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Editorial

Artificial Intelligence in Medical Education: Promises and Challenges

Artificial intelligence (AI) refers to a broad category of software that enables computers and robots to mimic intelligent behaviour with minimal human intervention[1]. AI can perform tasks that typically require human intelligence, such as perception, reasoning and decision making.

Two terms are often used in relation to AI- one is machine learning (ML) and other is deep learning (DL). Machine learning is a system that learns from previously available data and it becomes more efficient when more data are provided[2]. Deep learning is structured like human brain with the capability of interpreting data at various levels and working different data bases simultaneously until the desired result is obtained[3]. The ability of the system to learn by itself is an important characteristic. AI can upgrade health system by improving workflow, reducing medical errors and also may help patients process their own data to improve health[4].

As the information age wanes, the era of artificial intelligence is becoming more prevalent. Like many other professions, physicians of coming days will be greatly impacted by this environment. AI technologies are developed to analyze a variety of health data including clinical, behavioural, environmental and drug information and data from biomedical research as well as patients. As a result, diagnosis and therapy can be offered more quickly and precisely, doctors can be guided during surgery and more personalized prescriptions will become feasible[4,5]. According to futurist author Topol's voice, we can say that nearly every clinician in the future, from specialist to paramedics will be using artificial intelligence technology and especially deep learning[4].

To survive the challenges of AI technologies and changes it will offer to the future doctors, AI systems should be integrated into medical education courses. Developing curriculum specially designed to train future physicians on AI, would be a very smart intervention to support medical students` learning journeys, providing personalized experiences and improved outcomes[6].

Since the invention of AI in 1955, its applications have grown in a quickly changing digital environment where public expectations are rising and propelled by social media, industrial leaders and medical practitioners. Artificial intelligence has fixed various issues in education in last few years including language processing, reasoning, planning and cognitive modelling[7].

The health care industry, particularly medical education is being transformed by AI. Medical education has typically been "one-size-fits-all", with students required to memorize from a plethora of possibilities. But making a medical judgment in an age where medical knowledge is growing exponentially, AI can assist in tailoring the learning process to the needs of the particular students, allowing them to focus on areas where they need more practice[8].

Artificial intelligence can be used as an assisting device to provide individualized learning programmes, tracking learners' progress and providing real time feedback[8].

AI-supported robotics training and virtual reality can be used as tools to create immersive and interactive environments, allowing students to practice their skills in simulated scenarios that mimic real-world situations. This approach will enable students to gain experience and improve their clinical decision-making skills without the risks associated with real-life procedures[8].

With the advancement of AI and ML, there will be a change in professional identity and physicians will have to incorporate data science, information science and engineering tools into their skill set. Medical colleges of the future will be transformative rather than functioning as information providers and AI will strongly influence the learning of the students[9].

Personalized learning materials and role plays with an intelligent artificial agent will enhance learners' interaction with computers and students' sense of responsibility will be activated and they may work harder to upgrade their skill[10].

Another aspect of AI is Educational Data Mining (EDM), which explores the unique type of data resulting from educational settings to better understand students and their learning environment. EDM focuses on modelling and predicting students' progress and improving computer systems that can adapt without needing human intervention in the learning cycle[11].

AI also has the potential to carry out routine administrative works and repetitive jobs and can free educators to focus on

tasks requiring creativity and specialized knowledge[12].
With rapid development and incorporation of new technologies, medical curricula suffer from information overload. The introduction of AI can reduce curricular overload by transferring some biomedical and clinical knowledge to AI algorithms[13].
AI is capable of monitoring a group of patients, observing their outcomes and recommending appropriate educational resources that can be provided just in time[14]. Furthermore, medical students at risk of suicide can be identified through natural language processing algorithmic models and a smartphone application[15].
Using AI-generated cutting-edge technology, medical students can be given learning tools with advanced technology to encourage personalized learning, contact with peers and instructors and access to a wealth of information. Using commonly available gadgets and online learning can supplement students' knowledge and promote peer-to-peer or student-to-faculty interaction[16].
Simultaneously, this system can trace errors made by students during case studies, do deep learning and assist them in resolving these issues. Intelligent tutoring systems can follow learners' psychological processes in solving problems, evaluate levels of understanding, provide timely support and clarification and inspire them to be in self-regulation, self-monitoring and self-explanation[7].
Every coin has two sides. Despite having enormous potential, there are obstacles that must be overcome if AI is to be successfully incorporated into medical education. Health care data are complex, confidential, variable and subject to strict privacy regulation. AI depends heavily on digitalized data. The availability, coding and reliability of health data are highly variable, which can slow down the development of effective AI and cause performance issues when AI is widely implemented. Naturally, countries with standard digital health data infrastructure will have an advantage when working with AI[17].
Another important challenge is the need for education and upgraded skills of health professionals for proper utilization of AI. Teachers must be aware of AI system’s promise and limitation in order to use it effectively[18].
Implementation of artificial intelligence in medical education requires cutting-edge computing hardware, data storage and secure networks. Educational institutes have to make investments both in skilled manpower and infrastructure and in collaboration between academics, businesses and regulatory bodies if AI is to be used correctly and successfully in medical education[19].
Artificial intelligence has made data simultaneously more valuable and easier to abuse. Its algorithm can be taught to be biased against specific groups or towards any objective. Therefore, AI-enabled healthcare products should be rigorously tested to understand their performances across populations with medical and demographic differences[17].
There are also concerns about loss of human touch and empathy in the management of patients, which is achieved by distant learning with AI. So future physicians should stress a humanistic approach to cope with the biopsychosocial complexity of patients, which is not easily reachable through machines[16].
Integration of AI into medical education may present new challenges. Students may become overly reliant on AI and neglect to develop critical thinking and problem-solving skills. Another problem of AI in medical education is the potential for cheating and plagiarism. Students may use AI to gain an unfair advantage over their peers. Automated essay generators and online cheating tools provide students with the means to submit works they have not completed. Luckily, as the technology for cheating grows, so do the tools used to recognize plagiarism[20].
Artificial intelligence’s very fast update cycle and its “black box” nature (the software reaches conclusions that are mathematically so complex, they cannot always be understood by humans) mean that traditional regulatory bodies may not be sufficiently risk-averse or timely. A single flaw in the AI system may result in harm to thousands of patients, rather than a small number of patients harmed by a single provider's error. Government should provide clarity on applicable laws and regulations and consider new methods of regulation that take these challenges into account. Administrative and procedural systems need to be updated to monitor these AI systems during and after their implementation. The performance also needs to be examined periodically to ensure it does not degrade over time, and data should be kept safe from cyber attacks[17].
Another conflicting issue is who will take the liability of unwanted outcomes. If a medical student or physician follows a recommendation from AI software that contradicts the typical standard care, the physicians are opening themselves up to liability for any bad outcome arising from the recommendation. Developers and lawmakers should keep this problem in mind, as it will likely affect the willingness of clinicians to adopt and use such software[21].
Artificial intelligence is increasingly being implemented in educational institutes in developed countries, including medical colleges. The future of medical education will essentially run with AI-driven technologies, assisting teachers in understanding their students better and helping each student learn as per his/her learning pattern. It is essential to incorporate this technology into medical education to ensure that healthcare professionals have the necessary skills for

providing high-quality care in the future. Every country will need to determine its own path to using AI in health education and health care, consistent with its values, resources and specific health care challenges. Before jumping into AI technologies, countries like Bangladesh need to conduct research to explore the effectiveness of AI applications in medical education. This exploration can potentially transform the entire educational system for medical students, given that AI is a rapidly growing field with numerous new advancements on the horizon.

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