

Original Article

KNOWLEDGE OF ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS IN HEALTH CARE WORKERS

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Abstract:

Objective: To assess the knowledge and extent of application of artificial intelligence among healthcare workers along with comparison between male and female gender as well as seniority of healthcare workers.

Materials and Methods: A cross-sectional study was conducted among 300 healthcare professionals in two hospitals Ghurki Trust Teaching Hospital Lahore and Allied Hospital Faisalabad over 6 months using a questionnaire proforma by chat GPT.

Results: The study included 356 participants, mostly female (72.2%) with an average age of 28.08±4.20 years. Most had 1-9 years of work experience (61.5%). Nearly half (49.4%) had no AI application experience, and only 14.0% had formal AI training. Despite this, 80.3% recognized AI's importance in healthcare. AI was used by 24.4% of participants, mainly in patient monitoring (25.3%), research (27.2%), and diagnostics (19.7%). Challenges included clinical validation (33.1%) and cost (32.6%). Ethical concerns were significant, with 80.9% worried about privacy and 59.0% distrusting AI with sensitive data. Education and training (71.1%) were key for AI integration.

Conclusion: Learning and application of artificial intelligence is the need of the hours and the general opinion is that if used under doctors' supervision, it will help improve patient care.

Keywords: Artificial intelligence, Machine learning, Deep learning

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INTRODUCTION

Artificial intelligence (AI) is nowadays understood as a system's ability to interpret and learn from data correctly, and to achieve specific goals and tasks through flexible adaptation to those learning¹. Healthcare

systems are complex for all stakeholders. Healthcare workers are on the frontlines of the battle against illness and disease, be they doctors, nurses, OT technicians, pharmacists, physiotherapists, radiology, or lab technicians. In this ever-advancing world, their knowledge and perception of the application of artificial intelligence in their field is of utmost importance as it can help improve patient care and streamline administrative tasks. Understanding AI's role in clinical practice is crucial for successful implementation by equipping healthcare providers with essential knowledge and tools². The emergence of smartphones, wearables, sensors, and communication systems has revolutionized

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medicine with the capability of containing artificial intelligence (AI) powered tools (such as applications) in very small sizes³.

Machine learning (ML) is a subdomain of AI that focuses on developing systems that learn or improve performance based on the data they ingest. It is the science of computer algorithms. Deep learning is a powerful subset of ML that involves training artificial neural networks with multiple layers to learn complex patterns and representations from data⁴. ML and AI technologies are increasingly being deployed in healthcare settings to process, interpret, refine, and act on the vast volume of data that is now available. AI promises benefits to the healthcare industry, but it also poses challenges in this new dimension of healthcare, and its impact on health professionals, organizations, and governments is yet unknown⁵.

The purpose of this study was to assess the knowledge of healthcare workers about artificial intelligence and its applications in the field of medicine and to compare knowledge about AI among various healthcare workers. By gaining this insight, we wanted to determine the lag of our healthcare workers regarding recent advances in information and technology related to the medical field and make necessary measures for improvement. Utilization of AI technologies in the healthcare system improves efficiency, reduces the workload of healthcare workers, and offers benefits to the patients.

MATERIAL AND METHODS

The study was conducted by cross-sectional study design in Ghurki Trust Teaching Hospital Lahore and Allied Hospital Faisalabad. The study duration was 6 months and the sample size was 356 healthcare workers including doctors, dentists (House officers to consultants), nursing staff, pharmacists, radiology technicians, physiotherapists, operation theatre assistants, auditors, and human resource personnel. Staff from Basic departments of anatomy, physiology, biochemistry was excluded. The sampling technique was convenient proforma was generated by GPT-4 and the reliability of each

question was assessed by pilot testing we took the data initially from 20 participants and then analyzed each question through Chronbach's alpha, in our study the alpha value was obtained as 0.82 indicating that tool was reliable and then the final data collection was done accordingly. Ethical approval was obtained by IRB of Lahore Medical & Dental College. The questionnaire was composed of four sections. The first section contained awareness and understanding of AI, second section was about the impact of AI on patient outcomes and healthcare professionals about their apprehension about their expected replacement. The third section was about the ethics and privacy issues of using AI and the fourth one was about the future of AI in medicine. SPSS version 22 was used for data analysis. Data were presented as tables. Frequencies and percentages were given for categorical variables. The chi-square was applied to test the association between AI parameters and demographic characteristics of participants taking a p value less than 0.05 as significant.

RESULT

The study comprised 356 participants, predominantly female (72.2%), with an average age of 28.08 ± 4.20 ranging from 23-52 years. Most had 1-9 years of working experience (61.5%), while fewer had 1-10 months (30.1%) or ≥ 10 years (8.4%). Regarding AI parameters, nearly half of the participants had no AI application experience (49.4%), and only a minority had formal AI training (14.0%). Nonetheless, 80.3% recognized the importance of AI in healthcare. Understanding of AI concepts varied, with only 24.4% having a clear understanding of both deep learning and machine learning.

In practice, AI was utilized in workplaces by 24.4% of participants, with common applications in patient monitoring (25.3%), research (27.2%), and diagnostics (19.7%). Challenges identified included clinical validation (33.1%) and cost (32.6%). The majority (85.7%) believed AI could improve

patient outcomes, though concerns about AI replacing jobs were mixed, with 41.3% not worried at all and 8.7% extremely worried. Ethical considerations were significant, with

80.9% concerned about privacy and 59.0% distrusting AI with sensitive data. Preparing staff for AI integration primarily involved education and training (71.1%). (Table 1)

Table 1: Summary statistics of different AI parameters

Awareness & understanding		
AI Application Experience	n	%
None	176	49.4
Less Than 01 Year	128	36.0
02 - 04 Years	46	12.9
More Than 04 Years	5	1.7
Knowledge of AI in Healthcare	n	%
Yes	119	33.4
No	237	66.6
Formal Training on AI	n	%
Yes	50	14.0
No	306	86.0
Importance of AI in Healthcare	n	%
Yes	286	80.3
No	70	19.7
Understanding Deep Learning VS Machine Learning	n	%
Not at All	87	24.4
I Know Only One Term	51	14.3
I Know Both Terms but The Difference Is Not Clear	131	36.8
I Know Both Terms and Differences Are Clear	87	24.4
Practice		
AI Applications in The Workplace	n	%
Yes	87	24.4
No	269	75.6
AI in Healthcare Tasks	n	%
Diagnostics	70	19.7
Admin Tasks	79	22.2
Patient Monitoring	90	25.3
Research	97	27.2
Diagnostics, Admin Tasks	1	0.3
Diagnostics, Research	6	1.7
Admin Tasks, Patient Monitoring	1	0.3
Patient Monitoring Research	1	0.3
Diagnostics, Patient Monitoring, Research	2	0.6
Diagnostics, Admin Tasks, Patient Monitoring, Research	5	1.4
Admin Tasks, Patient Monitoring, Research	4	1.1
Challenges with AI Technology	n	%
Clinical Validation	118	33.1
Cost	116	32.6
Data Breaches	46	12.9

Workforce Education	68	19.1
Clinical Validation, Workforce Education	8	2.2
Impact		
The Potential of AI To Improve Patient Outcomes	n	%
Yes	305	85.7
No	51	14.3
AI Compared to nuclear weapons	n	%
Yes	241	67.7
No	115	32.3
Concern About AI Replacing Jobs	n	%
Extremely Worried	31	8.7
Moderately Worried	63	17.7
Mildly Worried	115	32.3
Not Worried at All	147	41.3
Ethics Privacy and Trust		
Privacy Issues with AI	n	%
Yes	288	80.9
No	68	19.1
Trust In AI For Handling Sensitive Data	n	%
Yes	146	41.0
No	210	59.0
Preparing Staff for AI Integration	n	%
Education and Training	253	71.1
Investment in Tools	47	13.2
Promoting a Culture of Innovation	27	7.6
Expert Talks	23	6.5
Education, Training & Investment in Tools	1	0.3
Education, Training & Expert Talks	1	0.3
Education, Training & Investment in Tools & Expert Talks	2	0.6
Education, Training & Investment in Tools & Promoting Culture of Innovation & Expert Talks	2	0.6
Regulations For AI in Healthcare	n	%
Yes	328	92.1
No	28	7.9

Experience level also influenced AI understanding and application, with those having 1-9 years of experience showing greater AI utilization and optimism about its potential to improve patient outcomes. There were significant differences in preferred methods for preparing staff for AI based on experience, with education and training being the most

favoured approach as $p < .05$. Overall, while there is a strong recognition of AI's importance in healthcare, varied levels of experience and understanding, along with significant ethical and practical concerns, highlight the need for targeted education and training to maximize AI's benefits. (Table 2).

Table 2: Association between AI parameters and demographic characteristics of participants.

Parameters	Gender		p-value
	Male	Female	
AI in Healthcare Tasks			
Diagnostics	54(54.5)	36(14.01)	<.001
Admin tasks	17(17.17)	62(24.12)	
Patient monitoring	3(3.03)	67(26.07)	
Research	18(18.18)	79(30.74)	
Diagnostics and Admin tasks	-	1(0.39)	
Diagnostics and Research	-	6 (2.33)	
Admin tasks and patient monitoring	-	1(0.39)	
Patient monitoring Research	1(1.01)	-	
Diagnostics and patient monitoring and Research	2(2.02)	-	
Diagnostics and admin tasks and patient monitoring and Research	2(2.02)	3(1.17)	
admin tasks and patient monitoring and Research	2(2.02)	2(0.78)	
Challenges with AI Technology			
Clinical validation	37(37.4)	81(31.5)	.005
Cost	28(28.3)	88(34.2)	
Data breaches	5(5.1)	41(16.0)	
Workforce Education	24(24.2)	44(17.1)	
Clinical validation and workforce education	5(5.1)	3(1.2)	

Table 3:

Understanding Deep Learning vs. Machine Learning	Working Experience			p-value
	01 - 10 Months	01 - 09 Years	≥10 Years	
Not at all	25(23.4)	56(25.6)	6(20.0)	.001
I know only one term	10(9.3)	32(14.6)	9(30.0)	
I know both terms but the difference is notz clear	31(29.0)	88(40.2)	12(40.0)	
I know both terms and differences are clear	41(38.3)	43(19.6)	3(10.0)	
AI Applications in the Workplace	Working Experience			p-value
	01 - 10 Months	01 - 09 Years	≥10 Years	
Yes	20(18.7)	49(45.8)	18(60.0)	<.001
No	87(81.3)	170(77.6)	12(40.0)	
The potential of AI to Improve Patient Outcomes	Working Experience			p-value
	01 - 10 Months	01 - 09 Years	≥10 Years	
Yes	96(89.7)	180(82.2)	29(96.7)	.038
No	11(10.3)	39(17.8)	1(3.33)	
Preparing Staff for AI Integration	Working Experience			p-value
	01 - 10 Months	01 - 09 Years	≥10 Years	
Education and Training	72(67.3)	160(73.1)	21(70.0)	.049
Investment in Tools	20(18.7)	24(11.0)	3(10.0)	
Promoting a Culture of Innovation	10(9.3)	16(7.3)	1(3.3)	

Expert Talks	4(3.7)	16(7.3)	3(10.0)
Education and Training & Investment in Tools	-	-	1(3.3)
Education and Training & Expert Talks	-	1(0.5)	-
Education and Training & Investment in Tools & expert talks	1(0.9)	1(0.5)	-
Education and Training & Investment in Tools & Promoting Culture of Innovation & expert talks	-	1(0.5)	1(3.3)

Table 4:

Knowledge of AI in Healthcare	Job Title		p-value
	Paramedics	Doctors	
Yes	14(21.2)	105(36.2)	.021
No	52(78.8)	185(63.8)	
Understanding Deep Learning vs Machine Learning	Job Title		p-value
	Paramedics	Doctors	
Not at all	21(31.8)	66(22.8)	<.001
I know only one term	22(33.3)	29(10.0)	
I know both terms but the difference is not clear	18(27.3)	113(39.0)	
I know both terms and differences are clear	5(7.6)	82(28.3)	
AI Applications in the Workplace	Job Title		p-value
	Paramedics	Doctors	
Yes	27(40.9)	60(20.7)	.001
No	39(59.1)	230(79.3)	
Challenges with AI Technology	Job Title		p-value
	Paramedics	Doctors	
Clinical validation	7(10.6)	111(38.3)	<.001
Cost	25(37.9)	91(31.4)	
Data breaches	16(24.2)	30(10.3)	
Workforce Education	17(25.8)	51(17.6)	
Clinical validation, workforce education	1(1.5)	7(2.4)	
The potential of AI to Improve Patient Outcomes	Job Title		p-value
	Paramedics	Doctors	
Yes	63(95.5)	242(83.4)	.011
No	3(4.5)	49(16.9)	
Preparing Staff for AI Integration	Job Title		p-value
	Paramedics	Doctors	
Education and Training	54(81.8)	199(68.6)	.039
Investment in Tools	4(6.1)	43(14.8)	
Promoting a Culture of Innovation	1(1.5)	26(9.0)	
Expert Talks	6(9.1)	17(5.9)	
Education and Training & Investment in Tools	1(1.5)	-	
Education and Training & Expert Talks	-	1(0.3)	
Education and Training & Investment in Tools & expert talks	-	2(0.7)	
Education and Training & Investment in Tools & Promoting Culture of Innovation & expert talks	-	2(0.7),	

DISCUSSION

The World Health Organization and many national health systems around the world have flagged the importance of a health workforce that understands how to work properly with AI⁶.

Regarding AI parameters, 66.6% of participants had no knowledge of AI, and nearly half (49.4%), of the participants in our study had no experience of AI application and only a minority had formal AI training (14.0%). Nonetheless, 80.3% recognized the importance of AI in healthcare. A study conducted in the United Kingdom showed 64% of respondents reported never coming across applications of AI in their work and 87% did not know the difference between machine learning and deep learning, although 50% knew at least one of the two terms⁷. A systematic review conducted by Chen et al concluded that 53% lacked basic knowledge of clinical AI and the experience of application was seen in 10-30% of participants⁸.

In practice, 75.6% of study participants had never used any AI application. Out of those who used AI (24.4%) participants, found its common applications in patient monitoring (25.3%), research (27.2%), and diagnostics (19.7 %). According to a study conducted in India AI has many applications in radiology, diagnostics, and robotic surgery⁹.

Challenges identified in our study included clinical validation (33.1%) and cost (32.6%). A study conducted by Shaheen discovered that healthcare workers are challenged by bias, missteps, and accidents. Patient concern regarding confidentiality also posed as a challenge as the data can be accessible breaching privacy¹⁰. According to Novak et al provision of infrastructure as well as the regulatory framework is a major challenge¹¹ in AI using in health care.

The majority (85.7%) believed AI could improve patient outcomes, though concerns about AI replacing jobs were mixed, with 41.3% not worried at all and 8.7% extremely worried. A study conducted in Bangladesh at various nursing institutes revealed seven key

themes reflecting healthcare workers' concerns, including job security and economic concerns; trust and acceptance of AI; ethical and moral dilemmas; quality of patient care; workforce role redefinition and training; patient-provider relationships; healthcare policy and regulation¹². In a study conducted in Nigeria 29.3% (n=77) of the respondents agreed that human specialists will be replaced by AI in the near future¹³.

Ethical considerations were significant, with 80.9% concerned about privacy and 59.0% distrusting AI with sensitive data. Preparing staff for AI integration primarily involved education and training (71.1%)¹⁴.

A huge number (92.1%) of participants believed that there should be established regulations in hospitals related to the use of AI by healthcare workers as there may be ethical implications. A recent study by Ploug and Holm (2020) investigated the ethical concerns of AI for medical diagnostics and treatment planning. The authors argued that patients should be able to withdraw from being evaluated by AI because a trustful relationship between physicians and patients is essential for the success of the treatment process¹⁵.

There is this huge concern about patient privacy. Eighty percent of our participants were concerned that the data that is being utilized by AI may breach the privacy of the patients. Doctor-patient confidentiality is a very important aspect of patient management¹⁶.

Out of 356 participants, 71.1% advocated that education and training of healthcare staff is the most important aspect in implementing and promoting the use of AI while 13.2% thought investment in the latest tools is more important. Gender differences were notable, with more females thinking admin tasks, patient monitoring, and research are the areas where AI can be put to good use while most of the male participants thought AI has beneficial use in diagnostics which was a significant difference (p-value<0.001). Clinical validation, cost, and data breaches were the main concerns in females as compared to males (p-value 0.005). Research on the preference for AI in

healthcare among male and female workers is limited. Ogolodom found that healthcare workers, including both males and females, have a good understanding of AI and its potential benefits, but are concerned about job security¹³. Yun reported that male healthcare workers, particularly those with higher academic qualifications, have a better understanding and stronger willingness to participate in AI-related activities¹⁷.

Based on seniority as in work experience, the most senior staff knew about AI, ML, and DL but were not clear about the differences between them while the junior staff was clear about the difference as well. Sixty percent of senior staff is already using AI in their workplace which was a significant difference from their junior colleagues ($p\text{-value} < 0.001$). Participants belonging to all age groups believed that education and training are the way to prepare staff for the use of AI. Just like in our study Experienced healthcare workers generally have positive perceptions of AI, recognizing its potential benefits for patients and care pathways according to Fazakarley in the UK. However, they also express concerns about patient data security, misdiagnosis, and increased workloads¹⁸.

AI is increasingly popular among paramedical staff, as evidenced by the development of various AI based systems and tools. Budijono (2021) discussed the use of AI in emergency response systems and paramedic assistant robots, respectively. Strum (2022) highlights the potential of machine learning in paramedicine, particularly in clinical decision-making and patient outcome prediction.^{19,20} Our paramedical staff has yet to pull up their socks as they lack in-depth knowledge (78% did not know), understanding of the application of AI (59% had never used AI) as well as challenges associated with its use. However, most (95.4%) of them believed that AI has the potential to improve patient outcomes.

The limitations of the study were sample size, observer bias, and selection bias. The study predominantly included female participants (72.2%), which might have influenced the

findings. Workshops and courses in the organization should be arranged to facilitate our healthcare workers in becoming more proficient in the use of AI-based tools.

CONCLUSION

Overall, the perception of AI among healthcare workers is contingent upon the level of understanding, exposure, and experience with AI technology. Education and training programs that familiarize healthcare professionals with AI applications and demonstrate their potential benefits will likely foster greater acceptance and utilization of AI in healthcare settings

AUTHOR'S CONTRIBUTION:

SAB: Literature Search, Writing of manuscript
AS: Conceptualization of article, Manuscript writing, drafting and revision

AR: Data Collection

TK: Data Collection

MSN: Data Analysis

RA: Review of Manuscript

SS: Final Review

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