

Public Perceptions of Robotic versus Laparoscopic Surgery in India: A Knowledge, Attitudes, and Perceptions (KAP) Survey

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Abstract

Background: Minimally invasive surgery (MIS) has transformed surgical care by reducing postoperative pain, complications, and recovery time. Laparoscopic surgery and robotic-assisted surgery (RAS) are the two principal MIS approaches; however, public understanding of their differences remains limited. This study assessed the knowledge, attitudes, and perceptions (KAP) of the Indian public toward laparoscopic and robotic surgery.

Methods: A cross-sectional, questionnaire-based survey was conducted among Indian adults (≥ 18 years) who were patients or caregivers involved in surgical decision-making. The survey instrument was adapted from a previously published questionnaire developed by Brar et al. (2024). The 20-item online survey assessed demographics, knowledge, perceptions of safety and cost, and surgical preferences. Healthcare professionals were excluded from participation. Data were analyzed using descriptive statistics.

Results: Forty-six respondents completed the survey (52.2% males; 47.8% females). Doctors were the primary source of information for laparoscopic (61.0%) and robotic surgery (43.5%). Most participants (60.9%) perceived both approaches as equally safe, while 28.3% believed robotic surgery offered better outcomes. Robotic surgery was perceived as more expensive by 80.4% of respondents. Mean trust scores were high for both techniques on a five-point Likert scale (laparoscopic: 4.26 ± 0.85 ; robotic: 4.08 ± 0.94). Surgical decisions were mainly influenced by physicians (60.9%), followed by self-education (32.6%).

Conclusion: Respondents demonstrated high awareness and trust in minimally invasive surgery. Both laparoscopic and robotic approaches were perceived as safe and effective; however, robotic surgery was viewed as more expensive. Surgical decision-making remained predominantly doctor-led, with an emerging trend toward patient self-education and shared decision-making.

Keywords: Robotic surgery; Laparoscopic surgery; Public perception; Minimally invasive surgery; Surgical decision-making;

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Introduction

Minimally invasive surgery (MIS) has revolutionized surgical care by offering clear advantages over open surgery, including reduced postoperative pain, fewer wound complications, shorter hospital stays, and faster recovery times [1].

Laparoscopic surgery is a minimally invasive surgical technique performed through small abdominal or body wall incisions using long, camera-guided instruments and specialized ports. A high-definition camera provides real-time visualization of internal structures, allowing surgeons to perform procedures with precision while minimizing tissue trauma compared with open surgery. Among MIS techniques, laparoscopic surgery and robotic-assisted surgery (RAS) are the two most widely practiced approaches. While both share similar advantages, key distinctions exist. Foundational work demonstrated the technical feasibility and potential advantages of robotic surgery [1]. Subsequent evidence and meta-analyses have shown that robotic-assisted surgery is generally comparable to laparoscopy for many procedures and may offer advantages in selected complex operations, particularly in terms of reduced blood loss, lower conversion rates, and improved surgeon ergonomics, although it is often associated with longer operative times and higher costs [2]. Robotic techniques have been particularly advantageous in complex procedures that require precise manipulation within confined anatomical spaces.

Despite these technological advances, studies in both Western and Asian populations indicate that public understanding of the differences between laparoscopic and robotic surgery remains limited, with misconceptions remaining common. Early literature reported confusion regarding the role of robotic systems in surgery [1], while more recent studies have shown that many individuals believe robotic systems operate autonomously or perceive robotic and laparoscopic procedures as equivalent, highlighting persistent gaps in surgical health literacy [3,4].

In the Indian context, adoption of robotic-assisted surgery has increased steadily over the past decade. Literature describes a growing presence of robotic systems across tertiary care centers, alongside challenges related to cost, access, specialized training requirements, and infrastructural constraints [5].

Despite this growth, robotic surgery continues to constitute a smaller proportion of procedures compared with laparoscopy [6]. Reports estimate that more than 300 robotic systems are installed nationwide, with over 60,000 robotic-assisted procedures performed annually [7-9].

Public acceptance of robotic-assisted surgery is influenced by multiple factors, including trust in technology, perceived safety, quality of clinician-patient communication, and patient e-health literacy [3,10]. However, data examining public-level understanding, attitudes, and decision-making related to laparoscopic and robotic surgery in the Indian population remain limited.

This study aims to assess public awareness and perceptions of laparoscopic and robotic surgery in India. It seeks to evaluate the prevalence of misconceptions, compare perceived safety and clinical outcomes, examine economic considerations, and identify key factors influencing surgical decision-making.

Methodology

This cross-sectional study assessed public knowledge, attitudes, and perceptions (KAP) regarding laparoscopic and robotic surgery in India.

The survey instrument was adapted from a previously published questionnaire by Brar et al. (2024) titled *“Robotic Surgery: Public Perceptions and Current Misconceptions.”* The adapted questionnaire underwent internal content validation by independent subject experts to ensure contextual relevance and clarity. A pilot test was conducted among five individuals representative of the target population to assess readability, comprehension, and completion time. Participants were informed that they could withdraw at any time by closing the survey. Data were analyzed using descriptive statistical methods. Participants were informed that they could withdraw at any time by closing the survey. Minor wording refinements were made based on feedback, and no structural changes were required.

The survey was administered online using Google Forms. Eligible participants were adults aged ≥ 18 years residing in India who had decision-making authority regarding surgical care for themselves or family members. Healthcare professionals were excluded to minimize professional bias.

Participation was voluntary, and no personally identifiable information was collected, ensuring anonymity and confidentiality. Participants were informed that they could withdraw at any time by closing the survey. Upon completion of the survey, participants were provided with an educational video explaining the key differences between laparoscopic and robotic surgery to promote informed understanding of both surgical approaches.

The questionnaire consisted of 20 items organized into four domains:

1. Demographic characteristics
2. Knowledge of laparoscopic and robotic surgery
3. Perceptions of safety, cost, and outcomes
4. Attitudes and preferences regarding surgical decision-making

Response formats included multiple-choice questions, binary (Yes/No) options, and five-point Likert scales (1 = very low to 5 = very high). Demographic variables collected included age, gender, education level, and role in surgical decision-making. Awareness was assessed based on prior exposure to laparoscopic or robotic surgery and sources of information such as physicians, media, and family members.

Attitude and perception domains explored participants' trust in each surgical approach, perceived safety, and preferences. An optional open-ended question allowed participants to describe their reasoning and information needs when choosing between laparoscopic and robotic surgery.

As this study involved an anonymous, voluntary, non-interventional online survey with no collection of personally identifiable information, formal institutional ethics committee approval was deemed not mandatory in accordance with commonly accepted guidelines for minimal-risk survey-based research. The study adhered to the ethical principles outlined in the Declaration of Helsinki and applicable national ethical guidance for anonymous questionnaire-based research. Electronic informed consent was obtained from all participants prior to survey initiation.

Participants were recruited using convenience sampling through WhatsApp and other social media platforms. Convenience sampling was selected due

to the exploratory nature of the study. To prevent duplicate responses, each participant was permitted a single submission.

Results

A total of 46 respondents completed the survey, and all responses were included in the final analysis.

Participant Demographics

Table 1 presents the demographic characteristics of the study population. Of the 46 participants, 52.2% were males and 47.8% were females. Approximately half of the respondents were aged 46–60 years, followed by participants aged >60 years, those aged 31–45 years, and those aged 18–30 years, in descending order of frequency.

The sample comprised predominantly postgraduate-educated participants, followed by graduates, and a smaller proportion of participants who had completed school-level education only.

Sources of Information

Table 2 summarizes respondents' sources of information regarding laparoscopic and robotic surgery.

For laparoscopic surgery, doctors were the predominant source of information (61.0%), followed by friends and family (19.5%), television/news media (12.2%), social media (4.9%), and workplace exposure (2.4%).

For robotic surgery, doctors remained the most common source (43.5%), though media platforms played a greater role, with 21.7% citing television/news media and 21.7% citing social media.

Perceptions of Safety, Outcomes, and Cost

Participants' perceptions regarding the safety, outcomes, and cost differences between laparoscopic and robotic surgery are shown in Table 3.

A majority of respondents (60.9%) perceived both techniques as equally safe. When asked which technique produced better outcomes, 28.3% favored robotic surgery, 34.8% considered both approaches comparable, 34.8% were uncertain, and 2.2% favored laparoscopic surgery. Regarding cost, 80.4% identified robotic surgery as the more expensive option.

Trust Ratings (Table 4)

Participants rated their trust in laparoscopic and robotic surgery on a five-point Likert scale (1 = very low trust; 5 = very high trust).

Laparoscopic surgery achieved a mean trust score of 4.26 ± 0.85 , while robotic surgery had a mean score of 4.08 ± 0.94 , indicating a slightly higher level of trust in laparoscopy.

Decision-Making Influences and Information Priorities (Table 5)

Physician advice was the predominant influence on participants' surgical decision-making (60.9%), followed by self-education and personal judgment (32.6%). When asked about the major factor influencing surgical choice, 46.5% reported trust in the doctor's expertise, followed by shared or informed decision-making (23.3%) and surgeon reputation (9.3%).

Information priorities before choosing between laparoscopic and robotic surgery were primarily related to safety, risks, and complications (23.9%), followed by cost and financial considerations (21.7%) and procedure-related details (21.7%).

Table 1. Background information

Frequency (n=46)		%
Gender		
Male	24	52.2
Female	22	47.8
X ² : 0.0212, p value: 0.88		
Age		
18-30	2	4.3
31-45	10	21.7
46-60	23	50.0
>60	11	23.9
X ² : 17.6, p value: < 0.001		
Education level		

Table 2. Sources of information about laparoscopic and robotic surgery

Source	Laparoscopic Surgery		Robotic surgery	
	n	%	n	%
Doctor	25	61.0	20	43.5
Friends/Family	8	19.5	6	13.0
News/TV	5	12.2	10	21.7
Social media	2	4.9	10	21.7
work	1	2.4	0	0.0

Table 3. Participants' perceptions of safety, outcomes, and cost

	Laparoscopic surgery	Robotic surgery	Both are almost same	Not sure	p value
Which of the two types of surgery do you think is safer for patients?	6 (13.0%)	2 (4.3%)	28 (60.9%)	10 (21.7%)	<0.0001
Which of the two types of surgery do you think gives better results?	1 (2.2%)	13 (28.3%)	16 (34.8%)	16 (34.8%)	0.004
Which of the two types of surgery do you think costs more?	1 (2.2%)	37 (80.4%)	3 (6.5%)	5 (10.9%)	<0.0001
If both options were available, which would you prefer for yourself or your family?	14 (30.4%)	10 (21.7%)	15 (32.6%)	8 (17.4%)	0.43

Table 4. Trust ratings for laparoscopic and robotic surgery

Trust rating	Laparoscopic surgery	Robotic surgery
1	1	0
2	0	3
3	6	9
4	18	14
5	21	19
Mean + SD	4.26 + 0.85	4.08 + 0.94
t = 0.96, p value: 0.34		

Table 5. Determinants of surgical decision-making and information priorities

	n	%
If you recently heard about Robotic technologies, what would you rely on most when deciding?		
Cost of surgery	1	2.2
Doctor's advice	28	60.9
Family's opinion	1	2.2
My own judgment after reading/learning	15	32.6
Along with doctor advice will also read myself	1	2.2
Reason for Choice of the surgery		
Trust in doctor's expertise and advice	20	46.5
Shared or informed decision-making (doctor + self-study + multiple opinions)	10	23.3
Dependence on illness or case-specific factors	3	7.0
Awareness, technology, and self-education	3	7.0
Trust and confidence in the surgeon	4	9.3
Cost	1	2.3
Professional / healthcare background	2	4.7
What kind of information would you like to know before choosing between robotic and laparoscopic surgery? *		
Cost & Financial Aspects	10	21.7
Safety, Risks & Complications	11	23.9
Recovery & Healing	7	15.2
Success Rate & Outcomes	9	19.6
Procedure Details & Differences	10	21.7
Surgeon Expertise & Experience	5	10.9
Case-specific Information / Appropriateness	5	10.9
Availability & Access	2	4.3
General / Other / Everything	7	15.2

*Multiple responses

Discussion

As surgical technology continues to advance more rapidly than public understanding, bridging the gap between innovation and perception remains important. This cross-sectional KAP study provides an exploratory overview of how members of the Indian public perceive and differentiate between laparoscopic and robotic surgery, two key modalities of minimally invasive surgery (MIS). Overall, participants expressed high levels of trust in both techniques, identified doctors as their primary source of surgical information, and demonstrated openness toward technological innovation. However, the relatively high educational background of respondents in this sample may have influenced awareness levels and perceptions, and these findings should therefore be interpreted cautiously when considering the broader and more diverse Indian population. Persistent uncertainty regarding safety, cost, and the role of robotic systems suggests that

public understanding has not fully kept pace with clinical adoption.

In this study, doctors were the most frequently cited source of information for both laparoscopic (61.0%) and robotic surgery (43.5%). This finding underscores the central role of clinicians in shaping patient understanding when newer surgical technologies are introduced. For robotic surgery in particular, a substantial proportion of respondents reported obtaining information from television, news media, or social media platforms. While these channels can increase awareness, they also carry a recognized risk of misinformation. Systematic reviews have reported that a significant proportion of health-related content disseminated through digital platforms contains inaccuracies or misleading claims [11,12]. Consequently, information acquired through such sources may not reliably translate into accurate understanding and may contribute to unrealistic expectations regarding surgical outcomes.

A majority of respondents (60.9%) perceived laparoscopic and robotic surgery to be equally safe, suggesting that both approaches are broadly recognized as minimally invasive techniques with comparable risk profiles. However, the findings indicate that gaps in understanding persist, particularly with respect to robotic surgery. This tendency to associate newer technology with improved outcomes reflects a broader pattern of “technology optimism,” which has been described in technology adoption frameworks such as the Technology Acceptance Model (TAM) [13]. Evidence indicates that robotic surgery does not consistently outperform laparoscopy across all procedures, with benefits often limited to selected complex operations [2].

Cost emerged as a prominent differentiating factor, with 80.4% of participants perceiving robotic surgery as more expensive. This perception is consistent with literature documenting the higher capital, maintenance, and operational costs associated with robotic platforms [14]. In the Indian context, where affordability strongly influences treatment decisions, cost-related concerns may act as a practical barrier to wider public acceptance of robotic surgery, despite perceived technological advantages.

Trust ratings for both surgical approaches were high, with slightly higher mean trust scores for laparoscopy compared with robotic surgery. This difference may reflect the longer history, greater familiarity, and wider availability of laparoscopic surgery within Indian healthcare settings. Laparoscopy has been routinely practiced for decades, allowing patients to draw on personal or community experiences, which may reinforce confidence. In contrast, robotic surgery remains less accessible, limiting firsthand exposure and familiarity among patients.

The present findings are broadly consistent with prior work by Brar et al. (2024), who reported moderate-to-high comfort levels with robotic surgery and identified cost and limited understanding as key concerns [15]. Participants in the current study demonstrated trust in minimally invasive techniques while simultaneously expressing uncertainty regarding robotic technology. The reliance on digital media for initial exposure to robotic surgery further

highlights the growing influence of non-clinical information sources on patient perceptions.

Decision-making remained predominantly doctor-led, with 60.9% of respondents indicating that they would rely primarily on their physician’s advice when considering robotic surgery. This finding aligns with data showing that doctors remain the most trusted source of health information in India [4]. At the same time, some participants reported engaging in self-education or shared decision-making, suggesting a gradual shift towards participatory models of care. This evolving dynamic highlights the importance of ensuring that patients have access to accurate, balanced, and comprehensible information when evaluating surgical options.

When asked about information priorities, respondents most frequently cited safety, risks, and complications, followed by cost considerations and procedural details. This emphasis indicates that patients prioritize outcome-oriented information over purely technological attributes. The importance placed on surgeon expertise is consistent with existing evidence demonstrating that patient trust is often more closely linked to confidence in the surgeon than to the technology itself [3].

These findings suggest that while Indian patients appear receptive to surgical innovation, their preferences are shaped by perceived safety, affordability, and trust in medical professionals. Efforts to address knowledge gaps should therefore focus on strengthening clinician patient communication, promoting responsible digital health literacy, and ensuring transparent discussions around the benefits, limitations, and costs of emerging surgical technologies.

Looking ahead, emerging technologies such as artificial intelligence (AI)-assisted surgical planning, intraoperative decision support systems, and augmented reality-guided procedures are expected to further transform minimally invasive surgery. As these technologies become increasingly integrated into clinical workflows, public perceptions of surgical innovation will likely evolve alongside them. Understanding patient trust, technology acceptance, and expectations will therefore remain essential to ensuring informed consent and patient-centered adoption of future surgical platforms [16].

Limitations & Future Recommendations

This study has several limitations. The small sample size and use of convenience sampling limit generalizability and introduce potential selection and digital access bias, particularly given the relatively high educational level of respondents. As participation required internet access, the findings may not fully represent the broader and socioeconomically diverse Indian population.

Responses were based on self-reported perceptions rather than actual surgical experiences and may be subject to recall or social desirability bias. Additionally, socioeconomic and geographic factors influencing access to robotic surgery were not directly assessed.

Larger, multicentre studies involving more diverse populations are needed to better understand public perceptions of minimally invasive surgical technologies in India. Future large-scale studies exploring regional, socioeconomic, and digital literacy variations will be important to guide patient education strategies and policy development.

Conclusion

This study demonstrates that while public awareness of laparoscopic and robotic surgery in India is considerable, notable knowledge gaps persist. Doctors remain the most trusted source of surgical information; however, the growing influence of digital and mass media highlights the need for accurate and reliable public communication. Although both approaches are widely perceived as safe and effective, robotic surgery is frequently associated with higher costs and limited accessibility, which may contribute to its comparatively lower acceptance.

Surgical decision-making remains predominantly doctor-led, but an emerging trend toward patient self-education suggests a shift toward shared decision-making. Targeted patient education and transparent clinician communication are essential to align expectations with clinical realities.

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Declaration of conflicts of interest statement: Authors declare no conflict of interests.

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