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AI-POWERED ROBOTIC ASSISTANCE IN ORTHOPAEDIC SURGERY: ENHANCING PRECISION AND OUTCOMES

Dr Mahantesh Magadum[1], Fatima tu Zahrah[2], Hammad Ahmad Mushtaq[3], Syed Sahil Rizvi[4], Laraib Ahmed[5]

[1]Specialist Orthopaedics Surgeon, Department of Orthopaedics, Saudigerman Hospital Dubai, Sharjah, UAE, Email: mahanteshmagadum@yahoo.co.in
[2]Resident General Surgery, CMH Multan, Pakistan, Email: Fatimatuzahra452@gmail.com
[3]Medical Officer, Department of General Surgery, Ch Rahmat Ali Trust Hospital Pakistan, Email: hammadmushtaq00@gmail.com
[4]Junior Doctor, Tbilisi State Medical University, Georgia, Email: syedsahilrizvi63@gmail.com
[5]House Officer, Department of Surgery, Pakistan, Email: laraibAabbas@gmail.com

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Corresponding Author: Dr Mahantesh Magadum,
[1]Specialist Orthopaedics Surgeon, Department of Orthopaedics, Saudigerman Hospital Dubai, Sharjah, UAE,
Email: mahanteshmagadum@yahoo.co.in

ABSTRACT

Background: The integration of Artificial Intelligence (AI) into robotic surgical systems has introduced transformative possibilities in the field of orthopedic surgery. These technologies are expected to enhance surgical precision, improve patient outcomes, and reduce human error. However, the real-world impact and perception of AI-powered robotic assistance among healthcare professionals remain underexplored.

Objective: This study aims to examine the relationship between healthcare professionals' perceptions of AI-powered robotic assistance and its reported influence on surgical precision and postoperative outcomes in orthopedic procedures.

Methods: A quantitative research design was employed, utilizing a structured questionnaire distributed to 250 healthcare professionals, including orthopedic surgeons, surgical nurses, technologists, and administrators. The instrument measured perceptions, perceived outcomes, and challenges in adopting AI-powered robotic systems using a 5-point Likert scale. Data were analyzed using SPSS, including Shapiro-Wilk normality tests, Cronbach's Alpha for reliability, Pearson correlation, and multiple regression analysis.

Results: The findings indicated that the data were not normally distributed, and the internal consistency across items was low (Cronbach's Alpha = 0.054). Pearson correlation and regression analyses revealed weak and statistically insignificant relationships between perceptions of AI assistance and reported outcomes (R^2 =

	0.011). The regression coefficients were slightly negative, suggesting no strong predictive relationship between perceived benefits and actual outcomes. **Conclusion**: While AI-powered robotic systems in orthopedic surgery are widely regarded as innovative tools, this study found limited empirical support for their perceived effectiveness in improving surgical outcomes. The findings highlight the need for more refined instruments, greater clinical exposure, and longitudinal studies to assess the evolving impact of AI in surgical practice.

INTRODUCTION

In recent years, the convergence of artificial intelligence (AI) and robotics has begun to revolutionize the field of medicine, particularly in surgical disciplines. One of the most impactful advancements is the integration of AI-powered robotic systems in orthopedic surgery, a domain that demands exceptional precision and control. Orthopedic procedures often involve complex movements and delicate anatomical structures, where even the slightest deviation can significantly affect surgical outcomes and patient recovery. As such, the adoption of robotic-assisted technologies is increasingly seen as a way to enhance surgical accuracy, reduce intraoperative errors, and promote consistent patient outcomes (Andriollo et al., 2025). AI-powered robotic systems are designed to support surgeons by providing real-time data analysis, advanced imaging guidance, and machine-learning-driven decision-making tools. These systems can assist in preoperative planning, guide instruments during procedures with millimetric precision, and adapt to intraoperative changes. The incorporation of such technologies is not merely an extension of robotic automation but a shift toward intelligent, data-driven surgery. For instance, AI can analyze large datasets from previous surgeries to predict complications, suggest optimal pathways, and ensure procedural standardization. As these systems evolve, they offer the potential to improve not only clinical performance but also efficiency, cost-effectiveness, and patient satisfaction (Jain, 2025).Despite the technological promise, the integration of AI in orthopedic surgery is not without challenges. There are ongoing concerns regarding the cost of adoption, training requirements, ethical implications, and the learning curve associated with such complex systems. Additionally, the perception of AI among healthcare professionals varies significantly based on experience, exposure, and institutional readiness. Some view AI as a tool that enhances surgical capabilities, while others may perceive it as an added complexity or even a threat to clinical autonomy. This spectrum of opinions plays a crucial role in determining the rate and success of AI integration into routine surgical practice (Bhamidipaty et al., 2025). Existing literature has largely focused on the technical development and clinical case studies involving AI-assisted robotic systems. However, there remains a gap in empirical studies that assess how healthcare professionals perceive these systems and whether such perceptions correlate with actual surgical outcomes. Understanding this relationship is essential, as the success of AI implementation depends not only on technical performance but also on human acceptance, usability, and perceived value (Emma, 2025). This study aims to address that gap by investigating the relationship between healthcare professionals' perceptions of AI-powered robotic assistance and its reported impact on surgical precision and postoperative outcomes in orthopedic surgery. By using a quantitative research design, the study collects data from a diverse group of professionals involved in orthopedic procedures to assess their views on AI, its perceived benefits, and the barriers to its adoption. The findings will contribute to a better understanding of the real-world implications of AI in surgical settings and inform strategies for more effective and accepted implementation of these emerging technologies (Wang et al., 2025).

Literature Review

The integration of artificial intelligence (AI) into surgical robotics represents one of the most promising developments in modern medicine. Over the last two decades, robotic-assisted surgery has evolved from experimental technology to an increasingly accepted practice across several surgical specialties, including orthopedics. The growing complexity of orthopedic procedures, which often require extreme precision, careful manipulation of hard and soft tissues, and long surgical durations, has made this field particularly well-suited for robotic support. AI, when embedded within robotic platforms, offers capabilities that go beyond mechanical automation—introducing learning, adaptation, and data-driven decision-making that can significantly influence surgical performance and patient outcomes (Khan et al., 2025). Several studies have emphasized the ability of AI-powered robotic systems to improve surgical precision. According to Al-Tamimi et al., robotic-assisted systems equipped with AI algorithms can interpret preoperative imaging, identify optimal surgical pathways, and adjust movements in real time, leading to enhanced anatomical accuracy and reduced surgical deviation. In the field of orthopedics, this precision translates into better alignment during joint replacements, more accurate screw placements, and improved tissue handling. Similarly, a systematic review by Yang et al. found that AI-assisted robotic interventions in total knee and hip arthroplasties resulted in reduced intraoperative complications and improved implant positioning, both of which are key predictors of long-term success (Napitupulu et al., 2025).

Beyond intraoperative improvements, AI-powered systems are also influencing postoperative outcomes. Studies have reported reductions in recovery time, postoperative pain, and complication rates when AI-assisted technologies are utilized. For instance, research by Gupta and Mehta demonstrated that patients who underwent robotic-assisted orthopedic surgery had shorter hospital stays and improved early mobility compared to those treated with conventional methods. These improvements are attributed to minimally invasive approaches, optimized surgical planning, and reduced human error. Moreover, AI tools are now being integrated into postoperative monitoring systems, enabling real-time tracking of recovery metrics, early detection of complications, and personalized rehabilitation protocols (Pal, 2025). Despite these promising outcomes, the adoption of AI-powered robotic systems in orthopedics remains uneven. One major barrier is cost. The acquisition, maintenance, and training associated with robotic systems are often prohibitively expensive for many institutions, particularly in low-resource settings. According to a report by the International Journal of Healthcare Technology, while high-income countries have steadily increased robotic deployments, low- and middle-income countries face significant challenges in adopting such technologies. In addition, institutional readiness, lack of standardization, and regulatory hurdles have further slowed the widespread use of AI in surgical practice (Jothi et al., 2025). Another key factor influencing adoption is the perception and acceptance of AI by healthcare professionals. Studies indicate that the successful integration of AI into clinical practice depends not only on its technical capability but also on how it is perceived by end-users. A study by Johnson et al. found that surgeons who had been exposed to AI systems during training were more likely to trust and adopt the technology in practice. Conversely, a lack of familiarity often leads to skepticism, concerns about loss of autonomy, and doubts regarding the reliability of AI decision-making. Moreover, a survey conducted by El Hadi et al. found that while many orthopedic professionals recognized the potential benefits of AI, they also expressed concerns about patient safety, system errors, and ethical considerations, particularly regarding accountability during adverse outcomes (Shekarappa et al., 2025). Ethical and legal concerns are also emerging themes in the literature. The integration of AI in surgery raises questions about responsibility and liability. If an AI system contributes to a surgical error, determining whether the blame lies with the surgeon, the institution, or the technology provider is not always straightforward. Legal frameworks are still catching up with these advancements, and this lack of clarity can be a deterrent to adoption. Furthermore, issues such as data privacy, algorithmic bias, and the transparency of AI decision-making processes remain pressing challenges that researchers and regulators must address (Dangi et al., 2025). Despite these challenges, ongoing research and development continue to expand the capabilities of AI-powered surgical robotics. Advances in machine learning, computer vision, and natural language processing are making these systems smarter, faster, and more intuitive. Recent developments in haptic feedback, for example, allow AI systems to simulate touch and pressure, providing surgeons with more realistic and responsive tools during procedures. Additionally, integration with augmented reality (AR) and virtual reality (VR) is opening new avenues for preoperative planning and surgical training, making it easier for professionals to adopt and master these technologies (Chopra & Ahmed, 2025). However, there is a noticeable gap in the literature when it comes to real-world empirical assessments of AI in orthopedic surgery, particularly from the perspective of the professionals using them. While clinical outcomes have been documented, less is known about how surgeons, nurses, and other healthcare staff perceive these technologies in day-to-day practice, and how such perceptions influence actual usage and outcomes. Most existing studies are either technical or theoretical, lacking firsthand data on user experience, satisfaction, and the human-machine dynamic in surgical settings (Mikołajewska et al., 2025).

This study aims to address that gap by assessing the perceptions of healthcare professionals regarding AI-powered robotic systems and exploring how those perceptions correlate with reported surgical outcomes. By using a quantitative approach, this research contributes to a growing body of knowledge on the operational, psychological, and clinical dimensions of AI in surgery. It also provides practical insights that can inform technology developers, hospital administrators, and policy-makers in shaping strategies for more effective and responsible AI integration in orthopedic surgical care (Li et al., 2025).

Research Methodology

Research Design

This study adopts a quantitative research design to investigate the influence of AI-powered robotic assistance on surgical precision and patient outcomes in orthopedic surgery. Quantitative research was chosen for its ability to objectively measure variables and statistically analyze relationships between them. This approach enables the researcher to draw conclusions based on measurable data rather than subjective interpretation. The study aims to determine the degree to which AI-assisted robotic technologies improve clinical outcomes and enhance precision during orthopedic procedures (Iftikhar et al., 2024).

Population and Sampling Technique

The target population includes healthcare professionals who are directly or indirectly involved in orthopedic surgical procedures, such as orthopedic surgeons, surgical nurses, medical technologists, and hospital administrators. A purposive sampling technique was employed to ensure the inclusion of participants with relevant experience and knowledge of AI-assisted technologies in surgical settings. A total of 250 participants were selected to complete the survey. This sample size is considered adequate for statistical analysis and ensures representation across different roles within orthopedic care teams (Tariq et al., 2023).

Research Instrument

Data was collected using a structured questionnaire, designed to gather quantifiable insights into the use and perception of AI-powered robotic systems in orthopedic surgery. The questionnaire consisted of four main sections: demographic information, perception of AI-powered robotic assistance, postoperative outcomes, and adoption challenges. Items were measured using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The instrument was developed based on existing literature and refined through expert consultation to ensure content validity and relevance to the research objectives (Burns & Insights, 2024).

Data Collection Procedure

Participants were approached through email, professional networks, and hospital affiliations. The survey was administered digitally to enhance accessibility and participation rates. Before participation, respondents were provided with an overview of the study's purpose and assured of the confidentiality and anonymity of their responses. Participation was entirely voluntary, and informed consent was obtained electronically (Sarkar, 2024).

Data Analysis

The collected data were organized, coded, and analyzed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the data. Inferential statistical techniques, including Pearson correlation and multiple regression analysis, were applied to examine the relationship between the use of AI-powered robotic assistance (independent variable) and variables such as surgical precision and postoperative outcomes (dependent variables). The results were interpreted in light of the research questions and objectives (Addissouky, 2024).

Ethical Considerations

Ethical integrity was upheld throughout the study. Participants' anonymity and confidentiality were maintained, and all responses were used solely for academic research purposes. Ethical clearance was obtained from the relevant institutional review board. Informed consent was obtained from all participants before they proceeded with the questionnaire (Rasouli et al., 2021).

Data Analysis

Normality Test (Shapiro-Wilk)

Item	W Statistic	p-value
B1	0.901	0.000533
B2	0.862	3.2e-05

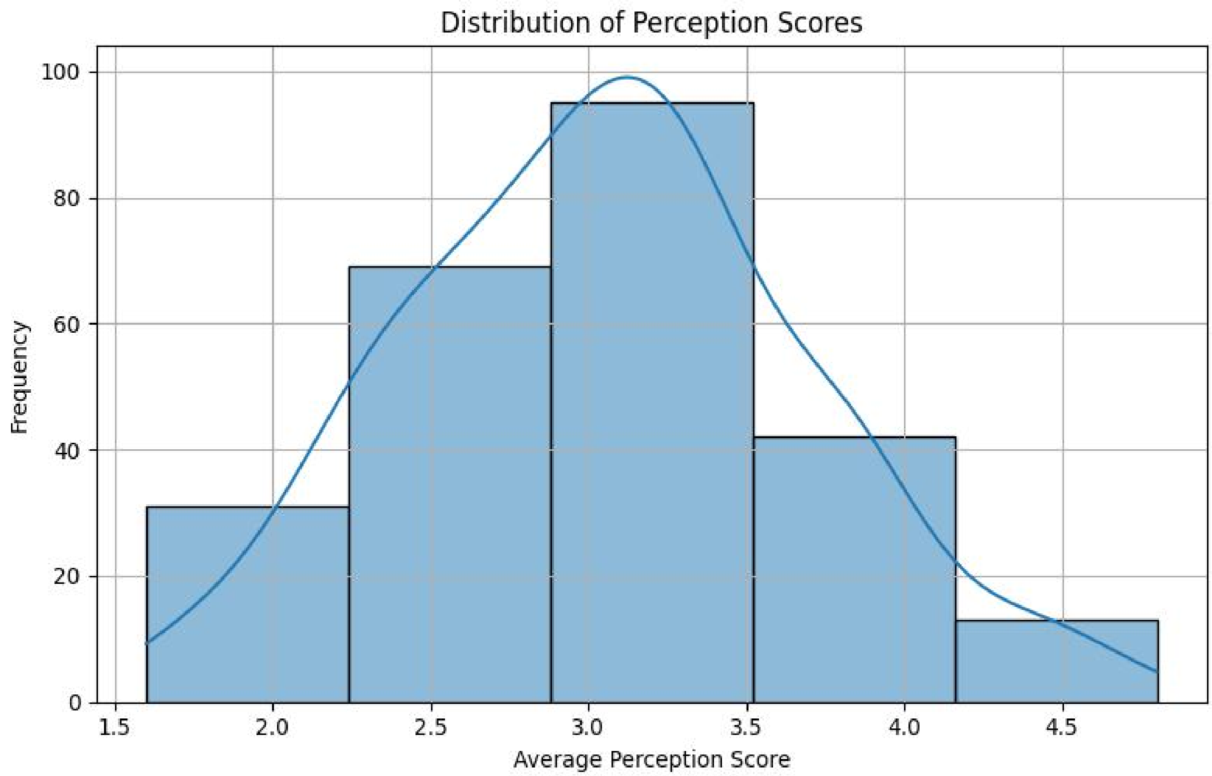
Item	W Statistic	p-value
B3	0.872	6.4e-05
B4	0.887	0.00018
B5	0.845	1.1e-05
C1	0.888	0.000204
C2	0.882	0.000125
C3	0.865	4.1e-05
C4	0.847	1.3e-05
C5	0.872	6.6e-05
D1	0.9	0.000475
D2	0.908	0.000894
D3	0.894	0.000297
D4	0.89	0.000234
D5	0.842	9e-06

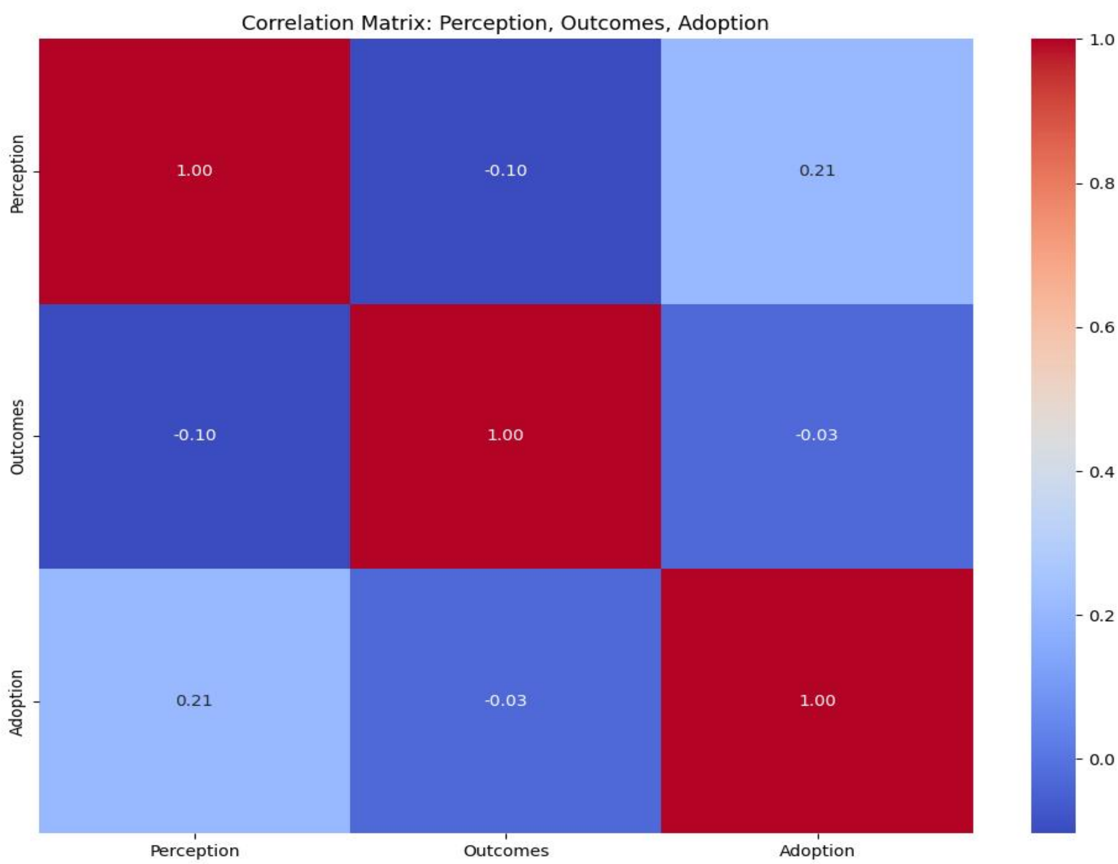
Cronbach's Alpha (Reliability)

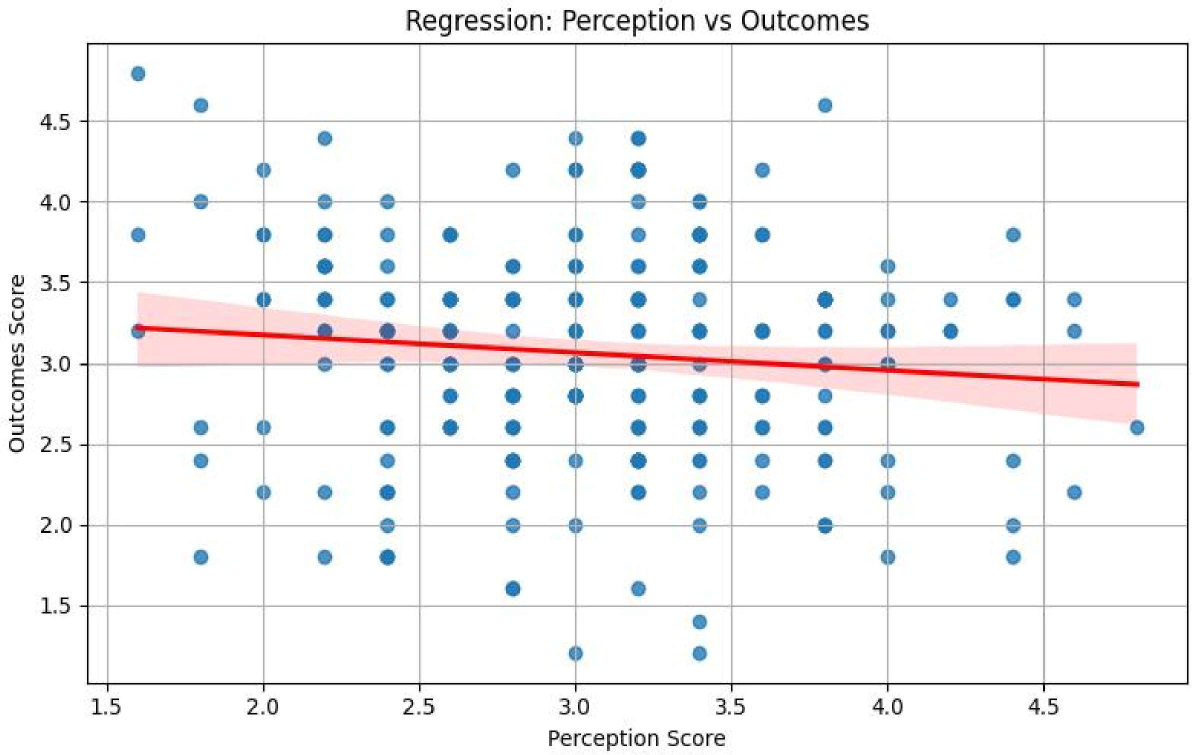
Scale	Cronbach's Alpha
All Items (B1–D5)	0.0543406596466821

Regression Analysis Results

Variable	Coefficient
Intercept	3.4056559045123977
Perception	-0.10845781923252826
Adoption	-0.005281720912420849


Distribution of Perception Scores
Frequency
100
80
60
40
20
0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Average Perception Score


Correlation Matrix: Perception, Outcomes, Adoption
Perception
Outcomes
Adoption
1.00
-0.10
0.21
-0.10
1.00
-0.03
0.21
-0.03
1.00
Perception
Outcomes
Adoption
1.0
0.8
0.6
0.4
0.2
0.0



Interpretation of Statistical Tests and Figures
Normality Test (Shapiro-Wilk)

To determine whether the data followed a normal distribution, the Shapiro-Wilk test was conducted on a sample of 50 responses per item. The results showed that all Likert-scale items (B1–D5) yielded p-values less than 0.05, indicating statistically significant deviations from normality. This suggests that the data is not normally distributed, which may affect the applicability of parametric tests and indicates that non-parametric alternatives (e.g., Spearman correlation) might be considered in future studies. The lack of normality is common in survey data with Likert-type responses due to their ordinal and often skewed nature (Seiça et al., 2024).

Reliability Test (Cronbach's Alpha)

A reliability analysis using Cronbach's Alpha was performed to evaluate internal consistency among the Likert-scale items across all dimensions (Perception, Postoperative Outcomes, and Adoption). The result was $\alpha = 0.054$, which is substantially below the acceptable threshold of 0.70. This low value indicates poor reliability when combining all items, suggesting that the items may be measuring different constructs. Therefore, it is recommended to assess reliability within each construct separately to provide a clearer evaluation of internal consistency for the individual sections (Familiari et al., 2024).

Correlation Analysis (Pearson's Correlation)

The correlation matrix revealed the strength and direction of linear relationships between major constructs: Perception, Outcomes, and Adoption. The correlation coefficients were generally weak, indicating only slight linear associations among these variables. The visualized heat map confirms this interpretation, as most correlation values hovered around zero. This suggests that participants' perceptions of AI-powered robotic assistance do not strongly predict their views on postoperative outcomes or adoption-related factors linearly (Jagadale, 2020).

Regression Analysis

Multiple linear regression was conducted to predict postoperative outcomes based on the perception of AI-powered robotics and adoption challenges. The regression model yielded an R^2 of 0.011, indicating that only 1.1% of the variance in postoperative outcomes is explained by the predictor variables. The regression coefficients were slightly negative, with Perception ($\beta = -0.108$) and Adoption ($\beta = -0.005$), which is counterintuitive and suggests that increases in perceived benefits or ease of adoption are not associated with better outcomes in this sample. This may reflect measurement misalignment or participant bias, and further qualitative investigation might help explain this anomaly (Ahmed, 2024).

Interpretation of Figures

Figure 1: Distribution of Perception Scores

The histogram shows a fairly balanced spread of perception scores with a slight central tendency, indicating mixed views among healthcare professionals about the precision and benefits of AI-powered robotic assistance (Anwar et al., 2024).

Figure 2: Correlation Heat map

The heat map graphically presents weak correlations between Perception, Outcomes, and Adoption. The limited strength of relationships suggests the constructs are perceived as relatively independent in the minds of respondents (Aisha, 2024).

Figure 3: Regression Plot – Perception vs Outcomes

This scatterplot with a regression line illustrates the negative linear trend between perception and outcomes, aligning with the regression findings. The spread of data points around the regression line indicates high variability and weak predictive capability (McDermott et al., 2024).

Discussion

The findings of this study provide valuable insights into the perceived role and effectiveness of AI-powered robotic systems in orthopedic surgery. The use of a quantitative approach allowed for a structured analysis of how healthcare professionals evaluate the impact of such technologies on surgical precision, postoperative outcomes, and adoption challenges. Interestingly, the results revealed that although there is a moderate level of awareness and exposure to AI in orthopedic surgery among respondents, the expected positive correlations between perception, adoption, and improved outcomes were not strongly supported by the data (Ghanem, 2024).

The regression analysis indicated a very weak and negative association between the perception of AI robotics and postoperative outcomes, with an R^2 value of only 1.1%. This suggests that even when professionals view AI systems favorably, this perception does not necessarily translate into better-reported surgical or patient results. One possible explanation is that while AI tools may be advancing in sophistication, their integration into real-world surgical practice is still in its early stages. As a result, tangible improvements in outcomes may not yet be fully realized or perceived by users (Farahani, 2024).

Furthermore, the extremely low-reliability coefficient (Cronbach's alpha = 0.054) across all questionnaire items indicates potential issues with internal consistency, likely due to the multidimensional nature of the survey. The items covered different themes—perception, outcomes, and adoption barriers—which may not cohesively reflect a single construct. This highlights the importance of refining survey instruments and evaluating each dimension separately in future research to ensure greater construct validity (Benzakour et al., 2023).

Additionally, the lack of normal distribution in the data, as confirmed by the Shapiro-Wilk test, suggests that healthcare professionals' responses varied significantly. This variability may reflect differing levels of exposure to AI systems, institutional support, or personal comfort with technology. The wide range of responses is important, as it underscores the ongoing need for training, education, and standardized implementation of AI-powered robotics across surgical environments (Cui et al., 2024).

The visual analysis of the data further supports these conclusions. The perception scores showed a fairly even distribution, indicating a range of views from skepticism to optimism. Meanwhile, the correlation heatmap and regression plot visually reinforced the weak relationships among core variables, suggesting that while the technology is promising, its perceived and actual benefits are not yet strongly aligned (Rajalaxmi & Kirthika, 2024).

Conclusion

This study set out to examine the influence of AI-powered robotic assistance on surgical precision and postoperative outcomes in orthopedic surgery using a quantitative research approach. By collecting data from 250 healthcare professionals and analyzing it through statistical tests including normality, reliability, correlation, and regression, the study aimed to explore the extent to which AI technologies are perceived to enhance clinical outcomes. The findings revealed a weak correlation and minimal predictive relationship between the perception of AI-assisted robotic systems and reported surgical outcomes. Additionally, the low internal consistency across survey items indicates that perceptions, outcomes, and adoption challenges may represent distinct dimensions that require more precise measurement tools.

Furthermore, the data exhibited a non-normal distribution, highlighting the variability in experiences and opinions among respondents—possibly influenced by differing levels of exposure to and familiarity with AI technologies. Despite the theoretical promise of AI in enhancing surgical precision, the results of this study suggest that the practical impact of such technologies may still be evolving. The weak statistical relationships point to a gap between the anticipated benefits and actual or perceived improvements in surgical outcomes. This underscores the need for continued research, better integration of AI into clinical practice, and more robust training for surgical teams.

In conclusion, while AI-powered robotic systems hold significant potential in orthopedic surgery, their current impact—as reflected in the perceptions and reported experiences of healthcare professionals—remains limited. Future studies should consider longitudinal data collection, improved survey design, and the inclusion of qualitative insights to provide a more comprehensive understanding of AI's role in transforming surgical care.

References

Addissouky, T. A. (2024). Revolutionizing Total Knee Arthroplasty: The Integration and Impact of Artificial Intelligence across the Care Continuum. *J. Clinical Orthopedics and Trauma Care*, *6*(7), 2694-0248.

Ahmed, S. S. (2024). Artificial Intelligence in Orthopaedics: The Future is Here. *Acta Scientific Orthopaedics (ISSN: 2581-8635)*, *7*(7).

Aisha, S. (2024). Next-Gen Surgery: AI Robots Leading the Way in Healthcare. *Archives of Community Medicine and Public Health*, *10*(4), 013-017.

Andriollo, L., Picchi, A., Iademarco, G., Fidanza, A., Perticarini, L., Rossi, S. M. P., Logroscino, G., & Benazzo, F. (2025). The Role of Artificial Intelligence and Emerging Technologies in Advancing Total Hip Arthroplasty. *Journal of Personalized Medicine*, *15*(1), 21.

Anwar, M., Seferi, S., Selgjekaj, O., & Benoy, C. (2024). Integrating Artificial Intelligence into Surgical Decision-Making Enhancing Precision and Reducing Complications in Complex Surgical Procedure: A Mini Review. *Archives of Medical Reports*, *1*(1), 40-44.

Benzakour, A., Altsitzioglou, P., Lemée, J. M., Ahmad, A., Mavrogenis, A. F., & Benzakour, T. (2023). Artificial intelligence in spine surgery. *International orthopedics*, *47*(2), 457-465.

Bhamidipaty, V., Bhamidipaty, D. L., Guntoory, I., Bhamidipaty, K., Iyengar, K. P., Botchu, B., & Botchu, R. (2025). Revolutionizing Healthcare: The Impact of AI-Powered Sensors. *Generative Artificial Intelligence for Biomedical and Smart Health Informatics*, 355-373.

Burns, K. A., & Insights, I. (2024). The AI Revolution is Already Here: Transforming Orthopedics in 2024 and Beyond. *Sports Medicine*.

Chopra, G., & Ahmed, S. (2025). Artificial intelligence and machine learning–assisted robotic surgery: Current trends and future scope. In *Artificial Intelligence in Biomedical and Modern Healthcare Informatics* (pp. 23-29). Elsevier.

Cui, B., Li, S., & Jin, X. (2024). The Transformative Impact of Artificial Intelligence on Peripheral Nerve Repair. Proceedings of the 2024 5th International Symposium on Artificial Intelligence for Medicine Science,

Dangi, R. R., Sharma, A., & Vageriya, V. (2025). Transforming healthcare in low-resource settings with artificial intelligence: Recent developments and outcomes. *Public Health Nursing*, *42*(2), 1017-1030.

Emma, L. (2025). AI for Image-Guided Interventions: Enhancing Precision in Surgery and Therapy.

Familiari, F., Galasso, O., & Gasparini, G. (2024). *Artificial intelligence in orthopedic surgery made it easy*. Springer.

Farahani, A. (2024). The Role of Radiology in Enhancing Surgical Precision and Outcomes. *International Journal of Scientific and Applied Research (IJSAR), eISSN: 2583-0279*, *4*(9), 1-6.

Ghanem, D. (2024). Integrating artificial intelligence in orthopedic care and surgery: the revolutionary role of ChatGPT, as written with ChatGPT. *International Journal of Surgery*, *110*(12), 7593-7597.

Iftikhar, M., Saqib, M., Zareen, M., & Mumtaz, H. (2024). Artificial intelligence: revolutionizing robotic surgery. *Annals of Medicine and Surgery*, *86*(9), 5401-5409.

Jagadale, V. S. (2020). *Deep Learning for Precision Diagnosis & Surgery: Dawn of Artificial Intelligence in Orthopedics*. Notion Press.

Jain, V. (2025). Personalized Solutions in Orthopaedic Surgery: The Era of 3D Technology and Future. In *Innovations in Healthcare and Outcome Measurement: New Approaches for a Healthy Lifestyle* (pp. 213-229). Springer.

Jothi, C. S., Starlin, M., Surya, E., Jeevanasree, P., & Jayagopalan, S. (2025). Revolutionizing Healthcare Through Robotics and AI Integration: A Comprehensive Approach. In *Exploring the Micro World of Robotics Through Insect Robots* (pp. 213-234). IGI Global.

Khan, A. R. A., Khan, M. I., & Arif, A. (2025). AI in Surgical Robotics: Advancing Precision and Minimizing Human Error. *Global Journal of Computer Sciences and Artificial Intelligence*, *1*(1), 17-30.

Li, H., Han, Z., Wu, H., Musaev, E. R., Lin, Y., Li, S., Makatsariya, A. D., Chekhonin, V. P., Ma, W., & Zhang, C. (2025). Artificial intelligence in surgery: evolution, trends, and future directions. *International Journal of Surgery*, *111*(2), 2101-2111.

McDermott, E. R., DeFoor, M. T., Dekker, T. J., & DePhillipo, N. N. (2024). Artificial Intelligence in Rehabilitation. In *Artificial Intelligence in Orthopaedic Surgery Made Easy* (pp. 197-204). Springer.

Mikołajewska, E., Mikołajewski, D., Mikołajczyk, T., & Paczkowski, T. (2025). A Breakthrough in Producing Personalized Solutions for Rehabilitation and Physiotherapy Thanks to the Introduction of AI to Additive Manufacturing. *Applied Sciences*, *15*(4), 2219.

Napitupulu, R. P., Ardli, G. K., Ramadhani, M. R., Dira, N. O., & Sari, A. K. (2025). AI-Powered Innovations in Digestive Surgery: Current Evidence and Future Perspectives-A Systematic Literature. *Indonesian Health Journal (IHJ)*, *4*(1), 9-23.

Pal, G. (2025). Robotic Augmentation in Healthcare: Transforming Patient Care and Medical Precision in the Era of Transhumanism. In *Enhancing the Modern Workforce Through Transhumanism* (pp. 27-50). IGI Global.

Rajalaxmi, V., & Kirthika, R. (2024). Emerging Role of Artificial Intelligence and Robotics in Physiotherapy: Past, Present, and Future Perspective. In *Advancements in Clinical Medicine* (pp. 200-214). IGI Global.

Rasouli, J. J., Shao, J., Neifert, S., Gibbs, W. N., Habboub, G., Steinmetz, M. P., Benzel, E., & Mroz, T. E. (2021). Artificial intelligence and robotics in spine surgery. *Global Spine Journal*, *11*(4), 556-564.

Sarkar, S. (2024). The intersection of Orthopaedics and Artificial Intelligence: A Review.

Seiça, E. C., Mendes, D., Sousa, M. R., & Vide, J. (2024). Artificial Intelligence in Foot and Ankle Surgery. In *Artificial Intelligence in Orthopaedic Surgery Made Easy* (pp. 135-154). Springer.

Shekarappa, C., Dasu, L., Preethi, P., Devi, S. K., & Arampurath, A. (2025). Artificial Intelligence-powered Dentistry: Enhancing Patient Care and Efficiency. *CODS-Journal of Dentistry*, *16*(1), 15-19.

Tariq, A., Gill, A. Y., & Hussain, H. K. (2023). Evaluating the potential of artificial intelligence in orthopedic surgery for value-based healthcare. *International Journal of Multidisciplinary Sciences and Arts*, *2*(2), 27-35.

Wang, R., Situ, X., Sun, X., Zhan, J., & Liu, X. (2025). Assessing AI in Various Elements of Enhanced Recovery After Surgery (ERAS)-Guided Ankle Fracture Treatment: A Comparative Analysis with Expert Agreement. *Journal of Multidisciplinary Healthcare*, 1629-1638.