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Uses of Artificial Intelligence in Health: Kap Survey among Medical & Allied Health Science Students of Khyber Pakhtunkhwa

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ABSTRACT

Background: Artificial intelligence (AI) is transforming healthcare and medical education; however, its adoption in developing countries is still relatively limited. **Objective:** This study evaluates the knowledge, attitudes, and practices of medical and allied health sciences students in KP, Pakistan, regarding the application of AI in healthcare. **Study Design:** Cross-sectional survey. **Settings:** Medical and Allied Health Sciences colleges in KP, Pakistan. **Duration:** August 1, 2023, and October 5, 2023. **Methods:** An online survey, with 577 medical and allied health sciences students from Khyber Medical University, KP, Pakistan. The collected data were analyzed quantitatively using SPSS version 26, with a significance level set at $p = 0.05$. **Results:** Approximately, 55.5% of participants had no awareness of AI. Knowledge levels differed considerably (mean score 57%, good 22.2%, poor 20.8%) and were significantly associated with gender, residence, age, experience, and educational level. Students' attitudes toward AI were mainly poor (30.2%) or moderate (44.7%). Although formal AI training was limited (61.7%). AI practice among KP students differed significantly by gender, college status, years of study, and educational status (all $p < 0.001$). **Conclusion:** This study revealed that awareness and knowledge of AI among medical and allied health sciences students in Khyber Pakhtunkhwa, Pakistan, remain limited, with significant variations across demographic and educational factors. Despite inadequate formal training and generally moderate-to-poor attitudes toward AI, students demonstrated strong interest in learning about AI and integrating it into healthcare practice. These findings highlight the importance of incorporating structured AI education and training into medical curricula to better prepare future healthcare professionals for an increasingly technology-driven healthcare system.

Keywords: AI, Virtual reality, Augmented reality, Deep learning, Machine learning, COVID-19, Healthcare.

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INTRODUCTION

Artificial Intelligence (AI) refers to the development of intelligent computer systems that mimic human cognitive abilities, such as learning and problem-solving, through advanced algorithms.¹ Machine Learning (ML), a branch of AI, improves the accuracy and efficiency of medical tasks by allowing computers to learn from previous experiences.² It supports healthcare professionals in handling clinical information and enhancing patient outcomes.³ Deep learning (DL), a specialized form of neural networks, consists of multiple layers that identify features from raw data and is widely applied in speech recognition and image analysis. Distributed Ledger Technology (DLT) allows secure data sharing and recording across interconnected ledgers.⁴ The

Metaverse is an evolving virtual and augmented reality space where users interact through avatars,⁵ providing customized healthcare experiences using advanced technologies such as digital twins and telepresence.⁶ Its growing influence in healthcare includes uses in medical training, research, and patient observation, while also improving the practical skills of medical students through innovations in real-time health monitoring.^{7,8} A transformer is an advanced deep learning architecture used in multiple domains, including computer vision and natural language processing,⁹ with important healthcare applications such as electronic medical records management and COVID-19 detection.^{10,11} Cloud-based networks support the secure storage and retrieval of patient information, improving remote accessibility for healthcare workers. A recent cross-sectional KAP study conducted in

Pakistan in 2022 included participants from several medical institutions, with only two ($n=02$) students from KMU and RMI accounting for a limited 0.4%.¹² The study examined their awareness of current AI applications in Khyber Pakhtunkhwa and evaluated their interest in incorporating AI as a teaching approach in medical education. Addressing the limited research available on this topic among Pakistani medical students, the present study is the first in KP, Pakistan, to explore perceptions regarding the role of AI in medical education and its possible impact on specialization preferences and future educational directions.

The increasing use of AI in health sciences, particularly with ChatGPT, highlights a significant research gap in Pakistan. This study aims to explore this topic to facilitate the integration of AI into healthcare and health education.

METHODS

The cross-sectional study was conducted in the Medical and Allied Health Sciences colleges in KP, Pakistan. The study lasted three months. The total population was 50000, as 60000 on the KMU site. The sample size is calculated in OpenEpi with an anticipated frequency of 50%, an absolute precision of 5%, and a 95% confidence level; the sample size should be 382. The inclusion criteria were medical and allied health science students who completed the survey. The incomplete survey, non-medical personnel, and/or non-responders were excluded. Ethical approval was obtained from the IPH&SS-Ethics Board of Khyber Medical University, Peshawar, KP, Pakistan, Ref No. KMU/IPHSS/Ethics/2023/AI/0134 (10-07-2023).

The survey comprised four sections: 1) Knowledge about AI (9 questions) assessed as Good (>4.1), Average (3.1-4), or Poor (<3); 2) Attitude towards AI (5 questions) categorized as Positive (>4.1), Average (3.1-4), or Negative (<3.3); 3) Practices regarding AI (6 questions) rated as Good (>4.1), Average (3.1-4), or Poor (<3). Responses were measured using a 5-point Likert scale. This online survey was conducted using an online questionnaire from Aug 2023 to Oct 2023. A total of 584 opened the link, and 577 participants completed the questionnaire, representing 50000 Medical and Allied health science students from colleges in KP, Pakistan. A validated electronic questionnaire was created in Google Forms and sent to focal persons and students at different colleges via social media applications such as WhatsApp, Facebook Messenger, and Email. The first reminder was given on the 3rd day, and the 2nd on the 7th day. The Advanced Study and Research Board ASRB of Pakistan approved them. At the beginning of the survey, written informed consent was obtained from individual participants, with no personal data collected. The questionnaire had four sections. The first section collected demographic information from the participants; the second section focused on their knowledge of AI; the third section focused on Attitudes toward AI; and the 4th section focused on practices toward AI. The rest of the survey contained 21 questions. Responses to closed questions were collected on a 5-point Likert scale (i.e., "Strongly disagree", "Disagree", "Neutral", "Agree", "Strongly agree"). In the practice section, dichotomous questioning was used to determine whether participants received AI training as

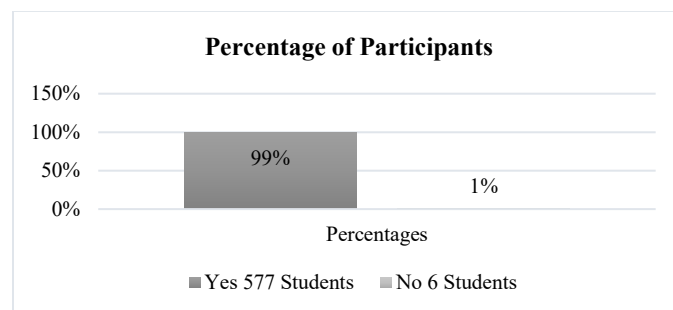
part of their curriculum. The proposed study was an online survey.

Data was analyzed by using SPSS 26 Software and Excel. The dependent variables are knowledge about AI, practice with AI, and attitude toward AI, and the independent variables are Age, Gender, Educational level, College status (public/private), District, Number of years, and Departments. Descriptive analysis includes frequencies or percentages described for categorical variables such as gender, educational level, number of years, districts, college status, and departments. Age was converted to a categorical variable. Cross-tabulation was performed to examine the independent variables across the outcome categories. Tables and figures were used to present data. A p-value equal to or less than 0.05 was considered significant; otherwise, it was non-significant. Statistical analysis was conducted using IBM SPSS Statistics version 26 and Excel. The study included finding frequency, charts, percentages, cross-tabulations, and the Chi-square test.

RESULTS

Most variables were categorical, such as gender, educational level, college status (public or private), study year, department, and district in KP, and statistical analysis was performed using frequencies and percentages. Of 584 participants, only 6 refused to participate in this online survey. (Figure 1)

Figure 1: Percentages of participants



The demographic details were presented in a single table with frequencies and percentages, as shown in Table 1.

The proportion of students with good AI knowledge was statistically insignificant across genders ($P = 0.054$), and the proportion across districts was statistically significant ($P = 0.0001$) but insignificant in public and private colleges ($P = 0.152$). Knowledge about AI was highly significant, along with experience, with a P value of 0.00001. Knowledge was insignificant in different departments; the P value was 0.218. As the educational level was statistically significant ($P = 0.005$), the P value was 0.005. Age is statistically significant ($P = 0.018$). Most of the participants strongly agreed or agreed with the application of AI in medical education and health care. AI improved healthcare systems, patient care, patient treatment, potential diagnoses, and healthcare in remote peripheries where experts were not available. Knowledge about AI in the Division was statistically insignificant. The p-value was 0.929, and the percentages are shown in Table 2.

Table 1: Demographic details

Characteristics	Characteristics	Total number	Percentages	Total % (n)
Gender	Male	208	36%	36 (208)
	Female	369	63.8%	63.8 (369)
Age	17-25 years	444	76.9%	76.9 (444)
	26-35 years	133	23%	23 (133)
Name of department	BS Allied Health Science	314	54.4%	54.4 (314)
	Pharm-D	8	1.4%	1.4 (8)
	Public Health	30	5.2%	5.2 (30)
	BS Physiotherapy	77	13.3%	13.3 (77)
Name of districts	Peshawar Division	294	51.0%	51.0 (294)
	Malakand Division	7	1.2%	1.2 (7)
	Mardan Division	86	14.9%	14.9 (86)
	Kohat Division	65	11.3%	65 (11.3)
	D.I Khan Division	116	20.1%	20.1 (116)
	Hazara Division	9	1.6%	1.6 (9)
Educational level	BDS	6	1.0%	1.0 (6)
	BS Allied Health Science	380	65.9%	65.9 (380)
	DPT	35	6.1%	6.1 (35)
	MBBS	142	24.6%	24.6 (142)
	Postgraduates (for Allied Health Science)	14	2.4%	2.4 (14)
College status	Private	295	51.1%	51.1 (295)
	Public	282	48.9%	48.9 (282)
No of years	1 years (1st + 2nd semester)	170	29.5%	29.5 (170)
	2 years (3rd +4th semester)	102	17.7%	17.7 (102)
	3 years (5th +6th semester)	118	20.5%	20.5 (118)
	4 years (7th +8th semester)	100	17.3%	17.3 (100)
	Final year	87	15.1%	15.1 (87)

Table 2: Statistical analysis of knowledge of AI

Variable		Poor 118 (20.5%)	Average 329 (57%)	Good 130 (22.5%)	P value
Gender	Male	65 (17.6%)	222 (60.2%)	82 (22.2%)	.054
	Female	53 (25.5%)	107 (51.4%)	48 (23.1%)	.054
College status	Public	62 (22.0%)	166 (58.9%)	54 (19.1%)	.152
	Private	56 (19.0%)	163 (55.3%)	76 (25.8%)	.152
No of years	1st year	31 (18.2%)	104 (61.2%)	35 (20.6%)	.000
	2nd year	17 (16.7%)	58 (56.9%)	27 (26.5%)	.000
	3rd year	20 (16.9%)	80 (67.8%)	18 (15.3%)	.000
	4th year	36 (36.0%)	52 (52.0%)	12 (12.0%)	.000
	Final year	14 (16.1%)	35 (40.2%)	38 (43.7%)	.000
Age	17-25	90 (19.6%)	256 (55.2%)	96 (25.2%)	0.018
	26-35	27 (23.3%)	72 (62.2%)	33 (13.5%)	0.018
Departments	BS Allied Health Science	62 (19.8%)	179 (57.2%)	72 (23.0%)	.218
	BS Physiotherapy	16 (20.8%)	41 (53.2%)	20 (26.0%)	.218
	Public Health	10 (33.3%)	16 (53.3%)	4 (13.3%)	.218
	Pharm-D	4 (50.0%)	2 (25.0%)	2 (25.0%)	.218
Divisions	Peshawar	54 (18.4%)	178 (60.5%)	62 (21.1%)	.528
	Malakand	26 (22.4%)	64 (55.2%)	26 (22.4%)	.528
	Mardan	19 (22.1%)	40 (46.5%)	27 (31.4%)	.528
	Kohat	15 (23.4%)	38 (59.4%)	11 (17.2%)	.528
	D.I Khan	1 (11.1%)	5 (55.6%)	3 (33.3%)	.528
	Hazara	2 (28.6%)	4 (57.1%)	1 (14.3%)	.528
Educational level	BDS	2 (33.3%)	4 (66.7%)	0 (0.0%)	.005
	BS Allied Health Science	76 (20.0%)	231 (60.8%)	73 (19.2%)	.005
	DPT	11 (31.4%)	19 (54.3%)	5 (14.3%)	.005
	MBBS	24 (16.9%)	71 (50.0%)	47 (33.1%)	.005
	Postgraduates	5 (35.7%)	4 (28.6%)	5 (35.7%)	.005

The practice of AI among KP students was statistically significant across variables such as gender (P value = 0.000), college status (P value = 0.000), number of years (P value = 0.000), and educational status (P value = 0.000). Age is

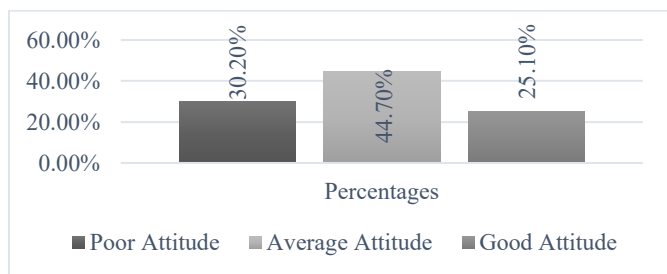
statistically insignificant across departments (P value = 0.519). Practice about AI was statistically insignificant at the Division level (P = 0.242), and the percentages of poor, average, and good practice at the district level are shown below in Table 3.

Table 3: Practice about AI

Variable		Poor 396 (68.6%)	Average 129 (22.4%)	Good 52 (9.0%)	P Value
Gender	Male	249 (67.5%)	98 (26.6%)	22 (6.0%)	.000
	Female	147 (70.7%)	31 (14.9%)	30 (14.4%)	.000
College status	Public	212 (75.2%)	61 (21.6%)	9 (3.2%)	.000
	Private	184 (62.4%)	68 (23.1%)	43 (14.6%)	.000
Number of years	1st year	118 (69.4%)	42 (24.7%)	10 (5.9%)	.000
	2nd year	73 (71.6%)	22 (21.6%)	7 (6.9%)	.000
	3rd year	82 (69.5%)	29 (24.6%)	7 (5.9%)	.000
	4th year	85 (85.0%)	12 (12.0%)	3 (3.0%)	.000
	Final year	38 (43.7%)	24 (27.6%)	25 (28.7%)	.000
Age	17-25	306 (69%)	100 (22.6%)	37 (8.4%)	.38
	26-35	89 (67.4%)	29 (22%)	14 (10.6%)	.38
Departments	BS Allied Health Science	215 (68.5%)	73 (23.2%)	26 (8.3%)	.519
	BS Physiotherapy	53 (68.8%)	15 (19.5%)	9 (11.7%)	.519
	Public Health	24 (80.0%)	3 (10.0%)	3 (10.0%)	.519
	Pharm-D	5 (62.5%)	1 (12.5%)	2 (25.0%)	.519
Educational level	BDS	4 (66.7%)	2 (33.3%)	0 (0.0%)	.000
	BS Allied Health Science	270 (71.1%)	88 (23.2%)	22 (5.8%)	.000
	DPT	30 (85.7%)	4 (11.4%)	1 (2.9%)	.000
	MBBS	81 (57.0%)	32 (22.5%)	29 (20.4%)	.000
	Postgraduates	11 (78.6%)	3 (21.4%)	0 (0.0%)	.000
Division	Peshawar	201 (68.4%)	66 (22.4%)	27 (9.2%)	.242
	Malakand	74 (63.8%)	36 (31.0%)	6 (5.2%)	.242
	Mardan	59 (68.6%)	16 (18.6%)	11 (12.8%)	.242
	Kohat	49 (75.4%)	9 (13.8%)	7 (10.8%)	.242
	D.I Khan	7 (77.8%)	1 (11.1%)	1 (11.1%)	.242
	Hazara	6 (85.7%)	1 (14.3%)	0 (0.0%)	.242

Most students have an average attitude towards AI of 258 (44.7%), a good attitude of 145 (25.7%), and a poor attitude of 174 (30.2%), as shown in Figure 2.

Figure 2: Attitude toward AI



Regarding AI knowledge, individuals were asked about the basic concept of AI and its subtypes. It was observed that among 577 participants, 259 (44.9%) were aware of artificial intelligence, machine learning, deep learning, and neural networks. In 259 students 164(63.3%) were male and 95(36.7%) were female. 318 (55.1%) did not know about AI or its subtypes. Out of 318, 164 (63.3%) were male, and only 95 (36.7%) were female. Most students (378, 65.5%) did not know about GDPR; of these, 247 (65.3%) were male and 131 (34.7%) were female. 199 (34.5%) students answered yes, so they knew about GDPR. Out of 199 (34.5%), 122 (61.3%) were male, and 77 (38.6%) were female. Most students (378, 65.5%) did not know about GDPR; of these, 247 (65.3%) were male and 131 (34.7%) were female. 199 (34.5%) students answered yes, so they knew about GDPR. Out of 199 (34.5%), 122 (61.3%) were male, and 77 (38.6%) were female, as shown in Table 4.

Table 4: Knowledge about AI and its subtypes and GDPR

Variables	Answer	No of students	Percentages	Gender	No (Percentages)
Knowledge about AI and its subtypes	No	318	55.1%	Male	205 (64.5%)
	No	318	55.1%	Female	113 (35.5%)
	Yes	259	44.9%	Male	164 (63.3%)
	Yes	259	44.9%	Female	95 (36.71%)
Knowledge about GDPR	No	378	65.5%	Male	247 (65.3%)
	No	378	65.5%	Female	131 (34.7%)
	Yes	199	34.5%	Male	122 (61.3%)
	Yes	199	34.5%	Female	77 (38.7%)

DISCUSSION

The study highlights the limited understanding and applications of artificial intelligence (AI) among medical students in Khyber Pakhtunkhwa, Pakistan. Most participants (55.1%) were unfamiliar with key AI terms such as "artificial intelligence," "algorithm," and "machine learning" only a small portion (34.5%) were familiar with the term GDPR. As compared with the studies carried out in Nepal, more than half of the study participants knew about the term "artificial intelligence."¹³ Higher awareness levels were noted in surveys from developed countries like Canada (83.3%).¹⁴ In research conducted in Spain, 51.9% of participants said they were unfamiliar with AI.¹⁵ Compared with a survey conducted in Saudi Arabia, 71.9% participants were familiar with the term "artificial intelligence".¹⁶ According to a Syrian survey, 34.7% of participants have some knowledge of ML and DL, 23.7% are aware of AI applications in medicine, and 70% have a fundamental understanding of AI.¹² As compared to the Pakistani study, most students have a basic knowledge of AI (71.3%), but only a minority (35.3%) are familiar with AI subtypes, indicating limited understanding of the AI subtypes. Our study aligned with a previous survey in Pakistan, revealing that 75% of participants were unaware of the practical uses of AI in medicine.¹² According to our survey results, more than 70% of survey participants believe AI will assist in analyzing patient medical data for diagnoses and enhance treatment compliance. A previous study in Pakistan indicated that 74.4% recognized AI's critical role in modern diagnostics, considering it essential for advanced medical care. Studies in UK medical colleges revealed that 75% of students recognize the importance of AI in medicine;¹⁷ our study also found similar results, indicating that three-fourths support AI integration in medical education. A survey in Pakistan found that 66.6% of respondents believe AI implementation could reduce diagnostic errors.¹² A similar finding in a study conducted in Singapore, 78.6% of students agreed to apply AI in the future.¹⁸ Factors hindering AI implementation in Pakistan include inadequate training, insufficient curriculum integration, and limited technological advancement. While students recognize AI's importance, they have limited advanced knowledge of its applications in healthcare. Our survey results indicated that students generally had positive attitudes toward artificial intelligence (AI) in medicine, viewing it as a tool to enhance the field by making it more interesting and reducing workload. Other studies reported similar findings related to medical students.^{14,19-21} Our study findings show the concerns about job loss and human replacement were prevalent, with over 50% believing AI might diminish job opportunities for healthcare professionals. Almost 50% of the Nepal survey students believed that AI would make fewer jobs available to them.¹³ Compared to a previous study by Zhang *et al.*, healthcare workers believed AI might eventually replace humans in some skills and were worried about losing their jobs.²² According to our study, more than 60% students reported a lack of training in AI. Compared with other studies with similar findings, such as a survey conducted in Jordan, students.²³ According to our study findings, only 32.1% having encountered AI tools in their practice. Compared with other studies conducted in Nigeria, which showed that the majority of respondents had used AI programs in the past, "Grammar checkers" were the most

popular, indicating high AI use.²⁴ According to our data, just 28.9% of people use AI for medical diagnosis and research. This research is the first in KP to assess students' knowledge, attitudes, and practices across various Pakistani institutes, along with the influencing factors. AI will play a more prominent role in future medicine and healthcare.

CONCLUSION

This study found that most healthcare students in KP had average knowledge, poor AI practice, and average attitudes toward artificial intelligence. While students generally recognized the potential benefits of AI in medical education and healthcare, awareness of key AI concepts and regulations such as GDPR remained limited. AI knowledge was significantly associated with study year, age, educational level, and experience, whereas AI practice varied significantly by gender, college status, study year, and educational level.

LIMITATIONS

Distributing the online questionnaire via social media may introduce selection bias and social desirability bias, affecting the authenticity of participants' responses. Additionally, the use of a small convenience sample limits the generalizability of the findings to other students or populations. The study focused on clinical-year medical students at Khyber Medical University in Pakistan, suggesting that results may not apply to other demographics or institutions. Non-response bias can also impact the survey outcomes.

SUGGESTIONS / RECOMMENDATIONS

Researchers recommend that medical schools incorporate artificial intelligence (AI) into their curricula. They suggest creating a task force of experts to assist in educator training and address potential challenges in teaching AI. Ethical considerations are also emphasized in the integration process.

CONFLICT OF INTEREST / DISCLOSURE

There are no conflicts of interest.

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