Knowledge and Attitude of Healthcare Workers towards the Adoption of Artificial Intelligence in Healthcare Service Delivery in Saudi Arabia

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ABSTRACT

Objective: the aims of this study was to assess the knowledge and attitudes of healthcare workers towards the adoption of artificial intelligence in healthcare service delivery in Saudi Arabia.

Methods: An online questionnaire was published, and responses were collected from 315 healthcare workers, including Physician, nurses, and technicians at the hospitals in Saudi Arabia.

Results: Out of 320 distributed questionnaires, 315 were completed. The majority of participants demonstrated a high level of knowledge about AI and its applications in healthcare. A remarkable 76.5% agreed that AI cannot fully replace healthcare jobs. Participants also expressed concerns about the potential for AI to cause job losses. The study reveals high agreement about the potential for AI to improve patient care and provide new economic opportunities for hospitals. Statistically significant differences in perceptions of AI were found based on medical specialty and educational qualifications, but not gender, age, or years of experience.

Conclusions: Healthcare workers in Saudi Arabia have a strong knowledge of AI and have mixed attitudes towards its adoption. To facilitate the integration of AI into healthcare, it is necessary to increase training and qualification of healthcare workers, and address concerns about job losses. This approach will support the advancement of healthcare services in line with the goals of Vision 2030.

Keywords: artificial intelligence, healthcare workers, healthcare service,Knowledge, Attitude, Saudi Arabia.

INTRODUCTION

In an era of rapid technological innovation, the healthcare industry stands out as one of the most responsive sectors to modern technological developments, especially in the Kingdom of Saudi Arabia as it moves towards Vision 2030 [1]. With the advancement of technology, the world is witnessing a paradigm shift in how healthcare is delivered, and among the contemporary technologies of great importance to researchers and practitioners alike is the use of artificial intelligence [2,3]. Therefore, the Kingdom of Saudi Arabia is striving to integrate artificial intelligence into healthcare systems to improve the quality of care, reduce costs, and more.

Artificial intelligence is a transformative force in healthcare, as it has the potential to revolutionize various aspects from diagnosis and treatment to patient care management and operational efficiency [4,5]. However, the success of this transformation depends largely on the knowledge and attitudes of healthcare professionals towards artificial intelligence [5].

Understanding healthcare professionals' knowledge and attitudes toward the adoption of AI in healthcare service delivery is crucial for several reasons. First, their acceptance and competence in using AI technologies can significantly impact the effectiveness and efficiency of healthcare services [6]. Second, their attitudes toward AI can influence the pace and extent of its adoption within healthcare organizations [7]. Furthermore, insights into the factors shaping healthcare workers' perceptions of AI could inform targeted interventions to facilitate seamless integration of AI into clinical workflows and promote a culture of innovation in healthcare settings [8]. Studies suggest that healthcare workers' knowledge of AI technologies plays a critical role in facilitating the integration of these applications into healthcare [9]. According to Chikhaoui et al., healthcare workers have concerns about privacy and ethics associated with the use of AI, which may impact their willingness to adopt this technology [10].In the context of Saudi Arabia's Vision 2030, AI is considered a key tool to advance the health sector and address challenges such as epidemics and shortages of medical personnel [11,12]. However, understanding healthcare professionals' attitudes towards AI should be prioritized to ensure the success of the integration process and achieve the desired goals of Vision 2030 by enhancing knowledge and positive attitudes [1,3].

Therefore, this study aims to assess the knowledge and attitudes of healthcare workers towards the adoption of artificial intelligence in healthcare service delivery in Saudi Arabia.

Research problem
Healthcare is witnessing an unprecedented development in providing quality and efficient care services [2]. With the acceleration and increase in the use of artificial intelligence in healthcare and the competition between research and health organizations to adopt artificial intelligence technology to improve the patient experience and help address some of the pressing issues facing healthcare today [3,11], in order to gain a deeper understanding of the impact of these emerging technologies on healthcare professionals, and to ensure the continued development of healthcare services in the Kingdom of Saudi Arabia and focus efforts in this sector to address the challenges related to healthcare services by raising their quality and efficiency [1], we can provide a closer look at the ways in which artificial intelligence technology is used in healthcare, and discuss the attitudes and knowledge that may hinder the process of integrating artificial intelligence into healthcare, which hinders the achievement of the goals of Vision 2030 to improve the quality of healthcare.

Aim and Objectives
The study Aims to investigate the Knowledge and Attitude of healthcare workers towards the adoption of artificial intelligence in healthcare service delivery in Saudi Arabia.
This aim is achieved through the following objectives:
1. To Assess the level of healthcare providers' Knowledge the adoption of artificial intelligence
2. To Assess the level of healthcare providers' attitudes the adoption of artificial intelligence
3. To Assess the level of knowledge of artificial intelligence technologies and their applications in medical contexts.
4. To Assess the Relationship between level of healthcare providers' Knowledge & Attitudes about the adoption of artificial intelligence and their personal data

MATERIALS AND METHODS
Study design and setting
A cross-sectional study design was conducted to investigate the Knowledge and Attitude of healthcare workers towards the adoption of artificial intelligence in healthcare service delivery in Saudi Arabia. The data collection was conducted from My, to July 2024. Sampling with simple random sampling method was used to get the required sample size. The target population were the health care service delivery working at the governmental hospitals in Saudi Arabia, which include (193 employees).

Study participants
The researcher used a census sample consisting of all nurses who work in government hospitals in the kingdom of Saudi Arabia for a year or more, which is expected to give a correct demographic indicator and a more reliable consultation pattern without errors in the sample.

Data Collection
Data will be collected through structured questionnaires distributed electronically to participants. The questionnaire will be designed based on established frameworks and previous literature on adoption of artificial intelligence, with a focus on departments that collect and analyze artificial intelligence in healthcare service delivery.

Study instruments
The current study relies on the questionnaire as a main tool for collecting data related to the study sample. The questionnaires were a set of questions used to elicit a wide range of objective data from the healthcare workers, as well as subjective data about their thoughts and perceptions. The questionnaire was initially designed based on an extensive literature review of previous studies.
The questionnaire was provided with a cover letter explaining the purpose of the study, the method of response, the aim of the research, and data security in order to encourage a high response. The questionnaire was provided with a covering letter clarifying the purpose of the study, the way of responding, the aim of the research and the security of the data in order to encourage a high response.

Data Analysis
Data were analyzed using SPSS version 23.0. The frequencies, percentage, mean and standard deviation were computed to describe the study variables and items. In order to conduct the statistical test, standard deviations were used to portray data in tables and charts. The chi square test used to assess correlation between variables. A P value of 0.05 was declared statistically significant.

Ethical considerations

Approval was obtained from the Regional Research and Ethics Committee of the Saudi Ministry of Health. Written consents were obtained from all participants. All collected data was kept confidential.

RESULTS

Socio-demographics of the participants

A total of 315 of 320 questionnaires were completed and returned, yielding a response rate of 98.4%. The demographic and baseline characteristics of participants are presented in Table 1.

Table 1: Sociodemographic traits of participants (n=315)

Variable		N	%
Your gender	Male	189	60.0%
	Female	126	40.0%
Your age	21-30 years old	88	27.9%
	31-40 years old	131	41.6%
	41-50 years old	65	20.6%
	More than 51 years	31	9.9%
Highest qualification achieved:	Diplomaor less	69	21.9%
	Bachelor's	191	60.6%
	Master's degree	49	15.6%
	Ph.D.	6	1.9%
Medical Specialization	Physician	45	14.3%
	Nurse	175	55.6%
	Medical technician	58	18.4%
	Health administrator.	37	11.7%
Years of experience	Less than 5 years	58	18.4%
	5-15 year	184	58.4%
	15-25 year	46	14.6%
	More than 25 years	27	8.6%
Having participated in an AI training course	Yes	166	52.7%
	No	149	%47.3

Our study highlights key demographic trends among healthcare workers in Saudi Arabia. Males dominate the sample at (60.0%), while females represent (40.0%), which expresses the demographic composition of the healthcare workers. The age of the participants was widely distributed. (27.9%) were between 21 and 30 years old, and (41.6%) were between 31 and 40 years old.Most of them (58.4%) had 5-15 years of experience.The distributions of the study participants according to educational level showed that the highest group of the study participants was finished the bachelor's degree (60.6%), (21.9%) was finished the diploma degree and less, (15.6%) was finished the master's degree.The results illustrated that only (1.9%) of them have the PHD degree. Most of them (58.4%) had 5-15 years of experience,and almost half have participated in AI training courses (52.7%).

Knowledge about Artificial Intelligence

Table 2: Distribution of healthcare providers' Knowledge the adoption of artificial intelligence(n=315)

Paragraph	Disagree		Neutral		Agree		Mean±SD
	N	%	N	%	N	%	
I have good knowledge of artificial intelligence (AI) in the context of healthcare?	42	13.3%	46	14.6%	227	72.1%	1.59 ±0.72
Artificial Intelligence (AI) capabilities are greater to human knowledge	42	13.3%	46	14.6%	227	72.1%	1.60 ± 0.72

I have knowledge regarding the application of artificial intelligence in healthcare settings	30	9.5%	41	13.0%	244	77.5%	1.68 ± 0.64
artificial intelligence (AI) can improve the practice of health care	27	8.6%	77	24.4%	211	67.0%	1.59 ± 0.64
artificial intelligence (AI) can decrease diagnostic errors and improving treatment outcomes in health care	36	11.4%	36	11.4%	243	77.1%	1.66 ± 0.68
artificial intelligence (AI) can enhance the accuracy of medical data analysis compared to human capabilities	172	54.6%	54	17.1%	89	28.3%	0.74 ± 0.87
I have sufficient knowledge about the technical and legal challenges related to the integration of artificial intelligence (AI) into healthcare systems	40	12.7%	24	7.6%	251	79.7%	1.67 ± 0.69
AI helps health care providers in making their daily Todo lists, also continuously assess the quality of health care and redirect them accordingly.	183	58.1%	47	14.9%	85	27.0%	0.69 ± 0.87
AI will help the health care providers to improve work and patient relationships.	25	7.9%	109	34.6%	181	57.5%	1.50 ± 0.64
Virtual simulations could support the training phase of health care providers, preparing them for emergencies such as a cardiac arrest.	114	36.2%	102	32.4%	99	31.4%	0.95 ± 0.82
It will be difficult to totally replace health care providers' consultation with digital tools	24	7.6%	50	15.9%	241	76.5%	1.69 ± 0.61
If there is a contrast between health care providers and AI opinion, the opinion of health care providers will be considered as 'right'.	66	21.0%	126	40.0%	123	39.0%	1.18 ± 0.76

Table (2) showed that the majority of healthcare providers (76.5%, n=241) agreed with the highest mean score (1.69 ± 0.61) that (It will be difficult to totally replace health care providers' consultation with digital tools). More than three-quarters of healthcare providers surveyed (79.7%, 77.5%, 77.1%, 72.1%, 72.1%) also agreed that (I have sufficient knowledge about the technical and legal challenges related to the integration of artificial intelligence (AI) into healthcare systems), (I have knowledge regarding the application of artificial intelligence in healthcare settings), (artificial intelligence (AI) can decrease diagnostic errors and improving treatment outcomes in health care...), (I have good knowledge of artificial intelligence (AI) in the context of healthcare), and (Artificial Intelligence (AI) capabilities are greater to human knowledge),respectively.

On the other hand, the highest percentage of healthcare providers surveyed (58.1%,54.6%) disagreed with the statements that (AI helps health care providers in making their daily Todo lists, also continuously assess the

quality of health care and redirect them accordingly.), and (artificial intelligence (AI) can enhance the accuracy of medical data analysis compared to human capabilities), respectively.

Attitudes Towards Artificial Intelligence

Table 3: Distribution of healthcare providers' Attitudes the adoption of artificial intelligence (n=315)

Paragraph	Disagree		Neutral		Agree		Mean±SD
	N	%	N	%	N	%	
artificial intelligence (AI) is better than an employee in many routine jobs	74	23.5%	85	27.0%	156	49.5%	1.59 ±0.72
I have knowledge about AI applications used in healthcare	56	17.8%	72	22.9%	187	59.4%	1.60 ± 0.72
I admire what AI can do	30	9.5%	41	13.0%	244	77.5%	1.68 ± 0.64
artificial intelligence (AI) can provide new economic chances for my hospital	21	6.7%	24	7.6%	271	86.0%	1.59 ± 0.64
artificial intelligence (AI) will cause many job losses	59	18.7%	119	37.8%	137	43.5%	1.66 ± 0.68
I would like to use AI in my own job	51	16.2%	116	36.8%	147	46.7%	0.74 ± 0.87
artificial intelligence (AI) can enhance patient care and experience	62	19.7%	60	19.0%	193	61.3%	1.67 ± 0.69
artificial intelligence (AI) can help increase healthcare efficiency and reduce costs	59	18.7%	119	37.8%	137	43.5%	0.69 ± 0.87
Are you worried about the ethical implications of using artificial intelligence (AI) in healthcare decision-making	192	61.0%	85	27.0%	37	11.7%	1.50 ± 0.64
In your opinion, should there be regulations in place to govern the development and use of artificial intelligence (AI) in healthcare	40	12.7%	87	27.6%	188	59.7%	0.95 ± 0.82
artificial intelligence (AI) is better than an employee in many routine jobs	30	9.5%	40	12.7%	245	77.8%	1.69 ± 0.61

Table (3) showed that the majority of healthcare providers (77.8%, n=245) agreed with the highest mean score (1.69 ± 0.61) that (artificial intelligence (AI) is better than an employee in many routine jobs). More than three-quartersof healthcare providers surveyed (86.0%, 77.5%) also agreed that (artificial intelligence (AI) can provide new economic chances for my hospital), (I admire what AI can do). In addition, more than half of healthcare providers surveyed(61.3%, 59.4%) also agreed that (artificial intelligence (AI) can enhance patient care and experience), (I have knowledge about AI applications used in healthcare.),respectively.

On the other hand, the highest percentage of healthcare providers surveyed (61.0%)disagreed with the statements that (Are you worried about the ethical implications of using artificial intelligence (AI) in healthcare decision-making.).

Table 4: Relationship between level of healthcare providers' Knowledge &Attitudes about the adoption of artificial intelligence and their personal data. (n=315)

Variable		Low		Moderate		High		P-value
		N	%	N	%	N	%	
Your gender	Male	52	16.5%	62	19.7%	75	23.8%	0.121
	Female	21	6.7%	63	20.0%	42	13.3%	

Your age	21-30 years old	5	1.6%	51	16.2%	32	10.2%	
	31-40 years old	46	14.6%	32	10.2%	53	16.8%	0.242
	41-50 years old	19	6.0%	29	9.2%	17	5.4%	
	More than 51 years	5	1.6%	7	2.2%	19	6.0%	
Medical Specialization	Physician	5	1.6%	13	4.1%	27	8.6%	
	Nurse	38	12.1%	63	20.0%	74	23.5%	0.000
	Medical technician	4	1.3%	18	5.7%	36	11.4%	
	Health administrator.	3	1.0%	11	3.5%	23	7.3%	
Highest qualification achieved:	Diplomaor less	7	2.2%	27	8.6%	35	11.1%	
	Bachelor's	55	17.5%	59	18.7%	77	24.4%	0.000
	Master's degree	9	2.9%	18	5.7%	22	7.0%	
	Ph.D.	1	0.3%	3	1.0%	2	0.6%	
Years of experience	Less than 5 years	12	3.8%	17	5.4%	29	9.2%	
	5-15 year	34	10.8%	69	21.9%	81	25.7%	0.142
	15-25 year	12	3.8%	15	4.8%	19	6.0%	
	More than 25 years	4	1.3%	10	3.2%	13	4.1%	

Table (4) showed that there are a highly statistical significance differences between the level of Knowledge & Attitudes to the adoption of artificial intelligence in healthcare service delivery in Saudi Arabia with Medical Specialization and Highest qualification achieved(P=0.000*). There are no statistical significance differences between the level of Knowledge & Attitudes about AI with gender,age, and years of experience (0.121, 0.242 & 0.131) respectively.

DISCUSSION

The use of modern technologies such as artificial intelligence in healthcare systems is one of the most important topics in the world of technology. Artificial intelligence is defined as the ability of machines to simulate human intelligence and perform tasks that normally require human cognition [13]. Accordingly, the integration of artificial intelligence with healthcare will contribute to changing the way healthcare is provided and managed to become a comprehensive, integrated and effective healthcare system, as artificial intelligence can help analyze large amounts of data, identify patterns, and even make predictions about future patient outcomes [13,14].The present study aimed to assess the knowledge and attitudes of healthcare workers towards the adoption of artificial intelligence in healthcare service delivery in Saudi Arabia.

The result showedthat morethan two thirds of studied healthcare providershad good knowledge about AI, this illustrates the trend of healthcare professionals towards using artificial intelligence in healthcare.This result disagreement with Lai, et al, (2020)who founda general deficiency of knowledge on the participants of AI [15].Also, the present result showed that the majority of healthcare providers had good attitude about AI, this is consistent with the findings of Sayed and Saleem (2021) which showed that more than half of the participants had a positive attitude towards the use of AI in healthcare settings [16].

The study suggests that about half of healthcare workers have concerns that AI will cause job losses. According to Frey and Osborne (2017), AI will replace at least 100 occupations in the coming years [17]. However, these findings contradict another study that showed that the majority of healthcare workers have no concerns about AI replacing them in their jobs [18].

The study findings indicated that most of healthcare providers agreed the following items of attitude toward AI: artificial intelligence (AI) can provide new economic chances for my hospital, artificial intelligence (AI) is better than an employee in many routine jobs, I admire what AI can do. Similarly, they agreed that; Are you worried about the ethical implications of using artificial intelligence (AI) in healthcare decision-making.This finding was consistent with may studies mentioned that respondents' collective views were mixed; the public perceived chances, identifying both benefits e.g. improved effectiveness and threats e.g. data abuse and job losses [19].The results of this study showed no significant differences in respondents' answers by gender, age.However, the current study found that there are statistically significant differences between Medical Specialization and Highest qualification achieved for healthcare workers and their perception of the role of artificial intelligence in healthcare. This is because Specialization and Highest qualification achieved are among the most important environmental stimuli that affect the way healthcare providers think and their impression of anything, which in turn affects the perception of healthcare providers.This is consistent with the published literature on healthcare workers' perception of the use of AI[16,20].

This study faced several limitations: only three types of medical jobs and one administrative job in the healthcare sector were surveyed, and the sample was concentrated on the largest hospitals in Saudi Arabia. Other limitations include the limited sample size and the descriptive nature of the study. Furthermore, empirical studies may provide more realistic and comprehensive results.

CONCLUSION

This study assessed the knowledge and attitudes of healthcare professionals towards the application of artificial intelligence in the healthcare sector. The study was conducted in hospitals in Saudi Arabia. The results revealed a high level of knowledge about artificial intelligence applications, as well as different opinions about the fear of replacing jobs with artificial intelligence. Therefore, there is a need to increase training on the benefits of applying artificial intelligence in healthcare and the potential of these technologies to improve healthcare operations and efficiency.

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