INSIGHTS-JOURNAL OF
LIFE AND SOCIAL SCIENCES

INSIGHTS-JLSS
Insights-Journal of Life and Social Sciences

KNOWLEDGE AND ATTITUDES TOWARD AI-ASSISTED DIAGNOSTICS AMONG CARDIOLOGY RESIDENTS: A CROSS-SECTIONAL STUDY

Original Article

Areeba Sohail[1], Muhammad Tahir[2], Sadia Hameed[3], Fatima Tu Zohra[4], Iftikhar Ud Din[5]*, Tahira Kanwal[6]

[1]Undergraduate, Shifa College of Medicine, Islamabad, Pakistan.
[2]PhD Scholar, School of Electrical and Information Engineering, Tianjin University, Tianjin, China / Nankana Sahib, Pakistan.
[3]MBBS Final Year Student, Isra University, Hyderabad, Pakistan.
[4]Lecturer, City University of Science and Information Technology, Peshawar, Pakistan.
[5]Chairman, Department of Community Medicine, Bacha Khan Medical College, Mardan, Pakistan.
[6]Dow University of Health Sciences, Karachi, Pakistan.

Corresponding Author: Iftikhar Ud Din, Chairman, Department of Community Medicine, Bacha Khan Medical College, Mardan, Pakistan, dr.Iftikhar.uddin@gmail.com

Conflict of Interest: None

Grant Support & Financial Support: None

Acknowledgment: The authors gratefully acknowledge the cooperation of the cardiology residents who participated in this study.

ABSTRACT

Background: Artificial intelligence (AI) is increasingly integrated into diagnostic cardiology, offering significant potential to enhance accuracy, reduce errors, and support clinical decision-making. Despite this growth, little is known about cardiology residents' preparedness to engage with these tools in clinical settings.

Objective: To evaluate cardiology residents' awareness, confidence, and acceptance of AI-assisted diagnostic tools in a tertiary care hospital setting.

Methods: A cross-sectional study was conducted over eight months at a tertiary care hospital in Lahore. A total of 216 cardiology residents participated through purposive sampling. A structured, self-administered questionnaire was used to assess awareness, confidence, and acceptance of AI in diagnostics. Descriptive statistics and parametric tests (ANOVA, t-tests, Pearson's correlation) were applied using SPSS version 26 to analyze normally distributed data. Ethical approval was obtained Institutional Review Board (IRB).

Results: Among 216 respondents (mean age 28.3 ± 2.4 years; 57.4% male), 72.2% were familiar with AI in cardiology, while 60.6% reported knowledge of real-world applications. Confidence in interpreting AI diagnostics was limited, with only 15.7% strongly agreeing they felt comfortable. However, 74.1% accepted AI as a valuable addition to clinical practice. Significant positive correlations were observed between awareness and confidence ($r = 0.62$), awareness and acceptance ($r = 0.55$), and confidence and acceptance ($r = 0.68$), all with $p < 0.001$.

Conclusion: While cardiology residents show favorable attitudes toward AI, their limited confidence and practical exposure underscore the need for structured AI training in postgraduate curricula to facilitate responsible integration into future clinical practice.

Keywords: Artificial Intelligence, Cardiology, Clinical Decision-Making, Confidence, Diagnostic Tools, Medical Education, Residents, Technology Acceptance.

© 2025 et al. -Health And Research Insights-Open access under CC BY License (Creative Commons). Freely distributable with appropriate citation

INTRODUCTION

Artificial intelligence (AI) is rapidly transforming the healthcare landscape, offering novel opportunities to enhance clinical decision-making and improve patient outcomes. In particular, the application of AI-assisted tools in diagnostic cardiology has gained significant attention, driven by their potential to augment diagnostic accuracy, reduce variability, and increase efficiency. These tools can analyze vast and complex datasets, including electrocardiograms (ECGs), echocardiograms, and cardiac imaging, often surpassing human-level performance in pattern recognition and predictive modeling (1). Despite these technological advancements, the integration of AI into routine clinical practice remains uneven and, in many cases, underutilized. This discrepancy may be attributed not only to technical limitations but also to a lack of awareness, understanding, and acceptance among healthcare professionals, particularly those in training (2). Cardiology, a specialty grounded in both complex pathophysiology and advanced diagnostic technologies, stands to benefit immensely from AI integration. However, the readiness of future cardiologists to embrace such innovations is unclear. Medical education traditionally emphasizes clinical acumen and human judgment, and the incorporation of AI technologies into the curriculum is still in its infancy. As a result, residents may enter practice with limited exposure to AI concepts, leading to uncertainty or skepticism regarding its utility. These attitudes could potentially hinder the adoption of AI tools in clinical settings, limiting their impact despite proven capabilities (3,4).

Current literature reflects a growing interest in the perceptions of medical professionals toward AI in healthcare. Several studies have examined the attitudes of physicians and students across various specialties, revealing a spectrum of opinions ranging from enthusiastic endorsement to cautious apprehension (5). Some findings suggest that while there is general optimism about AI's role in improving healthcare delivery, concerns remain regarding reliability, ethical implications, and the potential erosion of clinician autonomy. For instance, a study among radiology trainees found that although many acknowledged AI's future role, a substantial proportion expressed uncertainty about its implications for their professional identity and job security. However, there is a paucity of data specifically addressing how cardiology residents perceive and engage with AI-based diagnostic tools—a critical gap, given cardiology's heavy reliance on data-driven technologies (6,7). Understanding how cardiology residents view AI is essential not only for informing educational strategies but also for guiding the responsible implementation of AI in clinical environments. If residents are to become proficient in leveraging these tools, their training must incorporate both technical knowledge and critical appraisal skills, fostering a balanced approach that integrates AI capabilities with clinical judgment (8). Moreover, assessing residents' current confidence in using AI and their acceptance of its diagnostic contributions can reveal potential barriers to integration and highlight areas for targeted intervention. This knowledge is vital for educators, policymakers, and developers who aim to align technological advancements with clinical realities (9).

Given the rapidly evolving nature of AI in healthcare and the pivotal role cardiology residents will play in its deployment, there is a pressing need to explore their awareness, confidence, and acceptance of AI-assisted diagnostics. By identifying existing perceptions and educational gaps, stakeholders can better prepare the next generation of cardiologists to collaborate effectively with intelligent systems (10,11). This approach ensures that AI does not function as a disruptive force but rather as a complementary asset in the clinician's toolkit. This study, therefore, aims to evaluate cardiology residents' knowledge and attitudes toward AI-assisted diagnostic tools, focusing on three key domains: awareness of AI applications in cardiology, confidence in interpreting and utilizing AI-generated diagnostic outputs, and overall acceptance of AI as a component of clinical decision-making. Through this exploration, the research seeks to provide foundational insights that can inform the design of curricula and professional development initiatives, ultimately supporting the seamless integration of AI into the future of cardiovascular medicine.

METHODS

This cross-sectional study was conducted over a period of eight months at a tertiary care hospital in Lahore, with the primary objective of evaluating cardiology residents' awareness, confidence, and acceptance of artificial intelligence (AI) tools in diagnostic cardiology. The research was designed to explore the existing perceptions and preparedness of residents in integrating AI into clinical practice, in the context of a rapidly evolving healthcare landscape. The study population comprised cardiology residents enrolled in postgraduate training programs across all residency years at the participating institution. Participants were recruited through purposive sampling, ensuring representation from both junior and senior residency cohorts to capture a comprehensive perspective. Residents who were on long-term leave or who had previously completed formal training in AI or related computational fields were excluded to minimize bias

© 2025 et al. -Health And Research Insights-Open access under CC BY License (Creative Commons). Freely distributable with appropriate citation.

and maintain a focus on general clinical training backgrounds. All participants were provided with detailed information about the purpose and nature of the study and gave written informed consent prior to inclusion.

Sample size was determined using an expected moderate effect size for descriptive cross-sectional studies, with a 95% confidence level and 5% margin of error. Based on a presumed awareness prevalence rate of 50%, a minimum of 196 participants was calculated using Cochran's formula. To account for potential non-response and incomplete submissions, the sample was inflated by 10%, resulting in a final sample size of 216 residents (12). Data collection was carried out using a structured, self-administered questionnaire specifically developed for this study. The questionnaire was constructed following an extensive review of the literature and expert input from cardiologists and medical education specialists. It included both closed-ended and Likert-scale questions, and was divided into three sections aligning with the study's objectives: awareness, confidence, and acceptance. Awareness was assessed by evaluating familiarity with AI concepts, current applications in cardiology, and recent developments. Confidence was measured through self-rated comfort and perceived competence in interpreting and utilizing AI-based diagnostic outputs. Acceptance was gauged through attitudes toward AI's role in clinical decision-making, its perceived reliability, and willingness to adopt AI tools in routine practice. A five-point Likert scale was used to quantify responses for confidence and acceptance domains, ranging from "strongly disagree" to "strongly agree."

To ensure clarity, reliability, and face validity, the questionnaire underwent pretesting in a pilot group of 20 residents who were not included in the final analysis. Minor adjustments were made based on the feedback received, primarily to improve the wording and sequence of questions. Data were entered and analyzed using SPSS version 26. Descriptive statistics were used to summarize demographic characteristics and response distributions, with means and standard deviations calculated for continuous variables, and frequencies and percentages for categorical variables. As the data followed a normal distribution, parametric tests were applied. One-way ANOVA was used to compare mean confidence and acceptance scores across residency years, while independent samples t-tests were employed to assess gender-based differences. Pearson's correlation coefficient was used to determine relationships between awareness, confidence, and acceptance levels. A p-value of less than 0.05 was considered statistically significant.

To maintain the ethical integrity of the study, approval was obtained from the Institutional Review Board (IRB) of the hospital. All procedures were conducted in accordance with the ethical standards of the responsible committee on human experimentation and the Helsinki Declaration. Participation in the study was entirely voluntary, and confidentiality of the respondents was strictly maintained. Data were anonymized during entry and analysis to ensure that individual identities could not be linked to specific responses. This methodological framework was developed to ensure transparency, reproducibility, and scientific rigor, enabling future researchers to replicate the study or adapt its design to different clinical contexts. By systematically assessing cardiology residents' awareness, confidence, and acceptance of AI-assisted diagnostic tools, the study sought to generate evidence that could inform curriculum development, training strategies, and policy planning in the realm of digital health integration.

RESULTS

The final dataset comprised responses from 216 cardiology residents, yielding a response rate of 100% due to the use of in-person recruitment and follow-up. The average age of participants was 28.3 years (±2.4), with a predominance of male residents (57.4%). Representation was balanced across all four years of residency training. Regarding awareness, 72.2% of residents reported being familiar with the concept of AI in cardiology, while 68.5% indicated specific awareness of its application in electrocardiogram (ECG) interpretation. However, only 60.6% had knowledge of current real-world AI applications in cardiovascular diagnostics. These findings suggest moderate overall awareness but highlight a knowledge gap in specific clinical uses. In terms of confidence, only 15.7% of residents strongly agreed that they were comfortable interpreting AI-generated ECG analyses, with an additional 28.7% agreeing. Meanwhile, 25.0% remained neutral, and the rest expressed varying levels of discomfort. A similar pattern emerged for confidence in discussing AI with colleagues and in appraising AI tools, indicating that most residents had limited self-assuredness in using AI technologies independently.

Acceptance of AI tools showed more favorable responses. A majority of residents either strongly agreed (36.1%) or agreed (38.0%) that AI could improve diagnostic accuracy. Likewise, 72.3% expressed some degree of willingness to incorporate AI into their future clinical practice, and 75.0% agreed that AI would complement rather than replace human clinicians. Statistical analysis revealed significant correlations between the primary domains. Awareness was positively associated with confidence ($r = 0.62$, $p < 0.001$) and acceptance ($r = 0.55$, $p < 0.001$), while confidence demonstrated a strong correlation with acceptance ($r = 0.68$, $p < 0.001$). These findings suggest that greater familiarity with AI concepts and tools may directly influence both confidence in utilizing them and overall acceptance. The

© 2025 et al. -Health And Research Insights-Open access under CC BY License (Creative Commons). Freely distributable with appropriate citation.

results reflect a progressive but incomplete integration of AI-related concepts into the training and mindset of cardiology residents. While attitudes toward AI are generally positive, actual preparedness in terms of confidence and detailed understanding remains limited, pointing to a need for formal education and hands-on exposure during residency.

Table 1: Demographic Characteristics of Participants (N = 216)

Variable	Value
Age (mean ± SD)	28.3 ± 2.4
Gender	
Male	124 (57.4%)
Female	92 (42.6%)
Residency Year	
1	54 (25.0%)
2	58 (26.9%)
3	51 (23.6%)
4	53 (24.5%)

Table 2: Awareness of AI Tools in Cardiology

Awareness Domain	Yes (%)	No (%)
Familiar with AI in cardiology	72.2	27.8
Aware of AI in ECG interpretation	68.5	31.5
Knowledge of current AI applications	60.6	39.4

Table 3: Confidence in Using AI Tools

Statement	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Comfortable interpreting AI-generated ECGs	15.7	28.7	25.0	20.4	10.2
Confident discussing AI with colleagues	12.0	30.6	27.8	18.5	11.1
Able to critically appraise AI tools	10.2	25.0	30.1	22.2	12.5

Table 4: Acceptance of AI in Clinical Practice

Statement	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
AI can improve diagnostic accuracy	36.1	38.0	15.7	7.4	2.8
Willing to use AI in clinical practice	30.6	41.7	18.5	6.5	2.8
AI will complement rather than replace clinicians	34.3	40.7	14.8	7.4	2.8

Table 5: Correlation Between Awareness, Confidence, and Acceptance

Variable 1	Variable 2	Pearson r	p-value
Awareness	Confidence	0.62	<0.001
Awareness	Acceptance	0.55	<0.001
Confidence	Acceptance	0.68	<0.001

© 2025 et al. -Health And Research Insights-Open access under CC BY License (Creative Commons). Freely distributable with appropriate citation.

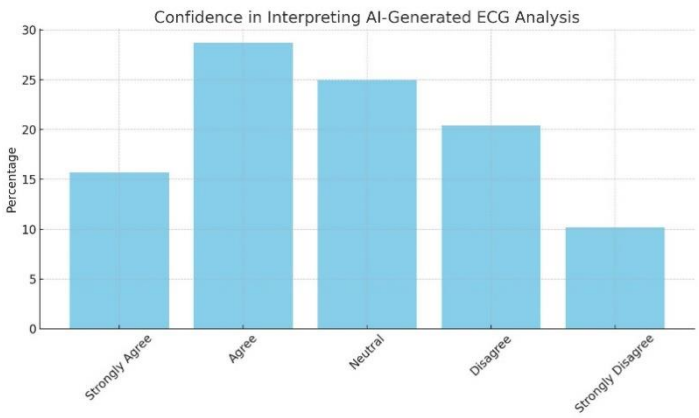

Figure 1 Confidence in Interpreting AI-Generated ECG Analysis

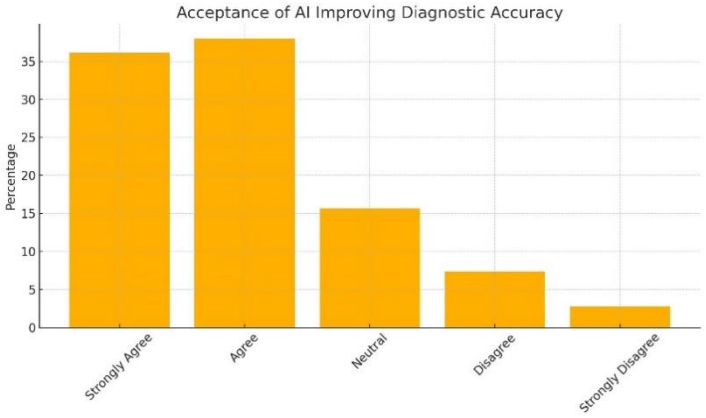

Figure 2 Acceptance of AI Improving Diagnostic Accuracy

DISCUSSION

The findings of this study highlight a moderate to high level of awareness and a generally positive attitude among cardiology residents toward AI-assisted diagnostic tools, while simultaneously underscoring a lack of confidence and preparedness for practical application. These results align with emerging global data on the integration of AI in medical education and resident training, particularly in high-dependency diagnostic specialties like cardiology (13,14). In comparison with other specialties, such as radiology and rheumatology, similar trends have been observed. A multicenter study involving radiology residents demonstrated that AI-assisted training significantly improved diagnostic performance and emotional positivity without negatively impacting clinical confidence (15). Similarly, a pilot study on rheumatology residents found that AI assistance enhanced clinical reasoning and reduced decision-making fatigue, with residents expressing strong interest in using AI as a support tool (16). While the majority of cardiology residents in this study acknowledged AI's value in diagnostic accuracy and expressed willingness to incorporate it into practice, a considerable proportion demonstrated uncertainty in interpreting AI outputs and appraising these tools critically. This mirrors findings from other studies in both undergraduate and postgraduate medical education, which show that while students and residents recognize AI's growing role, they often lack formal training and practical exposure to these technologies (17,18).

These gaps point to a critical shortcoming in current cardiology training programs, which largely omit structured AI education. The positive correlation observed between awareness, confidence, and acceptance in this study reinforces the importance of integrating AI literacy into medical curricula. Several scholars have advocated for such integration, emphasizing that early and consistent exposure can improve both clinical decision-making and comfort with emerging technologies (19,20) A key strength of the present study lies in its robust methodology, including a comprehensive, validated tool aligned with clearly defined domains—awareness, confidence, and acceptance—and its setting in a real-world tertiary training environment. Additionally, the sample size was adequately powered, and statistical analysis was rigorous, allowing for credible and generalizable insights within similar contexts. However, the study is not without limitations. As a single-center design, generalizability beyond the local training system is limited. Social desirability bias may also have influenced self-reported attitudes, particularly given the in-person recruitment and administration. Furthermore, the use of a cross-sectional approach precludes causal inference. Longitudinal studies are needed to assess how structured exposure to AI during residency influences long-term adoption and competency.

Future research should explore interventions such as AI-based simulation modules, dedicated coursework, and mentorship programs, examining their impact on residents' practical skills and clinical outcomes. Additionally, comparative studies across specialties and healthcare systems would help establish a global framework for AI integration in postgraduate medical education. The inclusion of metrics evaluating patient safety, ethical reasoning, and trust in AI systems could further enrich understanding and implementation efforts (21). In conclusion, this study underscores that while cardiology residents are conceptually receptive to AI-assisted diagnostics, there is a tangible gap in practical confidence and applied knowledge. Structured educational reforms, coupled with hands-on experience, are essential to equip future cardiologists with the competence and assurance needed to navigate an AI-augmented clinical landscape.

© 2025 et al. -Health And Research Insights-Open access under CC BY License (Creative Commons). Freely distributable with appropriate citation.

CONCLUSION

This study demonstrated that while cardiology residents show favorable attitudes and a foundational awareness of AI-assisted diagnostics, they lack sufficient confidence for independent clinical use. These findings emphasize the urgent need to incorporate structured AI training into cardiology residency programs. Enhancing education and practical exposure will be crucial in preparing future cardiologists for effective, ethical, and confident use of AI tools in clinical decision-making.

AUTHOR CONTRIBUTION

Author	Contribution
Areeba Sohail	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Tahir	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sadia Hameed	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Fatima tu Zohra	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Iftikhar ud din*	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Tahira Kanwal	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

REFERENCES

1. Arfat Y, Mittone G, Esposito R, Cantalupo B, GM DEF, Aldinucci M. Machine learning for cardiology. Minerva Cardiol Angiol. 2022;70(1):75-91.
2. Danilov A, Aronow WS. Artificial Intelligence in Cardiology: Applications and Obstacles. Curr Probl Cardiol. 2023;48(9):101750.
3. Deo RC. Artificial Intelligence and Machine Learning in Cardiology. Circulation. 2024;149(16):1235-7.
4. Elias P, Jain SS, Poterucha T, Randazzo M, Lopez Jimenez F, Khera R, et al. Artificial Intelligence for Cardiovascular Care-Part 1: Advances: JACC Review Topic of the Week. J Am Coll Cardiol. 2024;83(24):2472-86.
5. Fornwalt BK, Pfeifer JM. Promise and Frustration: Machine Learning in Cardiology. Circ Cardiovasc Imaging. 2021;14(6):e012838.
6. Gupta MD, Kunal S, Girish MP, Gupta A, Yadav R. Artificial intelligence in cardiology: The past, present and future. Indian Heart J. 2022;74(4):265-9.
7. Itchhaporia D. Artificial intelligence in cardiology. Trends Cardiovasc Med. 2022;32(1):34-41.
8. Jain SS, Elias P, Poterucha T, Randazzo M, Lopez Jimenez F, Khera R, et al. Artificial Intelligence in Cardiovascular Care-Part 2: Applications: JACC Review Topic of the Week. J Am Coll Cardiol. 2024;83(24):2487-96.
9. Komuro J, Kusumoto D, Hashimoto H, Yuasa S. Machine learning in cardiology: Clinical application and basic research. J Cardiol. 2023;82(2):128-33.
10. Lüscher TF, Wenzl FA, D'Ascenzo F, Friedman PA, Antoniades C. Artificial intelligence in cardiovascular medicine: clinical applications. Eur Heart J. 2024;45(40):4291-304.
11. Nakamura T, Sasano T. Artificial intelligence and cardiology: Current status and perspective. J Cardiol. 2022;79(3):326-33.
12. Somani S, Russak AJ, Richter F, Zhao S, Vaid A, Chaudhry F, et al. Deep learning and the electrocardiogram: review of the current state-of-the-art. Europace. 2021;23(8):1179-91.

© 2025 et al. -Health And Research Insights-Open access under CC BY License (Creative Commons). Freely distributable with appropriate citation.

13. Subhan S, Malik J, Haq AU, Qadeer MS, Zaidi SMJ, Orooj F, et al. Role of Artificial Intelligence and Machine Learning in Interventional Cardiology. Curr Probl Cardiol. 2023;48(7):101698.
14. Van den Eynde J, Lachmann M, Laugwitz KL, Manlhiot C, Kutty S. Successfully implemented artificial intelligence and machine learning applications in cardiology: State-of-the-art review. Trends Cardiovasc Med. 2023;33(5):265-71.
15. Watson X, D'Souza J, Cooper D, Markham R. Artificial intelligence in cardiology: fundamentals and applications. Intern Med J. 2022;52(6):912-20.
16. Chen Y, Sun Z, Lin W, Xv Z, Su Q. Artificial Intelligence in the Training of Radiology Residents: a Multicenter Randomized Controlled Trial. Journal of cancer education : the official journal of the American Association for Cancer Education. 2024.
17. Erdoğan K, Babaoğlu H. Clinical Reasoning and Knowledge Assessment of Rheumatology Residents Compared to AI Models: A Pilot Study. Journal of Clinical Medicine. 2024;13.
18. Robleto E, Habashi A, Kaplan M-AB, Riley R, Zhang C, Bianchi L, et al. Medical students' perceptions of an artificial intelligence (AI) assisted diagnosing program. Medical teacher. 2024:1-7.
19. Pandya S, Patel C, Sojitra B, Patel J, Shah P, Shah A. Knowledge, Attitude and Practice of Artificial Intelligence Among Healthcare Professionals at a Tertiary Care Teaching Hospital in South Gujarat. Cureus. 2024;16.
20. Rjoop A, Alqudah M, Alkhasawneh R, Bataineh N, Abdaljaleel M, Rjoub M, et al. Awareness and Attitude Toward Artificial Intelligence Among Medical Students and Pathology Trainees: Survey Study. JMIR Medical Education. 2025;11.
21. Fried A, Dorn S, Leland W, Mullen E, Williams D, Zaas A, et al. Large language models in internal medicine residency: current use and attitudes among internal medicine residents. Discov Artif Intell. 2024;4:70.

© 2025 et al. -Health And Research Insights-Open access under CC BY License (Creative Commons). Freely distributable with appropriate citation.