Vol. 3 No. 2 (2024): Journal of Rashid Latif Medical College

Original Article

Artificial intelligence in Medical Education-A Cross sectional study in Private Setup

Arooj Javed

Dubai Medical Centre, UAE

*Corresponding Author Arooj Javed
aroojjaved88@gmail.com

Received: 29th August, 2024

Revised: 23rd November, 2024

Accepted: 30th November, 2024

DOI: 10.69545/y05fkm17

Abstract

Objective: For healthcare providers, expectations, duties, and job descriptions must change as the information age fades and the artificial intelligence age becomes more prevalent. In order to identify areas that can benefit from curriculum restructuring, this study looked at how aspiring doctors perceived the potential effects of artificial intelligence on medicine.

Methodology: A nationwide study including 3018 medical students was carried out using a cross-sectional approach across multiple centers. An online survey created and disseminated using a web-based service served as the study's instrument.

Results: Artificial intelligence was viewed by the majority of medical students as an assistive technology that might ease patients' access to healthcare (76.7%), physicians' access to information (85.6%), and errors (70.5%). Nonetheless, 44.9% of the participants expressed concern over a potential cutback in physician services, which would result in joblessness. Additionally, it was decided that the application of artificial intelligence in medicine would harm patient-physician interactions (42.7%), devalue the medical profession (58.6%), and erode trust (45.5%). Furthermore, almost half of the participants (44.7%) agreed that they could maintain professional secrecy when using AI apps, whereas 16.1% contended that AI in medicine could lead to professional confidentiality violations. Out of all the individuals involved, a mere 6.0% claimed to be knowledgeable enough to advise patients about the advantages and disadvantages of artificial intelligence. They also stated that they lacked the necessary education for "applications for reducing medical errors" (95.8%), "knowledge and skills related to artificial intelligence applications" (96.2%), and "training to prevent and solve ethical problems that might arise as a result of using artificial intelligence applications" (93.8%).

Conclusion: The participants indicated that the medical curriculum needed updating in light of the requirements for transforming healthcare through artificial intelligence. In addition to ensuring that professional values and rights are upheld, the update should focus on providing aspiring physicians with the information and abilities they need to use artificial intelligence technologies successfully.

Keywords: Medical Students, Medical Ethics, Medical Curriculum, Artificial Intelligence Medicine

Introduction

The term "artificial intelligence" (AI) encompasses a wide range of technologies that allow computers and robots to simulate human intelligence [1]. The era of artificial intelligence is replacing the information age, but some professions—like medicine—will be disproportionately affected by this shift. AI is developing quickly and changing the medical field, most notably through a process that was prompted by the Covid-19 pandemic. Artificial intelligence (AI) tools are being developed to assess a wide range of health data, including data from patients and the biological literature, as well as clinical, behavioral, environmental, and medication information [1]. In addition to a number of other improvements, diagnosis and treatment can now be carried out more swiftly and accurately, imaging techniques are becoming better, surgeons and patients may benefit from guided surgery, drug research is made easier, and more customized therapies are achievable [2, 3]. Modern medicine typically approaches these recognized challenges from a futuristic perspective. The appeal of AI applications in medicine, which appear to be getting more integrated into healthcare, is increased by this futuristic tendency. The broad range of applications of artificial intelligence in medicine was highlighted by futurist author Topol's statement that "nearly every clinician in the future; from specialist physicians to paramedics, will be using artificial intelligence technology and especially deep learning" [2].

However, a number of ethical issues have been raised, such as the risk to data security, the evolving nature of physician-patient interactions in the medical field, the possibility of creating social inequality, and the advancement of AI robots that could eventually replace many professional tasks and raise the unemployment rate.

It is the responsibility of healthcare providers to guarantee that AI applications offer practical technologies to enhance patient care. Because of this, medical students must acquire sufficient knowledge and expertise on AI applications in medicine. They might even need to employ apps that weren't available when they were in school. In order to promote a better understanding of the various aspects of health care AI, both positive and negative, the World Medical Association thus calls for a review of medical curricula and educational opportunities for patients, physicians, medical students, health administrators, and other healthcare professionals [4].

The Standing Committee of European Doctors (CPME) also emphasized the importance of AI systems in basic and continuing medical education in a 2019 statement [5]. To raise awareness of the appropriate use of AI, they suggested integrating AI systems into residency training, continuing medical education, and medical education programs. Nonetheless, a number of writers in the literature emphasize that a fundamental and required reform in education is necessary because current medical education is unable to satisfy the demands of artificial intelligence [2, 6–11]. In that regard, creating curriculum proposals that are especially intended to teach aspiring doctors about AI would be quite beneficial.

Developing effective AI curricula requires first understanding how today's medical students view AI in medicine, what they know and don't know, and how they understand the ethical implications of AI. Curriculum creators discover the discrepancies between the ideal and real features of the targeted learner group through a procedure known as "Needs Assessment of Targeted Learners," as defined by Kern et al. [12]

Similarly, identifying perceived and unperceived requirements is defined as part of the needs assessment process by The CanMEDS Physician Competency Framework, a globally accepted framework that outlines the skills doctors need to provide effective care [13]. In order to develop curricula, Grunhut et al. advise conducting national surveys of medical students regarding their attitudes and expectations regarding learning AI in medical school. These surveys should pinpoint the attainable objectives that physicians will be expected to meet, the expectations placed on aspiring physicians, and the information and resources that

faculty members will require in order to meet these expectations [14].

The limited number of current studies in the literature that primarily focus on students' understanding and views of AI in medicine fall short of providing a thorough needs assessment. The following categories apply to the limited foci of the pertinent studies: observational studies across the globe. The existing data, effect estimates, and statistical significance of the relationships between infertility and its risk variables will all be compiled in this review.

Methodology:

Medical students participated in this multicenter study in a cross-sectional design during the 2019–2020 academic year. The procedures followed were outlined in the Checklist for Reporting Results of Internet E-survey (CHERRIES) [23].

Results:

Opinions on the value of AI in medicine and perceived competence for utilizing AI

The participants ranged in age from 17 to 40 years old, with a mean age of 20.6 ± 2.4 years. Men made up 38.7% of the sample, women made up 59.5%, and 1.7% of respondents preferred not to disclose their gender. The majority of participants (87.9%) believed that artificial intelligence (AI) may be a tool or an assistant that would help them rather than believing that it could replace physicians. With fewer people needing them, over half of the students (44.9%) said there would be a chance they would lose their careers.

Of the participants, three out of four (74.4%) felt that the broad adoption of AI will improve medical practice. Furthermore, a quarter of the participants (26.3%) said that the application of AI in their field of specialization will affect their decision. While the remaining participants said that they had taken part in certain restricted activities, such seminars and presentations, or that they had gotten training online, the majority of students (75.6%) said that they had not received any training on artificial intelligence in medicine. A mere 2.8% of participants indicated that they felt well-informed about the application of artificial intelligence in medicine, however 35.2% of participants gave a positive response when asked if they could assess the accuracy of a diagnostic application through AI. Just 6.0% of all students said they were "competent enough" to tell patients about the risks and features of AI technologies. However, over half of the students (44.7%) said they could use AI technologies to maintain professional confidentially.

Perceptions of the possible influences of AI on medicine

The item "Facilitates physicians' access to information" (85.8%) had the highest level of agreement among students about their perceptions of the potential influences of AI in medicine, whereas the item "Violations of professional confidentiality may occur more" (16.1%) had the lowest level of agreement (Fig. 1). The subdomains of "Knowledge and Trust" was more popular among the participants than "Disadvantages and Risks" and "Informed Self Control." The majority of students supported artificial intelligence in medicine because they believed it would improve doctors' access to information (85.8%) and patients' access to treatment (76.7%), lower errors (70.5%), and assist doctors in making better judgments (68.8%). The participants' perceptions of the risks and drawbacks of artificial intelligence (AI) in medicine were split roughly in half: 58.6% agreed that AI would diminish the value of the medical profession; 45.5% worried that the use of AI-assisted applications in medicine would undermine the basic principle of trust in patient-physician relationships; and 42.7% agreed that AI would have a negative impact on the doctor-patient relationship.

In the "Informed Self Control" subdomain, students were similarly evenly distributed between the positive and negative extremes: 52.7% felt that AI would help with patient education, and 46.9% believed that technology would give patients more control over their health. The PAIM scale scores did not correlate with age ($p > 0.05$). The mean PAIM scale and the "Knowledge and Trust" subscale scores were comparatively higher among men. The test results of students in various academic years did not, however, differ much.

On the need for an education

The overwhelming majority of participants (93.8%) agreed that medical education should include formal instruction on AI applications. According to the participants, training on a variety of topics pertaining to AI in medicine is crucial (Fig. 2). "Knowledge and skills related to AI applications" (96.2%), "Applications for reducing medical errors" (95.8%), and "Training to prevent and solve ethical problems that may arise with AI applications" (93.8%) were the most often mentioned themes that they felt were essential to medical education.

The following subjects were recommended by the participants to be added in addition:

A condensed lecture on computer use, coding, Python, artificial intelligence, criteria for choosing AI applications, data leakage mechanisms, requirements to be met by the software in which the data will be recorded, and evaluating the dependability of AI apps, Shifting the importance and value of the TFL profession, AI is only useful in conjunction with clinical judgment, surgical expertise, and experience, Global advancements in artificial intelligence, Patient communication: what should be considered, what should be avoided, and what are the potential concerns associated with using AI apps, AI discussion forums, AI app training.

Discussion:

Opinions on the value of AI in medicine and its possible influences on medical practice

In this study, we looked at how aspiring physicians saw the potential impact of artificial intelligence on healthcare. They were generally positive and optimistic about AI in medicine. They viewed AI as a helpful tool that could increase physicians' access to information, aid in their ability to make better clinical decisions, reduce medical errors, and enhance patients' access to healthcare. In a comparable study, two-thirds of the students said that advancements in AI will make medicine more fascinating [16], while in a different study, two-thirds of the students had favorable opinions on the clinical application of AI [18]. Students' perceptions were more positive in the "Knowledge and Trust" subdomain of the PAIM scale than in the "Disadvantages and Risks" and "Informed Self Control" subdomains. This could be interpreted as them being both fascinated by the promise of a new technology and deeply concerned about it at the same time. This is in line with previous studies; privacy and confidentiality issues, patient safety, the effect on the humanistic aspects of the field, and the emergence of commercialized medicine are among the issues brought up with AI in healthcare [2, 14, 17, 25–27]. The results differed based on the gender of the pupils but not on their academic year. We believed that the gender difference was a sign of potential male interest in technology. The hypothesis that there is little knowledge or comprehension of artificial intelligence (AI) in modern medical school is supported by the lack of variation between the study years. The vast majority of respondents believed that artificial intelligence (AI) could only support or even replace doctors, not replace them. Similarly, most students polled for earlier studies saw AI as a tool or a partner rather than a competitor [16, 18]. However, half of the participants in this study expressed anxiety about a decline in the need for doctors and the ensuing unemployment. Other studies have also shown this concern about the potential negative effects of AI on professional income and opportunities, while their participants expressed less anxiety overall,

ranging from 29.3 to 38.6% [15–17, 28]. Concerns concerning medical professionalism are raised by the obvious implications of AI on clinical care, in addition to fears about employment security and personal opportunities. Indeed, a number of academics correctly point out that AI would be unable to have meaningful conversations with patients and show empathy for them, which would breed mistrust [18, 29]. Niet and Bleakley emphasized the complex framework of clinical care, which is founded on clinical intuition, and stated that technological treatment could not achieve this [30]. Mehta described this elusive aspect of intuition as the "art of care," concluding that AI could not accomplish it [20]. It's possible that students' lack of preparation for AI technology in medicine contributes to the worries about a decline in the need for doctors and unemployment. Almost half of the students said that integrating AI into medicine would weaken the humanistic aspect of the field, devalue medicine, and undermine patient-physician confidence. These are not insignificant worries. Rather than disregarding them as irrational responses, medical education and laws that safeguard those principles and the fiduciary character of the profession need to address them.

On the need for education

We also looked at the students' knowledge of artificial intelligence and what they believed about the necessity of including certain subjects within the medical curriculum. Only 2.8% of participants in the survey felt they had received an organized and consistent education regarding artificial intelligence (AI) and its applications in medicine. Additionally, just one-third of respondents said that they could evaluate a diagnostic application's dependability using artificial intelligence.

In addition, only 6.0% of the participants felt qualified to inform patients about the features and risks associated with AI technologies, despite the fact that future doctors have a responsibility to provide their patients clear and trustworthy information about AI applications in medicine [7, 14, 20, 30]. Furthermore, the statement "Violations of professional confidentiality may occur more" received the least amount of agreement regarding the potential effects of AI in medicine. This is a noteworthy discovery because maintaining secrecy is one of the main issues and a major worry in the Big Data era. Since its misuse or breach could have severe consequences for both individuals and society, it is often understood that healthcare data is one of the most valuable types of data [31].

Ignorance of that kind of risk indicates a serious need for medical students to have specialized training. Education is necessary, as evidenced by the participants' overconfidence in maintaining professional confidentiality and their sense of inadequacy when it comes to telling patients. Similar findings have been found in studies conducted in other countries since Pinto dos Santos's initial research on what nation was published in 2019 [15, 17–19, 21, 28]. "Students' knowledge of AI is alarmingly low and insufficient to become future physicians," according to a recent review by Grunhut et al. [14]. Future doctors will definitely need AI training incorporated into medical and health informatics curricula, as demonstrated by Sapci and Sapci in their systematic review [32]. In this regard, a recently created scale called MAIRS-MS to assess medical students' preparedness for AI in medicine may serve as a starting point [33].

What to teach and how

The students believed that artificial intelligence (AI) ought to be taught at medical school, which was also demonstrated in the other studies [15–17, 19]. This belief ran parallel to their lack of knowledge and sense of incompetence. In their analysis, Lee et al. found that nearly all curriculum recommendations lacked specific learning outcomes and were not grounded in a particular education theory, despite the fact that there are some suggestions in the literature for curricular objectives [7, 8, 11, 14, 32, 34]. Reaching an

agreement on suitable educational philosophy and desired learning outcomes may benefit from taking the views of the medical students into account. To the best of our knowledge, the only study that looked at how important AI topics were to students was one conducted by Wood et al. with 117 medical students [17]. The students in that study believed that of the seven topics, medical genetics and genomics, radiology and digital imaging, individualized health data/device monitoring, and easy prediction models were the most crucial. Contributing to the study's findings, we discovered that the students indicated a wish to acquire specialized knowledge and abilities on a wide range of other AI-related subjects, including applications for boosting clinical judgment and lowering medical errors, AI-assisted emergency response, and AI-assisted risk assessment for illnesses. Furthermore, it was observed that the students considered the ethical concerns arising from AI applications to be of utmost importance and would like to receive training on this subject. This expectation is consistent with the query posed by Grunhut et al.: "How can a physician who is not trained in AI expect to navigate ethical scenarios, like when a computer algorithm predicts a patient has a high chance of dying?" [14]. AI in medicine will unavoidably create new ethical issues in addition to the ones that already exist. For this reason, any educational endeavor must include instruction in the prevention and resolution of ethical issues. Accordingly, the AMEE guidance on artificial intelligence in medical education suggests that "Medical AI should be designed with complex issues already inherent in medical informatics' ethics as guiding principles." AI cannot go from artificial intelligence to artificial wisdom unless these moral precepts are incorporated into it [8]. "The ethical and legal implications of AI systems were considered essential in ensuring safe and informed use of AI systems," according to Lee et al.'s summary of their review of the literature. "Specific learning objectives should include

(1) frameworks to approach AI ethics and

(2) facilitating discussions of important AI ethics topics like liability and data privacy." Regarding technique, Wartman and Combs developed an education model that replaced the current medical education model, which is mostly based on rote learning, by aiming to provide students with the ability to integrate and use information from expanding sources in an elective manner [6]. Grunhut et al. claim that such significant curriculum modifications should be implemented using already tested techniques [14]. The following are some recommended ways to teach students AI fundamentals and enhance their comprehension of AI ethics: cross-disciplinary courses, small-group sessions, experiential learning/providing opportunities for students to work directly with AI tools, e-modules, interactive case-based.

Conclusion:

The participants indicated that the medical curriculum needed updating in light of the requirements for transforming healthcare through artificial intelligence. In addition to ensuring that professional values and rights are upheld, the update should focus on providing aspiring physicians with the information and abilities they need to use artificial intelligence technologies successfully.

Table 1 The internal reliability coefficients of the total items and dimensions of the scale

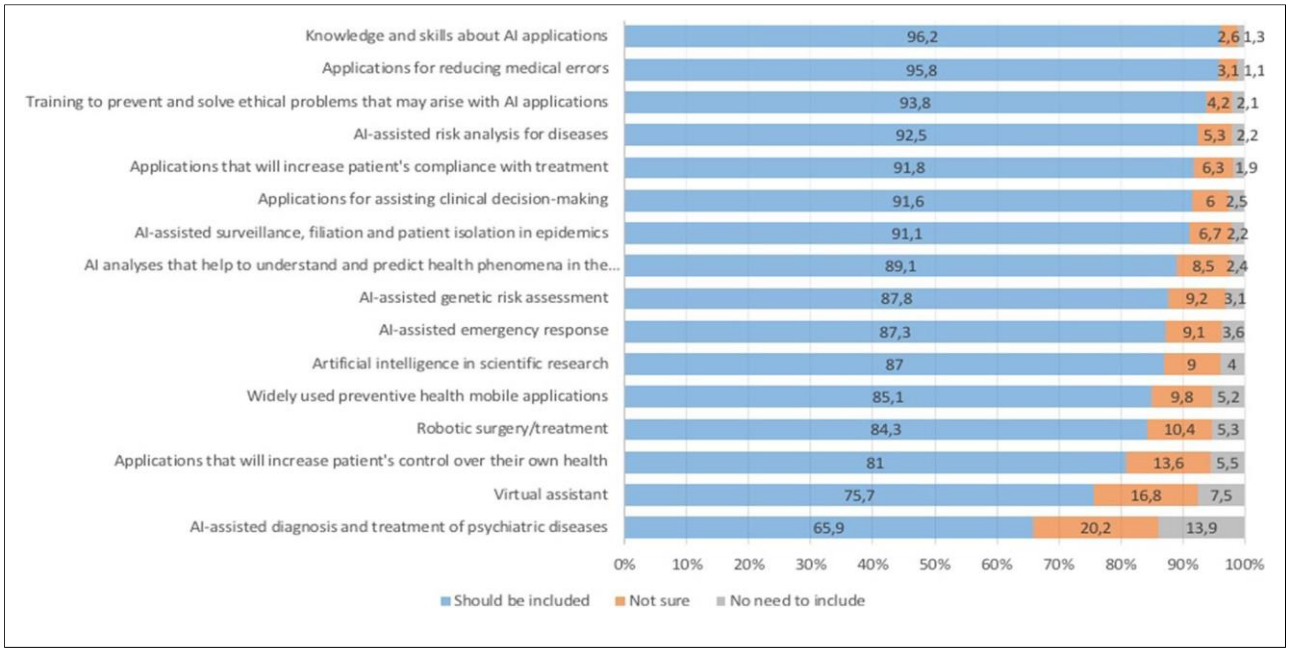
Variables	Items	Cronbach Alpha
Knowledge and Trust	5	0.793
Disadvantages and Risks	5	0.816
Total Item	12	0.841
Informed Self Control	2	0.718

Table 2 Pattern Matrix of the PAIM Scale's factor structure

	Component		
	Knowledge and Trust	*Disadvantages and Risks*	*Informed Self Control*
1. Devalues the medical profession.		−0.793	
2. Reduces errors in medical practice.	0.800		
3. Facilitates patients' access to the service.	0.704		
4. Facilitates physicians' access to information.	0.760		
5. Enables the physician to make more accurate decisions.	0.715		
6. Increases patients' confidence in medicine.	0.401		
7. Facilitates patient education.			0.844
8. Negatively affects the relationship of the physician with the patient.		−0.778	
9. Damages the trust which is the basis of the patient-physician relationship.		−0.811	
10. Reduces the humanistic aspect of the medical profession.		−0.771	
11. Violations of professional confidentiality may occur more.		−0.582	
12. Allows the patient to increase his control over his own health.			0.821

Table 3 Total variances explained by individual components

Items	Initial Eigenvalues		
	Total	*Percentage of Variance Explained*	*Cumulative Percentage*
1	4.477	37.306	37.306
2	1.804	15.035	52.341
3	1.002	8.354	60.695
4	.868	7.232	67.927
5	.672	5.598	73.525
6	.546	4.548	78.074
7	.533	4.444	82.518
8	.502	4.185	86.703
9	.473	3.944	90.647
10	.429	3.575	94.222
11	.386	3.217	97.440
12	.307	2.560	100.000



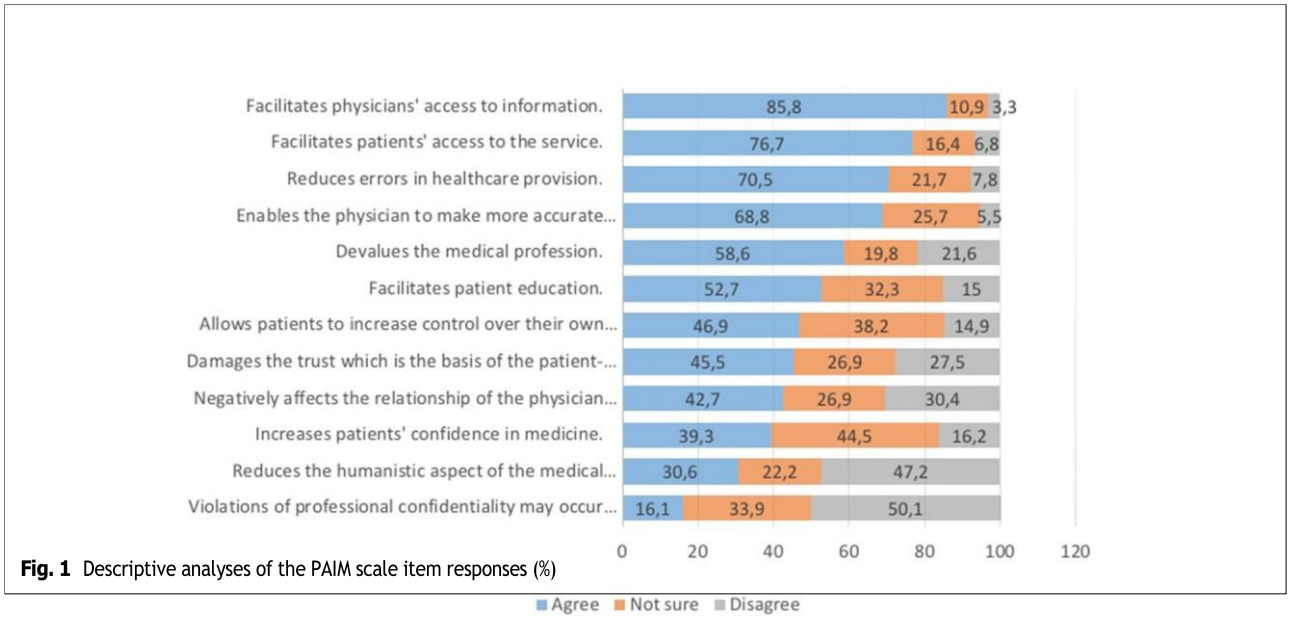


Fig. 1 Descriptive analyses of the PAIM scale item responses (%)

References

1. Wang F, Preininger A. AI in health: state of the art, challenges, and future directions. In: Yearbook of medical informatics. 2019;28:16–26.
2. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nat Med. 2019;25:44–56.
3. Matheny M, Israni ST, Ahmed M, Whicher D, Edu N. Artificial intelligence in health care: the Hope, the hype, the promise, the peril. Washington: National Academy of Medicine; 2019.
4. Association TWM. Statement on augmented intelligence in medical care. Geneva: Association TWM; 2019.
5. Doctors TSCoE: Policy on AI in Health Care. 2019.
6. Wartman SA, Donald Combs C. Medical education must move from the information age to the age of artificial intelligence. Acad Med. 2018;93:1107–9.
7. Park SH, Do KH, Kim S, Park JH, Lim YS. What should medical students know about artificial intelligence in medicine? J Educ Eval Health Prof. 2019;16:16–21.
8. Masters K. Artificial intelligence in medical education. Med Teacher. 2019;41(9):976–80.
9. Liaw W, Kakadiaris IA. Artificial intelligence and family medicine: better together. Fam Med. 2020;52(1):8–10.
10. Katznelson G, Gerke S. The need for health AI ethics in medical school education. Adv Health Sci Educ Theory Pract. 2021;26(4):1447–58.
11. Lee J, Wu AS, Li D, Kulasegaram KM. Artificial intelligence in undergradu- ate medical education: a scoping review. Acad Med. 2021;96(11S):S62–70.
12. Kern DE, Thomas PA. Hughes MT: curriculum development for medical education. A six-step-approach. 2nd ed: Johns Hopkins University Pres; 2009.
13. Canada. RCoPaSo: CPD activity toolkit - Conducting needs assessment. 2015.
14. Grunhut J, Wyatt AT, Marques O. Educating future physicians in artificial intelligence (AI): an integrative review and proposed changes. J Med Educ Curric Dev. 2021;8:23821205211036836.
15. Pinto dos Santos D, Giese D, Brodehl S, Chon SH, Staab W, Kleinert R, et al. Medical students' attitude towards artificial intelligence: a multicentre survey. Eur Radiol. 2019;29:1640–6.
16. Bisdas S, Topriceanu CC, Zakrzewska Z, Irimia AV, Shakallis L, Subhash J, et al. Artificial intelligence in medicine: a multinational multi-center sur- vey on the medical and dental Students' perception. Front. Public Health. 2021;9:795284.
17. Wood EA, Ange BL, Miller DD. Are we ready to integrate artificial intel- ligence literacy into medical school curriculum: students and faculty survey. J Med Educ Curric Dev. 2021;8:23821205211024078.
18. Javed K, Arooj M. EXPLORING PERSPECTIVES OF MEDICAL FACULTY AND UNDERGRADUATE MEDICAL STUDENTS ON CHATGPT IN MEDICAL EDUCATION. Pakistan Postgraduate Medical Journal. 2023 Dec 30;34(04):197-202.
19. Oh S, Kim JH, Choi SW, Lee HJ, Hong J, Kwon SH. Physician confidence in artificial intelligence: an online Mobile survey. J Med Internet Res. 2019;21(3):e12422.
20. Blease C, Kharko A, Bernstein M, Bradley C, Houston M, Walsh I, et al. Machine learning in medical education: a survey of the experiences and opinions of medical students in Ireland. BMJ Health Care Inform. 2022;29(1):e100480.
21. Mehta N, Harish V, Bilimoria K, Morgado F, Gingsburg S, Law M, et al. Knowledge and attitudes on artificial intelligence in healthcare: a provin- cial survey study of medical students. MedEdPublish. 2021;10(75):1–8.

22. Sit C, Srinivasan R, Amlani A, Muthuswamy K, Azam A, Monzon L, et al. Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicentre survey. Insights Imaging. 2020;11(1):14.
23. Cho SI, Han B, Hur K, Mun JH. Perceptions and attitudes of medical students regarding artificial intelligence in dermatology. J Eur Acad Dermatol Venereol. 2021;35(1):e72–3.
24. Javed K, Nasir UB, Javed A. Measuring Emotional Intelligence in First Year Medical Students. National Journal of Health Sciences. 2023 Mar 21;8(1):18-22.
25. Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet E-surveys (CHERRIES). J Med Internet Res. 2004;6(3):e34.
26. Eaker S, Bergstrom R, Bergstrom A, Adami HO, Nyren O. Response rate to mailed epidemiologic questionnaires: a population-based rand-
27. omized trial of variations in design and mailing routines. Am J Epidemiol. 1998;147(1):74–82.
28. Javed KA, Rafique SA, Azhar T. Impact of gamification on education prime time. Pakistan J Medical Health Sci. 2022 Mar 27;16(03):18.
29. Khanna V, Ahuja R, Popli H. Role of artificial intelligence in pharmaceutical marketing: a comprehensive review. J Adv Sci Res. 2020;11(3):54–61.
30. Mori Y, Neumann H, Misawa M, Kudo SE, Bretthauer M. Artificial intel- ligence in colonoscopy - now on the market. What's next? J Gastroenterol Hepatol. 2021;36(1):7–11.
31. Rigby MJ. Ethical dimensions of using artificial intelligence in health care. AMA J Ethics. 2019;21:121–4.
32. Gong B, Nugent JP, Guest W, Parker W, Chang PJ, Khosa F, et al. Influ- ence of artificial intelligence on Canadian medical Students' prefer- ence for radiology specialty: ANational survey study. Acad Radiol. 2019;26(4):566–77.
33. Inkster B, Sarda S, Subramanian V. An empathy-driven, conversational artificial intelligence agent (Wysa) for digital mental well-being: real- world data evaluation mixed-methods study. JMIR Mhealth Uhealth. 2018;6(11):e12106.
34. van der Niet AG, Bleakley A. Where medical education meets artificial intelligence: 'Does technology care?'. Med Educ. 2021;55(1):30–6.
35. Walsh K. Artificial intelligence and healthcare professional education: superhuman resources for health? Postgrad Med J. 2020;96(1133):121–2.
36. Sapci AH, Sapci HA. Artificial intelligence education and tools for medical and health informatics students: systematic review. JMIR Med Educ. 2020;6(1):e19285.
37. Karaca O, Caliskan SA, Demir K. Medical artificial intelligence readiness scale for medical students (MAIRS-MS) - development, validity and reli- ability study. BMC Med Educ. 2021;21(1):112.
38. McCoy LG, Nagaraj S, Morgado F, Harish V, Das S, Celi LA. What do medical students actually need to know about artificial intelligence? NPJ Digital Med. 2020;3(1):8