

Perceptions and Educational Needs of Bangladeshi Medical and Dental Students Regarding Artificial Intelligence in Healthcare

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ABSTRACT

Objective: The increasing prevalence of artificial intelligence (AI) technologies in the field of healthcare brings forth diverse applications. This study explores the perceptions of undergraduate medical and dental students regarding AI, their current educational opportunities related to AI, and their preferences for the delivery medium of AI curriculum in Bangladeshi medical and dental students.

Methods: A survey consisting of 32 questions was distributed to undergraduate medical and dental students from January to June 2023 across different medical and dental schools in Bangladesh. Questions were scored on a Likert scale from 1 (strongly disagree) to 5 (strongly agree), and descriptive analyses were applied to analyze data. Descriptive statistics were applied to the data.

Results: A total of 729 responses were collected from students across medical and dental schools, with a mean respondent age of 22.54 years. The majority of respondents agreed that AI applications would be commonly used in medicine in the future (94%) and that their use would improve medical practice (84%). Additionally, 73% recognized the necessity of using and understanding AI during their careers, and 67% supported the formal integration of AI education into medical curricula. However, 85% reported a lack of conventional AI-related educational opportunities, and 74% perceived current learning opportunities as inadequate.

Conclusion: The study highlights a significant gap in AI-related educational opportunities for medical and dental students in Bangladesh, emphasizing the need to integrate AI training into conventional medical curricula to prepare future practitioners for its clinical applications.

Keywords: Deep Learning; Denta; Health; Medical; Students

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Introduction

The integration of Artificial Intelligence (AI) technologies into clinical practice is increasing drastically with the invention of tools like image-based diagnostics in radiology, robotic-assisted surgeries, virtual health assistants, and gene editing

technologies like CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats).¹ The advancement of technology shows promising accuracy and effectiveness, comparable to that of specialty-trained physicians. Although many of these AI technologies are still under research, they are expected to alter the traditional roles of

physicians and healthcare providers, especially in imaging-based diagnostics, as they move closer to clinical application. Healthcare professionals may soon need to develop solid skills in interpreting and utilizing AI, as well as incorporating AI tools into their clinical workflows. Furthermore, other critical skills, such as ethical decision-making, and the enhancement of human connection and empathy in doctor-patient interactions, could gain increased significance. Professional and regulatory organizations are starting to acknowledge AI as a fundamental tool for healthcare providers. This is evidenced by the recent formation of the Task Force Report on Artificial Intelligence and Emerging Digital Technologies by the Canadian Royal College of Physicians and Surgeons.²

Despite the significant changes AI might introduce, there has been restricted progress in establishing a formal education on AI and Machine Learning (ML) regarding health professional trainees at various levels. Curricular programs on AI and ML for medical professionals as well as students are often elective, vary across institutions, and are predominantly research-oriented.³ Insufficient understanding of AI and its clinical applications could potentially hinder its future adoption and effective utilization by healthcare providers. Prior research has explored undergraduate medical and dental students' views on AI, revealing their belief in AI's crucial role in future clinical practice.^{4,5} These studies also report a general lack of knowledge and familiarity about AI among medical and dental trainees, alongside undergraduates. To date, no research has been conducted to evaluate the extent of exposure to current educational offerings on AI in medicine and dentistry for undergraduate students, nor to assess their interest and perceived need for AI education. Furthermore, the specific AI topics that students are keen to learn, and their preferred methods of curriculum delivery remain unexplored. To limit this disparity in knowledge, this study aims to assess the level of awareness, interest, and perceived educational needs regarding AI among medical and dental undergraduate students in Bangladesh.

Materials and Methods

A cross-sectional study was chosen to capture a snapshot of the perceptions and knowledge of AI among undergraduate medical and dental students. The study was conducted from January to June 2023 by distributing online

questionnaires to all medical and dental schools in Bangladesh utilizing a range of computerized platforms such as student portals, social media, and newsletters for undergraduate students, following the stipulations set by each institution.

Questionnaire Design

A 37-item pre-validated questionnaire was adapted from Pucchio and his team in 2022.⁶ In the survey's first segment, 12 questions were designed to gather demographic information about the participants. The second segment included three questions aimed at assessing the understanding of participants regarding AI in everyday life. The third segment comprised 20 questions focused on the attitudes, understanding, and beliefs of participants about AI in the medical/dental field, featuring 16 questions on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The final segment contained 13 questions, 12 of which were on a Likert scale, to evaluate the participants' approach to AI educational opportunities during their education and their preferred methods of learning about AI. The questionnaire was validated by three experts in medical education and AI and was piloted on 5 undergraduate students to ensure clarity and ease of filling. Due to the diverse distribution methods, the exact number of students who received the survey is unknown, but approximately 10,000 Bangladeshi undergraduate medical and dental students likely had the chance to participate. The research team was not informed about the responses, but email addresses were gathered to contact participants to avoid duplicate responses from individuals.

Statistical Analysis

Statistical analyses were conducted using SPSS 27.0 (IBM Corp., Armonk, NY). Quantitative demographic information was presented in a descriptive format, including both counts and percentages. Data from the Likert scale was displayed as percentages of participants who differed in response to each specific statement, along with the number of pertinent responses. Every statement in the results section corresponds to an individual Likert scale question.

Results

A total of 784 respondents were gathered,

however, only 729 met the inclusion criteria and thus were considered for analysis. Among the respondents, 38.2% were female and 61.7% were male. A total of 68% of students belonged to the medical specialty, and 31.9% belonged to the dental specialty. A total of 56.1% of students identified

that they had a direct family relation with a master's or higher degree. Only 15.2% of students had a background in mathematics and/or statistics. The students who considered themselves 'tech-savvy' were 37.5%. The demographics of the participants are shown in Table 1.

Table 1: Demographic data of study participants

Features	N (%)
Gender	
Male	450 (61.7)
Female	279 (38.2)
Specialty	
Medical	496 (68)
Dental	233 (31.9)
Study Year	
1 st year	157 (21.5)
2 nd year	116 (15.9)
3 rd year	258 (35.3)
4 th year	108 (14.8)
5 th year	90 (12.3)
Type of background	
Rural	220 (30.1)
Urban	509 (69.8)
Do you have a direct family relation with a person having an advanced degree (Master's or higher)?	409 (56.1)
Have you studied mathematics, statistics, or computer science at the school or college level?	111 (15.2)
Do you have a high degree of technological literacy or a keen interest in the field?	274 (37.5)

Information on the roots of education about AI is outlined in Table 2. A significant proportion of students (75.8%, 360) indicated that they were not provided any formal instructions during their medical school training regarding AI. The preferred modes of learning concerning AI in medicine included lectures (23.8%, 263), workshops (27.1%, 299), and synergetic initiatives with other departments, like computer science (17.3%, 191).

Merely 35% of participants (78 strongly agree, 177 agree) possessed the ability to articulate concepts related to AI including neural networks, machine learning, and deep learning, with 65% lacking comprehension of AI research methodologies. Regarding perceptions of AI in medicine among students, a significant portion considered correct that AI has enhanced the field of dentistry and medicine (75% agree; 178 strongly agree, 369 agree), is widely utilized in medical and

dental practice (60% agree; 121 strongly agree, 316 agree), and will take the current knowledge of medicine to the next level with time (72% agree; 203 strongly agree, 322 agree). Respondents concurred on the cost-effectiveness of artificial intelligence (68%; 274 strongly agree, 222 agree) and its potential to optimize physicians' work (79% agree; 198 strongly agree, 378 agree). However, there was no consensus regarding AI replacing some or all physicians (62% disagree; 247 strongly disagree, 205 disagree) and expressed a lack of fear regarding the advancement of AI (58% disagree; 157 strongly disagree, 266 disagree). In terms of the impact on their chosen specialties, medical students were uncertain (29.6% agree, 46.2% disagree), but they acknowledged the importance of understanding AI throughout their careers (66% agree; 219 strongly agree, 262 agree) and anticipated using AI applications in their

professional lives (70% agree; 232 strongly agree, 278 agree).

Survey participants expressed a belief that formal instruction in AI should be incorporated into undergraduate education (71% agree; 147 strongly agree, 371 agree). However, they indicated a lack of previous training in formal curricula (83% disagree; 218 strongly disagree, 387 disagree). Medical students reported no exposure to AI training through external educational avenues beyond the conventional medical school syllabus (64% disagree; 159 strongly disagree, 308 disagree) or through work experiences and research (68% disagree; 137 strongly disagree, 359 disagree). A

subset of students autonomously acquired knowledge about AI (45% agree, 46% disagree).

Respondents did not find the learning opportunities related to AI in medicine to be sufficient (68% disagree; 178 strongly disagree, 318 disagree). Students acknowledged that their comprehension of the subjects of mathematics or programming posed a barrier to comprehending AI (46% agree; 207 strongly agree, 128 agree). While acknowledging the importance of learning AI in medicine (67% agree; 170 strongly agree, 318 agree), students also expressed a wish to learn more about AI if given the opportunity (76% agree; 195 strongly agree, 360 agree).

Table 2: Characteristics of Population Survey

	N (%)
Were you aware that various software we utilize in daily life wilds artificial intelligence?	N = 729
No	46 (6.3)
Yes	395 (54.1)
Yes, but superficially	288 (39.5)
If yes, where did you educate yourself about the functioning of artificial intelligence in devices of daily use?	N = 1428
Work experience	198 (13.8)
Formal education (College, University, Lectures)	173 (12.1)
Scientific Literature	216 (15.1)
Social Media	384 (52.6)
News	147 (10.2)
Friends / Family	254 (17.7)
Other	56 (3.9)
Were you provided any formal education regarding artificial intelligence before or during medical school?	N = 729
No	556 (76.2)
Yes	173 (23.7)
If yes, what media did you use to learn about artificial intelligence?	N = 298
As an online course	12 (4)
As part of a discretionary curriculum offered by a dental/medical school	27 (9)
As a conventional part of my medical/dental degree syllabus	51 (17.1)
As a part of a research project	94 (31.5)
Other	114 (38.2)
Do you know that artificial intelligence is currently a part of routine functioning in medicine/dentistry?	N = 729
No	131 (17.9)
Yes	230 (31.5)
Yes, but superficially	368 (50.4)
If yes, how did you learn about the utilization of artificial intelligence in medicine?	N = 1534
Formal tutelage	102 (6.6)
My friends (non-healthcare)	405 (26.4)

My colleagues (in healthcare)	368 (23.9)
My teachers/mentors (healthcare)	266 (17.3)
The media	58 (3.7)
Published papers	177 (11.5)
Movies and TV series	89 (5.8)
Other	69 (4.4)

Your preferred format for gathering information about artificial intelligence in medicine/dentistry is: N = 1484

Workshops	502 (33.8)
Lectures	362 (24.3)
Conferences	166 (11.1)
Collaborative activities	212 (14.2)
Extracurricular activities	188 (12.6)
Other	54 (3.6)

Discussion

Our investigation revealed that a substantial portion of surveyed medical students in Bangladesh hold the belief that AI plays a crucial role in the future of medicine and dentistry, and they express a strong interest in opportunities to learn about AI. Despite these positive attitudes, our findings also highlight a shortage of educational options across the participating institutions in Bangladesh. It becomes imperative to consider integrating educational opportunities on AI into formal medical curricula due to the increasing prevalence of AI in healthcare research and the swift advancement of AI equipment for its clinical implementation. Moreover, recognizing that the skill sets required for using AI may differ from those generally mastered by medical practitioners. The ideal content of interest, learning media, and perceived obstacles of medical mentees should guide the incorporation of AI content into medical curricula.

Our results align with prior investigations involving medical and dental undergraduates, where a recurring theme has been the observed deficiency in AI knowledge among medical trainees. A survey conducted by Teng et al. (2022) similarly indicated that medical undergraduates possess a rationed understanding of AI, underscoring this prevailing trend.⁷ They highlighted the increasing knowledge gap, foreseeing it as a potential obstacle to the advancement and application of AI in medicine, a notion supported by existing literature. Notably, despite expressing optimism about AI in their respective fields, healthcare learners were uncertain about its relevance, revealing a certain cognitive

dissonance.⁸ Participants believed in the revolutionary potential of AI in medicine while simultaneously harboring doubts about its direct impact on their future practice. These observations point towards an insufficiency of sensational reporting in media or medical literature, understanding of AI applications, or limited exposure to AI in clinical settings.

Cohort surveys of medical students done recently have demonstrated varying concerns about AI potentially replacing physicians in the future, with some expressing worry and others considering it a non-issue. Gong et al. (2019) observed that such concerns dishearten students towards pursuing imaging-based diagnostic specialties like radiology.⁹ Our results align more closely with a 2021 European Pinto dos Santos et al. survey, which did not indicate anxiety among medical students regarding physician replacement by AI.¹⁰ While anxiety levels about AI may differ among study cohorts, addressing concerns related to the clinical use of AI through curriculum could alleviate apprehensions.

Although AI applications are advancing toward clinical implementation, limitations in its understanding pose hurdles to its effective integration by healthcare workers. Teaching initiatives could address this issue, along with addressing evolving demands like the humanistic and ethical roles of doctors. Immediate expansion in dental and medical curriculum is essential to meet this growing need. Given that both our study and previous surveys have shown a desire among medical students to incorporate AI into formal medical education, any changes in this direction are likely to be received positively by the undergraduate medical student population.¹¹

Prior research work has outlined probable roles for the integration of AI education, proposing profitable goals such as determining the suitable technology for specific clinical contexts, exploring the empathetic and moral aspects of AI, and recognizing standard betterment applications of AI.^{6, 12} This study contributes by evaluating current educational offerings, discerning the favored ways of AI education among medical students, and identifying possible obstacles to adoption. Notably, our findings reveal the absence of a formal curriculum on AI across all Bangladeshi medical schools, and educational chances are scarce comparably even outside of Bangladesh. Question and answer sessions conducted as part of our study uncovered a significant impediment to the incorporation of AI into conventional curricula, namely, non-AI content taking precedence for incorporation.

Nevertheless, the barrier identified by our respondents, who favored workshops to be their preferred format of learning, could potentially be alleviated through the adoption of a non-longitudinal learning format. Such formats would be more adaptable to learners and more feasible to implement within a packed curriculum. Despite survey respondents expressing skepticism that technical knowledge would hinder AI uptake, interviewed participants showed apprehension about the absence of computer science or mathematical knowledge hindering effective AI learning. Given the diverse educational backgrounds and varying degrees of technology experience among medical students, the medical AI curriculum should refrain from delving into intricate technical details.¹³

The study's limitations encompass participant bias and non-response. Although responses were driven out from all Bangladeshi medical schools, our respondent pool constitutes 4.53% of the total dental and medical undergraduate student population in Bangladesh. Variable support for survey dissemination among undergraduate medical faculties, such as some disseminating it through newsletters, others using the student portal, and some being ineffectual in aiding dissemination, likely contributed to bias in participants. Respondents were possibly expected to possess a stronger technical understanding and interest or knowledge of AI than non-respondents. Additionally, the survey results underrepresented senior medical students (e.g., 3rd and 4th years), and male respondents. Study design aspects also could introduce error or bias, with no conventional validation method for the survey, except for an in

vivo pilot to ensure clarity of questions possibly affecting face validity or construct validity. Furthermore, the recruitment medium for each participant was not specified, complicating study reproduction. The survey instrument's length, including questions beyond the research question's scope, may have contributed to participant non-response.

Multiple studies have demonstrated an insufficient understanding of AI, emphasizing the necessity of curriculum addressing AI in medicine. With our survey shedding light on chosen setups of AI-based education and obstacles to AI-based education, there is an opportunity for illuminated development of AI curriculum. We advocate experimenting with a condensed lecture or workshop, as students indicated receptiveness towards learning via these formats. Despite traditional medical education's historically sluggish adaptation to technological advancements, acknowledging the growing importance of AI in medicine in both Bangladesh and internationally is expected to lead to increased monetary and institutional support for educational initiatives. Future research should focus on developing educational content in the indicated formats and testing them within a medical student population.

Conclusion

The study highlighted a significant gap in educational opportunities related to AI in medicine among medical students in Bangladesh. Given the strong belief among students in the future importance of AI in medicine and their expressed desire to understand its applications, there is a clear need to integrate AI education into undergraduate medical curricula. Preparing the next generation of physicians to incorporate AI into clinical workflows will enable them to navigate its widespread adoption effectively. This approach can facilitate the thoughtful and strategic implementation of AI tools in medical practice, ultimately enhancing patient care.

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Author Contribution

FC and ZR conceived the idea, collected data, and wrote the initial manuscript. FC and ZR collected data, analyzed the data, validated the results, and

proofread the finalized manuscript.

Data Availability Statement

All relevant data are within the manuscript. Additional data supporting this study are available from the corresponding author upon reasonable request.

Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki and was approved by the institutional ethical board (Ref: IRB/BDC/2023:025)

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Conflict of Interest

None

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