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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 37-item questionnaire adapted from Pucchio et al. was distributed online to undergraduate medical and dental students from January to June 2023 across medical and dental schools in Bangladesh. Responses to Likert-scale items (1 = strongly disagree, 5 = strongly agree) were summarized using frequencies and percentages. Categorical responses permitting multiple selections were reported as counts with percentages of respondents.
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: Artificial Intelligence; Dental; Medical Education; Medical Students; Perception

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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

The survey instrument was adapted from the questionnaire developed and validated by Pucchio et al. (2022) for Canadian undergraduate medical students, following the Consensus-Based Checklist for Reporting of Survey Studies (CROSS) guidelines. [6] The original instrument was designed in five sections: screening items, demographics, knowledge of AI in daily life, attitudes toward AI in medicine, and AI educational opportunities. For the present study, the instrument was modified for the Bangladeshi context as follows: the six screening questions from the original instrument were removed, as eligibility was confirmed at the point of recruitment; and five additional demographic items were introduced to capture variables relevant to the Bangladeshi population, including type of background (rural/urban), family educational attainment (direct family relation with a master's or higher degree), prior coursework in mathematics, statistics, or computer science, self-reported degree of technological literacy, and field of specialty (medical/dental). No changes were made to the wording or scoring of the original survey items.

The final adapted instrument comprised 37 items organized into four sections. The first section contained 12 demographic questions (7 original + 5 added). The second section included 3 questions assessing participants' awareness of AI applications in everyday life, with conditional follow-up items permitting multiple responses. The third section comprised 10 Likert-scale items (scored from 1 = strongly disagree to 5 = strongly agree) and 4 categorical items assessing attitudes, knowledge, and beliefs regarding AI in medicine and dentistry. The fourth section contained 8 Likert-scale items evaluating participants' access to AI educational opportunities during their training and their preferred formats for learning about AI.

The adapted questionnaire was reviewed for content validity and cultural appropriateness by three experts in medical education and AI. It was subsequently piloted with five undergraduate students from participating institutions to assess clarity, ease of completion, and estimated response time; minor revisions to phrasing were made based on pilot feedback. The final instrument was administered online via Google Forms and distributed across all medical and dental schools in Bangladesh using institutional student portals, social media, and newsletters, as permitted by each

institution.

Statistical Analysis

Statistical analyses were conducted using SPSS 27.0 (IBM Corp., Armonk, NY). Demographic data were summarized as frequencies and percentages. Likert-scale responses were reported as counts and percentages for each response category (strongly agree, agree, neutral, disagree, strongly disagree), with combined agreement (strongly agree + agree) and disagreement (strongly disagree + disagree) rates calculated for each item. For categorical questions permitting multiple responses, both the total number of responses and the number of respondents who answered the question are reported; percentages for these items were calculated using the number of respondents as the denominator. Each statement presented in the Results section corresponds to an individual survey item. As this was a descriptive survey study adapted from the methodology of Pucchio et al. (2022), which employed the same analytical approach, inferential subgroup comparisons were not performed. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies and the Consensus-Based Checklist for Reporting of Survey Studies (CROSS).

Results

A total of 784 respondents were gathered; however, only 729 met the inclusion criteria and thus were considered for analysis. Among the respondents, 38.3% were female, and 61.7% were male. A total of 68% of students belonged to the medical specialty, and 32% 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 37.6%. 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 (38.3)
Specialty	
Medical	496 (68)
Dental	233 (32)
Study Year	
1st year	157 (21.5)
2nd year	116 (15.9)
3rd year	258 (35.4)
4th year	108 (14.8)
5th year	90 (12.3)
Type of background	
Rural	220 (30.2)
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 (37.6)

Information on the roots of education about AI is outlined in Table 2. A significant proportion of students (76.3%, n=556) indicated that they had not received any formal instruction regarding AI during their medical or dental training. When asked about preferred formats for learning about AI (multiple responses permitted), workshops were most frequently selected (n=502, 68.9% of

respondents), followed by lectures (n=362, 49.7%), and collaborative activities with other departments such as computer science (n=212, 29.1%).

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 divided on whether AI would affect their chosen specialty (29.5% agree; 37 strongly agree, 178 agree; 70.5% disagree; 216 strongly disagree, 298 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; 128 strongly agree, 207 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: AI awareness, educational exposure, and learning preferences among study participants (N=729)

Questions	N (%)
Were you aware that various software we utilize in daily life wields artificial intelligence?	N = 729
No	46 (6.3)
Yes	395 (54.2)
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 (76.3)
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 (18)
Yes	230 (31.6)
Yes, but superficially	368 (50.5)
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)

† Multiple responses permitted; percentages based on total responses. Number of respondents per question: Q2 (n=683), Q4 (n=173), Q6 (n=598), Q7 (n=729).

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 limited 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 the curriculum could alleviate apprehensions.

Although AI applications are advancing toward clinical implementation, limitations in their understanding pose hurdles to their 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 curricula 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 opportunities are scarce, 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 drawn 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 present study employed a descriptive analytical approach, consistent with the methodology of the original instrument by Pucchio et al. (2022). Inferential statistical comparisons across subgroups (e.g., gender, specialty, study year) were not performed, which limits the ability to identify statistically significant differences in perceptions between demographic groups. Future studies should employ chi-square or logistic regression analyses to explore associations between demographic characteristics and AI-related attitudes, particularly by comparing medical and dental students and examining the influence of self-reported technological literacy on perceived educational needs. 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 a 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 an 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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