INTERNATIONAL JOURNAL OF ADVANCED RESEARCH
International Peer-Reviewed Research Journal
ISSN (Online): 3106-7980 | ISSN (Print): 3106-7972
Volume 3 • Issue 7 • November 2026

ROBOTS IN THE OPERATING ROOM: UNVEILING THE PERCEPTIONS AND AWARENESS OF HEALTHCARE WORKERS ABOUT ROBOTIC SURGERY IN PAKISTAN

Dr Ali Mansoor[*1], Dr Arham Rehman[2], Dr Hammad Hussain[3], Dr. Ahmad Hassan[4], Dr Ayesha Gull[5]

[*1,2,3,4,5]*House Officer*

[*1]am5757151@gmail.com, [2]arham.malikrehman135@gmail.com, [3]hammadhussain6277@gmail.com, [4]ahgondal20@gmail.com, [5]ayeshagull1704@gmail.com

DOI: https://doi.org/10.5281/zenodo.24132954

Keywords
Robotic surgery; Robotic-assisted surgery (RAS); Perception; Awareness

Article History
Received: 05 August 2026
Accepted: 19 October 2026
Published: 11 November 2026

Copyright @Author
Corresponding Author: *
Dr Ali Mansoor

Abstract

Background: *The adoption of robotic surgery is revolutionizing medical practice globally, offering precision and minimally invasive options. In Pakistan, where traditional medicine coexists with innovation, understanding healthcare workers' perceptions and awareness of this technology is pivotal for its successful implementation in the future.*

Methods: *This quantitative cross-sectional study involved 298 healthcare workers across Pakistan. The 17-day online survey was conducted from September 13 to September 29, 2025. We explored demographics, awareness, and perceptions of robotic surgery among healthcare workers. Data were collected voluntarily through online surveys and analyzed using SPSS.*

Results: *The study sample had a well-balanced gender distribution, diverse professional roles, and representation across medical specialties and healthcare settings. Most respondents were aware of robotic surgery (89.3%), although interest levels varied. The internet and social media were the primary sources of information (81.5%). A substantial majority correctly associated robotic surgery with laparoscopic surgery (78.5%). Concerns regarding surgical malfunctions and perceived cost disparities were prominent. A significant proportion of respondents (76.8%) believed that robotic surgery was not currently implemented in their hospitals. Differing perceptions of the surgeon's role further underscored the study's findings.*

Conclusion: *Healthcare workers in Pakistan are largely aware of robotic surgery, but their understanding of it remains limited. More effort is needed to educate them and to make robotic surgery a routine part of healthcare in Pakistan. Educational initiatives should focus on healthcare professionals, especially in areas where knowledge of robotic surgery is lacking, so that everyone can benefit from this technology.*

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH
International Peer-Reviewed Research Journal
ISSN (Online): 3106-7980 | ISSN (Print): 3106-7972
Volume 3 • Issue 7 • November 2026

INTRODUCTION

In the ever-evolving landscape of modern medicine, the incorporation of robotics into the operating room has sparked a transformative wave, redefining the boundaries of surgical practice. Since the da Vinci surgical robot was approved by the US Food and Drug Administration (FDA), the use of robotic surgery has increased exponentially worldwide.[1] Robotic surgery, as the name suggests, is the use of automated robots by surgeons to perform minimally invasive procedures with accuracy, control, and safety, thereby improving patient outcomes.[2]

The high-resolution, three-dimensional view provided by robotic systems makes the whole process very precise and effortless for the surgeon.[3] The major benefits of these minimally invasive procedures include less postoperative pain, quicker recovery, and minimal scarring compared with traditional surgery.[4]

Like all other procedures, robotic surgery has its limitations. The greatest is the upfront cost of acquiring and maintaining robotic surgical systems, which can be significantly higher than that of traditional surgical instruments. This cost can limit access to robotic surgery for certain healthcare facilities and patients.[5] In addition, surgeons and medical staff need specialized training to operate robotic systems effectively; such training programs can be time-consuming and costly, adding to the overall expense of implementation. Finally, robotic surgery relies heavily on technology, including software, hardware, and electrical systems. Technical malfunctions, software glitches, or power failures can disrupt procedures and potentially compromise patient safety.[6]

As the world embraces technological advancement, Pakistan stands at the crossroads of tradition and innovation, where ancient medical legacies converge with cutting-edge robotic surgery. The introduction of robotic surgery in Pakistan remains at a nascent stage.[7] The first da Vinci Surgical System (DVS) was deployed at the Sindh Government Qatar Hospital in Karachi in 2011;[8] however, this system encountered setbacks owing to inadequate maintenance. A second robotic platform was subsequently established at Civil Hospital Karachi in 2013. In addition, an automated robotic system developed by Cambridge Medical Robotics (CMR) in the United Kingdom was installed at SIUT, Karachi, where it has facilitated more than 100 successful procedures to date. The National Hospital and Medical Centre in Lahore, a private healthcare facility, has also reported 13 robotic surgeries.[9]

The successful integration of such technology, however, demands an in-depth understanding of how healthcare professionals, who are the custodians of medical practice, perceive and engage with this transformative leap. Their perceptions shape the acceptance and adoption of robotic technology and influence its integration within the broader healthcare ecosystem. In light of this, the objectives of our study were:

1. To assess the level of awareness of robotic surgery among healthcare workers in Pakistan.
2. To examine the sources from which healthcare workers in Pakistan acquire information about robotic surgery.
3. To explore healthcare workers' perceptions of and attitudes toward robotic surgery in terms of its safety, effectiveness, and impact on patient care.
4. To provide recommendations for healthcare institutions, policymakers, and educational initiatives, based on the findings, to enhance awareness and integration of robotic surgery within the healthcare landscape of Pakistan.

METHODS

Study Design and Setting

This descriptive, cross-sectional study used a quantitative approach to investigate the perceptions and awareness of healthcare workers regarding robotic surgery in Pakistan. The questionnaire items were selected for their alignment with the research objectives and their previous validation in similar contexts.

Ethical Approval

Ethical approval was obtained from the Ethics Review Committee (ERC). Participation was entirely voluntary, and responses were anonymous to ensure participant privacy.

Sampling and Sample Size

Non-probability convenience sampling was used. The online questionnaire was distributed to healthcare workers in various hospitals across Pakistan through multiple channels, including online messaging applications, QR codes, and social media platforms. The minimum required sample size, calculated using Raosoft software at a 95% confidence level and a 5% margin of error, was 384 respondents; however, only 298 responses were collected. Medical students were intentionally excluded to maintain a focused and homogeneous sample of healthcare professionals.

Data Collection

Data collection commenced on September 13, 2025, and concluded on September 29, 2025, a period of 17 days. The survey comprised three components:

1. **Demographic background:** This component gathered essential demographic information from the participants, enabling a comprehensive understanding of the sample.
2. **Knowledge and awareness about robotic surgery:** This component assessed the level of knowledge and awareness that healthcare workers possess regarding robotic surgery, including its applications and benefits.
3. **Perception of healthcare workers about robotic surgery:** This component explored the attitudes and perceptions of healthcare workers toward robotic surgery, including their views on its safety, effectiveness, and potential impact on patient care.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Frequency tables were computed for all variables to outline the distribution of responses, and percentages were calculated within each group to give a clear representation of the response distribution.

RESULTS

Demographic Characteristics

A total of 298 healthcare workers participated in this study. The gender distribution was relatively balanced, with 152 (51%) male and 146 (49%) female participants. The age distribution of the participants is presented in Table 1.

Table 1. Age distribution of the participants (N = 298)

Age group	Frequency	Percent	Valid percent	Cumulative percent
20–29 years	214	71.8	71.8	71.8
30–39 years	36	12.1	12.1	83.9
40–49 years	15	5.0	5.0	88.9
50+ years	33	11.1	11.1	100.0
Total	**298**	**100.0**	**100.0**	

In terms of professional roles, house officers constituted the majority, with 102 (34.2%) participants. General practitioners accounted for 55 (18.5%), postgraduate (PG) residents for 41 (13.8%), consultants for 29 (9.7%), and medical teachers for 27 (9.1%). This diversity of roles provides a well-rounded perspective on the perceptions and awareness of robotic surgery.

The study also covered various medical specialties. General surgery was the most common, with 28 (9.4%) participants, followed by urology with 22 (7.4%), gynecology and pediatrics with 19 (6.4%) each, and ophthalmology with 12 (4%). With regard to the healthcare setting, 140 (47%) participants were employed in government hospitals and 158 (53%) in private hospitals. This balance between public and private institutions allows insight into how perceptions of robotic surgery vary across healthcare settings.

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH
International Peer-Reviewed Research Journal
ISSN (Online): 3106-7980 | ISSN (Print): 3106-7972
Volume 3 • Issue 7 • November 2026

Awareness of Robotic Surgery

Of the 298 healthcare workers surveyed, 266 (89.3%) reported that they were already familiar with robotic surgery, whereas 32 (10.7%) had no prior knowledge of it. Interest in robotic surgery varied: 138 (47.3%) expressed strong interest, an equal number (138; 47.3%) expressed moderate interest, and 22 (7.4%) expressed no interest at all. Regarding personal experience with robotic technology, 138 (46.4%) participants had interacted with robots in some capacity, while 140 (47%) had never encountered robotic devices. The majority of respondents, 243 (81.5%), acquired their information about robotic surgery mainly from the internet and social media. A smaller proportion, 28 (9.4%), learned about it through their medical college curriculum, and 16 (5.4%) cited workshops and newspapers (Figure 1). This distribution highlights the significant role of digital platforms in disseminating information about robotic surgery within the medical community.

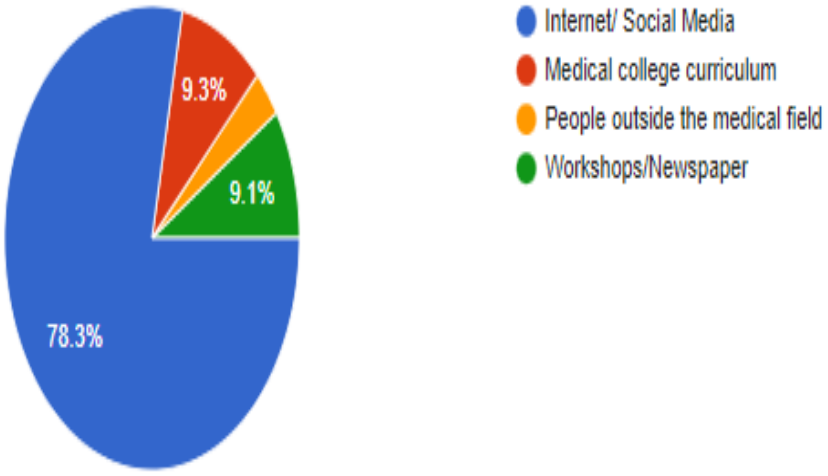


Figure 1. Sources of information about robotic surgery

Most respondents correctly associated robotic surgery with laparoscopic surgery (n = 234/298, 78.5%), whereas 34 (11.4%) mistakenly equated it with laser surgery (Table 2, Figure 2).

Table 2. Type of surgery associated with robotic surgery, by age group

Age group	Traditional open surgery	Laparoscopic / minimally invasive surgery	Laser surgery	Scarless surgery	Total
20–29 years	8	170	27	9	214
30–39 years	3	27	3	3	36
40–49 years	2	12	1	0	15
50+ years	4	25	3	1	33
Total	**17**	**234**	**34**	**13**	**298**

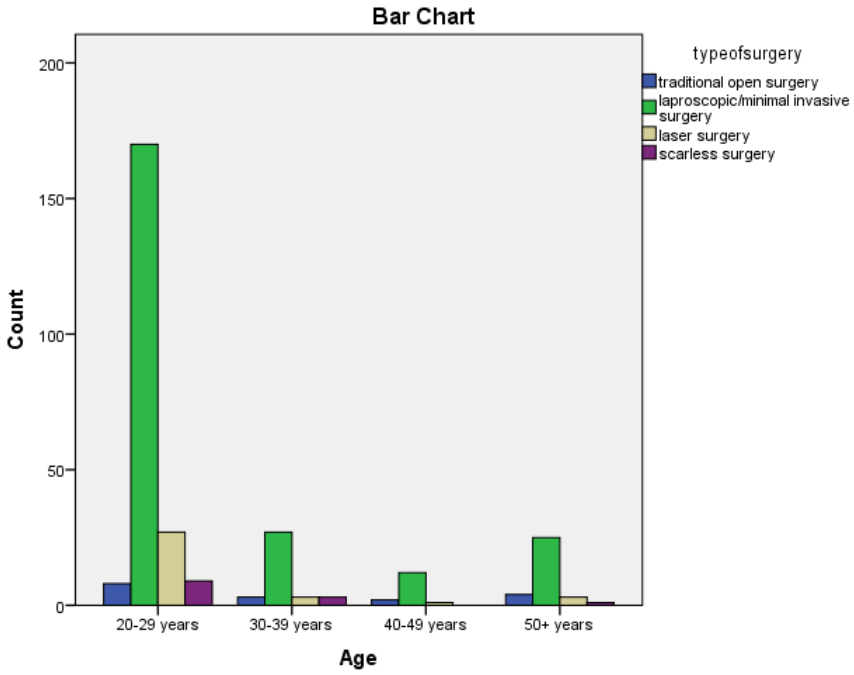


Figure 2. Type of surgery associated with robotic surgery, by age group

Regarding the surgeon's role in robotic surgery, 146 (49%) respondents believed that the surgeon controls the robotic arms and instruments and personally performs the entire operation, whereas 85 (28.5%) thought that the surgeon programs the robot's movements and the robot then performs the surgery independently (Table 3). These findings suggest varying levels of knowledge about the intricacies of robotic surgery among the participants.

Table 3. Respondents' understanding of the surgeon's role in robotic surgery (N = 298)

Statement	Frequency	Percent	Valid percent	Cumulative percent
1. The robot performs the surgery while a trained surgeon stands by and makes sure the robot does things correctly.	45	15.1	15.1	15.1
2. The surgeon controls the robotic arms and instruments, but the surgeon does all of the operating.	146	49.0	49.0	64.1
3. The surgeon programs the moves that the robot should make, then the robot does the surgery.	85	28.5	28.5	92.6
4. The surgeon tells the robot what to do, and the robot then follows each command.	22	7.4	7.4	100.0
Total	**298**	**100.0**	**100.0**	

Respondents were also asked what robotic surgery is associated with, compared with non-robotic surgery (multiple responses allowed; Figure 3). When asked about malfunctions during robotic procedures, 219 (73.5%) were uncertain, 61 (20.5%) believed that such malfunctions had occurred, and 18 believed that they had never happened. In terms of cost, the majority (237; 79.5%) perceived robotic surgery as more expensive than laparoscopic surgery, 32 (10.7%) considered the costs equivalent, and 29 (9.7%) believed robotic surgery to be less expensive. When asked about their personal preference, 170 (59.7%) healthcare workers would not choose robotic surgery for themselves, reflecting their reservations, whereas 120 (40.3%) were willing to undergo it.

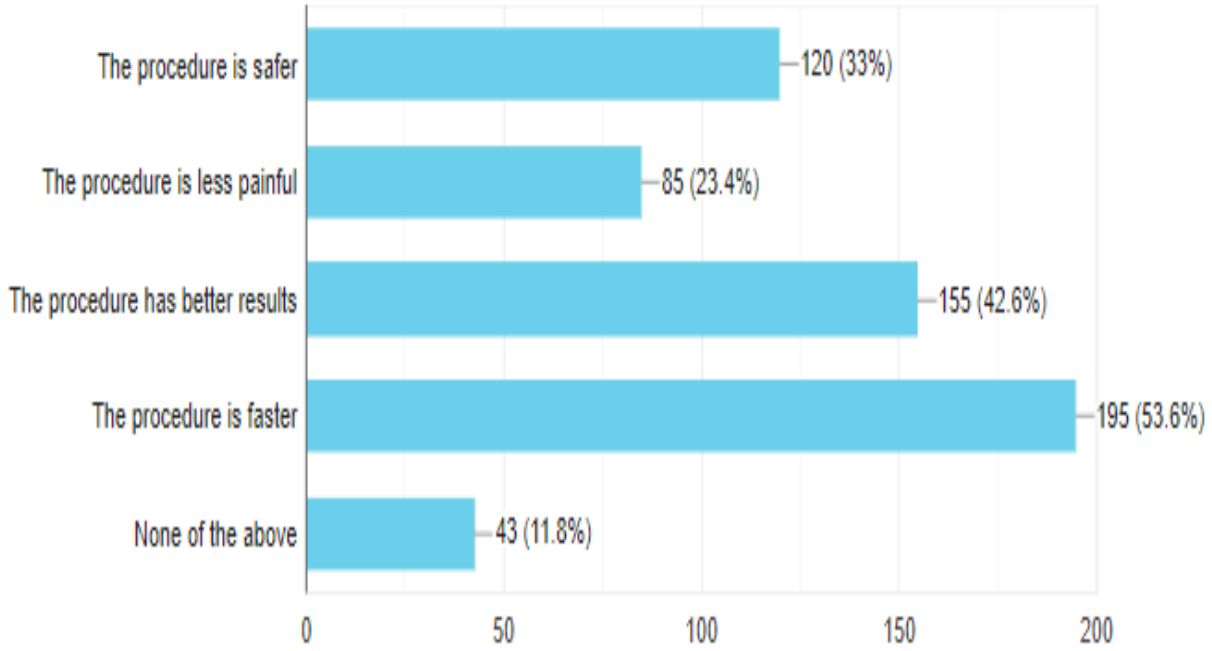


Figure 3. Perceived features of robotic surgery compared with non-robotic surgery (multiple responses allowed)

Furthermore, 140 (47%) healthcare workers perceived robotic surgeons as superior, and an even higher proportion, 201 (67.4%), regarded hospitals offering robotic surgery as better institutions. Finally, 155 (52%) identified remote and minimally invasive surgery as the primary real-world application of robotic surgery (Figure 4). These findings provide valuable insight into healthcare workers' attitudes toward, and beliefs about, the role and capabilities of robotic surgery.

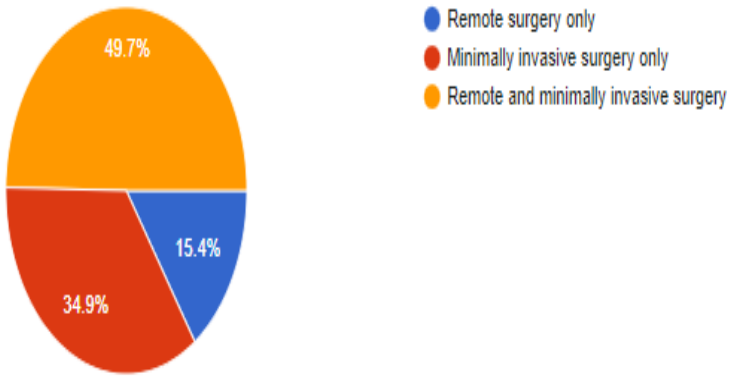


Figure 4. Perceived real-world applications of robotic surgery

Perceptions of Robotic Surgery

The perceptions of healthcare workers about robotic surgery were assessed using a Likert scale. The results are presented in Table 4.

Table 4. Perceptions of healthcare workers regarding robotic surgery, n (%)

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I personally accept robotic surgery in clinical practice.	50 (16.8)	115 (38.6)	105 (35.2)	19 (6.4)	9 (3.0)
I think patients in Pakistan are likely to accept robotic surgery.	23 (7.7)	89 (29.9)	85 (28.5)	79 (26.5)	22 (7.4)
I think robots will improve surgical outcomes.	24 (8.1)	132 (44.3)	94 (31.5)	26 (8.7)	22 (7.4)
I think robots could replace surgeons in the future.	14 (4.7)	70 (23.5)	69 (23.2)	101 (33.9)	44 (14.8)
I think robots can make surgeons weak and reluctant, with less professionalism and experience.	14 (4.7)	78 (26.2)	78 (26.2)	89 (29.9)	39 (13.1)
I think Pakistan should invest more in robotic surgery.	49 (16.4)	131 (44.0)	74 (24.8)	30 (10.1)	14 (4.7)

DISCUSSION

The findings of this study reveal several crucial insights into the perceptions and awareness of healthcare workers regarding robotic-assisted surgery (RAS) in Pakistan. These observations offer a valuable foundation for developing strategic interventions to promote the adoption and integration of robotic surgery into the country's healthcare system.

Our results align with the exploratory study by Buabbas et al. (2020),[10] which assessed public awareness of RAS in Kuwait. That study reported that only 36.8% of participants had heard of RAS and a mere 27.1% understood its purpose. Although participants recognized the potential benefits in terms of precision and efficiency, significant concerns were raised regarding safety and the risk of malfunction. Similarly, our study highlighted limited understanding among healthcare workers in Pakistan, emphasizing the need for structured education, training programs, and hands-on exposure to increase familiarity with, and confidence in, robotic systems.

A broader perspective on user interaction with robotics is provided by Youssef et al. (2022),[11] who surveyed recent advances in social robotics. They underlined that the acceptance of robotic technologies is largely driven by user familiarity, contextual application, and real-world experience, findings that echo our own. Healthcare workers who had prior exposure to or training in robotic systems demonstrated greater acceptance and a more positive attitude toward their implementation, reinforcing the importance of practical engagement in building trust in robotic surgical platforms.

In a related context, Croghan et al. (2018)[12] explored the use of robot-assisted surgical ward rounds via telepresence technologies. Their findings showed high feasibility and acceptance of such systems among both staff and patients. Although the technology differed from surgical robotics, the parallels are noteworthy: both studies emphasize that direct interaction with robotic systems improves acceptance, enhances perceived value, and fosters trust among users. This again supports the notion that familiarity is a critical determinant of the successful integration of robotic technologies in clinical settings.

Addressing surgeons' concerns, Verdezoto et al. (2021)[13] discussed the "invisible work" of maintenance in community health, which includes managing infrastructural failures and logistical gaps. Similar to their findings, our study identified apprehensions among surgeons in Pakistan regarding intraoperative system failures, an increased documentation burden, and a perceived loss of surgical autonomy. These insights draw attention to the often-unrecognized behind-the-scenes effort required to implement complex technologies successfully and underscore the importance of supportive infrastructure and workflow alignment.

With regard to cost perceptions and preferences, Muaddi et al. (2022)[14] found that the public often prefers laparoscopic over robotic procedures because of perceived risks and higher costs. In our study, healthcare workers echoed similar concerns, indicating that the high cost of robotic surgery may limit its accessibility and utility in public-sector hospitals. Stakeholders in both contexts prioritized affordability and reliability over technological novelty, suggesting that cost-benefit considerations play a pivotal role in the acceptance of RAS.

Perceptions of surgeon and institutional prestige associated with robotic surgery were evident in both our study and the work of Aldousari et al. (2021).[15] Their cross-sectional study reported that 35.5% of participants believed robotic surgeons to be more skilled, and nearly half viewed hospitals offering robotic services as superior. In Pakistan, healthcare workers similarly expressed that adopting robotic platforms could enhance institutional reputation and attract patients. These shared perceptions indicate that the symbolic value of robotic surgery may influence its adoption beyond purely clinical considerations.

Finally, the study by Ghazanfar et al. (2019)[8] offers critical insight into the practical feasibility of robotic surgery in Pakistan's public sector. Their evaluation of more than 100 procedures revealed acceptable clinical outcomes but highlighted significant financial barriers, including high capital and maintenance costs. These findings closely parallel our own, as healthcare workers emphasized the need for sustainable investment strategies, resource optimization, and institutional commitment to move robotic surgery from isolated trials to routine clinical practice.

LIMITATIONS

Although the study included 298 healthcare workers, the sample may not fully represent Pakistan's diverse healthcare workforce, particularly in rural areas, and it fell short of the calculated minimum sample size of 384. Convenience sampling may have introduced bias, as those more familiar with robotic surgery may have been more likely to participate. The cross-sectional design limits the ability to assess changes over time, and the lack of qualitative data may have restricted deeper insight into participants' views. Future studies should consider broader sampling, longitudinal approaches, and mixed methods for a more comprehensive understanding.

CONCLUSION

Healthcare workers in Pakistan are largely aware of robotic surgery, but their understanding of it remains limited. Our findings suggest that more effort is needed to educate them and to make robotic surgery a routine part of healthcare in Pakistan. Educational initiatives should focus on healthcare professionals, especially in areas where knowledge of robotic surgery is lacking, so that everyone can benefit from this technology.

REFERENCES

Shaligram A, Unnirevi J, Simorov A, Kothari VM, Oleynikov D. How does the robot affect outcomes? A retrospective review of open, laparoscopic, and robotic Heller myotomy for achalasia. Surg Endosc. 2012;26(4):1047–50. https://doi.org/10.1007/s00464-011-1994-5

Lirici MM. Current "robotic surgery": a real breakthrough or a misleading definition of laparoscopy with remote control of mechatronic instrumentation? Minim Invasive Ther Allied Technol. 2022;31:979–80.

Agha R, Muir G. Does laparoscopic surgery spell the end of the open surgeon? J R Soc Med. 2003 Nov;96(11):544–6.

Boys JA, Alicuben ET, DeMeester MJ, Worrell SG, Oh DS, Hagen JA, et al. Public perceptions on robotic surgery, hospitals with robots, and surgeons that use them. Surg Endosc. 2016 Apr;30(4):1310–6.

Chok AY, Zhao Y, Tan IE-H, Au MKH, Tan EJKW. Cost-effectiveness comparison of minimally invasive, robotic and open approaches in colorectal surgery: a systematic review and Bayesian network meta-analysis of randomized clinical trials. Int J Colorectal Dis. 2023 Mar;38(1):86.

Singh S, Bora GS, Devana SS, Mavuduru RS, Singh SK, Mandal AK. Instrument malfunction during robotic surgery: a case report. Indian J Urol. 2016;32:159–60.

Khan S, Khan MZ, Saeed R, Ahmed J, Naveed AK, Shah HH. Age of robotic surgery and telemedicine: is Pakistan lagging behind? Ann Biomed Eng. 2023.

Ghazanfar S, Qureshi S, Zubair M, Fateh U, Ahmed S, Quraishy MS. Feasibility of robotic surgery in a developing country, a public sector perspective. J Pak Med Assoc. 2019 Jan;69(1):44–8.

Ghazanfar S. Robotic surgery and its use in Pakistan. J Dow Univ Health Sci. 2019;13(2):53–4. https://doi.org/10.36570/jduhs.2019.2.001

Buabbas AJ, Aldousari S, Shehab AA. An exploratory study of public awareness about robotics-assisted surgery in Kuwait. BMC Med Inform Decis Mak. 2020 Jul 1;20(1):140.

Youssef K, Said S, Alkork S, Beyrouthy T. A survey on recent advances in social robotics. Robotics. 2022 Jul 18;11(4):75.

Croghan SM, Carroll P, Ridgway PF, Gillis AE, Reade S. Robot-assisted surgical ward rounds: virtually always there. BMJ Health Care Inform. 2018 Jan 1;25(1).

Verdezoto N, Bagalkot N, Akbar SZ, Sharma S, Mackintosh N, Harrington D, Griffiths P. The invisible work of maintenance in community health: challenges and opportunities for digital health to support frontline health workers in Karnataka, South India. Proc ACM Hum-Comput Interact. 2021 Apr 22;5(CSCW1):1–31.

Muaddi H, Zhao X, Leonardelli GJ, de Mestral C, Nathens A, Stukel TA, Guttman MP, Karanicolas PJ. Fear of innovation: public's perception of robotic surgery. Surg Endosc. 2022 Aug;36(8):6076–83.

Aldousari SA, Buabbas AJ, Yaiesh SM, Alyousef RJ, Alenezi AN. Multiple perceptions of robotic-assisted surgery among surgeons and patients: a cross-sectional study. J Robot Surg. 2021 Aug;15(4):529–38.

International Journal of Advanced Research