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ORIGINAL

A Thematic Analysis of Professional Gaps, Experiences, and Systemic Challenges in Integrating Artificial Intelligence in Healthcare

Un análisis temático de las brechas profesionales, experiencias y desafíos sistémicos en la integración de la inteligencia artificial en la atención médica

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ABSTRACT

Introduction: artificial intelligence (AI) is increasingly transforming clinical decision-making and diagnostic accuracy across healthcare systems worldwide. However, despite growing interest in Saudi Arabia, the perceptions and readiness of healthcare professionals toward AI integration remain underexplored. This study aimed to evaluate healthcare professionals' perceptions, experiences, and challenges regarding the use of AI-powered diagnostic and predictive analytics tools in hospital settings in Jeddah, Saudi Arabia, and to examine the factors influencing their adoption and confidence levels.
Method: a descriptive cross-sectional study was conducted among 240 healthcare professionals, including physicians, nurses, specialists, and allied health staff from selected hospitals in Jeddah. Data were collected using a validated bilingual questionnaire assessing familiarity, training, usage patterns, perceived benefits, and barriers to AI implementation. Quantitative data were analyzed using descriptive statistics and Chi-square tests, while qualitative responses underwent thematic SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis.
Results: overall, 59,2 % of participants reported using AI tools, primarily in diagnostic imaging. Although most participants demonstrated moderate familiarity with AI, only 30 % expressed confidence in AI-based diagnostics. Significant associations were observed between professional roles, years of experience, and AI utilization ($p < 0,05$). Major challenges included limited training, cost, and lack of institutional support. SWOT analysis revealed a strong willingness to adopt AI but highlighted patient resistance and ethical concerns as persisting threats.
Conclusions: AI integration in Saudi hospitals is advancing yet constrained by training and trust gaps. Strengthening institutional frameworks, implementing national AI competency programs, and aligning initiatives with Vision 2030 are essential to ensure effective, ethical, and sustainable AI adoption.

Keywords: Artificial Intelligence; Diagnostic Tools; Healthcare Professionals; Perceptions; Saudi Arabia.

RESUMEN

Introducción: la inteligencia artificial (IA) está transformando cada vez más la toma de decisiones clínicas y la precisión diagnóstica en los sistemas sanitarios de todo el mundo. Sin embargo, a pesar del creciente interés en Arabia Saudí, las percepciones y la disposición de los profesionales sanitarios hacia la integración de la

IA siguen siendo poco exploradas. Este estudio tuvo como objetivo evaluar las percepciones, experiencias y desafíos de los profesionales sanitarios en relación con el uso de herramientas de diagnóstico y análisis predictivo basadas en IA en entornos hospitalarios de Yeddah (Arabia Saudí) y examinar los factores que influyen en su adopción y niveles de confianza.

Método: se realizó un estudio descriptivo transversal con 240 profesionales sanitarios, incluyendo médicos, enfermeras, especialistas y personal sanitario auxiliar de hospitales seleccionados de Yeddah. Los datos se recopilaron mediante un cuestionario bilingüe validado que evaluó la familiaridad, la formación, los patrones de uso, los beneficios percibidos y las barreras para la implementación de la IA. Los datos cuantitativos se analizaron mediante estadística descriptiva y pruebas de Chi-cuadrado, mientras que las respuestas cualitativas se sometieron a un análisis FODA temático (Fortalezas, Debilidades, Oportunidades y Amenazas).
Resultados: En general, el 59,2 % de los participantes reportaron utilizar herramientas de IA, principalmente en diagnóstico por imagen. Si bien la mayoría de los participantes demostró un conocimiento moderado de la IA, solo el 30 % expresó confianza en el diagnóstico basado en IA. Se observaron asociaciones significativas entre los roles profesionales, los años de experiencia y el uso de la IA ($p < 0,05$). Los principales desafíos incluyeron la capacitación limitada, el costo y la falta de apoyo institucional. El análisis FODA reveló una fuerte disposición a adoptar la IA, pero destacó la resistencia de los pacientes y las preocupaciones éticas como amenazas persistentes.
Conclusiones: la integración de la IA en los hospitales saudíes avanza, pero se ve limitada por la falta de capacitación y confianza. El fortalecimiento de los marcos institucionales, la implementación de programas nacionales de competencias en IA y la alineación de las iniciativas con la Visión 2030 son esenciales para garantizar una adopción eficaz, ética y sostenible de la IA.

Palabras clave: Inteligencia artificial; Herramientas de diagnóstico; Profesionales de la salud; Percepciones; Arabia Saudita.

INTRODUCTION

Artificial Intelligence (AI) is rapidly transforming the landscape of modern healthcare, particularly in diagnostic and clinical decision-making domains. AI-powered tools, such as predictive analytics and diagnostic imaging systems, enable healthcare professionals to analyze vast datasets, identify subtle disease patterns, and support more accurate and timely diagnoses.[1,2] Recent studies have demonstrated that AI can achieve diagnostic performance comparable to, and in some cases surpassing, that of human experts across fields such as radiology, dermatology, and cardiology.[3,4,5]

Within hospital environments, AI technologies offer promising solutions to challenges such as high patient loads, limited human resources, and the increasing complexity of clinical data.[6,7] Moreover, predictive AI models have been shown to improve the accuracy of disease detection and treatment planning by integrating multi-modal health data and real-time analytics.[8,9]

In Saudi Arabia, the integration of AI into healthcare systems aligns closely with the Kingdom's Vision 2030, which emphasizes innovation, digital transformation, and improved healthcare quality.[10] However, despite growing governmental and institutional interest, implementation remains inconsistent. Many hospitals still face critical barriers, including insufficient training, limited infrastructure, high costs, and ethical or legal uncertainties.[11] Furthermore, understanding the attitudes, perceptions, and real-world experiences of healthcare professionals is essential for ensuring successful AI integration into hospital workflows and for maximizing its benefits on patient outcomes.[6,12]

While international research has explored the application of AI in clinical diagnostics, few studies have investigated its adoption from the perspective of healthcare professionals in Saudi Arabia, particularly within the hospital setting. The context of Jeddah, home to diverse public and private healthcare institutions, provides an ideal environment to examine how professionals from varied disciplines engage with AI tools, perceive their reliability, and navigate the challenges of implementation. The present study addresses a critical gap by examining not only the frequency and confidence of AI use but also the systemic and institutional factors influencing its integration. Moreover, through quantitative and thematic (SWOT) analyses, this research highlights how professional experience, training, and role diversity shape the success or limitation of AI adoption in real clinical settings. Findings from this study can inform evidence-based policies and targeted training programs that enhance the quality, efficiency, and sustainability of AI integration in Saudi healthcare.

This study aims to explore the perceptions, experiences, and challenges faced by healthcare professionals in integrating AI-powered diagnostic tools in hospitals in Jeddah, Saudi Arabia, and to evaluate the perceived impact of these tools on diagnostic accuracy, treatment outcomes, and clinical workflows. By assessing levels of familiarity, confidence, and satisfaction among professionals, and by identifying the barriers and

enablers to AI adoption, such as training, institutional support, and patient attitudes, the study provides an in-depth understanding of the systemic gaps affecting implementation. Through thematic (SWOT) analysis, the research delineates the strengths, weaknesses, opportunities, and threats associated with AI integration, thereby contributing valuable insights to the ongoing national and global discourse on digital transformation in healthcare.

This study is among the first in Saudi Arabia to combine quantitative perception analysis with thematic SWOT evaluation to assess AI adoption in hospital settings, offering a comprehensive evidence-based perspective to guide future AI integration strategies and healthcare policy development.

METHOD

Study Design

This study employed a cross-sectional design to explore the perceptions, experiences, and challenges faced by healthcare professionals in using AI-powered diagnostic and predictive analytics tools in selected hospitals across Jeddah, Saudi Arabia. Ethical approval was granted by the Ethical Committee at Batterjee Medical College, Jeddah (Ref. No. RES-2025-0015). Informed consent was obtained electronically from all participants prior to participation.

Study Setting and Participants

The study was conducted in various selected public and private hospitals across Jeddah to ensure diversity in clinical settings, patient populations, and levels of technological adoption. Participants included healthcare professionals such as physicians, nurses, specialists, physician assistants, pharmacists, and healthcare administrators who were directly involved in patient care and the use of diagnostic tools.

Inclusion criteria

Encompassed healthcare professionals, including physicians, nurses, and allied health practitioners, actively working in hospital settings in Jeddah and with direct or indirect experience in using AI-powered diagnostic or predictive tools.

Exclusion criteria

Included administrative or non-clinical personnel not involved in patient diagnosis or care, and healthcare professionals with no prior exposure to AI-based diagnostic tools.

Sampling Method and Sample Size

A convenience sampling technique was employed to recruit participants who met the inclusion criteria and were available during the study period. This method was selected because the targeted healthcare professionals worked in multiple clinical departments with varying schedules, making probabilistic sampling impractical within the study timeframe. Convenience sampling allowed efficient access to participants while maintaining representation across different specialties. The sample size was determined using Cochran's formula for population proportion estimation[13] with 0,5 as expected proportion because it maximizes sample size when the true proportion is unknown, thereby providing the most conservative estimate. A 95 % confidence interval and a margin of error of 0,063 (± 6,3 %), were applied to ensure acceptable precision while remaining feasible in relation to the available study population.

Although the minimum required sample size was 240 participants, the survey was successfully completed by 240 healthcare professionals. This sample offers a meaningful representation aligned with the study's objectives. The reduced sample size was largely attributable to the limited number of hospitals currently implementing artificial intelligence technologies, which restricted the pool of eligible respondents.

Instrument and Data Collection

Data were collected using a structured, self-administered questionnaire distributed in both online and paper-based formats to maximize participation. The instrument consisted of five sections: (1) demographic characteristics, (2) familiarity and training in AI tools, (3) frequency and type of AI tool usage, (4) perceived impact on diagnostic accuracy, workflow efficiency, and patient outcomes, and (5) perceived barriers and challenges.

The questionnaire employed a combination of closed-ended, Likert-scale, and open-ended items to ensure both quantitative and qualitative insights. The survey was bilingual (English and Arabic), and the Arabic version underwent rigorous forward–backward translation to ensure semantic equivalence and content validity.

Validation and Pilot Testing

Prior to full-scale data collection, a pilot study was conducted among 20 healthcare professionals from selected hospitals in Jeddah. The pilot assessed clarity, reliability, and relevance of the questionnaire items.

Feedback obtained from participants was used to refine question wording and structure. Reliability analysis from the pilot phase indicated acceptable internal consistency (Cronbach's α > 0,80). The validated instrument was subsequently used for the main study.

Statistical Analysis

IBM SPSS Statistics Version 26 was used to examine the data. The demographic features and response distributions of the participants were compiled using descriptive statistics, such as percentages and frequencies. Associations between categorical variables were examined using the Chi-square test (x^2), with a significance level set at $p < 0,05$.

Open-ended responses were analyzed thematically using a SWOT framework (Strengths, Weaknesses, Opportunities, and Threats) to identify key qualitative insights and contextualize quantitative findings.

Ethical Considerations

Ethical approval for the study was obtained from the Ethical Committee at Batterjee Medical College, Jeddah. Participants were informed of the study purpose, their voluntary participation, and the confidentiality of their responses. Written informed consent was obtained electronically prior to participation, with the option to withdraw at any stage without penalty.

Data Management

All collected data were securely stored in password-protected electronic files, accessible only to authorized members of the research team. Data will be retained for five years following publication and permanently deleted thereafter, in compliance with Batterjee Medical College's Research Data Policy.

RESULTS

Table 1. Frequency and Descriptive statistics of the participants based up on the demographic and basic question analysis

Variables	Categories	Frequencies (n)	Percentage (%)
Gender	Female	146	60,8
	Male	94	39,2
Age	25-34 years	125	52,1
	35-44 years	60	25,0
	45-54 years	54	22,5
	Above 55 years	1	,4
Professional role	Physician	95	39,6
	Nurse	30	12,5
	Physician assistant	26	10,8
	Healthcare administrator	31	12,9
	Specialist	45	18,8
	Pharmacist	9	3,8
	Student	4	1,7
Experience in years	Less than 5 years	102	42,5
	5-10 years	74	30,8
	11-20 years	53	22,1
	More than 20 years	11	4,6
AI tools in practice	Yes	142	59,2
	No	98	40,8
If, no: Would you consider using them in the future?	Yes	200	83,3
	No	40	16,7
How familiar are you with the principles of AI and its applications in healthcare?	Not familiar at all	23	9,6
	Slightly familiar	82	34,2
	Moderately familiar	102	42,5
	Very familiar	29	12,1
	Expert	4	1,7
Have you received formal training on using AI-powered diagnostic tools?	Yes	125	52,1
	No	115	47,9

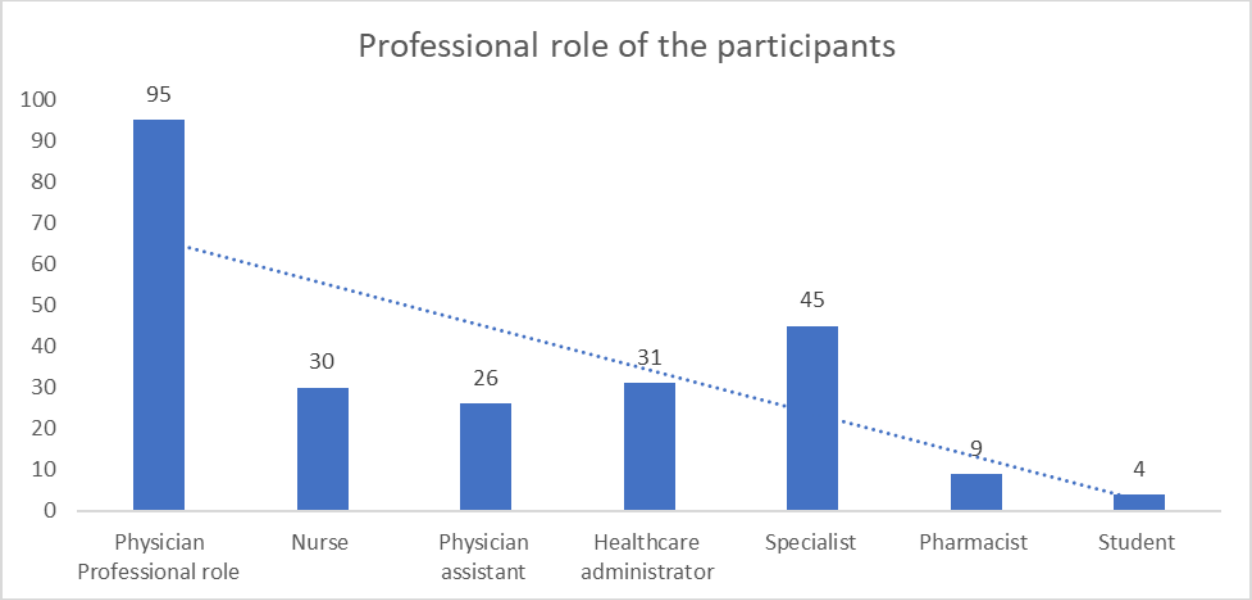

Figure 1. Professional role of the study participants

The responds consist of 60,8 % females and 39,2 % males, out of which 52,1 % were identified to be between the age of 25 – 34 years. 39,6 % were the physicians, 12,5 % were nurses and 18,8 % are pharmacist working at hospital settings, with 73,3 % participants have professional experience of over 10 years. 59,2 % agreed that they use AI tools in practice and 83,3 % expressed interest in using the AI tools in future, if in case they were not available at their premises. However, 42,5 % participants expressed that they are moderately familiar with the AI tools used in diagnosis, which can be considered low for a professional settings reason being that 47,9 % didn't receive any formal training regarding the use of AI tools in practice.

Very large percentage (90,1 %) of participants expressed that they either use Rarely or occasionally the AI tools in diagnosis and treatment. Moreover, only 42,9 % agreed on using AI tools in diagnostic imaging with only 30 % of participants showed confidence in the AI based diagnosis tools and their reports, with around 45 % expressed that the AI tools has improved their health-related accuracies. Only 46,7 % respondents highlighted that their diagnosis aligned 26 % said the diagnosis neither rarely or never aligned with the clinical judgements. 56,7 % expressed there was increase and 20,5 % expressed that there was decrease in the time required for making a diagnosis. From the patient's point of view, 49,2 % expressed occasionally and 14,6 % frequently patients concerns or resistance toward AI-powered tools in their care.

Table 2. The frequency and percentage of the responses related to the use of AI tools in clinical practice

Variables	Categories	Frequencies (n)	Percentage (%)
How often do you use AI-based tools for diagnosis and treatment planning?	Never	52	21,7
	Rarely	63	26,3
	Occasionally	101	42,1
	Frequently	18	7,5
	Always	6	2,5
What type(s) of AI tools do you use?	Predictive analytical software	62	25,8
	Diagnostic imaging tools	103	42,9
	Clinical decision support systems	52	21,7
	Nothing	22	9,2
On a scale of 1 to 5, how confident are you in the accuracy of AI-powered diagnostics?	Not confident at all	19	7,9
	Slightly confident	58	24,2
	Neutral	91	37,9
	Confident	62	25,8
	Very confident	10	4,2

To what extent has AI impacted your diagnostic accuracy?	Strongly improved	24	10,0
	Moderately improved	85	35,4
	No change	79	32,9
	Slightly reduced	43	17,9
	Significantly reduced	9	3,8
How often do AI-based diagnostics align with your clinical judgment?	Never	23	9,6
	Rarely	36	15,0
	Occasionally	112	46,7
	Frequently	56	23,3
	Always	13	5,4
Do AI tools reduce the time required for making a diagnosis?	Significantly reduce	47	19,6
	Slightly reduce	89	37,1
	No change	55	22,9
	Slightly increase	45	18,8
	Significantly increase	4	1,7
Do patients express concerns or resistance toward AI-powered tools in their care?	Never	30	12,5
	Rarely	47	19,6
	Occasionally	118	49,2
	Frequently	35	14,6
	Always	10	4,2

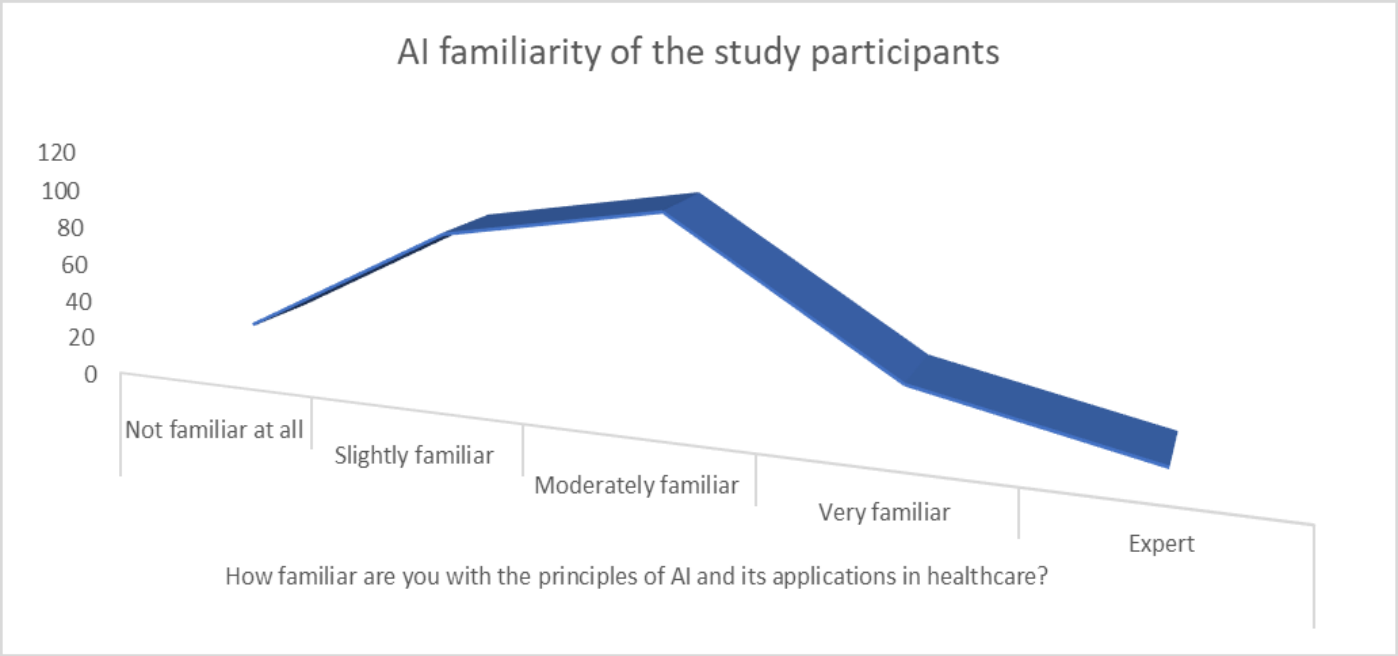

Figure 2. AI familiarities of the study participants

Lack of AI training, trust associated and the cost (37,5 %) with the AI tools are the major challenges identified by the study. Along with 41,7 % of respondents has neutral point of view towards the impact of AI on treatment outcomes of patients, which may be due to the introductory early stage of AI applications in diagnosis. However, 52,1 % of participants have reported that they have noticed overall improved job satisfaction post AI tools application in diagnosis.

55,4 % of respondents strongly agreed to the point that the AI tools should be integrated more widely into primary care practices, with better training (35,4 %), and improved software compatibility (27,5 %), better institutional support (22,9 %). Finally, 49,6 % agreed to the fact that they are using AI based diagnostic tools in their current practice.

Table 3. Response frequencies related to the challenges and outcomes regarding the AI tools in diagnosis

Variables	Categories	Frequencies (n)	Percentage (%)
What are the major challenges in using AI-based tools?	Lack of training	48	20,0
	Trust in AI recommendations	56	23,3
	Cost of AI tools	90	37,5
	Ethical or Legal concerns	26	10,8
	Patient reluctance to accept AI driven care	18	7,5
How would you rate the impact of AI on treatment outcomes for patients?	Very positive	23	9,6
	Positive	83	34,6
	Neutral	100	41,7
	Negative	30	12,5
	Very negative	4	1,7
How has the use of AI affected your overall job satisfaction?	Significantly improved	39	16,3
	Slightly improved	86	35,8
	No change	71	29,6
	Slightly reduced	35	14,6
	Significantly reduced	9	3,8

Table 4. The responses and their demographic outcomes related to the future perspectives of the AI tools in diagnosis

Variables	Categories	Frequencies (n)	Percentage (%)
Do you believe AI tools should be integrated more widely into primary care practices?	Strongly agree	56	23,3
	Agree	77	32,1
	Neutral	76	31,7
	Disagree	25	10,4
	Strongly disagree	6	2,5
What additional support would help you better integrate AI tools into your practice?	Training programs	85	35,4
	Improved AI software compatibility	66	27,5
	Institutional support and policies	55	22,9
	Collaboration with AI vendors	32	13,3
	None	2	0,8
Do you currently use AI-based diagnostic tools in your practice?	Yes, I use	119	49,6
	no, I don't	121	50,4

The Chi-square test was employed to examine the relationship between the demographic characters and professional variables i.e., independent variables which includes various perceptions and usage patterns of AI in healthcare i.e., dependent variables. Huge significant outcomes were identified in due process.

Association with Age

All aspects of AI perception showed significant association with age. Specially, extremely significant association was noticed with the participants receiving formal training on AI-powered diagnostic tools and AI reduces the diagnostic time ($p < 0,001$), highly significant association was noticed with AI on diagnostic accuracy ($p < 0,002$) and overall job satisfaction ($p < 0,008$). Furthermore, significant association was noticed with familiarities with AI principles ($p = 0,032$), frequency of use of AI ($p = 0,020$), types of tools used ($p = 0,014$) and the impact of AI on treatment outcomes ($p < 0,001$). Most of the participants accepted the fact that the integration of AI ($p = 0,016$) would strengthen the outcomes. Finally, the perception of major challenges associated with the AI was also identified to be high ($p < 0,001$).

Table 5. Chi-square test outcomes of the cohort demonstrating the utilisation of AI in diagnostic tools

Independent variable	Dependent variable	Chi-Square (x2)	Degree of freedom (df)	P-value	Significant association (p ≤ 0,05)
Age	How familiar are you with the principles of AI and its applications in healthcare?	22,515	120	0,032	Significant
	Have you received formal training on using AI-powered diagnostic tools?	23,913	3	0,000	Extremely significant
	How often do you use AI-based tools for diagnosis and treatment planning?	24,105	12	0,020	Significant
	What type(s) of AI tools do you use?	20,762	9	0,014	Significant
	To what extent has AI impacted your diagnostic accuracy?	30,780	12	0,002	Highly significant
	Do AI tools reduce the time required for making a diagnosis?	35,566	12	0,000	Extremely significant
	What are the major challenges in using AI-based tools?	47,439	18	0,000	Very highly significant
	How would you rate the impact of AI on treatment outcomes for patients?	37,525	12	0,000	Extremely significant
	How has the use of AI affected your overall job satisfaction?	27,050	12	0,008	Highly Significant
	Do you believe AI tools should be integrated more widely into hospitals?	24,761	12	0,016	Significant
What is your Professional Role?	How familiar are you with the principles of AI and its applications in healthcare?	47,532	24	0,003	Highly Significant
	Have you received formal training on using AI-powered diagnostic tools?	34,049	6	0,000	Very highly significant
	How often do you use AI-based tools for diagnosis and treatment planning?	48,515	24	0,002	Highly Significant
	What type(s) of AI tools do you use?	50,209	18	0,000	Extremely significant
	To what extent has AI impacted your diagnostic accuracy?	43,782	24	0,008	Very highly significant
	How often do AI-based diagnostics align with your clinical judgment?	41,679	24	0,014	Significant
	Do AI tools reduce the time required for making a diagnosis?	51,342	24	0,001	Very highly significant
	Do patients express concerns or resistance toward AI-powered tools in their care?	45,368	24	0,005	Highly significant
	How would you rate the impact of AI on treatment outcomes for patients?	56,836	24	0,000	Extremely significant
	How has the use of AI affected your overall job satisfaction?	53,356	24	0,001	Very highly significant
	Do you believe AI tools should be integrated more widely into primary care practices?	52,608	24	0,001	Extremely significant
Experience	How familiar are you with the principles of AI and its applications in healthcare?	27,910	12	0,006	Highly significant
	Have you received formal training on using AI-powered diagnostic tools?	26,433	3	0,000	Extremely significant

	How often do you use AI-based tools for diagnosis and treatment planning?	44,683	12	0,000	Extremely significant
	What type(s) of AI tools do you use?	31,252	9	0,000	Extremely significant
	On a scale of 1 to 5, how confident are you in the accuracy of AI-powered diagnostics?	27,487	12	0,007	Highly significant
	To what extent has AI impacted your diagnostic accuracy?	47,959	12	0,000	Extremely significant
	Do AI tools reduce the time required for making a diagnosis?	23,791	12	0,022	Significant
	Do patients express concerns or resistance toward AI-powered tools in their care?	30,056	12	0,003	Highly significant
	What are the major challenges in using AI-based tools?	29,780	18	0,040	Significant
	How would you rate the impact of AI on treatment outcomes for patients?	35,483	12	0,000	Extremely significant
	How has the use of AI affected your overall job satisfaction?	54,514	12	0,000	Extremely significant
	Do you believe AI tools should be integrated more widely into hospitals?	21,033	12	0,050	Significant
Do you currently use AI-based diagnostic tools in your practice?	How familiar are you with the principles of AI and its applications in healthcare?	39,780	4	0,000	Extremely significant
	Have you received formal training on using AI-powered diagnostic tools?	50,533	1	0,000	Extremely significant
	How often do you use AI-based tools for diagnosis and treatment planning?	62,197	4	0,000	Extremely significant
	What type(s) of AI tools do you use?	34,115	3	0,000	Extremely significant
	To what extent has AI impacted your diagnostic accuracy?	30,246	4	0,000	Extremely significant
	How often do AI-based diagnostics align with your clinical judgment?	25,754	4	0,000	Extremely significant
	Do AI tools reduce the time required for making a diagnosis?	12,911	4	0,012	Highly significant
	Do patients express concerns or resistance toward AI-powered tools in their care?	12,305	4	0,015	Significant
	What are the major challenges in using AI-based tools?	17,319	6	0,008	Highly significant
	How would you rate the impact of AI on treatment outcomes for patients?	14,739	4	0,005	Highly significant
	How has the use of AI affected your overall job satisfaction?	26,189	4	0,000	Extremely significant
	What additional support would help you better integrate AI tools into your practice?	14,073	4	0,007	Highly significant

Association with professional role

The professional role participants were extremely significantly associated with the type of AI tools used ($p < 0,001$), the rating of AI's role in treatment outcomes ($p < 0,001$) and the belief that the integration of AI in clinical decision making must be done ($p = 0,001$). Formal training with AI ($p < 0,001$), impact on diagnostic accuracy ($p = 0,008$), job satisfaction ($p = 0,001$) and perception of AI reduces diagnostic time ($p = 0,001$) was very highly significantly associated with the professional role of the participants. Further significant association

was identified with familiarities with AI (p = 0,003), frequency of AI use (p = 0,002) and patient concerns about AI (p = 0,005) and clinical judgement (p = 0,014) which may impact the integration, however this counts as opportunity for improvement in the implementation of AI in the clinical settings.

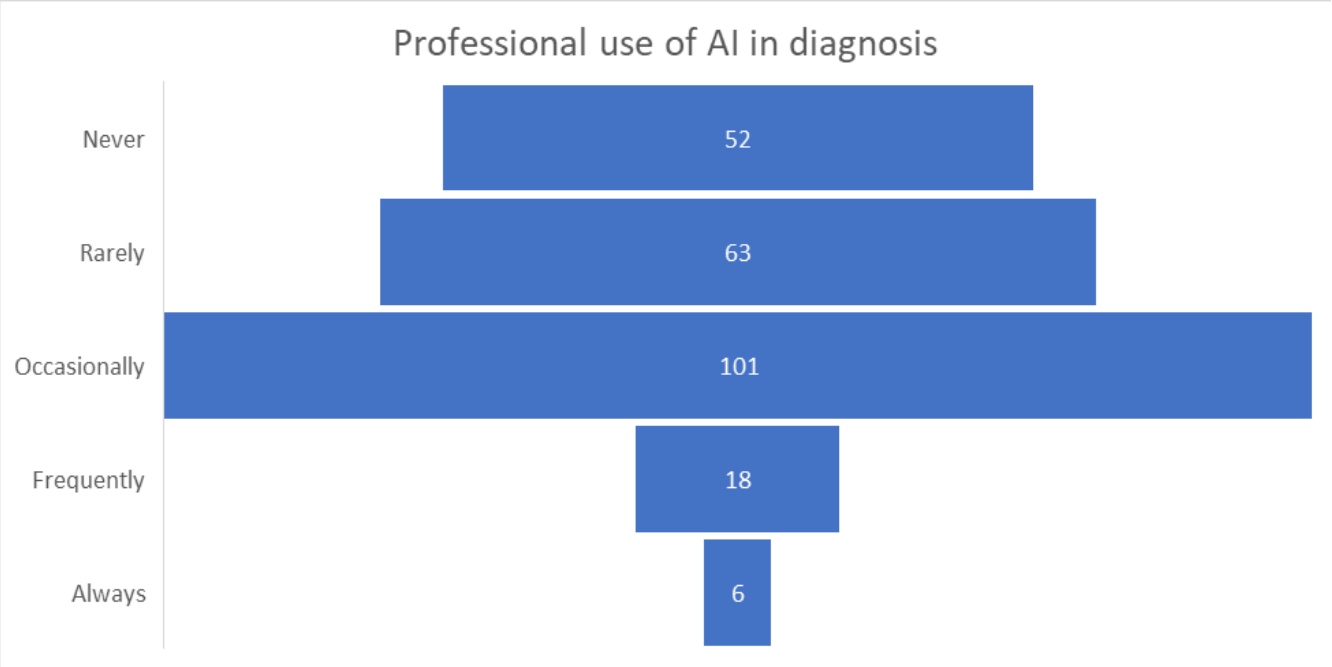

Figure 3. Professional use of AI in diagnosis

Association with professional experience

Formal training with AI is linked to the profession experience extremely significantly (p < 0,001), frequency of AI tools used (p < 0,001), types of tools used (p < 0,001), impact on diagnostic accuracy (p < 0,001), impact on treatment outcomes (p < 0,001) and job satisfaction and its effects (p < 0,001) were extremely significant with professional experience. Familiarities with AI principles (p = 0,006), confidence in AI based diagnosis (p = 0,007), and patient concerns (p = 0,003) were highly significant associated with the professional experience of the participants. However, significant association was noticed with the AI reduces diagnostic time (p = 0,002), Major challenges in the implementation of AI (p =0,040) and belief in integration of AI in the clinical settings (p = 0,050). The findings highlight an opportunity regarding integration of AI in clinical settings professionally.

Association with current AI use

The current study has successfully identified a extremely significantly association between factors of analysis like familiarities with AI principles (p < 0,001), receipt of formal training (p < 0,001), frequency of use of AI (p < 0,001), types of tools used (p < 0,001), diagnostic accuracy (p < 0,001), alignment with clinical judgement (p < 0,001), and job satisfaction and its effects (p < 0,001), with the participants current use of AI for the clinical purposes, which is a positive sign regarding the integration of AI and its acceptance. Furthermore, highly significant association was noticed with perception that the AI reduces diagnostic time (p = 0,012), major challenges in using AI (p = 0,008), impact on treatment outcomes (p = 0,005), and kind of additional support needed for integration (p = 0,007). A significant association was also identified for patients concerns or resistance towards acceptance of AI based outcomes clinically (p = 0,015) (table 5).

Four key components regarding the adoption of AI in healthcare was identified through thematic analysis of the qualitative and quantitative data and divided into Strengths, Weakness, Opportunities and Threats i,e, SWOT analysis, The current existence of AI and future options of AI integration was obtained.

Strengths: AI adoption and foundational readiness

Healthcare professionals appear to be ready for the adoption of AI in healthcare, and the overall findings indicate a strong willingness to adopt AI in the future. In particular, non-users of AI are positively motivated toward accepting AI in line with modernization trends in healthcare. Most respondents are familiar with AI principles, which suggests a foundational AI-based knowledge that can be further strengthened in the future. Moreover, the results of this study are supported by the participation of a wide variety of professionals, representing a broad cross-section of clinical practice.

Table 6. The thematic (SWOT) analysis of the responses and identification of gaps in the application of AI in clinical settings

Strengths High Willingness to Adopt AI in the Future Non-users are willing to use AI tools in the future. Indicates a positive outlook and acceptance toward AI among respondents, which aligns with modernization trends in healthcare. Moderate to High Familiarity with AI Most of respondents are moderately familiar with AI principles. This level of knowledge can be leveraged to implement targeted training programs. Diverse Professional Participation The dataset includes physicians (39,6 %), nurses (12,5 %), specialists (18,8 %), and others, providing insights across multiple roles.	Weakness Low Confidence in AI Diagnostics Majority remain neutral or only slightly confident in the accuracy of AI diagnostics. Indicates the need for more reliable AI tools or better evidence showcasing their efficacy. Training Gap Huge proportion of the participants not received formal training on AI-powered tools. The absence of training is a significant barrier to effective adoption. Limited Frequency of Use Less 10 % of the participants frequently or always use AI tools, with half of the sample size reporting rare or no usage. Highlights a gap in implementation despite willingness to adopt. Challenges in Integration Major challenges include cost, lack of training, and technical issues.
Opportunities Focused Training Programs One-third of the respondents identified training programs as essential for better integration of AI tools. Providing such training can directly address barriers and improve adoption rates. Targeted Development for Specific Roles Different roles basing up on the professional role i.e., physicians, pharmacist, nurses show varied familiarity and needs. Tailored solutions for each group can increase overall adoption. Support for Institutional Policies and Collaboration One-fourth identified institutional support as a key enabler, while emphasized collaboration with AI vendors. Broader Integration to Enhance Diagnostic Accuracy One-third of respondents report moderate improvement in diagnostic accuracy due to AI. Expanding use to capitalize on these benefits can improve outcomes further.	Threats Patient Resistance Almost half reported to be facing occasional resistance from patients regarding AI-powered tools, with few experiencing frequent concerns. Gender and Role-Specific Disparities Nurses and physician assistants responded low in training access. Low Alignment with Clinical Judgment Only one-fourth report frequent or always alignment between AI-based diagnostics and clinical judgment. High Cost and Resource Limitations Cost is cited as a significant barrier by respondents. Lack of affordable AI solutions could delay adoption in resource-limited settings.

Weakness: Avoidable barriers towards effective clinical implementation of AI

Extremely significant barriers to AI implementation were identified despite the positive results. Low confidence towards AI based diagnosis is a very critical weakness, where majority of the respondents reported that they are either low or moderated confident regarding the accuracy of AI based results – this highlights a more definite reliable tool with better efficacy proven earlier. This can be due to a crucial training gap which was not received by majority of respondents, which decreases the competency of the individual. Furthermore, there is a limited frequency of use where one-tenth of the participants reported use of AI and most of reported no use. This issue adds on as a significant challenge in AI integration, cost of AI, training related to AI along with the technical issues.

Opportunities: Chance for enhancement

Focused training programs related to the integration of AI offers prominent opportunity, which were identified by respondents as essential, for addressing the training gap. Targeted development of specific roles basing upon the profession presents as opportunity, such as tailored training programs for physicians, pharmacists, nurses, physician assistants. Institutional support and collaboration with the AI suppliers with stronger institutional policies and collaboration policies would potentiate the outcomes. Furthermore, one-third respondents highlighted moderated improvement in the diagnosis accuracy, which can be improved through broader integration of AI based diagnosis with accuracy for the sake of better patient centered outcomes.

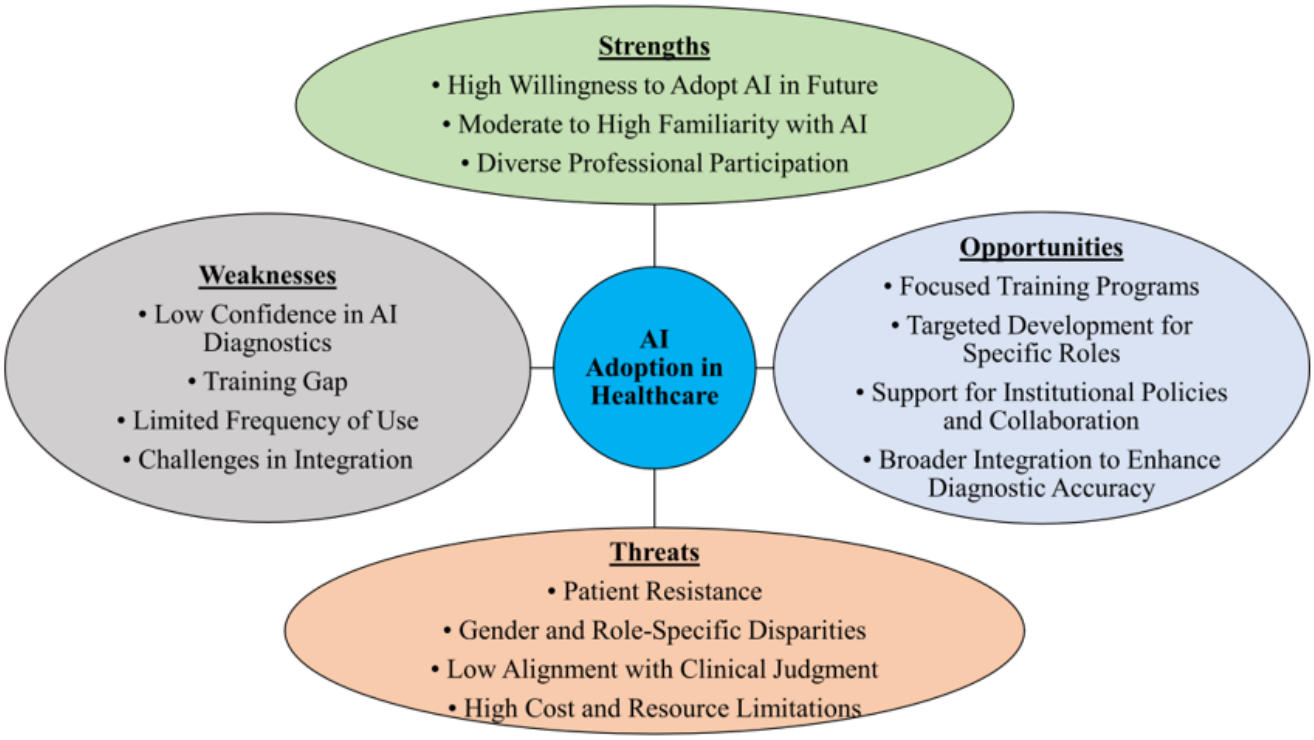

Figure 4. Hierarchy relationship of SWOT based thematic analysis of AI adoption in healthcare, illustrating the relation between the theme's domains and study outcomes of the participants

Threats: Risk factors needed to be addressed

Patient resistance and social lack of knowledge is a significant social threat was reported by half of the participants which may hinder the adoption of AI in healthcare. By conducting public awareness programs, the issue can be sorted. Professional role and gender disparities were clearly identified in the study, such as physician assistants reported lower access to training, risking adoption, creating workflow and accepting novel mediums in diagnosis. As an add-on Ai failing to align with the clinical judgement as only one-fourth participants highlighted that their clinical judgement or diagnosis is accurate with that of AI, which may limit trust and utility in future. High cost and resource limitations are also regularly cited as essential barrier which is needed to be addressed immediately.

DISCUSSION

The findings of this study provide valuable insights into the current state of artificial intelligence (AI) adoption in hospital-based clinical practice in Saudi Arabia. Overall, healthcare professionals demonstrated moderate familiarity and positive attitudes toward AI-powered diagnostic tools, yet their confidence in the accuracy of AI outcomes remained limited. These findings echo prior research indicating that while healthcare professionals recognize AI's potential, skepticism about its reliability and interpretability continues to impede widespread adoption.[14,15]

More than half of participants in the present study reported using AI tools in their practice, with diagnostic imaging and predictive analytics emerging as the most common applications. This reflects global trends, where radiology and oncology have been at the forefront of AI integration due to the technology's superior pattern-recognition capabilities.[16,17] However, the low frequency of consistent AI use and limited formal training highlight an important implementation gap.[18] Lack of structured education and exposure may hinder healthcare professionals' ability to critically interpret AI-generated data- raising concerns about overreliance on, or distrust in, algorithmic recommendations.[19]

A key finding of this study was the statistically significant association between professional experience, role, and the perceived impact of AI on diagnostic accuracy, treatment outcomes, and job satisfaction. Experienced clinicians, particularly physicians, showed higher familiarity and more frequent use of AI tools, aligning with prior work that associates seniority and specialization with increased technological engagement.[20,21] Nonetheless, cost, inadequate infrastructure, and lack of institutional support were repeatedly identified as barriers- consistent with other studies conducted in emerging healthcare systems.[22,23]

The thematic SWOT analysis conducted in this research provided an integrative perspective on systemic readiness for AI adoption. Strengths such as willingness to adopt AI and moderate baseline familiarity suggest

foundational readiness. Weaknesses, including training deficits and low confidence in diagnostic accuracy, underscore the need for competency-based training modules integrated into clinical education. Opportunities lie in targeted professional development programs and institutional collaborations with AI vendors to improve tool compatibility and integration. Conversely, patient resistance and ethical concerns, identified as threats, reflect global apprehension surrounding data privacy, transparency, and accountability in AI-assisted care.[24,25]

Regional and Global Comparison

When compared with similar research in the Gulf region and beyond, the present findings reveal both convergence and divergence in the dynamics of AI adoption. In the United Arab Emirates, a recent survey by Al Ketbi et al. demonstrated similarly high willingness among clinicians to integrate AI but noted stronger institutional support and earlier stages of implementation. This suggests that systemic backing plays a decisive role in transitioning from interest to sustained practice.[26] In Qatar, Qoronfleh et al.[27] found that while healthcare professionals perceive AI as beneficial for enhancing diagnostic efficiency, only a subset had received formal training; highlighting a training gap that aligns with the findings of the present study. Comparatively, the United Kingdom, where AI integration is more mature, shows higher confidence levels among clinicians due to standardized AI governance frameworks and national initiatives for digital competency.[28,29] The contrast underscores that the Saudi healthcare system's readiness is not primarily technological but educational and regulatory. Without structured, accredited training and clear ethical guidelines, even technologically equipped institutions may fail to realize AI's potential.

These comparative insights emphasize the importance of a multi-tiered strategy in Saudi Arabia: strengthening healthcare AI literacy, improving trust in AI systems, and ensuring interoperability across clinical environments. The observed regional parallels also highlight that AI adoption in the Gulf remains at a transitional stage, requiring policy alignment, investment in human capital, and continuous monitoring to ensure equity and patient safety.

Practical and Policy Implications

The outcomes of this study carry important implications for clinical practice, medical education, and health policy. At the practice level, integrating AI competencies into continuous medical education (CME) and postgraduate training programs could bridge the observed skill gap and enhance clinicians' confidence in interpreting AI outputs. The Ministry of Health (MOH) and the Saudi Commission for Health Specialties (SCFHS) could collaborate to establish national AI competency standards, ensuring that all healthcare professionals attain a baseline understanding of AI applications, ethical use, and data governance.

At the institutional level, hospitals should promote interdisciplinary collaboration between clinicians, data scientists, and IT specialists to create user-friendly AI interfaces and promote trust in automated decision support. The findings also suggest the need for formal AI governance committees within hospitals to oversee algorithmic validation, ethical review, and workflow integration.

At the policy level, the Saudi Ministry of Health could draw upon these findings to accelerate the implementation of the National Strategy for Data and Artificial Intelligence (NSDAI), focusing on clinical capacity-building rather than only infrastructure investment. Aligning AI adoption with the principles of Vision 2030- efficiency, innovation, and patient-centeredness- will ensure that technological progress translates into measurable health outcomes. Ultimately, empowering healthcare professionals through targeted training, institutional readiness, and regulatory clarity is essential to achieving a sustainable and ethically sound AI-enabled healthcare ecosystem in Saudi Arabia.

Limitations

There are a number of limitations to this study that should be noted. First, it is more difficult to determine a causal relationship between the adoption of AI and clinical results when a cross-sectional methodology is used. Second, the convenience sampling method may introduce selection bias, as participants with stronger opinions or familiarity with AI might have been more inclined to respond. Third, data were self-reported, which may lead to response bias or social desirability effects. Additionally, while the sample was diverse across professional roles, it was geographically restricted to hospitals in Jeddah, limiting generalizability to other regions of Saudi Arabia. Finally, although a mixed-method (quantitative and thematic) approach enriched data interpretation, future studies could benefit from longitudinal or experimental designs to assess real-time AI performance impacts.

CONCLUSIONS

This study underscores the evolving yet uneven integration of AI-powered diagnostic tools within hospital settings in Jeddah, Saudi Arabia. Healthcare professionals expressed optimism and willingness to embrace AI, yet gaps in training, infrastructure, and confidence hindered its full potential. The significant associations

between professional characteristics and AI use highlight the influence of both experiential and systemic factors on adoption success. Strengthening institutional support, improving access to tailored training programs, and addressing ethical and patient-centered concerns are essential for fostering trust and optimizing AI-assisted care. As Saudi Arabia advances toward Vision 2030, evidence-based strategies that combine technological readiness with professional empowerment will be critical to transforming healthcare delivery through AI innovation.

Future directions

Future research should adopt longitudinal and interventional study designs to evaluate how structured AI training and institutional support programs influence adoption rates, diagnostic accuracy, and patient outcomes over time. Comparative studies across multiple regions and hospital types could elucidate contextual differences in AI readiness and resource allocation. Additionally, qualitative explorations involving patients and administrators could enrich understanding of the socioethical and operational barriers to AI integration. Collaboration between universities, hospitals, and technology developers will be vital to developing context-specific AI governance frameworks that ensure transparency, accountability, and equitable access. Ultimately, building a robust AI ecosystem in Saudi healthcare requires continuous evaluation of human–machine collaboration, regulatory oversight, and capacity-building to ensure that AI remains a trusted and transformative partner in clinical decision-making.

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USE OF ARTIFICIAL INTELLIGENCE

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CONFLICT OF INTEREST

The authors declare no conflict of interest related to this study,

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