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Original Article

# Awareness, Knowledge, Attitudes, and Assumptions about AI in Clinical Practice among Final-Year Medical Students and Internees in Peripheral Hospitals of Sialkot, Pakistan

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## Abstract

**Objective:** The present study evaluated the level of knowledge, perceptions, and readiness of young physicians and final-year medical students on AI in healthcare, specifically in antibiotic selection.

**Methodology:** A structured questionnaire and descriptive statistics in a cross-sectional survey of 400 participants (221 final-year students, 179 house officers).

**Results:** Out of the respondents, 52.7% were female largely aged between 24-26 years. There was a high awareness of AI (79.7%), primarily through self-study and Internet sources (69.5%). Though 73.3% found AI helpful in antibiotic selection, only 38.5% partly and 27% completely agree to use it to inform prescribing, and decisions to prescribe still lie with physicians. Data privacy was also a concern (36.5%), as well as inappropriate recommendations (32.5%), and the absence of empathy (31%). Interestingly enough, 84 percent of participants did not receive formal AI training, but 77.3 percent supported its presence in the curriculum.

**Conclusion:** Young doctors and medical students are optimistic (but careful) about AI in healthcare. Potentially this would be useful in antibiotic stewardship, although safety, training and ethical issues have indicated that it is not something that should be introduced without some kind of formal education and evidence-based advice.

**Keywords:** Artificial intelligence, Healthcare, Antibiotic prescribing, Perceptions, Curriculum

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## Introduction

Artificial intelligence (AI) is a technology that finds more and more applications in the healthcare field, such as diagnostic imaging, risk-based prediction, and personalized treatment. It enhances study of medical images, risk assessment of patients and personal therapy.[1] Antimicrobial stewardship (AMS) is another area supported by AI as a decision support tool, faster diagnostics, and improved treatment. Machine learning could be used to analyze bulk data to identify trends and anticipate antimicrobial resistance (AMR) and patient response to treatments to promote judicious prescribing, improve patient outcomes, and reduce spread of antimicrobial resistance.[2] The global health risk that has led to AMR, treatment failures, severe infections and higher mortality; and has also created economic and healthcare burdens is antibiotic misuse.[3]

The digital health tools are adopted by medical students and young doctors in the beginning of their careers. They need to be aware, perceive and willing to implement AI in clinical decisions in the development of the curriculum and safe AI use. Although increasing evidence is available concerning AI in healthcare, there is still a dearth of research information about the perceptions of young physicians, especially with regard to antibiotic prescribing.[4]

Generative AI can revolutionize medical education, including admissions, personalized learning, assessment, and research, and there should be a better approach to AI literacy in medical education.[5] AI has the potential to support undergraduate education with personalized feedback, adaptable simulations, and virtual environments, providing real-world assessment, increased efficiency, less expense, and safer clinical training 6. The obstacles to further implementation are technical infrastructure, privacy issues around data, lack of representation in curricula, and the lack of integration in current learning systems.[6]

The purpose of this study is to evaluate the level of awareness, attitudes and perceptions of final-year medical students and house officers about AI in healthcare, and its application in the selection of antibiotics.

## Methodology

It is a cross-sectional survey research study of final year, medical students and house officers (24-28) in Sialkot, Punjab, Pakistan, who participated in teaching or clinic rotations. Informed consent was given by participants and only the duly filled forms were analyzed. Based on the literature on AI in healthcare and antibiotic stewardship, a self-administered questionnaire was created and tested on 20 students to ensure clarity and reliability in the pilot study and then delivered electronically through institutional email and messaging. The survey also gathered demographics and attitudes towards AI in healthcare, specifically regarding its application in the prescription of antibiotics, through a five-point Likert scale (strongly agree to strongly disagree), as in other research.

The study protocol was approved by Islam Medical and Dental College, Sialkot. Participation was voluntary, with informed consent obtained, and responses were anonymized to ensure confidentiality.

The data was analyzed by descriptive statistics, summarizing categorical variables in terms of frequencies and proportions. There were no inferential tests, because the study was to measure awareness and perceptions. Data has been prepared and tabulated in Microsoft Excel reporting results as the number of responses; the number of missing values was not included to percentages.

## Results

Out of 400 respondents, the majority of them were 24-26 years old (28.5%), followed by 24-26 (26.5) and 26-26 (25.5); the least aged 27-27 (19.5).

The demography of 400 respondents was as follows: 189 (47.3 percent) of the respondents were male, the number of female respondents was 211 (52.7 percent). Such distribution is close to evenness in general, which increases the external validity of the sample in both genders.

**Table 1:** *Participant Demographics (n=400)*

| Characteristic | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age (years) | 24 | 106 | 26.5 |
| | 25 | 114 | 28.5 |
| | 26 | 102 | 25.5 |
| | 27 | 78 | 19.5 |
| Gender | Male | 189 | 47.3 |
| | Female | 211 | 52.7 |
| Current Role | Final-year medical student | 221 | 55 |
| | Internee/House Officer | 179 | 45 |

In general, 319 (79.7) subjects knew about AI in healthcare, and 81 (20.3) did not. House officers (82%), as compared to final year students (77.8%), had a slight higher awareness in terms of AI familiarity in clinical setting.

### Sources of AI Information in Participants

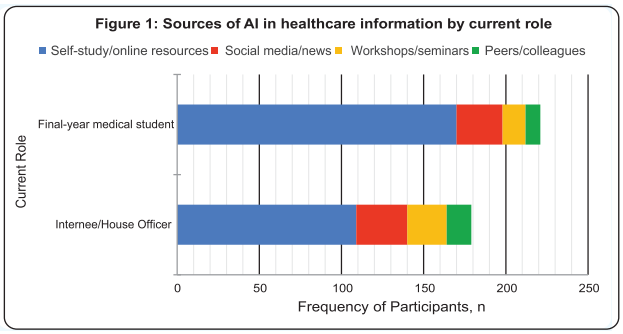
Self-study and online sources (279, 69.5%), social media/news (59, 15%), workshops/seminars (38, 9.5%), and peers/colleagues (24, 6%), were the major sources of AI information. Final-year students had the highest exposure to self-study (170), but the house officers received greater exposure in other areas.

**Table 2:** *Awareness & Sources of AI*

| Question | Response | Total n (%) | Final Year Students n (%) | Internees n (%) |
|---|---|---|---|---|
| Heard of AI in healthcare | Yes | 319 (79.7) | 172 (77.8) | 147 (82) |
| | No | 81 (20.3) | 49 (22.2) | 32 (18) |
| Source of AI information | Self-study/online resources | 279 (69.5) | 170 (77) | 109 (61) |
| | Social media/news | 59 (15) | 28 (12.7) | 31 (17.3) |
| | Workshops/ seminars | 38 (9.5) | 14 (6.3) | 24 (13.4) |
| | Peers/colleagues | 24 (6) | 9 (4.1) | 15 (8.4) |

***AI in Antibiotic Selection***: The majority of respondents thought that AI would help in picking up antibiotics (293, 73.3%), 81 (20.3%) said they did not know, and 26 (6.5) said they didn't agree. Agreement among final-year students was 74.7% (95% confidence interval 52.3 to 86.8), disagreement only 6.3%, and uncertainty 19; among house officers, similar results were obtained, with 71.5% agreement (95% interval 52.4 to 87.8), 21.8% disagreeing, and 6.7% undecided.

*Belief on AI Replacing Prescribers*: There were mixed feelings regarding the possibility of AI replacing prescribers: 59 (14.8%) thought that it was likely, 183 (45.8) were not sure, and 158 (39.5) disagreed. The proportion of final-year students that were uncertain (46.2 %) and those that disagreed (40.3 %) was nearly equal, whereas the same proportion of house officers indicated their uncertainty (45.3 %) and disagreement (38.5 %).




*Participant Perceptions of AI Assistance in Prescribing:* About AI-assisted clinical decision-making, 154 participants (86 students, 68 house officers) partially agreed and 112 (62 students, 50 house officers) fully agreed that AI could help but the final decision should remain in the hands of physicians, and 134 (73 students, 61 house officers) disagreed. It means that the level of trust towards AI as an adjunctive tool is medium.

*Participant Trust in AI-Led Treatment without Oversight:* A majority of the respondents did not support AI offering treatment without physician supervision: 223 (131 students, 92 house officers) opposed, 126 (67 students, 59 house officers) agreed to some extent and 51 (23 students, 28 house officers) agreed completely, meaning that physician supervision was in strong support.

*Willingness to Use AI in Future Clinical Practice*: When asked about future AI use, 136 (77 students, 59 house officers) participants were willing to use AI in full, 196 (106 students, 90 house officers) participants were willing to use AI carefully, and 68 (38 students, 30 house officers) participants were unwilling to use AI, which indicates a generally positive attitude toward AI in clinical work.

*Main Concerns Regarding AI Use in Healthcare*: The highest ranking concern was data privacy, which was mentioned by 146 respondents (81 students, 65 house officers), with mistaken recommendations (130; 75 students, 59 house officers) and lack of empathy (124; 65 students, 59 house officers) in the following places, which reflect fear of safety and interpersonal factors regardless of AI acceptance.

*Confidence in AI's Potential to Improve Clinical Outcomes*: A majority of participants stated that they were confident that AI will enhance clinical outcomes when used appropriately: 158 (90 students, 68 house officers) stated that they were highly confident, 148 (88 students, 60 house officers) moderately confident, and 94 (43 students, 51 house officers) expressed reservations, which means that most have moderate-to-high confidence in the benefits of AI.

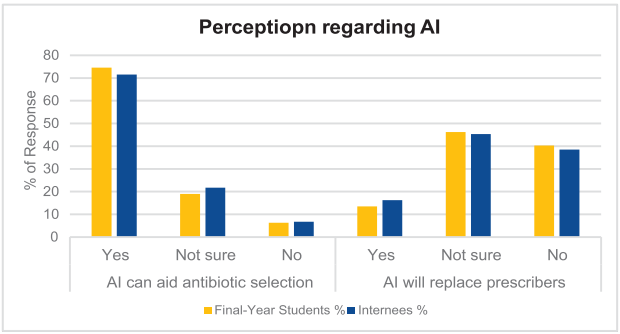



**Figure 2:** *Perception of Participants regarding AI*

*Formal AI Training during Medical Education*: The majority of the participants had not received formal training in AI: 336 (188 students, 148 house officers) had never had any preparation and 64 (33 students, 31 house officers) had received some training, which is an issue in medical education.

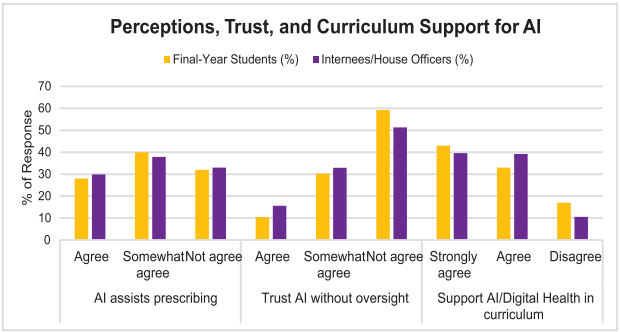



**Figure 3:** *Perceptions, Trust, and Curriculum Support for AI*

*Perceptions of Participants on Including AI and Digital Health in the Curriculum:* Most indicated that they supported the inclusion of AI and digital health in the curriculum: 166 (95 students, 71 house officers) strongly agreed, 143 (73 students, 70 house officers) agreed, and 91 (53 students, 38 house officers)

**Table 3:** *Perceptions, Attitudes, Confidence & Education Regarding AI (n=400)*

| Question | Response | Final-Year Students n (%) | Internees/House Officers n (%) | Total n (%) |
|---|---|---|---|---|
| **AI can aid antibiotic selection** | Yes | 165 (74.6) | 128 (71.5) | 293 (73.3) |
| | Not sure | 42 (19) | 39 (21.7) | 81 (20.3) |
| | No | 14 (6.3) | 12 (6.7) | 26 (6.5) |
| **AI will replace prescribers** | Yes | 30 (13.5) | 29 (16.2) | 59 (14.8) |
| | Not sure | 102 (46.2) | 81 (45.3) | 183 (45.8) |
| | No | 89 (40.3) | 69 (38.5) | 158 (39.5) |
| **AI assists prescribing; doctor has final say** | Agree | 62 (28) | 50 (29.9) | 112 (28) |
| | Somewhat agree | 86 (40) | 68 (37.9) | 154 (38.5) |
| | Not agree | 73 (32) | 61 (33) | 134 (33.5) |
| **Trust AI treatment without oversight** | Agree | 23 (10.5) | 28 (15.6) | 51 (12.8) |
| | Somewhat agree | 67 (30.3) | 59 (32.9) | 126 (31.5) |
| | Not agree | 131 (59.2) | 92 (51.3) | 223 (55.8) |
| **Willingness to use AI in practice** | Yes, definitely | 77 (34.9) | 59 (32.9) | 136 (34) |
| | Yes, with caution | 106 (47.9) | 90 (50.3) | 196 (49) |
| | No | 38 (17.2) | 30 (16.8) | 68 (17) |
| **Main concerns about AI** | Data privacy | 81 (36.6) | 65 (36.3) | 146 (36.5) |
| | Incorrect | 75 (34) | 55 (30.7) | 130 (32.5) |
| | Lack empathy | 65 (29.4) | 59 (33) | 124 (31) |
| **Confidence AI improves outcomes** | Confident | 90 (40.7) | 68 (38) | 158 (39.5) |
| | Somewhat | 88 (39.8) | 60 (33.5) | 148 (37) |
| | Not confident | 43 (19.5) | 51 (28.5) | 94 (23.5) |
| **Formal AI training** | Yes | 33 (15) | 31 (17.3) | 64 (16) |
| | No | 188 (85) | 148 (82.7) | 336 (84) |
| **Support AI/Digital Health in curriculum** | Strongly agree | 95 (43) | 71 (39.6) | 166 (41.5) |
| | Agree | 73 (33) | 70 (39.2) | 143 (35.8) |
| | Disagree | 38 (17) | 19 (10.6) | 57 (14.2) |
| | Strongly disagree | 15 (7) | 19 (10.6) | 34 (8.5) |
| **Interest in AI workshops/courses** | Very interested | 71 (32.2) | 56 (31.3) | 127 (31.8) |
| | Interested | 93 (42) | 72 (40.2) | 165 (41.3) |
| | Somewhat | 49 (22.2) | 40 (22.3) | 89 (22.3) |
| | Not interested | 8 (3.6) | 11 (6.2) | 19 (4.8) |

disagreed or strongly disagreed, meaning that there was a high level of support in the curriculum integration.

*Interest in AI-Related Workshops or Courses:* The majority of respondents were interested in AI-related workshops or courses: 127 (71 students, 56 house officers) were very interested, 164 (93 students, 72 house officers) were generally interested, 89 (49 students, 40 house officers) were lowly interested, and 19 (8 students, 11 house officers) were not interested, which means that AI education is in high demand.

## Discussion

The present study yields the new information about the attitudes of the final-year medical students and internees/house officers to the application of artificial intelligence (AI) in healthcare facilities. The most

important result is the overall readiness to embrace AI as an assistive tool in prescribing and clinical decision-making, with the majority of the respondents seeing its future potential, although they still demanded the established significance of physician supervision. These findings suggest the middle-ground standpoint: artificial intelligence is not meant to substitute clinical judgment, but, rather, supplement it, in accordance with the dynamic role of digital technology in clinical practice.

The one interesting finding of the present research study is that there is no formal education on artificial intelligence (AI) and digital health in contemporary medical education. Although the study participants mostly did not have any organized teaching experiences in the field, most of them were interested in AI-related workshops and welcomed the introduction of AI and digital health issues into the curriculum and similar kind of scenario was observed in a published study. [7] This highlights a clear gap between the technological demands of modern healthcare and the preparedness of future physicians, underscoring the need for curriculum reform. Similar calls for integration of AI competencies into medical training have been noted in recent studies, reflecting a growing recognition of digital health literacy as a core component of medical professionalism.[8]

A large number of participants were aware of use of AI in healthcare settings and numbers goes up to 80% and the similar kind of results were identified by a study published in China 9. Despite of being aware by the use of AI in healthcare, a large proportion of respondents e.g more than 80% did not receive any formal training during their formal medical education and remaining 20% received AI training on their own. Similar results are observed by a study published in Canada although an overall excitement currently surrounds the medical student population, recent surveys indicate that most of these students have not, in fact, been taught anything about artificial intelligence. As of 2022, just 15 per cent of Canadian medical students had so far encountered AI-related course material.[7] The necessity to integrate the skills of artificial intelligence into medical education has also been identified in recent studies, as the digital health literacy has come to be the critical component of the medical professionalism.[10,11,12] This study revealed that the participants despite having no formal training during their medical education, privately explored the AI and it's possible in their medical career. Similar kind of scenario was observed in a published study in America that students took part in independent studies of artificial intelligence, relieving them of the need to be supervised by faculty.[8] The information obtained in the course of the current study indicates that most of the respondents are confident that the implementation of artificial intelligence can be used to improve antibiotic prescription habits and lead to a decrease in antimicrobial resistance and several studies support this claim as well.[13,14] The findings of this study suggest that over 70 % of the participants support the inclusion of artificial intelligence in the curriculum of medical professionals or the delivery of specific training on the topic of artificial intelligence as is described in a study carried out in the United States.[8]

The current study has great academic and clinical relevance. Artificial intelligence (AI) and the associated digital health modules should be included in undergraduate and postgraduate curricula in medical education to enhance responsible use and equip future physicians to critically assess and implement AI tools. At the same time, the results of the study show that young doctors are in a good position to embrace AI and they need protective mechanisms, including transparency, systematic monitoring, and extensive education.

There are a few limitations to the current study. First, the cross-sectional study design does not allow drawing of causal conclusions. Second, the data rely on self-reported perceptions, which can be idiosyncratic personal exposure to technology or current norms of education at the institutions of the respondents. Third, the findings are narrowed to a certain geographic and institutional setting; therefore, they cannot be generalized. Future studies should incorporate studies that are larger and multi-center, longitudinal in nature, thus tracing how attitudinal dimensions evolve as a result of actual exposure to AI in clinical practice.

## Conclusion

The researchers find that undergraduate students in their final year and house officers are aware of AI potential to enhance healthcare, but it is essential that physicians have supervision over AI. Despite the lack of formal training, the participants are interested in AI education and want to see it implemented in the curricula. Significant ethical and clinical issues, such as data privacy, accuracy and empathy, should be addressed prior to safe implementation. Overall, the findings suggest that the future physicians will be enthusiastic and cautious, and with formal training, effective protective strategies, and further exploration, the application of AI in the clinical setting can be pursued safely.

**Ethical Approval:** The IRB/EC approved this study via letter no. 224/DME/KMC Dated April 13, 2023.

**Conflict of Interest:** None

**Funding Source:** None

**Authors' Contribution**

**NRR:** Conception.

**MUE, HN:** Design of the work.

**ME,HB,MS:** Data acquisition, analysis, or interpretation.

**HN,ME,HB,MS:** Draft the work.

**NRR,MUE:** Review critically for important intellectual content.

All authors approve the version to be published.

All authors agree to be accountable for all aspects of the work.

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