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ASSESSING PREPAREDNESS AND EXPERIENCES IN ARTIFICIAL INTELLIGENCE AMONG MEDICAL GRADUATES: A PILOT STUDY

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ABSTRACT

Artificial Intelligence (AI) has the potential to enhance healthcare systems and support medical professionals. Despite its growing applications in medicine, the integration of AI into medical education remains underexplored. This pilot study assessed the preparedness of medical graduates from the National Defence University of Malaysia (NDUM) in using AI in their practice. A cross-sectional survey using the Medical Artificial Intelligence Preparedness Scale for Medical Students (MAIRS-MS) was conducted from January to February 2024. Data were collected via an online questionnaire that also included demographic information and AI usage patterns. Respondents had graduated from NDUM within the past six years (2018-2023). Data were analysed using SPSS version 20, descriptive analysis was performed on demographic data, while the Mann-Whitney U Test, Spearman correlation, and Kruskal-Wallis Test were used for statistical analysis. A total of 43 respondents participated, the majority of whom were male and had used AI primarily for assignments. The total MAIRS-MS mean score was 52.53 ± 14.20 out of 110. Mean scores for cognition, ability, vision, and ethics domains were 16.91 ± 6.99, 20.14 ± 5.55, 7.93 ± 2.46, and 7.56 ± 2.18, respectively. A significant correlation was found between age and cognition. The findings highlight the need to strengthen AI literacy among medical graduates to better prepare them for future roles in healthcare.

1.0 INTRODUCTION

Since the first artificial intelligence (AI) program was developed in 1951 by Christopher Strachey, AI has undergone remarkable transformation. At that time, AI was rudimentary, designed mainly to perform basic logical tasks. Over the decades, AI has evolved dramatically, driven by the increasing need to solve complex, real-world problems across sectors such as healthcare, finance, and transportation [1]. The integration of AI in healthcare has seen significant growth in recent years, primarily due to its potential to help address the shortage of healthcare workers [2]. AI operates by learning from existing data on computers and analyzing new information by simulating human thought processes. It offers several benefits, including increased efficiency, accuracy, and precision. The use of AI has the potential to enhance the healthcare system and support healthcare workers. It helps reduce workloads, allowing for more interaction with patients and providing additional time for critical cases. Furthermore, AI saves money and improves monitoring capabilities [3]. Pucchio et al. emphasized that integrating AI into medical education could benefit future healthcare practitioners [4]. These professionals need to learn how to interpret and utilize AI and incorporate AI tools into their clinical workflows to improve their practice in the future. Although there has been a rise in the application of AI in the field of medicine, its application in medical education remains relatively unexplored, limited, inconsistent between institutions, and largely focused on research applications [4]. Previous studies have indicated that medical students have limited

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exposure to AI in their curriculum [5]. While many of these students demonstrate a positive attitude toward the use of AI in the medical field, they often possess low levels of knowledge and skills related to working with AI [6-7] .

Successfully integrating AI into healthcare depends significantly on the preparedness, knowledge, and experience of medical professionals, especially medical students who represent the future workforce. Incorporating AI into the medical curriculum is essential for equipping students with the skills needed to interpret, evaluate, and responsibly apply AI technologies in clinical practice. Studies have shown that formal AI education improves students' confidence, ethical awareness, and readiness to use AI in patient care [4, 6]. By assessing the preparedness and experience of healthcare workers regarding AI in healthcare, we can take a crucial step in preparing the future workforce to fully utilize AI technologies. This preparation will facilitate the effective integration of AI, ultimately enhancing patient care and healthcare delivery. Currently, there are limited studies of AI preparedness and experiences among medical school graduates in Malaysia and all those studies do not include the National Defense University of Malaysia (NDUM). At present, the medical curriculum in NDUM does not include AI as a formal course in the undergraduate curriculum. Hence, it is crucial to have an insight into the preparedness and experiences of AI for NDUM medical students. Therefore, this study aims to assess the preparedness and experiences of NDUM medical graduates in using AI.

2.0 METHODS AND MATERIAL

2.1 Study Design

This pilot cross-sectional study was conducted from January to February 2024 to assess the preparedness and experiences of medical graduates from the NDUM AI. The research sought to answer the following question: "What is the level of AI preparedness and experience among NDUM medical graduates, as measured by the Medical Artificial Intelligence Readiness Scale for Medical Students (MAIRS-MS)?". The sample size calculation followed the rule of thumb for pilot studies, with a minimum sample size of 30 participants required [8]. For this pilot study, the survey was disseminated using convenience and snowball sampling to obtain a representative sample of NDUM medical graduates across the 2018–2023 cohorts. Due to the nature of this distribution method, the exact number of surveys sent and declined could not be determined. However, a total of 43 complete responses were received. The inclusion criteria were NDUM medical graduates who consented to participate and completed all required sections of the questionnaire. The exclusion criteria included individuals who did not provide consent or who failed to complete all necessary parts of the questionnaire. All questionnaires were fully completed, with no missing data or outliers detected during the data cleaning process. Therefore, all responses were included in the final analysis.

2.2 Data Collection

Researchers conducted the survey using a questionnaire distributed through Google Forms. The survey invitation, which included an information sheet and the questionnaire link, was disseminated via email and messaging applications such as WhatsApp. An information sheet detailing the study's purpose and procedures was attached for participants' reference. Participants provided their consent by checking an agreement box. All responses were collected anonymously. No personally identifiable information was requested and each submission was coded without linking to individual identities. These measures ensured the confidentiality, integrity, and ethical handling of participant data throughout the study. The first section of the questionnaire gathered demographic information, including age, gender, AI usage, and commonly used AI platforms during undergraduate studies and current professional practice. The second section assessed AI preparedness using the Medical Artificial Intelligence Readiness Scale for Medical Students (MAIRS-MS), a validated instrument developed by Karaca et al. [9]. The MAIRS-MS questionnaire was developed to evaluate the perceived medical artificial intelligence preparedness of medical students. Although the scale was developed for medical students, it could also be used for measuring doctors' AI preparedness with needful modifications [9].

The questionnaire assesses preparedness toward AI across four domains: cognition, ability, vision, and ethics. The questionnaire consists of 22 questions eignt in cognition, eightin ability, three in vision, and three in ethics. Respondents answer each question using a 5-point Likert scale, where a score of (1) indicates "strongly disagree," (2) indicates "disagree," (3) indicates "neutral," (4) indicates "agree," and

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(5) indicates "strongly agree." The content validity of the MAIRS_MS was ensured through expert reviews, and construct validity was confirmed via exploratory and confirmatory factor analyses, which supported the four-domain structure. Regarding reliability, the MAIRS-MS demonstrated acceptable internal consistency across its domains. The Cronbach's alpha coefficients reported were: 0.83 for cognition, 0.77 for ability, 0.72 for vision, and 0.63 for ethics. These values indicate good reliability for cognition, ability, and vision domains, and acceptable reliability for the ethics domain, suggesting that the MAIRS-MS is a robust tool for evaluating AI readiness [9].

2.3 Data Analysis

The data obtained were entered into Microsoft Excel and then analyzed using the International Business Machines Statistical Package for Social Sciences (IBM SPSS) version 20.0. Descriptive analysis was used to assess demographic data. Mean scores and standard deviations were calculated for numeric data from each domain of MAIRS-MS. For inference statistical analysis, as the normality of the data distribution using the Shapiro-Wilk test which shows a significant departure from normality, $W(43) = 0.16$, $p < 0.001$ hence, non-parametric statistical methods were used for further analysis. Mann-Whitney U Test and Kruskall-Wallis test were performed to test the association between the categorical data and the respective domains of the MAIRS-MS. Meanwhile, the Spearman Rho Correlation is used to test the correlation between age and the score of each domain of MAIRS-MS

3.0 RESULTS AND DISCUSSION

3.1 Results

The questionnaire was completed by a total of 43 medical graduates. Table 1 shows the distribution of the respondents' characteristics included in this study. The majority of the respondents were male.

Table 1. Sociodemographic characteristics of respondents and (n=43)

Variables	n (%)
Age	
24	1 (2.33)
25	25 (58.14)
26	5 (11.63)
27	7 (16.28)
28	4 (9.30)
29	2 (4.65)
30	1 (2.33)
31	1 (2.33)
Gender	
Male	26 (60.00)
Female	17 (40.00)
Usage of AI during undergraduate studies	
Yes	24 (55.00)
No	19 (45.00)
Usage of AI during working life	
Yes	24 (55.81)
No	9 (20.93)
Not Applicable	10 (23.26)

Table 2. The reason for the usage of AI

Usage	Percent of Cases (%)
Assignment	64.5
Research	29.0
Helping to Determine Treatment of Patient	29.0
Drafting Message	29.0
Helping to Determine Diagnosis for Patient	16.1
Others	9.7

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The most common usage of AI is for assignments, followed by research, drafting messages, and helping in the treatment of patients, as shown in Table 2. Table 3 shows the domain of AI preparedness among the respondents. The vision domain earned the highest score at 7.93 ± 2.46, followed by the ethics (7.56 ± 2.18), ability (20.13 ± 5.55), and cognition domains (16.91 ± 5.99) respectively. The mean score for medical AI preparedness among respondents was 52.53 ± 14.20.

Table 3. Mean MAIRS-MS score of respondents

Factor	MAIRS-MS Score (Mean ± SD)	Possible Total Score
Cognition	16.91 ± 5.99	(8-40)
Ability	20.13 ± 5.55	(8-40)
Vision	7.93 ± 2.46	(3-15)
Ethics	7.56 ± 2.18	(3-15)
Overall	52.53 ± 14.20	(22-110)

Table 4 presents the association between respondents' demographic characteristics and their MAIRS-MS domain scores among medical graduates. The study found no significant difference in AI preparedness based on gender. A Spearman's rank-order correlation was conducted to assess the relationship between age and MAIRS-MS domain scores. Results indicated a moderate, positive correlation that was statistically significant (rs (41) = 0.303, p = 0.048). However, no significant correlations were observed in other domains, as shown in Table 5.

Table 4. The association between characteristics of respondents and MAIRS-MS Score (n = 43)

Variables	MAIRS-MS									
	Total Score		Cognition		Ability		Vision		Ethics	
	Mean	*p*	Mean	*p*	Mean	*p*	Mean	*p*	Mean	*p*
Gender										
Male	23.67	0.280[a]	24.63	0.088[a]	23.27	0.411[a]	21.19	0.597[a]	21.52	0.750[a]
Female	19.44		17.97		20.06		23.24		22.74	
Usage of AI During Under-graduate Studies										
Yes	22.96	0.574[a]	22.08	0.961[a]	22.75	0.659[a]	22.69	0.682[a]	24.44	0.142[a]
No	20.79		21.89		21.05		21.13		18.92	
Usage of AI During Working Life										
Yes	22.85		22.94		23.15		22.65		22.40	
No	18.50	0.642[b]	18.22	0.595[b]	18.44	0.625[b]	22.11	0.885[b]	17.56	0.400[b]
Not Applicable	23.10		23.15		22.45		20.35		25.05	

Note: [a] Mann Whitney U Test, [b] Kruskal-Wallis Test, p <0.05 taken as level of significant

Table 5. The correlation between age and MAIRS-MS Score (n = 43)

Variables	MAIRS-MS									
	Total Score		Cognition		Ability		Vision		Ethics	
	r	*p*	r	*p*	r	*p*	r	*p*	r	*p*
Age	0.232	0.134	0.300	0.048*	0.286	0.063	0.224	0.149	0.031	0.841

Note: r Spearman correlation, p<0.05 taken as level of significant

3. 2 Discussion

This study aimed to assess the experiences and preparedness of medical graduates regarding AI in their professional practice. Many of the respondents have used AI in their undergraduate studies. Most usage of AI medical graduates is used for assignment purposes during their undergraduate studies. This is also confirmed by a study by Alkhaaldi et al. [10] which shows that the usage of AI among medical graduates is for their assignment. The emergence of AI such as CHATGPT assists and makes it easier for students to write, revise, and summarize information [11]. However, with the increasing usage of AI among medical students the usage of AI must be done responsibly and ethically. In this pilot study, the mean scores obtained for all four domains and the total scores of MAIRS-MS are low compared to a previous study [12]. However, the respondents achieved approximately 50% of the possible score across all four domains. Nevertheless, interpreting these scores remains challenging due to the lack of an established cut-off value for the MAIRS-MS scale. Without predefined benchmarks, it is difficult to classify participants as having low, moderate, or high AI readiness.

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The cognition domain recorded the lowest mean score among all MAIRS-MS domains, followed by ability, vision, and ethics. The cognition domain specifically assesses the respondents' knowledge and understanding of AI concepts. The overall MAIRS-MS total score (52.53 ± 14.20 out of 110) and the cognition domain score (16.91 ± 5.99 out of a possible 40) indicate limited AI-related knowledge and preparedness among NDUM medical graduates. These findings are consistent with previous studies, both locally and globally, which have reported similarly low levels of AI knowledge among medical and dental students [13-15]. This lack of AI knowledge may be attributed to the limited inclusion of AI content within the medical curriculum. Furthermore, although students may be familiar with AI applications in general, prior studies suggest that possessing superficial awareness does not necessarily translate into a deep understanding of AI concepts or readiness to use AI in clinical practice [13, 16]. The consistent findings across different regions underscore that AI education remains a developing area in medical training, with substantial variability in exposure, depth of knowledge, and competency levels. On the other hand, this study identified a significant positive correlation between age and the cognition domain of the MAIRS-MS ($rs = 0.300$, $p = 0.048$), indicating that older respondents demonstrated higher levels of AI-related knowledge and understanding. This may be attributed to greater academic maturity, more clinical exposure, or increased opportunities for self-directed learning since graduation. Interestingly, this finding contrasts with a previous Malaysian study, which reported significant correlations between age and the ability, vision, and ethics domains, but not with cognition [15]. These contrasting results suggest that age may influence different aspects of AI preparedness depending on the study population, educational experiences, and clinical context. One possible explanation for this variation is that older and younger individuals may engage with AI differently. Younger graduates, having been trained in more digitally integrated environments, may be more familiar with AI technologies and their potential applications.

Conversely, older graduates may interpret AI through the lens of clinical experience, viewing it as a supportive tool rather than a transformative force. Despite these generational differences in cognitive preparedness, our findings showed no significant associations between age and the other domains ability, vision, and ethics indicating relatively consistent attitudes across age groups regarding the practical use of AI, its long-term role in healthcare, and its ethical implications. In particular, the consistency observed in the ethics domain suggests that regardless of age, medical graduates may share a similar foundational understanding of the importance of patient privacy, data protection, and accountability in the use of AI technologies. While ethical considerations in AI such as transparency, bias mitigation, and responsibility are complex, this stability across age groups reflects a baseline awareness that can be further developed through AI ethics training in medical education. These findings highlight the multifaceted nature of AI readiness and support the notion that knowledge alone is insufficient to ensure comprehensive preparedness. Variability in curriculum content, individual exposure to AI technologies, and institutional support may further contribute to these differences. Similar mixed patterns in age-related AI readiness have been reported in other studies [13, 16], underscoring the need for structured AI education that addresses cognitive, practical, and ethical competencies. This study found that gender was not significantly associated with AI preparedness, indicating that male and female medical graduates demonstrated similar levels of preparedness across all domains cognition, ability, vision, and ethics. This finding aligns with a previous cross-sectional survey [14, 16]. The lack of gender disparity suggests that AI preparedness may be shaped more by systemic factors such as curricular content, teaching strategies, and access to AI-related learning opportunities than by gender itself. As such, the integration of AI into the medical curriculum should be designed to provide equitable learning experiences for all students, ensuring that neither gender has an advantage or disadvantage in acquiring AI competencies. This also highlights the importance of adopting inclusive curriculum design that actively considers diverse learning needs and promotes equal participation [6].

3.3 Limitation

While this study provides valuable insights into the preparedness and experiences of medical graduates regarding AI, several limitations must be acknowledged, particularly concerning the generalizability of the findings. As a pilot study, the small sample size limits the statistical power and prevents broad extrapolation to the larger population of medical graduates. The participants may not fully represent the diverse demographics and levels of exposure to AI. Additionally, as a pilot study, the primary aim was to explore the overall preparedness of medical graduates regarding AI and to generate preliminary insights to inform future, larger-scale research, rather than to establish definitive conclusions. As a result, some of the complexities and challenges related to integrating AI into medical education and clinical practice may not have been thoroughly explored in this study. Selection bias could also be present, as individuals with

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a prior interest in AI may have been more inclined to participate, potentially skewing the results. Furthermore, the study relied on self-reported data, which may introduce recall bias or social desirability bias, where participants might have overestimated or underestimated their preparedness and experiences. Lastly, while this pilot study helps refine the research approach for future investigations, unforeseen methodological challenges may still arise in a larger-scale study. Despite these limitations, the study offers valuable preliminary insights, underscoring the need for broader research to enhance AI integration in medical education.

4.0 CONCLUSIONS

This study highlights the limited AI preparedness among NDUM medical graduates, particularly in foundational knowledge as reflected by the low cognition domain scores. These findings reveal a significant gap in AI literacy and emphasize the urgent need for structured integration of AI-related competencies into the medical undergraduate curriculum. Early introduction of AI education covering practical applications, ethical considerations, and interdisciplinary learning can better prepare future medical professionals to navigate and apply AI technologies responsibly and effectively in clinical practice. As AI continues to transform healthcare, ensuring that graduates possess the necessary knowledge and skills is essential for safe and ethical adoption. Future research with larger, more diverse samples and qualitative insights is recommended to further guide the development of AI-integrated curricula that align with real-world clinical demands.

5.0 CONFLICT OF INTEREST

The authors declare no conflicts of interest.

6.0 AUTHORS CONTRIBUTION

Mohamad Rom, F. Z. (Conceptualization; Writing – original draft; Investigation; Supervision)
Reiniatie, A (Writing – review & editing; Resources; Data analysis; Visualization)
Ramli, S. I. (Writing - original draft; Investigation)
Mahmud, A. A. (Supervision),
Suainbon, R. (Conceptualization)

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