Writing – review & editing, Investigation. **Enrico Cicalò:** Visualization. **Giovanni Sotgiu:** Formal analysis. **Pietro Fransvea:** Investigation. **Gaetano Poillucci:** Writing – review & editing, Investigation. **Raffaele Sechi:** Investigation. **Antonello Deserra:** Investigation. **Maria Jiménez-Herrera:** Supervision.

Data availability

Data available on request at the following address: ncillara@gmail.com.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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