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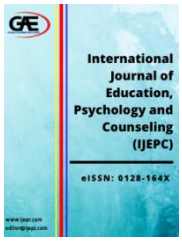

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HEALTHCARE PROFESSIONALS' KNOWLEDGE AND PERCEPTIONS OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE: A CROSS-SECTIONAL STUDY IN A PRIVATE SETTING IN MALAYSIA

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Abstract:

The integrations of Artificial Intelligence (AI) have generated tools that enhance the efficacy of various healthcare processes. AI-driven technology enables an accurate and early detection of diseases, personalizes treatment plans according to individual patient data, and streamlines administrative tasks. However, the study on the knowledge and perceptions among healthcare professionals in Malaysia was limited. Thus, this study was conducted to assess the knowledge and perceptions of AI in healthcare among healthcare professionals in a private setting in Malaysia. A cross-sectional study was conducted on 198 healthcare professionals in a private healthcare setting in Negeri Sembilan, from September 2023 until December 2023. A validated questionnaire comprised of demographic data and knowledge of AI was used. Descriptive analysis and Chi-square were used to analyze the data. Overall, most of the respondents (69.7%) had poor knowledge of AI with only 49.0% of the respondents defining AI as the use of computer algorithms to perform tasks that require human intelligence. Besides, the majority of the respondents (61.6%) are aware of the integrations of AI in the healthcare system. The majority of respondents (79.8%) have not yet utilized AI and lack experience in integrating AI into their daily work routines, however, the majority expressed a readiness to learn and incorporate AI into their professional practice (79.8%). Overall, the perceptions of AI among the respondents were moderate (70.2%). Hence, it is imperative to implement focused educational

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and training initiatives to tackle the diverse perspectives on Artificial Intelligence (AI) among healthcare professionals. Furthermore, it is crucial to thoroughly review and enhance the guidelines and policies regarding AI on the ethical framework in the hospital to ensure that AI is used ethically among healthcare professionals.

Keywords:

Artificial Intelligence, Healthcare Professionals, Knowledge, Perceptions

Introduction

Artificial intelligence (AI) is a form of cognitive computing that involves the use of software-driven computing equipment to perform human-like thinking and comprehension. This includes a range of technologies, such as Supervised Learning (SL), Machine Learning (ML), and other advanced computational methods. These technologies allow systems to examine data, identify patterns, and make decisions on patients' treatment plan.

Supervised learning can incorporate manual input into the machine learning process while also providing instruction labels. This feature allows humans to participate, allowing the algorithm to lessen the machine's error (Zhang & Li, 2023). While unsupervised learning used machine learning algorithms to analyse and group unlabelled data sets. These algorithms are referred to as "unsupervised" because they identify hidden patterns in data without the assistance of a human (Delua, 2021). It has been widely used for a variety of critical statistical tasks with numerous scientific and industrial applications (Watson, 2023).

Deep learning is a type of AI that focuses on artificial neural networks and algorithms inspired by the structure and function of the brain. It involves training neural networks on large amounts of data to learn patterns and make decisions without explicit programming. For example, deep learning algorithms have been used in Medical Image Analysis application. Medical Image Analysis has been utilized to enhance RT-PCR testing for diagnosis by identifying COVID-induced pneumonia using chest X-rays and CT images (Shorten et al., 2021).

The utilization of AI applications in healthcare is advancing rapidly. For instances, AI has been integrated into several categories including medical imaging analysis, predictive analytics, natural language processing, robotics and automation, and virtual assistants and chatbots. The application in medical imaging are reported in a study by (Hosny et al., 2018) where AI can automatically distinguish lung cancer nodules as benign or malignant. Similarly, Hosny et al. (2018) emphasize the capability of artificial intelligence to distinguish between benign and malignant lung nodules. In addition, artificial intelligence assists in the detection of liver abnormalities and the prediction of brain tumor features. Furthermore, AI-powered robotics and automation contribute to surgical procedures, drug discovery, and infection control, as seen in applications such as CT scanning with automated patient positioning and robots used as shielding layers during pandemics (Stoichitoiu et al., 2021; Zemmar et al., 2020).

Besides, during pandemic, the utilisation of a robot as a shielding layer, which serves to physically separate the healthcare professional from the patient, is a potent instrument that can be used to combat the ever-present concern of pathogen contamination and maintain surgical

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volumes (Zemmar et al., 2020). Numerous studies suggest that artificial intelligence is crucial to TCM quality evaluation, medication target discovery, compatibility optimization, and medical diagnosis, making AI pharmacy an emerging academic area (Gong et al., 2021; Lin et al., 2022). These trends showed that AI transformation in healthcare system is continuously progressing and healthcare professionals in various disciplines should be ready for this transformation.

Despite the potential benefits that AI presents in improving healthcare delivery, existing literature indicates a spectrum of knowledge and perception gaps among healthcare professionals. The challenge lies in comprehensively addressing the factors influencing their perceptions, including fear of change, lack of trust (Petersson et al., 2022), and inadequate understanding of AI capabilities. The perceptions of AI utilization among various healthcare professionals are crucial to improving the implementation and effectiveness of these technologies. However, the study on the different positions of healthcare workers was limited. Thus, this study aimed to assess the knowledge and perceptions of healthcare professionals in the integration of AI in the healthcare system

Methodology

Study Design and Population

This cross-sectional study was conducted in Negeri Sembilan, Malaysia, from September 2023 to January 2024. The study population for this research was healthcare professionals in a private hospital in Negeri Sembilan, Malaysia. Convenience sampling was used to recruit the respondents.

Data Collection

The data were collected by using a set of questionnaires in English language which consisted of socio-demographic data, knowledge, and perceptions of AI. The questionnaire underwent a pilot test on 19% of the target population and the content validity was reviewed by subject experts and experts in medical imaging. A reliability analysis was reliable with a reliability coefficient (α) of 0.71.

Ethical Consideration

This study was approved by the Research Ethics Review Board, with registered number UNIKL REC/2023/PG/TCA/02 and KPJUC/RMC/SOHS/EC/2023/458. Informed consent was obtained from each of the respondents before answering the questionnaire. All information was kept confidential.

Statistical Analysis

Data were statistically analyzed using SPSS Version 23.0 (SPSS Inc, Chicago, IL, USA). Descriptive analysis was performed to determine the perception levels of healthcare professionals on AI in healthcare. A total mean score for perceptions will be categorized according to Bloom's cut-off point into good, medium, and poor levels. Chi-square was used to test for significant differences between the different demographic variables and perception of AI.

Results

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In this study, a total of 198 respondents, with the mean age, of 33.9 ± 8.0 years. Female healthcare professionals constitute the largest proportion (81.3%) of the sample, followed by male (18.7%). Furthermore, a significant proportion of the respondents were working in the healthcare field for more than eight years and above (65.7%) and most of respondents are diploma holder (74.2%), followed by degree, and advanced degree. Moreover, based on the categorization of their position according to the professions, most of the respondents are allied health professionals which consists of radiographers, physiotherapists, occupational therapists, lab technologists, pharmacy assistants, speech therapists, and dietitians (36.4%), followed by nurses (35.9%), and others (Table 1).

Table 1: Sociodemographic Data (n=198)

Demographic data	n (%)
Age group	
Less than 25 years	16 (8.1)
25 to 54 years	175 (88.40
55 years and above	7 (93.5)
Educational level	
Diploma	147 (74.2)
Bachelor Degree	31 (15.7)
Advanced Degree	20 (10.1)
Professions Group	
Doctors	19 (9.6)
Nurses	71 (36.4)
Allied Health	72 (36.4)
Pharmacists	10 (5.1)
Others	26 (13.1)
Years of Working Experience	
Novice (1 to 3 years)	24 (12.1)
Intermediate (4 to 7 years	44 (22.2)
Expert (8 years and above)	130 (65.7)

Overall, most of the respondents (69.7%) had poor knowledge of AI with only 27.8% of respondents had moderate and only 2.5% of the respondents had good knowledge of AI (Figure 1). However, despite most of the respondents had poor knowledge, most of them have an awareness on AI integration in the healthcare field (61.6%). A total of 49.0% of the respondents defined AI as the use of computer algorithms to perform tasks that require human intelligence. Some of the respondents consider AI as the use of robots (20.2%), a virtual reality in healthcare (7.6%) and the rest did not familiar with the concept of AI

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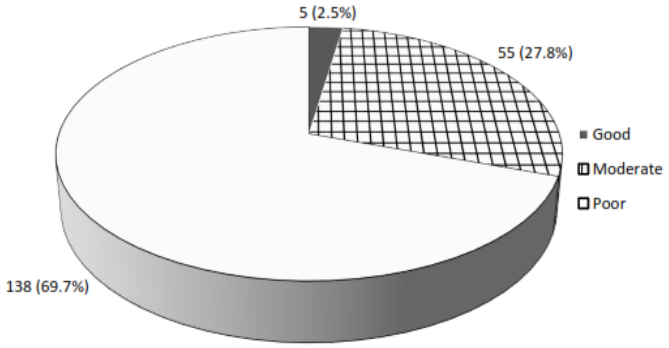

Figure 1: Knowledge Level of AI

Data in Table 2 provide an overview of the benefits, and, concerns of AI integrations in healthcare. The majority of the respondents acknowledged AI's capability to enhance productivity and efficiency in care delivery (81.3%). Similarly, a significant number of respondents recognized AI' role in increasing access for remote populations (64.1%), and AI's ability to analyze large amounts of patient data to identify disease patterns (73.7%). However, there remain potential benefits that received comparatively lower acknowledgment by the respondents. In addition, the majority of the respondents had a concern on the potential reduction in healthcare provider skills (55.6%) and the replace the need for human healthcare providers (54.0%), the potential of AI to make mistakes that could harm patients (55.1%), increase costs while reducing accessibility for patients (56.1%), and concerns about the privacy and security of patient data (70.7%).

Table 2: Benefits and Concerns of AI Integrations in Healthcare

Items	n (%)
Potential Benefits of AI	
Increased productivity and efficiency in care delivery	161 (81.3)
Increased access to care for remote populations	127 (64.1)
Reducing costs of healthcare treatment	57 (28.8)
Enhance medical diagnosis	66 (33.3)
Automating administrative tasks	98 (49.5)
Providing personalized treatment plans	65 (32.8)
Analyze large amount of patient data to identify pattern of disease	146 (73.7)
Concerns on AI Integration in healthcare	
Reduce skills of healthcare providers	110(55.6)
Replace the need for human healthcare providers	107 (54.0)
AI may make mistake that could harm patients	109 (55.1)
Increase costs and reduce accessibility for patients	111 (56.1)
Biased and perpetuate existing inequalities in healthcare	56 (28.3)
Biased and fairness in AI algorithm	63 (31.8)
AI make autonomous medical decisions	69 (34.8)
Privacy and security of patient data	140 (70.7)
Responsibility and accountability of AI decisions	80 (40.4)

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In this study, majority of respondents (79.8%) have not yet utilized AI and lack experience in integrating AI into their daily work routines. However, among those who have engaged with AI, their usage has primarily been through platforms such as ChatGPT and patient data systems. Despite this limited exposure, most of the respondents expressed their readiness to learn and incorporate AI into their professional practice (79.8%). Figure 2 presents the data of the perception levels on AI among the respondents. Overall, most of the respondents have a moderate perception on AI in healthcare (70.2%).

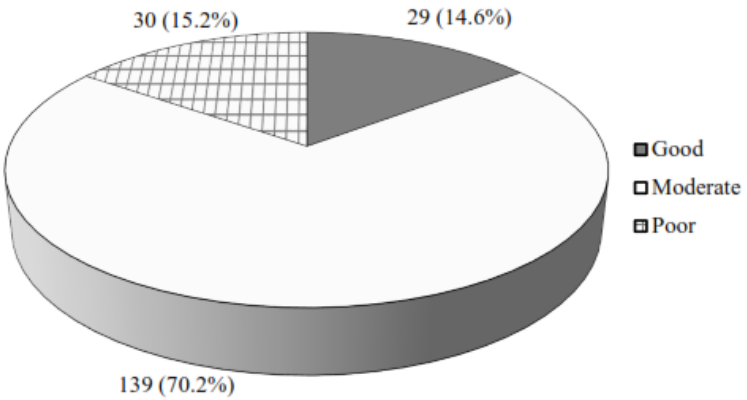

Figure 2: Perception Level of AI

Data in Table 3 provide a detail on the perceptions of AI. Overall, the mean score for each item shows that the respondents in this study had a moderate level of perceptions of AI. Furthermore, the respondents in the study generally held moderate perceptions regarding the potential benefits of AI in healthcare, particularly in areas such as improving patient care, clinical decision-making, population health outcomes, ethical considerations, concerns about AI potentially taking over their roles, determining responsibility in case of errors, the preparedness of healthcare professionals for AI integration, impacts on professional reputation and learning opportunities, reductions in financial costs, and adequacy of training in AI usage.

Table 3: Perceptions of AI

Items	Mean (±SD)
AI could improve the delivery of patient care.	3.57 (± 0.7)
AI could improve clinical decision making.	3.44 (±0.8)
AI could improve population health outcomes.	3.53 (± 0.7)
AI could reduce financial cost.	3.14 (±0.9)
AI could change role as healthcare professional.	3.40 (±0.8)
AI might take over role as healthcare professional.	3.16 (±1.0)
Healthcare professionals responsible on AI errors.	3.32 (±0.9)
Overall healthcare professionals are prepared for AI.	3.34 (±0.8)
Healthcare professionals have adequate training for using AI.	3.10 (±1.0)
Ethical framework for the use of AI in healthcare.	3.41 (±0.8)
AI might decrease professional reputation and learning.	3.33 (±0.9).

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In this study, there was significant association on knowledge of AI with different gender (p=0.02), education level (p=0.00) and working positions (p=0.00). However, there was no significant association with knowledge on AI with age groups (p=0.11) and years of working experiences (p=0.67). Besides, there was significant association on perception of AI with different gender (p=0.02), and working positions (p=0.04). However, there was no significant association with perception of AI with age groups (p=0.56), education level (p=0.76) and years of working experiences (p=0.70).

Discussion

Knowledge on AI is important for healthcare professionals. Healthcare professionals with a knowledgeable about AI can better understand its applications, benefits, and limitations which can effectively leverage these AI tools for their daily work practices. The healthcare sector's successful integration and adoption of AI technology heavily relies on the perception of artificial intelligence (AI) among healthcare professionals. The perspectives and beliefs of healthcare professionals play a crucial role in their adoption and utilization of AI tools as these technologies continue to advance and integrate into clinical operations. Gaining insight into these perspectives is crucial for ensuring the efficient and responsible integration of artificial intelligence in healthcare, ultimately enhancing patient outcomes and operational effectiveness.

Overall, the respondents in this study have a poor knowledge level on AI in healthcare. The findings were similar with a previous study among UK radiographers including students and retired radiographers. The study reported that the respondents had a lack of sufficient knowledge on AI, in aspect of AI terminology, skills, principles and use of AI in healthcare (Rainey et al., 2021). These findings are also similar to the study among physicians and nurses in eight public university hospitals in Tehran. It is reported that the level of knowledge among the respondents was average (14.66 ± 4.53) (Hamedani et al., 2023).

In this study, most of the respondents unable to defined AI correctly. Besides, majority had no experience in using AI in their daily practices at their workplace. A cross-sectional online survey among nurses in Bavaria Germany also reported the limited knowledge on AI (74.8%). The respondents in the study had diverse understanding on the definition of AI. Their definition included AI being associated with computers, software, human-like characteristics, robots and machine (Sommer et al., 2024).

In contrast, a finding in Columbia found that there are positive level of knowledge about medical robotics in general, however, the participants had low level of knowledge and experience with this robotics. From this study, it concluded that even though they recognize this medical robotics in healthcare field, however, the awareness and education on robot's functions and features are relatively low. despite they acknowledged on the benefits of AI integration in healthcare, there were some concern raised such as concern on the potential reduction in healthcare provider skills, and the replace the need for human healthcare providers. These findings are also similar to the previous studies. It is reported that 80% of the respondents believed there may be serious privacy issues with AI and 40% of them considered AI to be potentially more dangerous than nuclear weapons (Castagno & Khalifa, 2020).

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Besides, almost half of the respondents (54%) indicating concern that their jobs would be replaced by AI. The results here are consistent with (Abdullah & Fakieh, 2020). Similarly, a study by Sommer et al., (2024), some nurses consider AI as a threaten to their jobs, however it is inconsistent with the study by Oh et al., (2019) who indicated that healthcare professionals especially doctors do not believe they will be replaced by AI. Nonetheless, medical practitioners must to dispel these misconceptions that AI will replace them in this field. It implies that rather than viewing AI as a danger, healthcare professionals should embrace it as a symbiotic partnership between humans and technology that will improve their abilities and services (Ramiah, 2023).

Overall, this study revealed that there was a moderate perception among respondents regarding the integration of AI in healthcare. The finding was similar to the previous study conducted among healthcare providers in Main Assiut University Hospital which reported that the respondents had moderate perceptions of AI, which about half of nurses had a moderate level of perception (Khalaf et al., 2022). In line with these findings, it was also reported in a study by Abdullah & Fakieh (2020), the respondents in the study had a moderate perception toward AI, with mean of 3.01 (SD 1.13). Based on the detailed perceptions of AI, it was observed that most of the items were perceived moderately by the respondents. This could be due to the lack of experience in using the applications with this technology and due to a lack of understanding of this AI technology. According to Castagno & Khalifa (2020), inadequate experience and understanding of AI applications lead to disagreement, with some seeing potential benefits and others uncertain.

Moreover, AI is seen as a tool that will not replace the power of humans in healthcare for the foreseeable future. The role of healthcare professionals is important to provide explanations of the diagnosis ensuring patient understanding, and make informed decisions. Transparency in AI systems involves making the decision-making process understandable to both humans and machines. This includes providing clear explanations for AI-generated diagnoses and treatment recommendations, which is crucial for clinicians to validate the information and make informed judgments (Asan et al., 2020). Thus, the concern among healthcare professionals that AI may replace them should not be an issue of contention because rather than fearing on displacement, healthcare professionals should embrace the integration of AI in healthcare tools to enhance their practice.

These findings may also influence the perceptions of AI abilities to improve the delivery of patient care, clinical decisions, and improve population health outcomes. Despite, there was reported by the previous studies that AI is improving the healthcare system in these aspects, still the respondents in this study have a moderate perception. However, healthcare professionals should embrace and work together with this AI, to ensure the effectiveness of patient care. This is because there are some aspects that unable to be covered by the AI such as emotional intelligence, empathy, creativity and original thoughts, moral and ethical judgment, and also problem-solving skills.

Notably, AI cannot engage in meaningful conversations with patients, a crucial aspect for building trust, offering reassurance, and expressing empathy (Inkster et al., 2018). Furthermore, AI sensors may provide valuable diagnostic information, but physicians remain indispensable for interpreting data in ambiguous situations, integrating medical histories, conducting physical examinations, and facilitating comprehensive discussions (Krittanawong, 2017). The article

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suggests that new regulations and laws are needed to address the unique challenges of AI in healthcare, including the allocation of responsibility for AI errors (Ganapathy, 2021). A study by Kooli & Al Muftah, (2022) discusses the ethical dilemmas associated with AI in healthcare, including the need for continuous monitoring to minimize the impact of ethical issues.

The respondents also moderately perceived that the healthcare professionals are responsible on AI errors. In another study it states that lack of clarity regarding who is to be held responsible in the event of an error caused by an AI tool (Laï et al., 2020), especially when there is not a full understanding of how that AI tool behaves. A previous study stated that their study focused on the normative question of who should be liable for AI-related medical errors, not on how the medico-legal system currently approaches these issues (Khullar et al., 2021). Indeed, there is little case law on liability for errors that occur when healthcare professionals use AI to deliver care, and it is not yet clear how these issues will be resolved.

In this study, there was a significant association between the knowledge and perception of AI with different genders. Similarly, a study in Jeddah, Saudi Arabia, reported that male physicians exhibiting a more positive view of AI (Alkhatieb & Subke, 2024). The finding in this study may be due to knowledge and interest. In agreement to this, the study highlighted that the higher interest could lead to more exposure and engagement with AI technologies, influencing their perceptions positively (Adigwe et al., 2024). In Malaysia, a study reported that male had higher digital skills compared to female, where female had higher skills in information navigation skills (Ahmad et al., 2019).

Besides, in this study, there was a significant association between the perception of AI with different working positions. In line to this finding, there were significant differences in perceptions and worries about AI among different professions, with medical doctors being less concerned about the potential threat of AI compared to other health professionals (Castagno & Khalifa, 2020). This could be due to the different scope jobs for all the healthcare professionals. In agreement to this, a study suggested that the perception of AI's role in healthcare can vary based on the specific tasks and responsibilities of the healthcare professionals (Pedro et al., 2023). Thus, the perceptions of healthcare workers towards AI implementation can vary significantly based on their nature of work.

Conclusion

In conclusion, the study revealed that the knowledge level among healthcare professionals was poor. Besides, the study revealed that the perceptions among healthcare professionals are still at a moderate level. It is also noted that the respondents in this study demonstrate expressing doubts and uncertainties over its wider impacts and integration into healthcare systems, such as in aspects of the potential benefits in improving patient care, clinical decision-making, ethical considerations, the potential of AI to take over roles, responsibility in case of AI errors, and impact professional reputation and learning opportunities. This could be due to lack of experience and understanding of AI. Thus, providing comprehensive education, training, clear guidelines and standards for the safe and effective use of AI in healthcare should be implemented to ensure that they utilize this AI technology effectively for the care of the patient.

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