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Assessing the Healthcare Providers' Perception and Attitude toward the Integration of Artificial Intelligence Technology in Healthcare Settings

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Abstract: **Nowadays, the way that health organizations operate has changed dramatically because of technology. The recent rapid adoption of technology in healthcare has increased the need for healthcare providers and patients to use computer technology. So, the aim of the study is to assess healthcare providers' perception and attitude toward using artificial intelligence technology in healthcare settings at Ministry of health hospitals in Jeddah.Design: The quantitative, descriptive, cross-sectional design was implemented. The non-probability Convenience sampling technique was used to recruit the studied sample from the healthcare providers working in the two general hospitals. The sample size was equal to 366. Two electronic self-administered questionnaires were utilized to collect data about the perception of artificial intelligence and attitudes questionnaires of healthcare providers. Results: The findings demonstrated that most participants perceived AI as a valuable tool for improving healthcare efficiency, decision-making accuracy, and patient safety. High agreement was reported for AI's role in accelerating care processes, enhancing workflow efficiency, and supporting clinical judgment. Although perceptions were generally positive, most nurses demonstrated neutral attitudes toward AI applications. Conclusion: This finding concluded that the positive correlation between perception and attitude suggests that enhancing nurses' knowledge and practical engagement with AI may gradually shift attitudes from neutrality toward informed acceptance. This finding recommended that nurse leaders and educators should play a central role in shaping AI implementation strategies to ensure alignment with patient safety, ethical practice, and professional autonomy. Establishing clear policies and involving nurses in AI design and evaluation may further enhance trust and adoption.**

Keywords: **Artificial intelligence (AI); attitude; healthcare providers; healthcare settings; Ministry of health; perception.**

I. INTRODUCTION

The rapid progress in computing power, access to the internet, digitalization, and accumulated information has increased scholarly interest in artificial intelligence (AI) across multiple sectors. Healthcare providers in both the private and public sectors strive to leverage innovations to optimize the user experience, reduce costs, and improve the quality of care.

Although healthcare systems are among the most expensive in the world, technology continues to contribute significantly to saving lives and enhancing the quality of life for millions of people [1]. In parallel, healthcare systems are facing increasing challenges related to workforce shortages, workload burden, and efficiency, particularly among frontline healthcare professionals such as nurses.

AI is the science and engineering of creating intelligent machines that replicate human cognitive processes like learning and problem solving by using algorithms or a set of rules [2]. AI systems can act in a purposeful, intelligent, and adaptive way since they have the capacity to anticipate problems or address them as they arise.

The effective integration of AI technologies, including machine learning (ML), deep learning, and natural language processing, is expected to transform healthcare services from conventional methods to a value-driven approach, prioritizing personalized care [3,4]. ML and AI technologies are increasingly used in healthcare organizations to evaluate, analyze, improve, and respond to the large amount of data that is now accessible. These technologies have the potential to support healthcare providers by enhancing clinical decision-making and optimizing workflows. However, AI also presents challenges, and the effects of AI on medical professionals, healthcare organizations, and governments remain uncertain, particularly regarding acceptance, trust, and readiness for use in clinical practice [5,6].

In recent years, the utilization of AI has increased dramatically with the launch of Vision 2030 in Saudi Arabia, which aims to make the country one of the most efficient in healthcare [7]. Healthcare services are changing due to developments in AI, as these technologies are well adapted to analyze data and detect patterns and insights that people could not independently discover [8]. As a result, healthcare organizations can use algorithms to support clinical decision-making and improve the quality of care and experiences they provide. Additionally, AI can rapidly and precisely detect insights using large datasets, leading to enhanced patient satisfaction and improved clinical, operational, and financial performance [9].

The COVID-19 pandemic further accelerated the adoption of AI and highlighted the need for early and effective digital health strategies. AI played a crucial role during different stages of the pandemic, including identifying viral strains, supporting containment measures, and encouraging public compliance [10] In addition, AI contributed to improving workflows, supporting operational tasks, and facilitating the work of healthcare providers, thereby enhancing the quality of care delivered to patients [11]. These developments emphasized the importance of understanding how healthcare providers perceive and interact with AI technologies.

In spite of growing concerns about AI's ethical implications and predictable impacts, healthcare providers have been increasingly optimistic about the potential benefits of AI in healthcare over the past decade. Proactive patient care using AI is anticipated to reduce future risk for patients, healthcare providers and the profession as a whole. As a result, there has been a rise in studies looking at the application of AI in the healthcare sector. There is a wide range of opinions among nurses about using AI in healthcare, according to a recent study [12]. By understanding the perceptions and attitudes, policymakers in the health sector could devise plans to prepare hospitals and clinics better to implement AI and equip physicians and nurses to utilize the technology safely and effectively. However, there are lack of studies that investigated healthcare providers' perceptions and attitudes of AI technology. Therefore, the current study aims to gauge the perception and attitudes of healthcare providers regarding the application of artificial intelligence technology in healthcare in two governmental hospitals in Jeddah, Saudi Arabia.

II. BODY OF ARTICLE

MATERIALS AND METHODS

i. research design

This research utilized a quantitative descriptive cross-sectional design. This approach is widely used in healthcare research to obtain a snapshot of current perceptions and behaviors across a defined population at a specific point in time. Accordingly, this design was deemed appropriate to assess healthcare providers' perceptions and attitudes toward the integration of artificial intelligence within the study setting.

ii. research setting

This study was conducted in two governmental hospitals under the Ministry of Health in Jeddah, Saudi Arabia. These hospitals were selected due to their advanced medical facilities, diverse clinical specialties, and heterogeneous healthcare workforce. In addition, both hospitals are non-profit institutions that serve the general public.

The first setting was East Jeddah Hospital, a governmental hospital with a capacity of 300 beds. It employs approximately 620 staff nurses and 430 physicians and is recognized as a trauma center offering a wide range of medical specialties. The

hospital was established in 2016 and has received accreditation from the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI).

The second setting was King Abdullah Medical Complex, which has a capacity of 500 beds and employs approximately 600 staff nurses and 178 physicians. The hospital was established in 2013 under the Ministry of Health and provides elective medical and surgical services, supported by a state-of-the-art laboratory, trauma center, and outpatient clinics serving North Jeddah. The hospital has received accreditation from both the Joint Commission International (JCI) and the Saudi Central Board for Accreditation of Healthcare Institutions.

iii. sampling and sample size

A convenience sampling method was used in this study. The target population consisted of all full-time physicians (n = 608) and staff nurses (n = 1,220) working in inpatient and outpatient departments across the two selected hospitals.

The required sample size was calculated using the Raosoft sample size calculator, assuming a 50% response distribution, a 95% confidence level, and a 3% margin of error. The minimum required sample size was 318 participants. To account for potential nonresponse or incomplete questionnaires, the sample size was increased by 10%, resulting in a final target sample of 366 participants.

Inclusion criteria included registered healthcare providers (physicians and nurses) who were able to read and understand either English or Arabic and had at least one year of work experience.

Exclusion criteria included healthcare providers with less than one year of work experience, as they may not yet be sufficiently familiar with the hospital system, medical equipment, and patient care processes.

iv. tools of data collection

Data were collected using electronic self-administered questionnaires. Two main tools were utilized.

The first questionnaire consisted of two parts. The first part addressed socio-demographic characteristics and was developed by the researcher to collect information regarding age, gender, nationality, marital status, job type, current position, educational qualification, years of experience, and department.

The second part, titled “Perception about Artificial Intelligence Questionnaire,” was developed by [13]. It consisted of 37 items designed to assess healthcare providers’ perceptions of artificial intelligence applications. Responses were measured using a three-point Likert scale (0 = disagree, 1 = neutral, 2 = agree). Item scores were summed and converted into a percentage score. Scores ≤ 40% indicated low perception, scores from 41% to 80% indicated moderate perception, and scores ≥ 81% indicated high perception.

The second questionnaire also consisted of two parts. The first part assessed attitudes toward the medical application of artificial intelligence using a tool developed by [14]. The researcher modified the instrument by converting some multiple-choice questions into a Likert-scale format and omitting items not relevant to the present study. This section included 11 items measuring healthcare providers’ attitudes toward AI, perceived risks, and future directions of AI development in healthcare. Responses ranged from strongly disagree (1) to strongly agree (5).

The second part focused on “Areas of Artificial Intelligence Application in Healthcare Settings” and was developed by the researcher to identify participants’ perspectives on the most beneficial AI applications in healthcare. This section included 20 items rated on a five-point Likert scale ranging from not beneficial at all (1) to extremely beneficial (5).

"The categorization of attitudes was not arbitrary but was grounded in the established Bloom’s Cut-off Point criteria. Scores were transformed into percentage scores, where levels were defined as follows: Negative (<60%), Neutral (60%–80%), and Positive (>80%).

v. tool reliability and validity

The modification of the original instruments—including the adaptation of item formats to a Likert-scale structure and the strategic omission of non-relevant items to ensure clinical and cultural relevance—was supervised by a panel of experts (jury) consisting of three senior academic researchers from the Nursing Department at King Abdulaziz University, Jeddah. This panel evaluated the content validity and construct coherence of the modified scales to ensure that the adjustments did

not compromise the underlying theoretical dimensions of AI perception and attitude, with linguistic refinements made to the Arabic translation to ensure cross-cultural equivalence. Subsequently, a pilot study was conducted with 32 registered nurses (approximately 10% of the target sample) at East Jeddah Hospital to assess face validity and feasibility; participants reported an average completion time of 12–15 minutes and confirmed the clarity of the items. Reliability was empirically verified using Cronbach's alpha coefficients, yielding scores of 0.940 for the "Perception about Artificial Intelligence Questionnaire" and 0.758 for the "Questionnaire for Attitudes toward Medical Application of AI," both of which exceed the 0.70 threshold for psychometric reliability

vi. data collection procedure

First, after obtaining approval from the Nursing Faculty at King Abdulaziz University and the Ethics Committee of the Ministry of Health, data were collected using an electronic self-report questionnaire. Nurses who met the inclusion criteria and agreed to participate were invited via email to complete the survey. The invitation letter explained this study's objectives, emphasized the voluntary nature of participation, and assured confidentiality and data protection by the research team. Participants were required to provide informed consent prior to completing the survey. Reminders were sent daily to non-respondents to improve the response rate. Upon completion, all responses were securely saved and used solely for research purposes, ensuring data integrity and confidentiality.

The period of data collection commenced on 1 July 2024 and concluded in Janury 2024. This study received ethical approval from the Ministry of Health and King Abdulaziz University (Approval Code: A01941).

Prior to participation, all individuals were provided with a clear explanation of this study's purpose, its procedures, and their rights as participants. Informed consent was obtained from each participant before they proceeded to complete the survey. This process ensured that participation was voluntary and that individuals had the opportunity to decline or withdraw at any stage without any negative consequences. Confidentiality and anonymity were also maintained throughout this study to protect participants' privacy and personal information, in alignment with ethical research standards.

vii. data analysis

The Windows Statistical Package for Social Science (SPSS) SPSS ® -PC version 28 was used to analyze data. For all statistical analyses, the significance level was set at $P \leq 0.05$. analysis of data composed of descriptive as well as inferential analysis. Descriptive statistics were determined for the demographic data of the participants.

III. RESULTS

This study involved 366 participants more than two thirds of them were female (66.9%), majority of them were Saudi (72.4%) and more than half were unmarried (52.2%). Majority of participants were nurses (71.0%) while (29.0%) were physician. More than two third of the participants (67.5%) holding the position of staff nurse. The most represented age group was >35-40 years (44.5%) and most of them (85.5%) hold a bachelor's degree. Participants work in different departments, but half of them work in the Surgical ward (27.3%) and medical ward (20.8%).

Table I: Frequency and percentage of the Sociodemographic characteristics of healthcare providers (n=366)

Sociodemographic		Frequency	Percentage
Gender	Male	121	33.1
	Female	245	66.9
Nationality	Saudi	265	72.4
	Non-Saudi	101	27.6
Marital status	Married	175	47.8
	Not married	191	52.2
Job type	Physician	106	29.0
	Nurses	260	71.0
Position	Staff nurse	247	67.5
	Head nurse	7	1.9
	Supervisor	3	.8

	Director	4	1.1
	Resident	12	3.3
	Specialist	81	22.1
	Consultant	12	3.3
Age	21-25	64	17.5
	>25-30	40	10.9
	>30-35	68	18.6
	>35-40	163	44.5
	More than 40 years	31	8.5
Educational qualification	Diploma degree	37	10.1
	Bachelor's degree	313	85.5
	Master's degree and above	16	4.4
Department	Critical care (adult, pediatric, neonate)	21	5.7
	Emergency unit	14	3.8
	Hemodialysis	15	4.1
	Isolation ward	9	2.5
	Maternity ward	30	8.2
	Medical ward	76	20.8
	Nursery	10	2.7
	Nursing education	13	3.6
	Operating room	8	2.2
	Outpatient department	33	9.0
	Pediatrics ward	22	6.0
	Surgical ward	100	27.3
	Other	15	4.1

Table 2 reveals that the perception score was 54.03±10.43. More than half of healthcare providers (52.2%) had moderate perception regarding AI, high (47.0%) and only (0.8%) demonstrated a low perception

Table II: Perception score of utilization artificial intelligence questionnaire in healthcare setting (n=366)

Perception **Mean ± SD: 54.03±10.43**	**Frequency**	**Percent** **%**
Low	3	0.8
Moderate	191	52.2
High	172	47.0

Table 3 shows that the mean attitude score was 31.54 ± 6.43. Most of the participants (94.0%) had a neutral attitude regarding using AI, while 4.9% had positive attitude and 1.1% had a negative attitude regarding AI.

Table III: Describe frequency and percentage of attitude score toward medical application of artificial intelligence (n=366)

Attitude **Mean ± SD: 31.54±6.43**	**Frequency**	**Percent** **%**
Negative	4	1.1
Neutral	344	94.0
Positive	18	4.9

Table 4 presents a statistical analysis of how different sociodemographic factors relate to the perception levels (Low, Moderate, High) of healthcare providers toward AI applications as follow:

There is a statistically significant relationship between gender and AI perception with (p = .001). Males demonstrated a significantly more positive perception, with 60.3% had high perception. In contrast, only 40.4% of females registered a high perception, with a majority (58.8%) holding a moderate view. There is no statistically significant relationship between nationality and AI perception (p = .542). A statistically significant relationship exists between marital status and AI perception (p = .027). Married individuals held more positive views, with 54.3% having a high perception, compared to unmarried individuals, where 40.3% had a high perception.

The relationship between job type and perception is highly significant (p < .001). Physicians were overwhelmingly positive, with 73.6% registering a high perception. Conversely, nurses were far more moderate in their views; only 36.2% had a high perception, while a majority of 62.7% were in the moderate category. Position within the healthcare hierarchy showed a highly significant correlation with AI perception (p < .001). Seniority and specialization were linked to more positive views, with supervisors and directors showing 100% high perception, and specialists at 87.7%. This is in stark contrast to staff nurses, who had the least positive outlook, with only 33.2% holding a high perception and 65.6% holding a moderate view.

Age demonstrated a highly significant with AI perception (p < .001). The youngest group of providers (21-25 years) had the most moderate perception, with 96.9% in this category and only 3.1% holding a high perception. Positive perception peaked among the >35-40 age group, where 75.5% had a high perception, before declining again for those over 40. A highly significant relationship was found between educational level and perception (p < .001). Positivity increased with higher education. Those with a Diploma degree were predominantly moderate (86.5%). The percentage with a high perception increased among those with a bachelor's degree (50.5%) and was highest for those with a master's degree or above (56.3%).

The length of professional experience had a highly significant, non-linear relationship with AI perception, mirroring the trend seen with age (p < .001). Those with the least experience (1 to 5 years) had the lowest positive perception, with only 23.1% in the high category. Perception peaked among mid-career professionals, such as those with >15-20 years of experience (72.6% high), before dropping sharply for those with more than 20 years of experience (10.5% high). The clinical department where a provider works showed a highly significant correlation with their perception (p < .001). the most positive views were found in the medical ward (77.6% high perception) and the emergency unit (71.4% high). in contrast, staff in nursing education and the operating room held unanimously moderate views (100%), while others, such as the paediatric ward (90.9% moderate), were also notably less positive.

Table IV: Relationship between level of healthcare providers' perception about AI applications and their sociodemographic data (n=366).

Sociodemographic data		Perception score						p. value
		Low		Moderate		High		
		N	%	N	%	N	%	
Gender	Male	1	0.8%	47	38.8%	73	60.3%	**.001***
	Female	2	0.8%	144	58.8%	99	40.4%	
Nationality	Saudi	3	1.1%	139	52.5%	123	46.4%	.542
	Non-Saudi	0	0.0%	52	51.5%	49	48.5%	
Marital status	Married	1	0.6%	79	45.1%	95	54.3%	**.027***
	Not married	2	1.0%	112	58.6%	77	40.3%	
Job type	Physician	0	0.0%	28	26.4%	78	73.6%	**<.001***
	Nurses	3	1.2%	163	62.7%	94	36.2%	
Position	Staff nurse	3	1.2%	162	65.6%	82	33.2%	**<.001***
	Head nurse	0	0.0%	1	14.3%	6	85.7%	
	Supervisor	0	0.0%	0	0.0%	3	100.0%	
	Director	0	0.0%	0	0.0%	4	100.0%	
	Resident	0	0.0%	9	75.0%	3	25.0%	
	Specialist	0	0.0%	10	12.3%	71	87.7%	
	Consultant	0	0.0%	9	75.0%	3	25.0%	
Age	21-25	0	0.0%	62	96.9%	2	3.1%	**<.001***

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	>25-30	0	0.0%	32	80.0%	8	20.0%	
	>30-35	0	0.0%	33	48.5%	35	51.5%	
	>35-40	3	1.8%	37	22.7%	123	75.5%	
	More than 40 years	0	0.0%	27	87.1%	4	12.9%	
Educational qualification	Diploma degree	0	0.0%	32	86.5%	5	13.5%	**<.001***
	Bachelor's degree	3	1.0%	152	48.6%	158	50.5%	
	Master's degree and above	0	0.0%	7	43.8%	9	56.3%	
Years of experience	1 to 5 years	0	0.0%	83	76.9%	25	23.1%	**<.001***
	>5 to 10 years	2	2.0%	34	33.7%	65	64.4%	
	>10- 15 years	1	1.9%	34	63.0%	19	35.2%	
	>15 - 20 years	0	0.0%	23	27.4%	61	72.6%	
	More than 20 years	0	0.0%	17	89.5%	2	10.5%	
Department	Critical Care Unit	0	0.0%	15	71.4%	6	28.6%	**<.001***
	Emergency unit	0	0.0%	4	28.6%	10	71.4%	
	Haemodialysis	0	0.0%	12	80.0%	3	20.0%	
	Isolation ward	0	0.0%	8	88.9%	1	11.1%	
	Maternity ward	0	0.0%	11	36.7%	19	63.3%	
	Medical ward	0	0.0%	17	22.4%	59	77.6%	
	Nursery	0	0.0%	6	60.0%	4	40.0%	
	Nursing education	0	0.0%	13	100.0%	0	0.0%	
	Operating room	0	0.0%	8	100.0%	0	0.0%	
	Outpatient department	3	9.1%	20	60.6%	10	30.3%	
	Paediatrics ward	0	0.0%	20	90.9%	2	9.1%	
	Surgical ward	0	0.0%	45	45.0%	55	55.0%	
	Other	0	0.0%	12	80.0%	3	20.0%	

*: significant P<**.001**

Table 5 shows the relationship between level of healthcare providers' attitude about AI applications and their sociodemographic data. There is no statistically significant relationship between gender and attitude toward AI (p = .280). Nationality shows no statistically significant relationship with attitude (p = .993). There is no statistically significant difference in attitude based on marital status (p = .256) and there is no statistically significant relationship between job type and attitude (p = .096). Position is a highly significant predictor of attitude (p < .001). A definitively positive attitude is concentrated in managerial roles. directors were unanimously positive (100%), followed by supervisors (66.7% positive) and head nurses (28.6% positive). in contrast, specialists, consultants, and those over 40 were 100% neutral, while staff nurses were also overwhelmingly neutral (94.7%).

A statistically significant relationship exists between age and attitude (p = .015). The most positive attitudes were found in the >30-35 age group (13.2% positive). The most uniformly neutral attitudes were seen in the oldest group (>40 years, 100% neutral) and the youngest group (21-25 years, 98.4% neutral). Educational level is a highly significant factor (p < .001). Interestingly, those with a master's degree or above were unanimously neutral (100%). the small group with positive attitudes was found almost exclusively among those with a bachelor's degree (5.4% positive), while diploma holders were also overwhelmingly neutral (97.3%). Experience level showed a highly significant, non-linear relationship with attitude (p < .001). The most definitively positive attitudes were found in the mid-career group with >10-15 years of experience (20.4% positive). The most and least experienced providers—those with more than 20 years and 1 to 5 years—were the most neutral (100% and 98.1% respectively).

The clinical department is a highly significant predictor of attitude (p < .001). The emergency unit stands out with a majority positive attitude (57.1%). The nursery also showed a strong positive leaning (40.0% positive). In contrast, many departments, including the medical ward, surgical ward, operating room, and nursing education, were 100% neutral. the few negative attitudes recorded were concentrated in the outpatient department (12.1% negative)

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Table V: Relationship between level of healthcare providers' attitude about AI applications and their sociodemographic data (n=366).

Sociodemographic data		Attitude score						p. value
		Negative		Neutral		Positive		
		N	%	N	%	N	%	
Gender	Male	1	0.8%	111	91.7%	9	7.4%	.280
	Female	3	1.2%	233	95.1%	9	3.7%	
Nationality	Saudi	3	1.1%	249	94.0%	13	4.9%	.993
	Non-Saudi	1	1.0%	95	94.1%	5	5.0%	
Marital status	Married	3	1.7%	166	94.9%	6	3.4%	.256
	Not married	1	0.5%	178	93.2%	12	6.3%	
Job type	Physician	0	0.0%	104	98.1%	2	1.9%	.096
	Nurses	4	1.5%	240	92.3%	16	6.2%	
Position	Staff nurse	4	1.6%	234	94.7%	9	3.6%	**<.001***
	Head nurse	0	0.0%	5	71.4%	2	28.6%	
	Supervisor	0	0.0%	1	33.3%	2	66.7%	
	Director	0	0.0%	0	0.0%	4	100.0%	
	Resident	0	0.0%	11	91.7%	1	8.3%	
	Specialist	0	0.0%	81	100.0%	0	0.0%	
	Consultant	0	0.0%	12	100.0%	0	0.0%	
Age	21-25	0	0.0%	63	98.4%	1	1.6%	**.015***
	>25-30	0	0.0%	37	92.5%	3	7.5%	
	>30-35	2	2.9%	57	83.8%	9	13.2%	
	>35-40	2	1.2%	156	95.7%	5	3.1%	
	More than 40 years	0	0.0%	31	100.0%	0	0.0%	
Educational qualification	Diploma degree	0	0.0%	36	97.3%	1	2.7%	**<.001***
	Bachelor's degree	4	1.3%	292	93.3%	17	5.4%	
	Master's degree and above	0	0.0%	16	100.0%	0	0.0%	
Years of experience	1 to 5 years	0	0.0%	106	98.1%	2	1.9%	**<.001***
	>5 to 10 years	3	3.0%	95	94.1%	3	3.0%	
	>10- 15 years	1	1.9%	42	77.8%	11	20.4%	
	>15 - 20 years	0	0.0%	82	97.6%	2	2.4%	
	More than 20 years	0	0.0%	19	100.0%	0	0.0%	
Department	Critical care Units	0	0.0%	20	95.2%	1	4.8%	**<.001***
	Emergency unit	0	0.0%	6	42.9%	8	57.1%	
	Haemodialysis	0	0.0%	14	93.3%	1	6.7%	
	Isolation ward	0	0.0%	8	88.9%	1	11.1%	
	Maternity ward	0	0.0%	28	93.3%	2	6.7%	
	Medical ward	0	0.0%	76	100.0%	0	0.0%	
	Nursery	0	0.0%	6	60.0%	4	40.0%	
	Nursing education	0	0.0%	13	100.0%	0	0.0%	
	Operating room	0	0.0%	8	100.0%	0	0.0%	
	Outpatient department	4	12.1%	28	84.8%	1	3.0%	
	Paediatrics ward	0	0.0%	22	100.0%	0	0.0%	
	Surgical ward	0	0.0%	100	100.0%	0	0.0%	
	Other	0	0.0%	15	100.0%	0	0.0%	

***: significant**

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Table 6 shows that the multivariable linear regression analysis revealed distinct predictors for AI perception and attitude, effectively isolating independent effects while controlling for socio-demographic confounders. In Model 1 (AI Perception: $R^2 = .095$, $F = 6.29$, $p < .001$), Job Type emerged as the strongest predictor, with physicians demonstrating significantly higher scores than nurses (B = 8.22, 95% 95% CI [5.28, 11.16], p < .001), while Professional Experience over 10 years also positively influenced perception (B = 3.43, p = .003), providers with over 10 years of experience scored 3.43 units higher than those with less experience. In contrast, Model 2 (AI Attitude: $R^2 = .156$, $F = 11.05$, $p < .001$) identified a significant "Experience Paradox," where providers with over 10 years of experience exhibited a sharp decline in attitude scores (B = -4.55, 95% 95% CI [-5.90, -3.21], p < .001) despite their high intellectual perception. Additionally, Gender was a significant factor for attitude, with males exhibiting more positive dispositions (B = 2.02, p = .011), whereas Education (p = .824) and Nationality (p = .980) were not significant independent predictors in either model.

Table VI: Multiple Linear Regression Analysis of Factors Predicting AI Perception and Attitude among Healthcare Providers (n=366)

Predictor	Model 1: AI Perception	β	p	Model 2: AI Attitude	β	p
	B [95% CI]			B [95% CI]		
(Constant)	52.19 [49.62, 54.76]	—	<.001	33.40 [31.87, 34.93]	—	<.001
Gender (Male)	-0.62 [-3.23, 2.00]	-.028	.644	2.02 [0.47, 3.58]	.148	.011
Nationality (Saudi)	-0.54 [-2.85, 1.77]	-.023	.646	-0.02 [-1.39, 1.36]	-.001	.980
Marital Status (Married)	-2.79 [-5.22, -0.36]	-.134	.025	-1.56 [-3.01, -0.11]	-.122	.035
Job Type (Physician)	8.22 [5.28, 11.16]	.358	<.001	0.67 [-1.09, 2.42]	.047	.455
Education (Higher)	-1.85 [-7.06, 3.36]	-.036	.485	-0.35 [-3.45, 2.75]	-.011	.824
Experience (>10 yrs.)	3.43 [1.17, 5.68]	.163	.003	-4.55 [-5.90, -3.21]	-.351	<.001
Model Statistics						
R2	0.095			0.156		
F	6.29			11.05		
Sig. (p)	<.001			<.001		

IV. DISCUSSION

This study examined healthcare providers' perceptions and attitudes toward AI integration in Ministry of Health hospitals in Jeddah. To interpret the findings, the Technology Acceptance Model (TAM) was applied. According to TAM, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) determine users' attitudes and behavioral intentions toward technology.

Although participants showed moderate to high perceptions of AI's usefulness (PU), most (94%) reported neutral attitudes. TAM helps explain this "experience paradox": while providers recognize AI's potential benefits, neutral attitudes may arise from unfamiliarity, limited hands-on experience, or perceived complexity (PEOU). This indicates that high perception alone may not guarantee positive attitudes or adoption.

These findings suggest that targeted interventions—such as practical training to improve PEOU and demonstration projects to reinforce PU—are needed to foster positive attitudes and encourage AI adoption. By grounding the discussion in TAM, this study links perceptions and attitudes to clear, actionable constructs that can guide training, policy, and clinical implementation strategies.

In recent years, the integration of artificial intelligence into the healthcare system in Saudi Arabia has accelerated, largely in line with the goals of Saudi Vision 2030, which emphasizes technological advancement and digital transformation. As part of this national effort, institutions such as the Saudi Data and Artificial Intelligence Authority (SDAIA) and the National Healthcare Command and Control Center (NHCCC) have been instrumental in promoting the development and implementation of AI-driven platforms to enhance the quality and efficiency of healthcare services [15]. Notably, during the COVID-19 pandemic, Saudi Arabia leveraged AI through mobile applications such as Tawakkalna and Sehhaty, which played a key role in tracking, contact tracing, and preventive care, demonstrating the potential of AI in public health management [16]. Despite these advancements, the successful integration of AI in healthcare not only depends on technological infrastructure but also on the readiness and perception of healthcare professionals, particularly nurses, who represent the backbone of the healthcare workforce. Understanding nurses' attitudes, acceptance, and concerns toward AI

is essential, as their engagement is critical for the effective adoption and safe utilization of AI tools in clinical settings. This discussion explores nurses' perceptions toward AI in Saudi healthcare settings.

Regarding the perception score of utilizing artificial intelligence in healthcare settings, this study revealed that more than half of the participants had a moderate level of perception, around half of the sample had a high level, and less than one percent had a low level. These findings Similar a previous study conducted in Saudi Arabia among healthcare providers also reported that the overall perception toward AI was at a moderate level [17]. But the current results differ from a study conducted in Egypt, where the vast majority of nurse managers demonstrated a moderate level of perception toward AI [18].

The findings of this study show that healthcare providers hold generally positive perceptions regarding artificial intelligence, particularly regarding its ability to enhance efficiency, support clinical decision-making, and improve healthcare quality. These results are consistent with many recent studies. For example, speeding up health care processes was the main advantage indicated by Saudi healthcare providers [17]. Another study in KSA revealed that 77.2% of nurses agreed that AI technologies enhance personalized patient care, while 77.7% believed AI tools improve healthcare measures [19]. In Egypt, the majority nurses indicated the importance of AI in improving health quality and efficiency [13]. This agreement maybe attributed by that artificial intelligence has recently gained significant importance due to the health sector's inclination to utilize it across various departments, and it aims to offer essential information on its application.

In the current study, participants expressed concerns the integration of artificial intelligence in healthcare that could be negatively impact patient–provider relationships, reflecting caution toward the broader implications of digital tools on communication, empathy, and trust. This aligns with findings from a study conducted in China, where nearly half of healthcare providers reported concerns related to AI's ethical safety, accuracy, interpretability, and fairness [20].These apprehensions suggest that while AI may enhance efficiency, it also raises questions about maintaining the human aspect of care. Similarly, a systematic review highlighted that healthcare providers across multiple studies emphasized the importance of preserving personal connection in clinical practice, in which respondents widely agreed that although AI can assist with diagnostics and data analysis, it cannot replicate empathy, compassion, or the nuanced understanding essential to patient-centered care [21]. In complex circumstances, the experience of healthcare professional remains essential to synthesize patient history, examinations, and laboratory results in order to formulate a conclusive treatment plan for the patient.

Interestingly, in the current study, approximately two-thirds of the participants disagreed with the notion that artificial intelligence could replace their jobs. Consistently, A study in KSA was conducted among pharmacists, revealed that only 25.6% believed that AI would eventually replace healthcare provides [22]. Additionally, a study conducted in Egypt revealed that about 72% of nurses thought that AI will not replace their job as it will help them in their work [13]. This reflects that those staffs may view AI as a complementary tool rather than a threat, reflecting a shift toward greater acceptance and understanding of AI's supportive role in clinical practice. On another hand, this finding contrasts with a study in KSA in Riyadh, where the majority of respondents expressed concern that AI might eventually replace human roles in healthcare [17]. A survey conducted among Saudi healthcare providers revealed that 73% had worries of AI to replace their job [23]. Another study in KSA in Jeddah, reported that about 58% of their healthcare providers had worries from AI replacement to their job [15]. Similarly, a study conducted in Ghana, reported that 65% of healthcare students felt either threatened or uncertain about their job security due to the integration of AI technologies, particularly in fields like medical imaging [24].

A major finding of this study is the strong agreement among nurses that AI can help reduce diagnostic and therapeutic errors and support clinical decision-making. Approximately two-thirds of participants believed AI improves diagnostic accuracy and enhances the quality of clinical information provided to healthcare professionals as it delivers clinically relevant, vast amounts of high – quality data in real time. These findings were consistent with a study in KSA ,which mentioned that most of their participants reported that AI has the potential to minimize medical errors and provide clinically relevant, high-quality data in real time [15]. In Egypt, it was revealed that more than three quarters of studied health care providers agreed that AI helps to reduce human diagnostic and therapeutic errors [13]. In the same line, a study conducted in India among different physicians, revealed that their physicians perceived AI as beneficial for improving diagnostic precision and clinical workflow [25].

Although most of nurses in this study had agreed with the accuracy and efficiency of AI in its applications in healthcare settings, a particularly strong finding was revealed whereas nearly all nurses (98.6%) agreed that healthcare providers' clinical judgment remains essential. This reflects a consistent belief across the literature that AI cannot replace human expertise. This percentage was lower than a study conducted in Korea whereas about 43% agreed that AI is diagnostically superior to human doctors [14]. In France, most healthcare actors expressed confidence in AI's technical abilities, yet remained cautious about delegating critical decision-making to machines [26]. These findings emphasize that AI should function as a supportive tool, not a replacement for clinicians.

This study also revealed concerns about the safety of AI. Nearly two-thirds of participants (64.8%) believed that misleading algorithms could harm patients, over half of respondents (53.8%) expressed concerns about hacking and cybersecurity threats, and 46% of them believing that increasing dependency on AI could weaken clinical practice. These concerns were also reported in a previous study in KSA , 81.7% of nurses were concerned that technical malfunctions of AI could lead to negative outcomes and 80.7% believe that AI reduces critical thinking and decision-making skills among nurses [19]. Another study in KSA revealed that nurses strongly agreed that the incorporation of AI would result in a loss of their clinical experience and the delivery of inaccurate clinical judgments [27]. This reflects that AI implementation must prioritize patient safety, professional autonomy, and ensure that healthcare workers are not only users but also active participants in guiding the responsible use of AI technologies.

Regarding participants' attitudes toward medical applications of artificial intelligence, the current study revealed that only 4.9% of respondents had a positive attitude, while the vast majority (94%) had a neutral attitude and 1.1% had a negative attitude. Inconsistently, a study conducted in Eastern areas of Saudi Arabia, revealed a mildly positive overall attitude towards AI among nurses and students [19]. Additionally, These findings contrast with two previous studies: one

in Bangladesh, which reported about 73% of healthcare workers holding positive attitudes [28]. Another in Egypt found approximately 68% of healthcare workers with positive attitudes regarding AI applications [18]. Furthermore, a recent study conducted in Iraq found that about 54% of their healthcare providers had a positive attitude toward AI adoption [29]. In Jordan, nurses demonstrated relatively strong positive attitudes toward AI, albeit influenced by training and anxiety factors [29]. Another study conducted in Pakistan revealed that most of their healthcare professionals were willing to embrace AI incorporation in the healthcare sector [30].

Consistent with prior regional and international research, participants in this study strongly endorsed the usefulness of AI in the medical field. This aligns with findings from a systematic review study, which reported that Saudi nurses widely acknowledge AI as a transformative tool capable of improving clinical workflow, diagnostic accuracy, and patient outcomes [27]. Another study in KSA revealed that approximately 70% of their participants agreed that AI has useful applications in the medical field [15]. A study in Pakistan demonstrated that respondents outlined several benefits that the integration of AI can offer to the healthcare system. It has the potential to decrease workload, conserve time and resources, and enhance the efficiency of healthcare professionals [30].

Despite this optimism, the results indicate limited self-reported familiarity with AI. This low optimism was also mentioned in a previous study in KSA who mentioned that around half of their healthcare workers believed that they had good familiarity [15]. A study conducted in Pakistan revealed that although the majority of the healthcare professionals had some familiarity with AI, they lacked a deep understanding, possessing only a superficial understanding of AI and its fundamental concepts [30]. This fluctuating attitude is likely a result of the lack of AI tools within our healthcare environments, coupled with the restricted time available for healthcare professionals to investigate new developments associated with it.

A notable finding was the mixed attitudes toward AI's role in clinical decision-making. While participants moderately agreed that AI can reduce medical errors and were open to considering AI recommendations they did not express strong willingness to always rely on AI when making decisions and mildly agreed that AI is superior to the clinical experience of a human doctor. Comparatively, a study conducted in Iraq revealed lower mean scores, with healthcare workers showing only neutral or low agreement regarding AI's ability to reduce medical errors, the reliance on AI for clinical decisions , and the belief that AI is superior to human clinical judgment [29]. Another study conducted into the trust placed in AI for medical diagnosis revealed that participants generally exhibited diminished trust in AI, especially concerning high-risk illnesses., and did not regard the diagnostic capabilities of AI as being superior to those of human doctors, as only 22.4% of participants acknowledged AI's superiority in diagnostic proficiency [31].

Ethical concerns were strongly reflected in participants' attitudes, particularly regarding accountability for AI errors. They overwhelmingly agreed that healthcare providers—not patients—should bear legal responsibility for mistakes arising from AI use. In addition, the strong disagreement with patient accountability. This issue was also reported in a Study in KSA where approximately 78% of healthcare professionals expressed unease over the opaque nature of AI decision-making, including issues of algorithmic bias, misdiagnosis, and unclear liability for AI-related errors [27]. Notably, many participants feared losing their professional licenses due to AI-generated mistakes, suggesting deep apprehension about the potential consequences of AI integration in clinical practice. These high concerns in Saudi Arabia, maybe due to newly history of healthcare technology integration and the lack of established validation protocols. In the same line, a Chinese study stated that healthcare professionals lack trust in AI due to the unclear processes that result in its outcomes [32].

Healthcare professional in Saudi Arabia perceive artificial intelligence as highly relevant across multiple domains of healthcare, with especially strong expectations for its role in care planning, patient monitoring, and decision support. In the current study, there are two areas perceived as most promising—making nursing care plans (43.4%) and wearable/remote monitoring (43.2%). Similarly, a pervious study in KSA revealed that thought that AI would be useful in providing medical assistance in underserved areas was the highest was the main application reported statement [15]. A study in Korea found that 53% of healthcare providers felt the areas in medicine where AI would be most useful in the forming a treatment plan [14].

In Saudi Arabia, hospitals have increasingly implemented AI-enabled monitoring systems that integrate vital-sign data to predict sepsis, respiratory failure, and cardiac events, which may contribute to nurses' confidence in this domain [33]. Reflecting this trend, the current study found that a considerable proportion of nurses 41.0% and 38% recognized the value of AI in patient predictive analytics, early warning systems, and decision support for diagnosis and treatment. Similarly, a study conducted in South Korea revealed that 83% of healthcare professionals believed AI would be useful for diagnostic purposes in the future [14].

In the present study, participants also identified medical research and development (39.9%) and continuing medical education (40.2%) as important areas for AI integration. This aligned with a study in KSA who revealed that biopharmaceutical research was the second main frequent belief of participants for AI integration [15]. Another study indicated that, although the majority of their doctors had not participated in numerous technology-focused medical workshops, the physicians asserted that their primary objective was to investigate the application of AI in the future medical education and healthcare [25]. In the same line, a recent Saudi systematic review study mentioned that there is a show a strong need for educational and training activities to improve nurses' knowledge and skills in using AI tools efficiently [34].

i. limitations of the study

This study had several limitations related to the data collection process. It was conducted in two healthcare settings within the geographical area of Jeddah, Saudi Arabia, which may limit the generalization of the findings to other regions or healthcare contexts. As data were gathered at one point in time, it is not possible to determine cause-and-effect relationships or assess the temporal direction of associations among healthcare providers. Consequently, the descriptive nature of the study limits a deeper exploration of the contextual and experiential factors that may influence healthcare providers' behaviors and responses. Furthermore, the data for this study were obtained through a self-administered questionnaire completed by healthcare providers. This method is susceptible to various response biases, such as providing socially desirable answers, exaggerating responses, or under-reporting due to feelings of embarrassment. To minimize the impact of these biases, significant measures were taken to maintain the anonymity of responses and protect the privacy of participants. Also it should be noted that not all departments in the studied hospitals currently utilize AI tools in their clinical practice. Therefore, the neutral attitudes observed in certain departments, may reflect limited exposure to AI rather than a true assessment of its acceptance or perceived usefulness. Despite these limitations, the study provides useful baseline data to inform future research and practice.

V. CONCLUSION

This study assesses the healthcare providers' (nurses and physician) perceptions and attitudes toward artificial intelligence applications in healthcare settings and analyze their correlation with sociodemographic characteristics. The findings revealed moderate to high levels of perception regarding AI utilization, accompanied by predominantly neutral attitudes,

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indicating cautious acceptance rather than resistance. As well as positive correlation between perception and attitude suggests that enhancing nurses' knowledge and practical engagement with AI may gradually shift attitudes from neutrality toward informed acceptance.

VI. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed to enhance the integration and effective utilization of artificial intelligence technologies in Ministry of Health hospitals. These recommendations are directed toward hospital administration, nursing and medical practice, educational institutions, and future research directions.

i. recommendations for hospital administration and policymakers

To address the identified challenges regarding service quality and technical reliability, healthcare leaders should:

Develop clear national and institutional policies that support the safe and ethical integration of artificial intelligence technologies in healthcare settings, ensuring compliance with data privacy, patient confidentiality, and professional standards.

Allocate adequate financial and technical resources to support the implementation, maintenance, and continuous evaluation of AI systems in hospitals.

Involve nurses and physicians in decision-making processes related to the selection, design, and implementation of AI technologies to enhance acceptance and usability.

Establish continuous training and professional development programs to improve healthcare providers' knowledge, skills, and confidence in using AI-based systems.

Implement monitoring and evaluation frameworks to assess the impact of AI technologies on patient safety, quality of care, clinical outcomes, and healthcare efficiency.

Encourage a culture of innovation and readiness for digital transformation by supporting pilot projects and evidence-based adoption of AI technologies across healthcare institutions.

ii. recommendations for healthcare providers' practice

To maximize the benefits of artificial intelligence (AI) in daily patient care, nurses and physicians are encouraged to:

Engage actively in training programs and workshops to enhance knowledge and practical skills related to the use of artificial intelligence technologies in clinical practice.

Stay updated with emerging evidence and best practices related to artificial intelligence in healthcare to ensure safe and effective use in clinical settings.

iii. recommendations for education and community

To prepare the future workforce and align academic outcomes with clinical reality, nursing and medical colleges and universities should:

Include AI concepts, applications, and ethics in the curricula of nursing and medical schools to prepare future healthcare providers for AI-enabled clinical environments.

Establish continuous education courses and certification programs focusing on AI technologies, clinical decision support systems, and data management for practicing healthcare professionals.

Conduct community outreach campaigns to educate the public about the benefits, limitations, and safety of AI applications in healthcare, building trust and reducing misconceptions.

Promote collaboration between universities, healthcare institutions, and AI developers to conduct research, share best practices, and develop AI tools that meet real clinical needs.

iv. future research directions

To further advance knowledge in this field, future researchers are recommended to:

- Adopt a mixed-methods research design that combines quantitative surveys with qualitative interviews to gain deeper insights into the factors behind healthcare providers' acceptance, satisfaction, or resistance toward AI technologies.
- Conduct comparative studies across different regions of Saudi Arabia to identify best practices and potential regional disparities in AI adoption, readiness, and support within healthcare facilities.
- Assess the cost-effectiveness of AI systems in Ministry of Health hospitals to provide economic evidence supporting further investment in AI and digital health infrastructure.
- Investigate the perspectives of other healthcare team members, such as pharmacists, allied health professionals, and administrators, to obtain a multidisciplinary view of AI integration and its impact on clinical workflows.
- Conduct longitudinal studies to track changes in nurses' and physicians' perceptions, AI acceptance, and system effectiveness over time, especially after major AI system upgrades or implementation phases.

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