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Perceptions of Cardiac Surgeons Regarding the Integration of Artificial Intelligence in Cardiac Surgery

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Abstract

Background: **After the surge of artificial intelligence in late 2022, researchers started exploring the idea of using artificial intelligence in the medical field. Considering the endless possibilities of artificial intelligence, there is still some hesitation toward its use in the medical field. This study aims to explore the attitudes of cardiac surgeons toward involving artificial intelligence in diagnosing cardiac conditions and planning cardiac operations.**

Methodology: **: This study surveyed cardiac surgeons on AI integration in their field using a cross-sectional design and purposive sampling. Data were collected via a structured questionnaire and analyzed in IBM SPSS 29.0.**

Results: **Our study included 33 cardiac surgeons primarily male (n = 26, 78.8 %) and Saudi nationals (n = 26, 78.8 %), assessed attitudes towards AI in cardiac surgery. A significant majority supported AI for pre-operative (n = 17, 51.5 %), intra-operative (n = 11, 33.3 %), and post-operative tasks (n = 13, 39.4 %). The overall positive attitude towards AI was 54.2 % and overall positive perception towards AI was 50 %. However, perceptions of AI's integration into healthcare varied, with the highest approval for Documentation AI Assistance (n = 13, 39.40 %). No significant demographic differences were found affecting attitudes towards AI (p-values ranging from 0.576 to 1.000).**

Conclusion: **Our study reveals a positive yet cautious attitude towards AI in cardiac surgery, recognizing its potential to improve precision and efficiency but emphasizing the irreplaceable need for human judgment and expertise in managing patient-specific variables.**

Keywords: Artificial intelligence, Cardiac surgery, Perceptions, Attitudes

1. Background

In late 2022 a surge in Artificial Intelligence (AI) popularity was observed, captivating the attention of researchers, industry professionals, and the general public [1]. AI has revolutionized many industries, including healthcare [1]. While the potential benefits of the integration of AI in various medical subspecialties were discussed, the possible integration of AI in cardiac surgery remains not discussed, limited, and, undiscovered [2].

Cardiac surgeons face numerous challenges, including complex anatomical variations, uncertainties in decision-making, and the need for precise surgical planning. These challenges necessitate innovative approaches to enhance surgical precision and optimize patient care [2]. The integration of AI within the domain of cardiac surgery holds significant promise. In an optimal clinical setting, this integration can exhibit substantial potential in augmenting diagnostic precision, optimizing surgical planning, and ultimately leading to

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significant improvements in operative outcomes and mortality rates [2].

While the integration of AI in cardiac surgery is yet to be fully explored, existing research has shed light on the potential benefits of AI integration [1]. Several studies highlight the growing interest and active exploration of AI integration in other surgical domains [1–3]. A study by Layard Horsfall et al. has explored the attitude of neurosurgery team members regarding the possibility of using AI in neurosurgery [3]. Another study by B Li et al. also investigated vascular surgeons' perception of AI. These studies highlight the growing interest and active exploration of AI integration in medicine and surgical specialties [4].

In light of these developments, it is important to explore the potential benefits and challenges associated with AI integration in cardiac surgery. With the power of AI, cardiac surgeons can potentially overcome existing limitations, enhance surgical precision, and improve patient outcomes. This study aims to contribute to the ongoing discussion by examining the attitudes and perceptions of cardiac surgeons regarding the integration of AI in their practice.

To our knowledge, this was the first study to evaluate Saudi Arabian cardiac surgeons' perception toward the use of artificial intelligence (AI) in cardiac surgery. There have been surveys of clinicians and physicians in various fields before.

A global study of psychiatrists conducted by Doraiswamy et al., in 2020 revealed that half of the participants believed AI would significantly alter their work, particularly in areas such as information synthesis and updating medical records [5]. According to Blease et al. study of primary care professionals, the perceived advantages of AI included reduced administrative work and increased efficiency. However, due to the social and ethical implications of AI in healthcare, the respondents expressed concerns about whether patients and providers would accept its use [6]. The 2019 study conducted by Sarwar et al. evaluated pathologists' opinions regarding the use of AI in diagnostic pathology. The findings revealed that a significant majority (80.4 %) of pathologists believed AI would not have a major impact on the labor sector, while three-quarters (75 %) expressed excitement and interest in the technology [7]. Clinicians from a variety of disciplines were surveyed in Castagno and Khalifa study, which revealed that while most 79 % of them the clinicians believed that AI may be very helpful in their field, their understanding was lacking, with only 13 % understanding the distinction between deep learning and machine learning [8]. While these studies have highlighted clinicians' and physicians' perceptions of AI integration across fields such as psychiatry, primary healthcare, pathology, and other specialties [5–8], there is limited understanding of cardiac surgeons' views on AI integration in cardiac surgery. This gap in knowledge is what this study aims to address.

List of abbreviations

AI	Artificial Intelligence
KSA	Kingdom of Saudi Arabia
USA	United Stated of America

Artificial Intelligence (AI) has been used in radiology to segment medical images, aid in computer-aided diagnosis, and analyze radiology report content using natural language processing. This has allowed radiologists to make better and more efficient decisions by automatically recognizing complicated patterns [9]. In vascular surgery, about 212 studies were found to use AI techniques for diagnosis, prognosis, and image segmentation in cases of renal artery stenosis, peripheral artery disease, diabetic foot ulcer, venous disease, carotid stenosis, and aortic aneurysm/dissection [4]. In neurosurgery, AI algorithms have been created to predict, with over 94.0 % median accuracy, the recurrence, survival, and adverse events for patients undergoing surgery for traumatic brain injury, spinal lesions, and cancers [10]. While the application of AI in surgical fields, including vascular and neurosurgery, has been reviewed, there is paucity of empirical evidence regarding its use in cardiac surgery and its implications for patient care, clinical outcomes, and overall patient prognosis. Against this backdrop, the study aimed to assess cardiac surgeons' perceptions of integrating AI into their practice in Saudi Arabia.

2. Study methodology

A cross-sectional survey was adapted to collect data from cardiac surgeons regarding their perceptions and attitudes toward the integration of artificial intelligence (AI) in cardiac surgery. The target population for this study consisted of cardiac surgeons practicing in various medical institutions and hospitals in Saudi Arabia. A total of 33 participants were included, which is notably small. This limited sample size could be attributed to the highly specialized nature of the field, as cardiac surgeons represent a niche group within the medical community. Additionally, the recruitment relied on purposive sampling to target individuals with

specific expertise in cardiac surgery, which may have further restricted the pool of eligible participants. A purposive sampling method was employed to select participants with experience and expertise in cardiac surgery due to their in-depth understanding of both the complex clinical practice of cardiac surgery and the emerging AI technologies. These qualifications make them well-positioned to critically evaluate the potential benefits, ethical considerations, and challenges of integrating AI into cardiac surgery. The study employed a self-administered online questionnaire, developed based on previous surveys of clinicians' perception of AI in the field of medicine. The questionnaire was distributed to cardiac surgeons via email using Google Forms to collect the relevant data. The Google Forms Function was utilized to ensure only one response per participant, and participants were allowed to change and modify their answers up until submission. Descriptive statistical analysis was conducted to summarize the participants' demographic characteristics, such as age, gender, years of experience, and institutional affiliation. Quantitative data obtained from the closed-ended questions were analyzed using appropriate statistical methods, such as mean, standard deviation, and frequency distributions.

A comprehensive statistical analysis was conducted on the dataset, encompassing both descriptive and inferential methodologies. A descriptive analysis is conducted to summarize the demographic characteristics of the participants, which include age, gender, and other features. Moreover, Chi-Square Test and Fisher's Exact Test is used to the association between categorical variables. All statistical analyses are executed using IBM's SPSS Software, version 29.0.0.

All participants provided written consent. Participation was voluntary, and participants had the right to withdraw at any time during the survey. The survey responses were kept anonymous, and no personally identifiable information was collected. The collected data was stored in files with restricted access.

3. Results

Our study consists of 33 participants, out of which the majority were male (n = 26, 78.8 %) and Saudi nationals (n = 26, 78.8 %). Most of the participants were between the ages of 25 and 34 (n = 19, 57.6 %). Regarding their roles, 54.5 % were practicing cardiac surgeons (n = 18) and 45.5 % were cardiac surgery residents (n = 15). All participants currently practiced in Saudi Arabia (KSA). The majority received their training in KSA (n = 24, 72.7 %), while a smaller proportion were trained in other countries (n = 9, 27.3 %) (Table 1).

Table 2 shows the attitudes of cardiac surgeons towards AI integration in various surgical contexts. For pre-operative assessment, a substantial majority (n = 17, 51.5 %) strongly agreed with the utilization of AI, with another 42.4 % (n = 14) definitely supporting AI use in preoperative planning. Intra-operatively, 24.2 % (n = 8) definitely agreed to utilize AI for decision support, and 33.3 % (n = 11) strongly agreed with AI as a decision-support tool. Regarding post-operative and critical care, 39.4 % (n = 13) strongly agreed on AI's role in enhancing patient care. Views on AI's effect on surgical outcomes varied, with 18.2 % (n = 6) finding AI extremely effective. For training purposes, 36.4 % (n = 12) strongly agreed to involve AI, indicating a significant inclination towards integrating AI in enhancing surgical precision and patient safety. Notably, for overall attitudes of participants towards the use of AI in cardiac operations, 54.2 % exhibiting a positive attitude (above the 50th percentile) and 45.8 % showing a negative attitude (below the 50th percentile) (Fig. 1).

Fig. 2 shows the perception of participants on the integration of AI in various healthcare tasks. Highest approval was seen for Documentation AI Assistance, Diagnostic AI Tools, and Diagnostic Report AI Generation, each at 39.40 %. Slightly lower acceptance rates were noted for tasks like Intra-operative Video AI and Imaging Test AI Recommendations, both at 36.40 %. The least favored applications were Triage AI Utilization and Anomalous Anatomy Documentation, at 30.30 % and 27.30 % respectively. Notably, for overall perception

Table 1. Socio-demographic and other parameters of participants (n = 33).

		Frequency N (%)
Gender	Female	7 (21.2 %)
	Male	26 (78.8 %)
Age	25–34 Years	19 (57.6 %)
	35–44 Years	6 (18.2 %)
	55–64 Years	6 (18.2 %)
	65+ Years	2 (6.1 %)
Nationality	Non-Saudi	7 (21.2 %)
	Saudi	26 (78.8 %)
Working As	Cardiac surgeon	18 (54.5 %)
	Cardiac surgery resident	15 (45.5 %)
Practice Currently	KSA	33 (100 %)
Training Country	Other	9 (27.3 %)
	KSA	24 (72.7 %)

Socio-demographic and other parameters of patients presented as counts (n) and percentages (%).

Table 2. Attitudes of participants toward Integration of AI in diagnosing and planning cardiac operations (n = 33).

		Frequency N (%)
Pre-Operative Assessment		
Agree for AI Utilization	Disagree	2 (6.1 %)
	Neutral	5 (15.2 %)
	Strongly Agree	17 (51.5 %)
AI Utilization in Preoperative Assessment	No	2 (6.1 %)
	Probably Yes	8 (24.2 %)
	Definitely Yes	14 (42.4 %)
Agree to use AI in such Scenario	Strongly Disagree	1 (3.0 %)
	Neutral	10 (30.3 %)
	Strongly Agree	7 (21.2 %)
Intra-Operative Assessment		
Would you agree, as a surgeon, to be involved in a program that utilizes AI for intra-operative decision support?	No	3 (9.1 %)
	Probably Yes	7 (21.2 %)
	Definitely Yes	8 (24.2 %)
Do you agree with the use of AI in this scene as a decision-support tool?	Strongly Disagree	4 (12.1 %)
	Neutral	2 (6.1 %)
	Strongly Agree	11 (33.3 %)
Your vision about AI Effect on Surgical Outcomes Improvement and Patient Safety	Not Effective	5 (15.2 %)
	Somewhat Effective	4 (12.1 %)
	Very Effective	4 (12.1 %)
	Extremely Effective	4 (12.1 %)
As a surgeon, would you agree to be involved in such a case?	No	5 (15.2 %)
	Probably Yes	7 (21.2 %)
	Definitely Yes	5 (15.2 %)
Do you agree to utilize AI as illustrated in such a scenario?	Strongly Disagree	2 (6.1 %)
	Neutral	2 (6.1 %)
	Strongly Agree	12 (36.4 %)
Post-Operative Assessment		
AI Involvement in Postop and Critical care decision support Program	No	1 (3.0 %)
	Probably Yes	7 (21.2 %)
	Definitely Yes	8 (24.2 %)
Do you Agree with the usage of AI in such aspects of patient care?	Neutral	3 (9.1 %)
	Strongly Agree	13 (39.4 %)
How would you envision AI assisting in Improving surgical outcomes and patient safety?	Somewhat Effective	8 (24.2 %)
	Very Effective	4 (12.1 %)
	Extremely Effective	4 (12.1 %)
As a surgeon, would you agree to be involved in such a program?	Probably Yes	7 (21.2 %)
	Definitely Yes	9 (27.3 %)
Do you agree with the usage of AI in such program?	Neutral	2 (6.1 %)
	Strongly Agree	13 (39.4 %)
How would you envision AI assisting in improving surgical outcomes and patient safety in this case?	Somewhat Effective	5 (15.2 %)
	Very Effective	4 (12.1 %)
	Extremely Effective	6 (18.2 %)
Utilization of AI in Training		
Would you agree, as a surgeon, to be involved in a program that utilizes AI for training?	Neutral	3 (9.1 %)
	Strongly Agree	12 (36.4 %)
Do you agree with the usage of AI in that aspect?	Neutral	2 (6.1 %)
	Strongly Agree	13 (39.4 %)
AI in Medicine Management		
AI in Medication Management and Improvement	Somewhat Effective	3 (9.1 %)
	Very Effective	6 (18.2 %)
	Extremely Effective	6 (18.2 %)
As a surgeon, would you agree to utilize such service?	Probably Yes	5 (15.2 %)
	Definitely Yes	10 (30.3 %)

Attitudes of participants toward Integration of AI in diagnosing and planning cardiac operations presented as frequency (n) ad percentage (%).

of participants towards the use of AI, 50 % exhibiting a positive perception (above the 50th percentile) and 50 % showing a negative perception (below the 50th percentile) (Fig. 3).

Table 3 shows the association between various features of cardiac surgeons and their attitudes towards AI integration, dividing attitudes into negative and positive categories. The analysis across

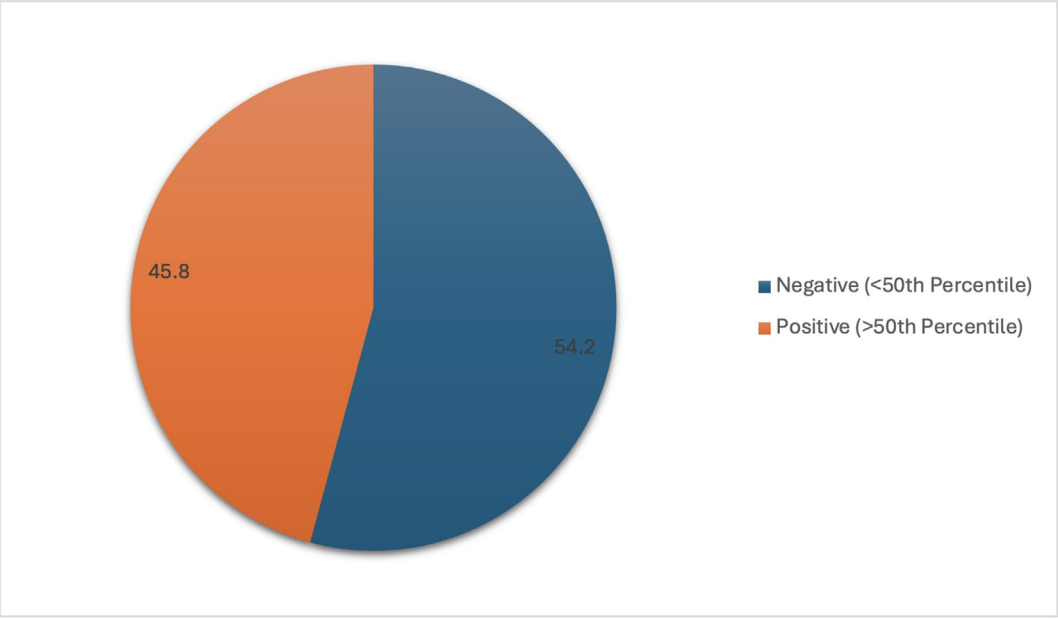

Fig. 1. Overall attitudes level of participants toward AI in cardiac operations.

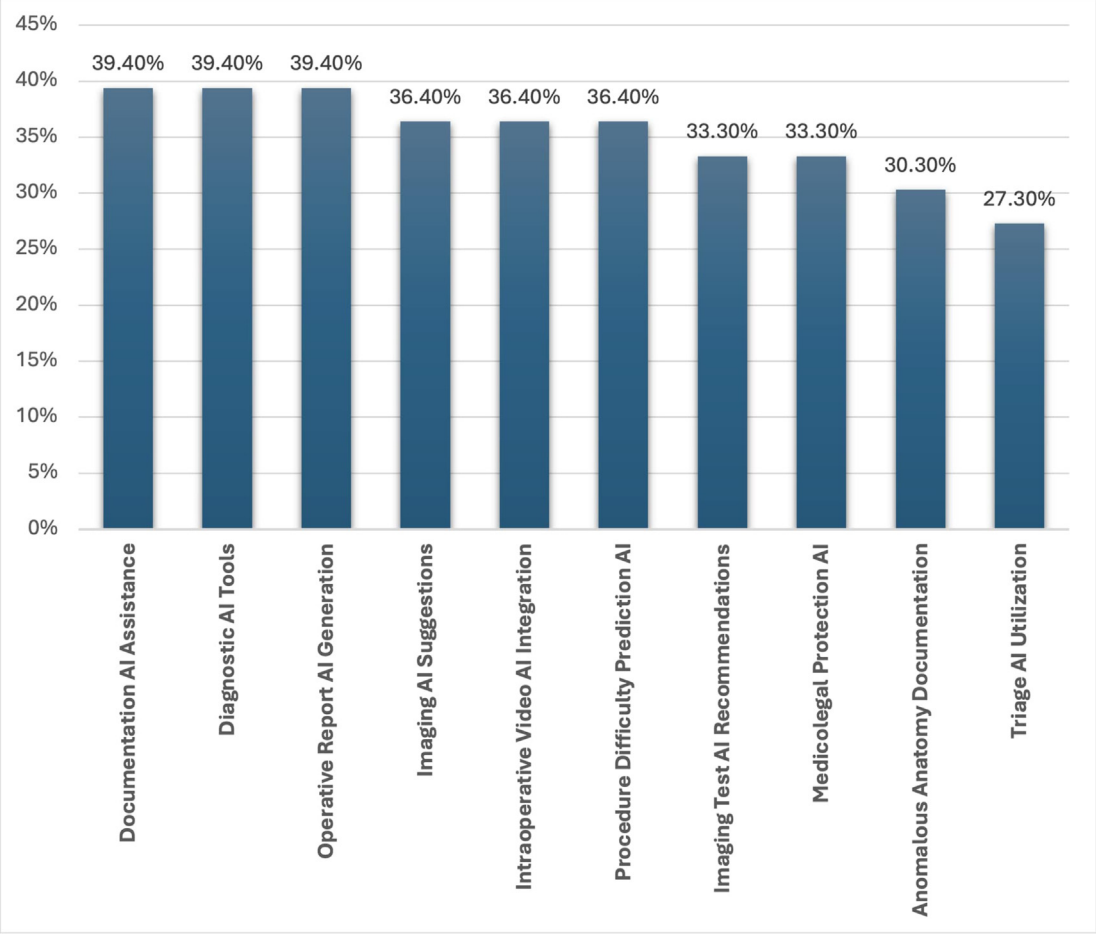

Fig. 2. Perception of participants toward Integration of AI in Health (n = 33).

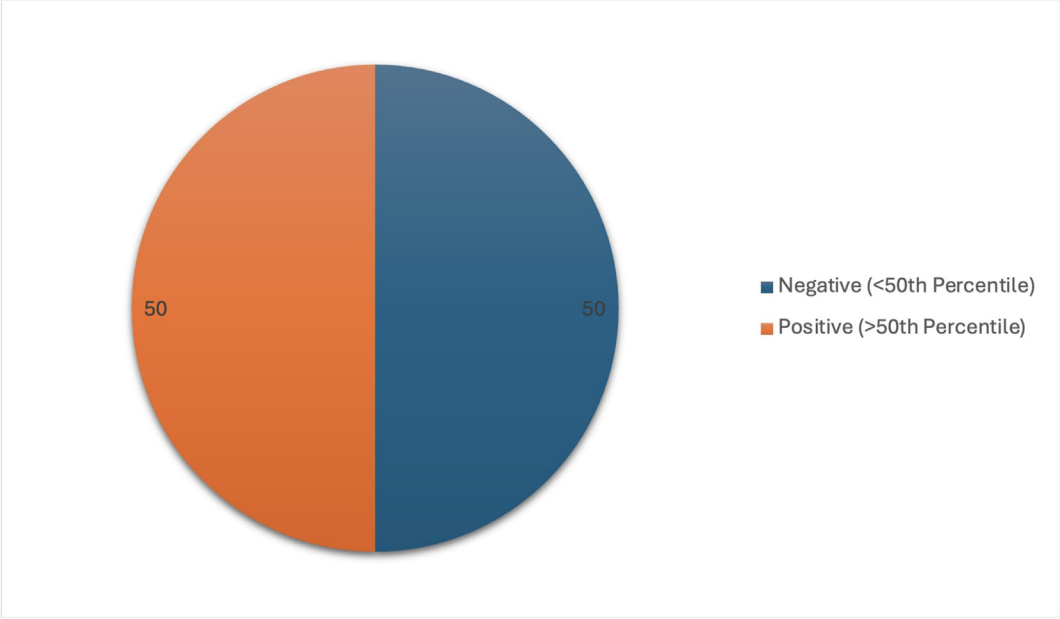

Fig. 3. Overall perception of participants (n = 33).

different age groups shows no significant variation in attitudes towards AI, with roughly even splits across each age category (p-value = 0.989). Gender differences also do not show a significant influence on attitudes, with females displaying a slightly higher negative attitude (60 %) compared to males (52.6 %), though statistically indistinguishable (p-value = 1.000). When looking at the country of training, surgeons trained in the USA/Canada had a slightly more negative attitude towards AI (62.5 % negative) compared to those trained in KSA (50 % negative), but this difference was not statistically significant (p-value = 0.679). Nationality also did not show a significant association with attitudes towards AI, with Non-Saudis showing a higher negative attitude (66.7 %) compared to Saudis (50 %), yet not significantly (p-value = 0.649). Lastly, no significant differences were found between the attitudes of cardiac surgery residents and fully trained cardiac surgeons (p-value = 1.000), suggesting that position and level of experience do not significantly affect attitudes towards AI integration in their field.

Table 4 shows the perceptions of cardiac surgeons towards AI integration in their field, segmented by various demographic and professional attributes. The results indicate uniformly divided opinions across different age groups (25–64 years), with each age bracket showing an equal distribution of 50 %

Table 3. Association between attitude towards AI Integration and different features of Cardiac Surgeon.

		Negative Attitude N (%)	Positive Attitude N (%)	Sig. Value
Age	25–34 Years	6 (54.5 %)	5 (45.5 %)	0.989[a]
	35–44 Years	3 (50.0 %)	3 (50.0 %)	
	55–64 Years	3 (60.0 %)	2 (40.0 %)	
	65+ Years	1 (50.0 %)	1 (50.0 %)	
Gender	Female	3 (60.0 %)	2 (40.0 %)	1.000[b]
	Male	10 (52.6 %)	9 (47.4 %)	
Country of Training	Other (USA/Canada)	5 (62.5 %)	3 (37.5 %)	0.679[a]
	KSA	8 (50.0 %)	8 (50.0 %)	
Nationality	Non-Saudi	4 (66.7 %)	2 (33.3 %)	0.649[a]
	Saudi	9 (50.0 %)	9 (50.0 %)	
You are working as	Cardiac Surgery resident	5 (50.0 %)	5 (50.0 %)	1.000[b]
	Cardiac surgeon	8 (57.1 %)	6 (42.9 %)	

P: P value for comparing between the different studied groups.
*: Statistically significant at $p \leq 0.05$.
[a] Chi-Square Test.
[b] Fisher's Exact Test.

Table 4. Association between Perception about AI Integration and different features of Cardiac Surgeon.

		Negative Perception N (%)	Positive Perception N (%)	Sig. Value
Age	25–34 Years	3 (50.0 %)	3 (50.0 %)	1.000[b]
	35–44 Years	2 (50.0 %)	2 (50.0 %)	
	55–64 Years	2 (50.0 %)	2 (50.0 %)	
Gender	Female	1 (50.0 %)	1 (50.0 %)	1.000[b]
	Male	6 (50.0 %)	6 (50.0 %)	
Country of Training	Other (USA/Canada)	3 (60.0 %)	2 (40.0 %)	0.576[a]
	KSA	4 (44.4 %)	5 (55.6 %)	
Nationality	Non-Saudi	2 (50.0 %)	2 (50.0 %)	1.000[b]
	Saudi	5 (50.0 %)	5 (50.0 %)	
You are working as	Cardiac Surgery resident	2 (40.0 %)	3 (60.0 %)	0.577[a]
	Cardiac surgeon	5 (55.6 %)	4 (44.4 %)	

P: P value for comparing between the different studied groups.
*: Statistically significant at $p \leq 0.05$.
[a] Chi-Square Test.
[b] Fisher's Exact Test.

positive and 50 % negative perceptions, signifying that age does not significantly influence perceptions of AI (p-value = 1.000). Gender-wise, both male and female surgeons mirrored this equal division in their views towards AI, each gender displaying a 50-50 split in perceptions, underscoring that gender does not play a role in shaping perceptions towards AI (p-value = 1.000). When examining the influence of the country of training, surgeons trained in the USA/Canada exhibited a slightly more negative perception of AI (60 % negative) as opposed to those trained in KSA, who showed a lean towards positive perceptions (55.6 % positive). However, this difference did not achieve statistical significance (p-value = 0.576). Similarly, nationality—Saudi versus Non-Saudi—showed no significant effect on perceptions, with an even split of 50 % in both groups (p-value = 1.000). Professional status, comparing cardiac surgery residents to fully trained cardiac surgeons, revealed a mild trend where residents were more positively inclined towards AI (60 % positive) compared to surgeons (44.4 % positive), though this was not statistically significant (p-value = 0.577).

4. Discussion

In late 2022, AI gained significant attention, particularly in healthcare, yet its integration into cardiac surgery remains underexplored [11]. Cardiac surgery faces challenges requiring innovative solutions, and AI holds potential to enhance diagnostic precision, surgical planning, and patient outcomes. Gala et al. shows that establishing robust AI-driven diagnostic frameworks specific to cardio and its surgery holds immense promise in revolutionizing diagnostic precision and efficiency in the field with respect to outcome [12]. Existing research in other surgical fields shows growing interest in AI. Regarding its role on cardiac surgery, Dias et al. highlighted that previous studies have developed systems that combine clinicians' physiological data with patient and OR device data to enhance surgical coordination, communication, and safety in the cardiothoracic operating room [13]. This study aims to examine cardiac surgeons' attitudes and perceptions towards AI integration in their practice, contributing to this evolving discussion.

Notably, the majority of the participants demonstrated a substantial acceptance of AI for pre-operative, intra-operative, and post-operative applications. Specifically, 51.5 % strongly agreed with the utilization of AI for pre-operative assessments, and 42.4 % supported its definite use in preoperative planning. Similarly the role of AI in pre-operative assessment is evaluated by Ng et al. which shows that AI advancements aim to revolutionize pre-operative assessments in colorectal and other surgeries, potentially reducing post-operative morbidity and mortality [14]. This positive stance was mirrored in the intra-operative phase, where 33.3 % strongly agreed with AI as a decision-support tool. Solanki et al. shows that AI enhances perioperative management by improving risk predictions, robotic surgeries, anesthesia depth monitoring, and early detection of complications [15]. For post-operative care and critical situations, 39.4 % strongly affirmed the role of AI in enhancing patient care. Similarly, Bian et al. highlights the role of AI in post-operative assessment with stating that the AI-assisted follow-up matches manual efficacy, saves costs, provides comprehensive feedback yet lacks depth, enhancing telemedicine and patient satisfaction [16].

These results are comparable to existing studies in the field, such as those by Khalifa et al. who found that AI could augment diagnostic accuracy and

operational efficiency in medical imaging and surgery [17]. Such findings underscore the potential of AI to significantly impact surgical outcomes positively by providing real-time data analysis, enhancing diagnostic precision, and offering predictive insights that can improve patient management and safety.

The acceptance rates for AI varied depending on the specific application, with the highest approval for documentation assistance, diagnostic tools, and report generation, each receiving a 39.40 % approval rate. These areas are often seen as more routine and data-intensive, where AI's capabilities can be maximally utilized without impinging on the surgeon's expertise or patient safety. In contrast, applications like triage AI utilization and documentation of anomalous anatomy were less favored, which may reflect concerns about AI's current ability to handle complex clinical judgments that require a deep understanding of contextual nuances in patient care. The findings highlight the need for unbiased data to train AI models in order to overcome AI biases, as well as the importance of adequately training surgeons on AI. Additionally, providing more practice and exposure to real-life situations can help improve the learning curve and reduce potential resistance to technology adoption.

This finding aligns with studies such as those by Chin-Yee et al. which suggest that while AI is welcomed for its efficiency in handling large data sets and performing routine tasks, there remains skepticism about its application in medical field where AI should complement, not compete with, clinical judgment in healthcare [18].

Male cardiac surgeons showed slightly higher positive attitude towards integration of AI in cardiac surgery than their female counterpart. Although the difference was not statistically significant, it can be attributed to the gender difference in comfort with technology, as males are frequently better socialized to work in technical domains and with technology. Moreover, our study also found no significant differences in attitudes toward AI integration across various demographic factors such as age and nationality. This suggests a broad uniformity in the perception of AI, likely reflecting a general consensus in the medical community about the potentials and limitations of AI irrespective of personal or professional backgrounds [19]. Interestingly, there was no significant difference in the attitudes between those trained in KSA and those trained in the USA/Canada, although there was a slight tendency for more negative perceptions among those trained in North America. This might be indicative of different exposure levels to AI technologies and varying curricular emphases on technology integration in medical training across regions. Furthermore, there was a slight tendency for Cardiac Surgery residents to have more positive attitudes and perceptions compared to Cardiac surgeons, although the difference was not significant. This could be attributed to residents being more accustomed to new technologies, as they are introduced to cutting-edge innovations, tools and techniques early in their careers, in contrast to surgeons who may not have had the same exposure.

The limitations of this study include the small sample size, which restricts the generalizability of the findings and limits the statistical power to detect significant trends. Additionally, the survey methodology might be affected by incomplete responses and low response rates, which could skew results. Despite the use of AI to analyze and interpret survey data, the absence of robust automated data handling might leave gaps in analysis, relying instead on deductive reasoning from available responses. These factors should be considered when interpreting the study's conclusions and integrating AI into clinical settings.

5. Conclusion

Our study highlights a generally positive outlook towards AI in cardiac surgery among the participants, tempered by a realistic assessment of where AI can be most beneficial. It underscores a nuanced reception of AI in cardiac surgery, acknowledging both the promising advantages and inherent limitations of its integration into clinical practice. While AI offers significant potential to enhance precision, efficiency, and decision-making in surgical settings, its effectiveness is contingent upon the retention of human judgment and expertise, particularly in understanding patient-specific variables that AI currently cannot fully capture. Training cardiac surgeons in AI systems and techniques is a crucial step toward successfully integrating AI into cardiac surgery and improving clinical outcomes and more research in the possible future implications of cardiac surgery is needed. Going forward, the medical community must navigate the balance between embracing innovative technologies and preserving essential human elements in patient care.

6. Implications and future direction

This study highlights the cautious but optimistic reception of AI in cardiac surgery, emphasizing its potential to enhance precision and efficiency while recognizing the importance of human judgment.

integrating AI into cardiac surgery requires a strategic approach that includes pilot studies to assess feasibility, specialized training programs to equip surgeons with AI-related skills, and collaborations with AI developers to refine technology for clinical use. Future research should focus on optimizing AI-assisted decision-making, improving surgical precision, and ensuring ethical implementation. By fostering interdisciplinary partnerships and continuous innovation, AI has the potential to enhance patient outcomes and revolutionize cardiac surgery. Future research should focus on expanding the sample size to increase generalizability and integrating more robust AI tools to handle data comprehensively. It is crucial to develop interdisciplinary collaborations to further explore AI's capabilities and limitations. Continued validation of AI applications and integration of AI education in medical training could foster a deeper understanding and more effective use of AI, ultimately advancing patient care in cardiac surgery.

7. Limitations

The limitations of this study include the small sample size, which restricts the generalizability of the findings and limits the statistical power to detect significant trends. Additionally, the survey methodology might be affected by incomplete responses and low response rates, which could skew results. These factors should be considered when interpreting the study's conclusions and integrating AI into clinical settings.

Ethics information

All participants provided written consent. Participation was voluntary, and participants had the right to withdraw at any time during the survey. This study was conducted in accordance with ethical guidelines and was granted by the Research Ethics Committee at King Faisal University reference number KFU-REC-2024-MAY-ETHICS2298.

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Author contributions

Conception and design of Study: NA, FK. Literature review: NA, FK, RA. Acquisition of data: NA, FK, IO. Analysis and interpretation of data: NA, IO. Research investigation and analysis: NA, IO. Data collection: NA, FK, RA, IO. Drafting of manuscript: NA, FK, RA, IO. Revising and editing the manuscript critically for important intellectual contents: NA, FK, RA, IO. Data preparation and presentation: NA. Supervision of the research: FK. Research coordination and management: NA. Funding for the research: NA, FK, RA, IO.

Conflict of interest

All authors declare no conflicts of interest related to this study.

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