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Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students

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This project is submitted

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DECLARATION

I hereby declare that this research for my final year project titled "Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students" at the Faculty of Medicine and Health Sciences, UNIMAS, during the period of 2024-2025, is entirely my own work except for quotations, summaries, and references, each of which I have explained the source. I attest that all references and citations have been properly acknowledged in the text. Furthermore, this research has not been submitted to any other university or institute for degree or diploma awards.

Signature

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ABSTRACT

Artificial Intelligence (AI) is revolutionising healthcare delivery by enhancing administrative procedures, improving diagnostic precision, and aiding in clinical decision-making. Despite its emerging importance, limited research has been conducted on the knowledge and attitudes towards AI in healthcare among Malaysian nursing students. This research seeks to investigate the knowledge and attitude towards Artificial Intelligence (AI) in healthcare among UNIMAS undergraduate nursing students, and to examine the correlation between knowledge and attitude towards artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students. A quantitative descriptive cross-sectional study was conducted among UNIMAS undergraduate nursing students. A total of 163 respondents were selected using a simple random sampling method. Data were collected using a self-administered questionnaire adapted from the Scale of Artificial Intelligence Literacy for All (SAIL4ALL) and the General Attitudes Toward Artificial Intelligence Scale (GAAIS). Data analysis was done by using IBM SPSS Statistics version 27 and Spearman correlation coefficient to examine the relationship between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students. The majority of UNIMAS undergraduate nursing students demonstrated a poor level of knowledge (36.20%) and negative attitude (35.60%). Further analyses found a statistically significant strong positive correlation between knowledge and attitude $r_s(163) = .448$, $p < .001$. UNIMAS undergraduate nursing students showed a poor level of knowledge and negative attitude on AI in healthcare. There is a statistical significant correlation between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students. These findings

emphasises the importance of implementing AI-related information into nursing program to prepare future registered nurses for a technology-driven healthcare environment.

Keywords: Knowledge, attitude, artificial intelligence, healthcare, nursing students

Pengetahuan dan Sikap terhadap Kecerdasan Buatan (AI) dalam Penjagaan Kesihatan dalam kalangan Pelajar Ijazah Sarjana Muda Kejururawatan UNIMAS.

ABSTRAK

Kecerdasan Buatan (AI) ini merevolusikan penjagaan kesihatan dengan meningkatkan prosedur pentadbiran, mempertingkatkan ketepatan diagnosis serta membantu dalam membuat keputusan klinikal. Walaupun kepentingan terhadap AI ini semakin berkembang, kajian mengenai pengetahuan dan sikap terhadap AI dalam penjagaan kesihatan dalam kalangan pelajar kejururawatan di Malaysia masih terhad. Kajian ini bertujuan untuk menyelidik tahap pengetahuan dan sikap terhadap AI dalam penjagaan kesihatan dalam kalangan pelajar ijazah sarjana muda kejururawatan UNIMAS, serta mengkaji hubungan di antara pengetahuan dan sikap terhadap AI dalam kalangan pelajar ijazah sarjana muda kejururawatan UNIMAS. Satu kajian kuantitatif deskriptif secara keratan rentas telah dijalankan dalam kalangan pelajar ijazah sarjana muda kejururawatan UNIMAS. Seramai 163 orang peserta telah dipilih menggunakan kaedah persampelan rawak mudah. Data dikumpulkan melalui soal selidik kendiri yang diadaptasi daripada Skala Literasi Kecerdasan Buatan untuk Semua (SAIL4ALL) dan Skala Sikap Umum terhadap Kecerdasan Buatan (GAAIS). Analisis data dilakukan menggunakan perisian IBM SPSS Statistics versi 27 dan pekali korelasi Spearman untuk meneliti hubungan antara tahap pengetahuan dan sikap terhadap AI dalam penjagaan kesihatan dalam kalangan pelajar ijazah sarjana muda kejururawatan UNIMAS. Majoriti pelajar ijazah sarjana muda kejururawatan UNIMAS menunjukkan tahap pengetahuan yang rendah (36.20%) dan sikap yang negatif (35.60%). Analisis lanjut menunjukkan terdapat hubungan positif yang kuat dan signifikan secara statistik antara pengetahuan dan sikap, $r_s(163) = .448$, $p < .001$. Pelajar ijazah sarjana

muda kejururawatan UNIMAS menunjukkan tahap pengetahuan yang rendah dan sikap yang negatif terhadap AI dalam penjagaan kesihatan. Terdapat korelasi yang signifikan secara statistik antara tahap pengetahuan dan sikap terhadap AI. Penemuan ini menekankan kepentingan untuk melaksanakan maklumat berkaitan AI ke dalam program kejururawatan bagi mempersiapkan bakal jururawat berdaftar untuk menghadapi persekitaran penjagaan kesihatan berasaskan teknologi.

*Kata kunci**:** Pengetahuan, sikap, kecerdasan buatan, penjagaan kesihatan, pelajar kejururawatan*

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
COVID-19	Coronavirus Disease 2019
CNE	Continuous Nursing Education
DL	Deep Learning
EMRs	Electronic Medical Record Systems
FMHS	Faculty of Medicine and Health Sciences
GAAIS	General Attitudes towards Artificial Intelligence Scale
IQR	Interquartile Range
LLM	Large Language Model
ML	Machine Learning
SAIL4ALL	Scale of Artificial Intelligence Literacy for All
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
UNIMAS	University Malaysia Sarawak

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter comprises of nine sub-sections, encompassing the study background, problem statement, research aim, research questions and research objectives, hypothesis, the significance of the study, operational definition of terms and chapter summary.

1.1 Background of the Study

Artificial Intelligence (AI) is an emerging topic that has received considerable interest among researchers in recent years and is seen as the beginning of the fourth digital industrial revolution (Waymel et al., 2019). The term “Artificial Intelligence” was invented in the 1950s, when AI originally started as the basic theory of human intelligence being demonstrated by machines (Bini, 2018). Artificial Intelligence refers to a software program that utilises data to either form judgment autonomously or assist in making decisions. Artificial Intelligence was created to mimic human intelligence, encompassing deep learning, machine learning, representation learning, as well as natural language processing. Artificial Intelligence has an impact on various disciplines, including medicine, psychology, linguistics and statistics, which is beyond computer science (Abid et al., 2019).

The initial applications of AI in healthcare were intended to replicate human reasoning processes. However, they were inevitably constrained by the boundaries of acknowledged knowledge in medicine. To enhance the effectiveness and precision of

applying knowledge in medicine to treatment and diagnostic challenges, some of the more current initiatives to create AI in the healthcare sector have relied on cognitive computing approaches. These approaches teach the system to analyse and synthesise medical articles and archives. However, they also go beyond the point where the system is able to recognise configurations and provide answers that might not have seemed apparent before (Koski & Murphy, 2021).

The significance of AI in the medical field is impossible to overestimate, considering its advantages and advancements. Artificial Intelligence in healthcare acts as a transformative force by improving patient care and its outcome, fostering innovation and enhancing productivity (El-Maksoud, 2024). These abilities are vital when healthcare workers attempt to find an equilibrium in the quality of treatment delivered, affordability and accessibility in a more multifaceted healthcare environment (World Health Organization, 2019). The role of AI in healthcare is anticipated to develop further as technology advances, which changes how healthcare is delivered (Alowais et al., 2023). Artificial Intelligence should play a crucial role in facilitating the advancement of intelligent care systems and healthcare simplification. For instance, the Coronavirus Disease 2019 (COVID-19) issue illustrates the way AI can potentially utilise in various intentions, such as contact tracing, diagnoses and treatment decision assistance, and the application of AI-driven technologies (Vaishya et al., 2020; Van Der Schaar et al., 2021).

Artificial Intelligence is essential for nurses in a variety of ways that will enhance the quality of patient care and their duties. For instance, AI is able to assist nurses by giving them fast and precise diagnosis support, which allows them to perform health assessments

accurately and precisely (Van Bulck et al., 2023). Besides, AI enables nurses to develop care plans specific to individuals by analysing the patient's information and offering insights into individualised intervention. Moreover, AI is also able to perform repetitive administrative duties, including data input and documentation, allowing nurses to focus on their patient's care (McGreevey et al., 2020). In addition, AI can also minimise medication errors by aiding with medication management such as including dosage calculations, interaction of drugs and medication administration.

In recent years, the research focusing on knowledge and attitude towards AI has significantly increased (Alruwaili et al., 2024; Hasan et al., 2024; Qin et al., 2024). For example, research by Hasan et al. (2024) reported that 875 faculty members and pharmacy students' knowledge of AI and attitudes towards AI were positively correlated. Besides, a study among registered nurses at three government hospitals in Saudi Arabia revealed that most respondents exhibited good fundamental knowledge of AI terminology (Alruwaili et al., 2024). In addition, research by Qin et al. (2024) revealed that the majority of the medical students at Quest International University, Perak, portrayed positive attitudes towards AI regarding its importance in the medical area.

However, research on the knowledge and attitude of AI among nursing students is still limited, especially among Malaysian nursing students. Hence, this quantitative research seeks to determine the knowledge and attitude towards AI among the University of Malaysia Sarawak (UNIMAS) undergraduate nursing students and examine the associations between the level of knowledge and attitude.

1.2 Problem Statement

The implementation of AI in healthcare offers potential for many advancements, from better patient care and treatment planning to improved diagnosis accuracy (Bajwa et al., 2021). Artificial Intelligence technology has the potential to improve nurses' skills and allow them to offer patients individualised and evidence-based care in a holistic manner (Pailaha, 2023). Despite the potential benefits and advancement, there is a noticeable gap in knowledge and attitude toward AI technologies among UNIMAS undergraduate nursing students.

Firstly, lack of awareness and education of AI are one of the problems related to knowledge and attitude among UNIMAS undergraduate nursing students. Traditional healthcare practices, fundamental sciences and clinical skills are the primary focus of nursing education. However, it is frequently not enough to integrate AI technology, leaving nursing students unprepared to meet the requirements of a rapidly evolving healthcare environment. Despite the increasing importance of implementing AI in contemporary healthcare, AI technologies such as decision-support systems, predictive analytics and automated patient monitoring remain overlooked in nursing courses (Montejo et al., 2024). This lack of awareness leads to a disconnect between the improvements in healthcare technologies, delays in integration into healthcare delivery and nursing students' readiness to use them effectively (Naureen et al., 2025).

Secondly, the negative perception of AI may also affect the nursing students' acceptance towards AI. For instance, concerns, including ethical dilemmas and job

displacement, are common among healthcare professionals. Artificial Intelligence also has consequences that could have a negative influence on the nursing profession, especially in terms of ethical issues regarding the patient's confidentiality and data protection. This is because the existing healthcare regulations are still insufficient for securing a person's health data (Farhud & Zokaei, 2021). According to the American Psychological Association in 2023, confidentiality refers to a professional ethics principle that mandates healthcare providers to restrict the disclosure of a patient's identity, condition, treatment, and any information entrusted to them for the purpose of assessment, diagnosis and treatment.

Thirdly, Electronic Medical Record systems (EMRs) are one example of AI that is commonly used in most hospitals in developed countries to manage patients' health records (Akwaowo et al., 2022). The information capacity of hospital database systems keeps expanding as EMRs are extensively utilised (Dong et al., 2021). Although EMRs appear beneficial in various situations, such as reducing errors in treatment planning and improving nursing care, a significant issue arises involving the confidentiality of the patient's data when using AI. For instance, data collection by AI can be hijacked and abused, which is utilised maliciously, thus decreasing data privacy (Farhud & Zokaei, 2021). Requirements for detailed personal data as input data also raise concerns regarding privacy issues. Violation of data privacy occurs when an individual gains access to other persons' data, the process where the data may be accessed and used inappropriately (Price & Cohen, 2019).

A research by Daher et al. (2024) reveals that the medical students in Lebanon reported poor knowledge towards concepts of AI, the way AI systems are trained, and the application of AI in healthcare delivery. Another study by El-Maksoud (2024) revealed a

negative attitude towards AI among nursing students from the Nursing College at King Khalid University, Saudi Arabia. For instance, the respondents doubt that AI helps in diagnosing and assessing patients, its ability to take over the nurses' job and the respondents also disagree on the reliability of AI in healthcare.

Therefore, further efforts are necessary to actively foster and support students' aspirations to embrace and adopt AI in healthcare (Labrague et al., 2023). Within the Malaysian context, there is a lack of research to assess the knowledge level and attitude towards AI, especially among nursing students, even though several studies have been conducted globally. However, studies on the knowledge and attitudes towards AI are still lacking in UNIMAS. Hence, this study will focus on investigating the knowledge and attitude towards AI among undergraduate nursing students in UNIMAS.

1.3 Research Questions

a. What is the level of knowledge on artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students?

b. What is the attitude towards artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students?

c. Is there any correlation between knowledge and attitude towards artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students?

1.4 Aim of the Study

This research aims to investigate the knowledge and attitude towards Artificial Intelligence (AI) in healthcare among UNIMAS undergraduate nursing students.

1.5 Specific Research Objectives

a. To assess the level of knowledge on artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students.

b. To assess the attitude towards artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students.

c. To examine the correlation between knowledge and attitude towards artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students

1.6 Hypotheses

1. Null hypothesis (H_0): There is no statistical significant correlation between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students.

2. Alternative hypothesis (H_A): There is a statistical significant correlation between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students.

1.7 Significance of the Study

The study on the knowledge and attitude of AI among undergraduate nursing students is still limited, especially in Malaysia. Thus, the purpose of this research is to recognise the knowledge and attitude towards AI among UNIMAS undergraduate nursing students. It is crucial to meet the study's objective in order to accomplish this goal, which includes evaluating the knowledge level and attitude of AI in healthcare among UNIMAS undergraduate nursing students and examining the association between the two variables.

The findings from this research can be beneficial in boosting and providing information on the comprehension and perception of AI among undergraduate nursing students in UNIMAS, therefore improving their knowledge of the use of AI and its benefits in healthcare settings. Besides, this study can also contribute as a framework and body of literature for future research and education, as there have been few scholarly articles on knowledge and attitude towards AI in healthcare among undergraduate nursing students, particularly in Malaysia. For instance, the influence of AI in nursing practice and how it impacts the roles of nurses and the quality of patient care. With an emphasis on the need for educational frameworks to train healthcare professionals, the World Health Organization (2018) has recognised the importance of technology in improving healthcare outcomes.

Furthermore, this study is important to establish the nursing student's fundamental understanding and exposure towards AI, which is able to develop nursing education curricula that prepare the students for technologically advanced healthcare settings. Glauberman et al.

(2023) stated that nursing programs have to implement the concepts of AI into their curricula to ensure that future nurses can use these technologies efficiently in clinical practice.

Apart from that, this research has the potential to influence how nursing students and healthcare workers utilise AI technologies, both academically and in clinical areas. Finally, this study can also promote a more positive view of AI as a beneficial tool in the care of the patient, as it aids in minimising errors and enhancing the standard of nursing care.

1.8 Definition of Key Terms

1.8.1 Artificial intelligence

Definition: The area of study that emphasises the capability of computing devices or other technologies to display or impersonate intelligent performance (Oxford University Press, 2023). Artificial intelligence is also described as software used to carry out tasks or generate results that were previously supposed to require human cognitive ability, specifically when machine learning is used to generate conclusions from large data collections.

1.8.2 Healthcare

Definition: Efforts taken to preserve, improve and develop an individual's emotional, mental, or physical health, particularly when conducted by licensed and qualified professionals (Merriam-Webster, 2023).

1.8.3 Knowledge

Conceptual definition: Knowledge refers to information or comprehension of a particular topic obtained via research or individual participation, whether it is established by a single person or held by a group (Cambridge University Press, 2024).

Operational definition: In this research, it indicates to knowledge of artificial intelligence among UNIMAS undergraduate nursing students towards artificial intelligence in healthcare, which was assessed using the modified Scale of Artificial Intelligence Literacy for All (SAIL4ALL) developed by Soto-Sanfiel et al. (2024). This scale consisted of 20 items and two subscales, including "Understanding AI in Healthcare, and "Application of AI in Healthcare". Each subscale consists of 10 items. This scale was quantified using a 5-point Likert scale of 1 (false with high confidence), 2 (false with moderate confidence), 3 (unsure), 4 (true with moderate confidence), and 5 (true with high confidence). The overall score for knowledge level ranged from 20 to 100. The overall level of knowledge was categorised using the visual binning feature via SPSS, using two cut-off points. Respondents scoring between 80-100 were classified as having good knowledge. Meanwhile, those scoring between 75-79 were considered moderate knowledge, and those scoring between 20-74 were categorised as having poor knowledge.

1.8.4 Attitude

Conceptual definition: Attitude is defined as the way an individual perceives regarding a matter or reacts towards it, frequently in an evaluative approach (Collins, 2020).

Operational definition: An investigation of the viewpoint of undergraduate nursing students in UNIMAS towards AI in healthcare, utilising the modified General Attitudes towards Artificial Intelligence Scale (GAAIS) by Schepman and Rodway (2020). This assessment comprises 20 items and was employed by utilising a 5-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree, to evaluate responses. The overall score of attitudes ranged from 20 to 100. The level of attitude was categorised into three groups: positive, neutral, and negative, using visual binning features via SPSS with two cut-off points. Respondents scoring between 72-100 were classified as positive attitudes. Meanwhile, those scoring between 66-71 were considered neutral attitudes, and those scoring between 20-65 were categorised as negative attitudes.

1.8.5 Socio-demographic Data

Conceptual definition: Socio-demographic data is defined as the information related to the social aspect of a population, such as social class, age and gender (Collins, 2025).

Operational definition: In this research, it refers to the socio-demographic data of UNIMAS undergraduate nursing students, which included several items such as age, gender and academic year.

1.9 Summary

The primary objective of this study was to investigate the knowledge and attitude towards artificial intelligence in healthcare among UNIMAS undergraduate nursing students. This chapter explains the background related to the study, including explanations of AI and why it is significant in nursing, problem statement, including the ethical issue involving patient's confidentiality, research question and objectives, significance of the study and definition of terms used in this study.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter acquires an overall perspective regarding the research topic through a literature review. It delivers a broad overview of information and viewpoints from different populations and backgrounds towards artificial intelligence in healthcare.

2.1 Literature Search

Several credible online databases were used to aid this literature review, including Google Scholar, ResearchGate, ScienceDirect, PubMed, Cureus, and Wiley Online Library. The terms “knowledge”, “attitude”, “artificial intelligence”, and “healthcare” were frequently utilised to obtain more appropriate articles on the topic. The reviewed articles were acquired from 2019 to 2024 to ensure the review will remain recent with the latest trends. This literature review omitted publications issued exceeding five years and those not including the publication date. Each article is chosen according to three themes: a) Knowledge towards Artificial Intelligence in Healthcare, b) Attitude towards Artificial Intelligence in Healthcare, and c) Relationship between Knowledge and Attitude towards Artificial Intelligence in Healthcare.

2.2 Knowledge towards Artificial Intelligence (AI) in Healthcare

A descriptive cross-sectional online survey was conducted by Kalaimani et al. (2023) amongst dentists and dental students in South India. From the total sample size of 1000 respondents, more than half of the respondents demonstrated good knowledge and awareness towards AI (63.5%, n = 635), while the remaining students were unaware of AI (36.5%, n = 365) (p = .00). However, specific knowledge about the types of large language model (LLM), such as GPT3 was limited, with 46.9% (n = 469) of respondents reporting poor understanding. Similarly, a study among 220 registered nurses at three government hospital in Saudi Arabia revealed that most of the respondent exhibited good fundamental knowledge of AI terminology (70.9%, n = 156) and aware of its application in the clinical field (67.3%, n = 148) (Alruwaili et al., 2024). A research by Swed et al. (2022) further supported these findings in a study among 1494 medical students and doctors in Syria, where 70% (n = 1,055) portrayed a good understanding of the fundamental concepts of AI and the application of its subtypes, including deep learning (DL) and machine learning (ML), with a mean knowledge score of 1.82 (SD = 1.83). However, knowledge of the application of AI in medicine was notably lower (23.7%, n = 357) and only a minority had sufficient understanding of AI subtypes such as deep learning and machine learning (34.7%, n = 523). Moreover, a study among 762 medical students in Sudan reported high levels of fundamental understanding of AI (84.3%, n = 642) but limited knowledge of AI subtypes, including ML and DL (32.7%, n = 249) (Amin et al., 2024).

On the contrary, some research revealed moderate to low levels of AI knowledge (Allam et al., 2023; Daher et al., 2024; Hasan et al., 2024; Khaled & Elborai, 2024; Wang et

al., 2024). Daher et al. (2024) found that among 365 medical students in Lebanon, 45.8% (n = 167) reported poor knowledge towards concepts of AI, the way AI systems are trained (50.2%, n = 183), and the application of AI in healthcare delivery (33.7%, n = 123). On the other hand, a study among 222 nursing students at Ain Shams University appears to show a moderate level of knowledge in regards to the requirement to teach about AI in the undergraduate program (90.9%, n = 202) and awareness of AI through the news, posters and social media (84.7%, n = 188) (Khaled & Elborai, 2024).

In addition, a study by Hasan et al. (2024) presented an overall moderate knowledge towards AI among 875 faculty members and pharmacy students in six nations in the Middle East, with a mean value of 42.3 (*SD* = 21.8) out of 100. Most respondents lacked understanding of the basic computational foundations of AI (41.7%, n = 365), with no notable dissimilarities between the faculty members and students. Meanwhile, Wang et al. (2024) revealed that minority of the undergraduate nursing students (35.1%, n = 119) and postgraduate nursing students (30.4%, n = 31) showed a complete or nearly complete understanding of AI, and only 19.3% (n = 65) revealed a complete or nearly complete understanding of the application of AI in nursing. Likewise, a study by Allam et al. (2023) indicated that among 4492 participants, most of the participants (87.1%, n = 3914) exhibited a low knowledge level towards AI.

The collective findings of all the research suggest that the level of knowledge towards AI varies significantly across contexts. The study also discovered that a positive understanding is frequently associated with exposure to pertinent information, continuous education such as attending discussion forums and conferences, and professional

networking. Therefore, it is crucial to incorporate AI-related terminology and its applications into nursing curricula for nursing students and continuous nursing education (CNE) for registered nurses, which can also be applied to other healthcare professionals to enhance their understanding and implementation of AI in healthcare. Apart from that, poor understanding of AI is usually related to inadequate knowledge, exposure and awareness, poor training in healthcare and no introduction to AI courses in nursing curricula, highlighting the need for systematic efforts to address these gaps.

2.3 Attitude towards Artificial Intelligence (AI) in Healthcare

A cross-sectional multicentre research conducted by Lukić et al. (2023) amongst 336 first-year nursing students at four universities in Croatia found that out of a total score of 100, the mean average student's mark on the attitude scale towards AI was 64.5 (*SD* = 11.7). The score was higher than the baseline value of 60 ($p < .001$). This result indicated an overall positive attitude towards AI among nursing students. Similarly, Qin et al. (2024) revealed that among 53 medical students at Quest International University, Perak, 90.6% (n = 48) portrayed positive attitudes towards AI regarding its importance in the medical area, the inclusion of AI in the medical school program and specialist training (83.0%, n = 44), and the implementation of AI in early diagnosis and assessment of the disease severity (75.5%, n = 40). Besides, a cross-sectional study among 470 medical students also portrayed a positive attitude towards AI, where the majority agreed to include AI in the medical program (76.7%, n = 237) and acknowledged the importance of AI in radiology (78.3%, n = 368) (Ahmed et al., 2022).

Furthermore, a cross-sectional research by Alghamdi and Alashban (2023) among 129 male radiologists in Saudi Arabia reported a positive attitude towards AI, where 34.1% (n = 44) acknowledged the development of the purpose of AI in radiology, the importance of AI in radiology (37.2%, n = 48) and application of AI to improve the patient's experience (34.1%, n = 44). However, many respondents believe that it would be time-consuming for AI to influence the role of radiologists (38.0%, n = 49). Another study by Hadithy et al. (2023) similarly noted positive attitudes among 61.1% (n = 135) of 221 medical students, who perceived AI would reduce the employment opportunities for doctors (61.1%, n = 135).

Contrarily, some studies revealed negative attitudes on AI (Boillat et al., 2022; Brandes et al., 2020; Daher et al., 2024; Dahmash et al., 2020; El-Maksoud, 2024; Qin et al., 2024). For instance, research by Daher et al. (2024) showed that among 365 medical students in Lebanon, 75.3% (n = 275) of respondents do not agree with the notion that AI would replace doctors in the future. Similarly, Qin et al. (2024) also portrayed negative attitudes towards AI, where 69.8% (n = 37) disagreed that AI will potentially replace doctors in the future. Another study by El-Maksoud (2024) revealed a similar negative attitude towards AI among nursing students from the Nursing College at King Khalid University, Saudi Arabia. From a total sample size of 220 nursing students, 21.8% (n = 48) of the respondents doubt that AI helps in diagnosing and assessing patients, its ability to take over the nurses' job (30.0%, n = 66) and the respondents also do not agree on the reliability of AI in healthcare (29.1%, n = 64).

In addition, Boillat et al. (2022) showed that the medical students perceived the utilisation of AI in healthcare enhanced the threats for both the healthcare professionals and the patients. Similarly, out of 101 participants, more than half of the medical students (52.5%) reported that they perceived that AI represented a danger to the radiology employment market (Brandes et al., 2020). Meanwhile, research by Dahmash et al. (2020) revealed that most of the participants (58.8%) were sceptical of the influence of AI in radiology, and their opinions of radiology as a career were negatively impacted by worries that AI could supplant radiologists in the future.

In short, most studies suggest that most healthcare students and professionals exhibit positive attitudes towards AI. The study also discovered that a positive attitude is closely

related to their knowledge of AI itself, perception towards the usefulness of AI and the contribution of implementing AI in healthcare. For instance, studies among healthcare workers worldwide suggest that knowledge of AI promotes acceptance and implementation in clinical practice. However, a negative attitude towards AI arises from the perceived usefulness of AI and the perception that AI has the potential to replace healthcare workers' roles. Thus, it is significant to conduct further research and education on AI, addressing the healthcare workers' concerns and the possible advantages of AI in the healthcare industry, as further understanding of AI can clarify misconceptions about its impact on their roles and influence a healthcare worker's attitude toward AI in healthcare.

2.4 Relationship between Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare

Several researchers have examined the relationship between knowledge and attitude towards AI in healthcare (Coakley et al., 2022; Elsayed & Sleem, 2021; Hasan et al., 2024; Khaled & Elborai, 2024; Mariano et al., 2025; Sheela, 2022). A study by Khaled and Elborai (2024) among 222 nursing students at Aim Sham University identified a strong positive association between the two variables, which are the nursing students' total knowledge towards AI and their total attitudes of AI ($r = 0.64$, $p < .01$). The researchers believe that this outcome might result from the evolution of AI, which has altered the technology and society's perspective, and necessitates updates in education to match these advancements. Similarly, a study by Elsayed and Sleem (2021) among 130 nurse managers at Mansoura University Hospitals found a strong positive correlation between nurse managers' attitudes and perceptions on the use of AI in nursing practices, further emphasising the impact of knowledge on the attitude toward AI in healthcare settings.

Besides, research among 189 nursing students from several selected nursing colleges in Bangalore, India, also revealed that nursing students with sufficient knowledge of AI and whose primary sources were self-taught demonstrated a positive attitude towards incorporating AI in healthcare (Sheela, 2022). Other than that, a study by Hasan et al. (2024) reported a positive correlation between knowledge of AI and attitudes towards AI among 875 faculty members and pharmacy students ($r = 0.824$, $p < .001$). This indicates that raising the awareness and understanding of AI may lead to greater adoption and acceptance of AI devices in pharmacy settings.

Additionally, Mariano et al. (2025) found a statistically significant positive correlation of $r_s(349) = .451$, $p < .001$, with high levels of knowledge associated with higher levels of attitude. This implies that people with a greater comprehension of AI are inclined to possess more positive attitudes regarding its applications and utilisation. The results highlight the importance of educating individuals and assisting them to understand the principles of AI in order to promote positive attitudes and behaviours.

In contrast, a study by Coakley et al. (2022) showed a weaker correlation between radiographers' familiarity with AI and their perception of AI among 96 radiographers in Europe ($r = 0.363$, $p < .001$).

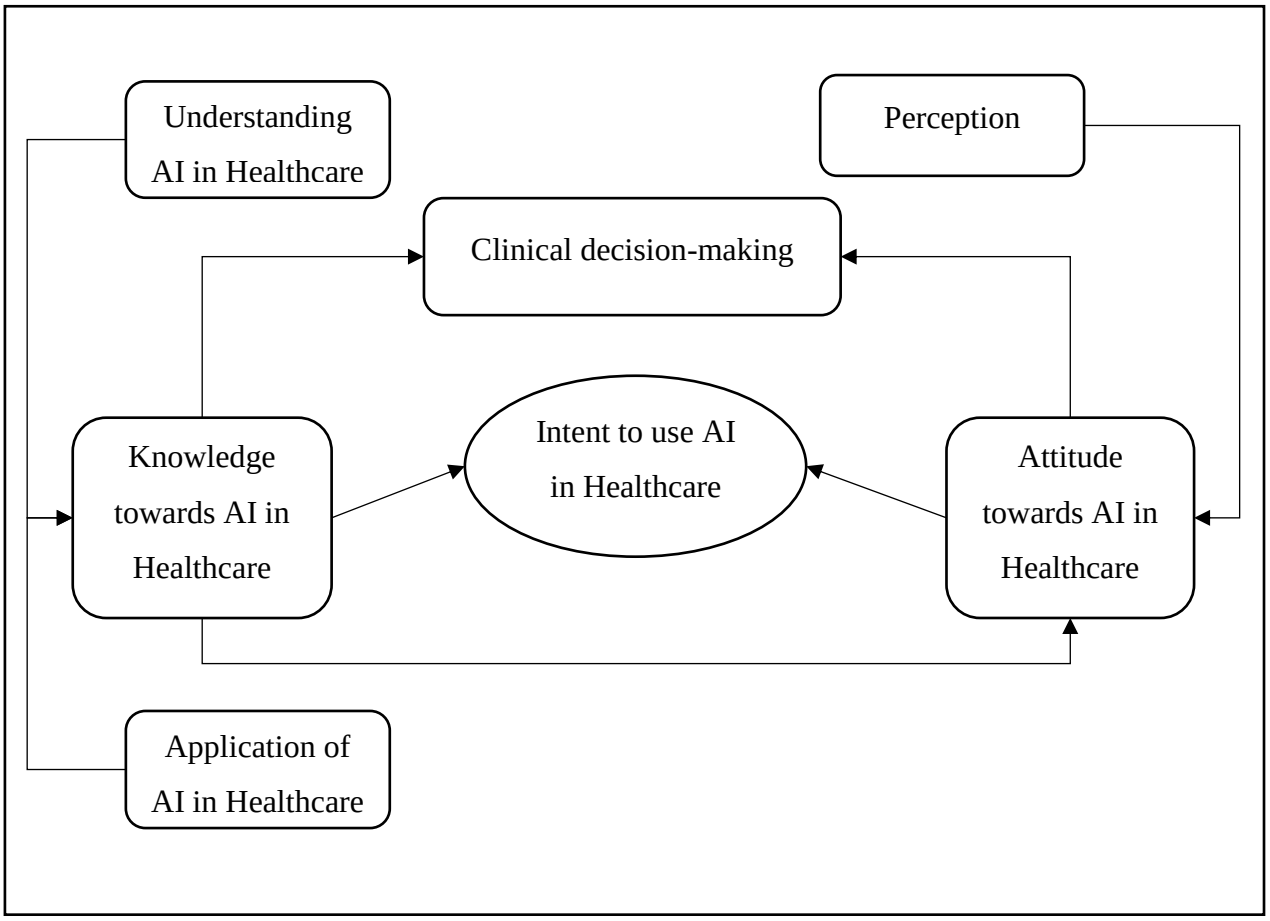
To put it briefly, there are relatively few studies that focus on the correlation between knowledge and attitude towards AI in healthcare among undergraduate nursing students, both in Malaysia and globally. Existing researches tend to focus on particular healthcare professionals, such as dentists, radiologists and pharmacists, or countries, providing a minimal focus on the nursing students in Malaysia. Hence, this research is conducted to fill in the gap to ensure that more research will be accessible to compare the findings and contribute to the body of literature in the future. Therefore, in order for the researcher to compare the results regarding the correlation between knowledge and attitude towards AI in future studies, it is essential that this study be conducted in Malaysia, especially in UNIMAS, Sarawak. By doing so, it strives to deliver a more comprehensive understanding.

2.5 Conceptual Framework

In quantitative studies, Imenda (2014) stated that a conceptual framework combines several associated concepts to provide a more comprehensive knowledge of a research problem, phenomenon of interest, or an explanation or prediction of a particular event. The dependent as well as independent variables from the study topic, the moderator variables, and every additional variable which is quantified in the research questions and hypotheses should be included in the elemental structure of the conceptual framework. Therefore, this framework will be utilised in this study, which will be adapted from a study by Choudhury (2022) (see Figure 2.1).

Figure 2. 1

Conceptual Framework for the Knowledge and Attitude towards AI in Healthcare among UNIMAS Undergraduate Nursing Students, adapted from Choudhury (2022)



2.6 Summary

This chapter presents a literature review related to the knowledge and attitude towards AI among healthcare professionals and trainees. The comprehensive range of research conducted between 2019 and 2024 provides a wide range of perspectives on the level of knowledge and attitude towards AI in various countries around the world.

Despite numerous studies that have been conducted globally among diverse healthcare professionals and trainees, there is relatively little research conducted in Malaysia, especially in Sarawak, that focuses on the knowledge and attitudes on AI in healthcare among undergraduate nursing students. Hence, it is essential to conduct this research to investigate the knowledge and attitude towards Artificial Intelligence (AI) in healthcare among UNIMAS undergraduate nursing students.

The following chapter will outline the methodology for analysing the data and accomplishing the research objective of the study, including the research design, research setting, population, sampling method, sampling size, inclusion and exclusion criteria, research instrument, ethical considerations, pilot study, data collection procedure, and data analysis.

CHAPTER 3

METHODOLOGY

3.0 Introduction

This research aims to investigate the knowledge and attitude towards artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students. This chapter will outline the methodology that will be applied to analyse the data and accomplish the research objective of the study. This chapter is divided into several subheadings, including research design in Section 3.1, research setting in Section 3.2, inclusion and exclusion criteria in Section 3.3, sampling method and sampling size in Section 3.4, research instrument in Section 3.5, ethical consideration in Section 3.6, data collection procedure in Section 3.7, data analysis in Section 3.8, and summary in Section 3.9.

3.1 Research Design

Quantitative descriptive cross-sectional methodology was utilised to conduct this study. Quantitative research refers to the procedure of gathering and analysing measurable data. This method can be applied to evaluate causal associations, make predictions, identify trends and averages, and generalise findings to broader populations (Bhandari, 2020). Meanwhile, cross-sectional studies refer to observational studies that analyse data from a population at a specific period. A cross-sectional study was used to conduct this study because it does not track people over time, is simple to perform and are beneficial in establishing preliminary evidence for organising more in-depth research in the future (Wang & Cheng, 2020).

3.2 Research Setting

To fulfil the target population criteria, this study was carried out at the Faculty of Medicine and Health Sciences (FMHS) at the University Malaysia Sarawak (UNIMAS) in Kota Samarahan, Sarawak, Malaysia. Currently, the faculty enrols students who are studying in medicine and nursing programs. The faculty offers a four-year program for the Bachelor of Nursing with Honours and a five-year program for the Doctor of Medicine. The study's target interest group was first-year to fourth-year undergraduate nursing students at UNIMAS. The faculty was designated as the research site as it is where lectures on nursing theory and clinical skills were conducted.

3.3 Population

Currently, the FMHS offers two undergraduate programs, including a Bachelor of Nursing with Honours and a Doctor of Medicine. However, in this study, students in the Bachelor of Nursing program from Year 1 to Year 4 were the main focus and population of this research. Respondents in this research was chosen from among the students in the nursing program. There are currently 238 nursing students registered in the Bachelor of Nursing program, comprising 52 first-year students, 64 second-year students, 58 third-year students and 64 fourth-year students. After excluding the post-registration nursing students and the main researcher, the total population were 234 nursing students, encompassing 51 first-year students, 63 second-year students, 57 third-year students and 63 fourth-year students.

3.4 Sampling

3.4.1 Sampling Method

Sampling is a process whereby investigators select a predefined amount of information from a wider population of interest for study purposes (Tuovila, 2020). The sampling method utilised to select participants for this study was simple random sampling, which was categorised under probability sampling. Simple random sampling encompasses choosing participants from a population at random. According to the method, every member of the population would be given a number, and a random subset of numbers would then be chosen from each member (Russel et al., 2021). Every participant in a population has a precisely equal probability of getting chosen. This approach was used to select participants for this study because it was the simplest among every probability sampling technique. Besides, it only needs a single random pick and a fundamental comprehensive understanding of the population. Any research involving this sampling method should have high internal and external validity and be less vulnerable to research biases, including sampling and selection bias because this method employs randomisation (Thomas, 2023).

This study sample involves undergraduate nursing students from Year 1 to Year 4 in the FMHS, UNIMAS. The total number of undergraduate nursing students in UNIMAS was 234, and the list of the total students was obtained from the FMHS academic office.

The number list of the total students was created and randomised by using Microsoft Excel. Firstly, the students were listed from number 1 to 234. The randomisation process

started by choosing the cell in which the researcher plans to generate the random number. Then, enter the formula "=RAND()" in the first cell below the heading row. Next, press the "Enter" key to generate a random number in the cell. After the randomised numbers were generated, the numbers were organised in an ascending order. Out of 234 students, the first 17 students were picked for a pilot study, and the remaining 163 out of 217 students was selected for the actual study.

3.4.2 Sample Size

The Taro Yamane formula was utilised to decide and calculate the sample size (Yamane, 1973). The sample size calculation for this study was based on the total number of undergraduate nursing students in FMHS, UNIMAS, Sarawak, N=234.

Figure 3. 1

Taro Yamane Sample Size Calculation for Actual Study

Taro Yamane formula:

$$n = \frac{N}{1 + N(e)^2}$$

N = The population size

n = The sample size

e = The acceptable sampling error

*95% confidence level and p = 0.05%

Calculation:

$$n = \frac{234}{1 + 234(0.05)^2}$$

= 148 participants

Based on the calculation, the study required a sample size of 148 participants. In order to take into account participants who were unreachable, an additional 10% non-response rate was included in the sample size. In addition to a 10% non-response rate, which was 15 extra participants, the final total sample size for this actual research was 163 participants. A 10% non-response rate was added to compensate those who refused to

participate in this study.

Calculation of sample size with non-response rate

Final sample size = Sample size + (sample size x 10% non-response rate)

= 148 + (148 x 10%)

= 148 + 14.8

= 162.8

= 163 participants

Calculation of pilot study

Pilot study = 10% x total sample size

=10% x 163

=16.3

=17 participants

Therefore, a total sample size of 163 participants was required to achieve the research aim and objectives. The pilot study involved 17 participants in the initial research phase. 10% of the total sample size, which was 163 participants, was calculated to find the total number of participants required for the pilot study.

3.4.3 Inclusion Criteria

The inclusion criteria for this research comprised undergraduate nursing students from the first year through the fourth year of UNIMAS who registered in the nursing programme. This is because undergraduate nursing students were the most likely group to be associated with the researcher's field of study. The students were also designated as participants based on their voluntary participation in the study. Both female and male students have equal opportunities to be involved in this research.

3.4.4 Exclusion Criteria

The exclusion criteria for this research consist of students who were unwilling or refused consent to be involved in the study because, in ethical consideration, involvement in this research is solely voluntary, and participants have the right to refuse. Besides, postgraduate and post-registration nursing students were also excluded since they have greater expertise and experience in the field of study. Hence, the answers provided could bias the results of the study. Moreover, students who were selected for the pilot study were all excluded from this study because they have already participated in answering the questionnaire, the results acquired from the participants in the pilot study may skew the findings of the main study.

3.5 Research Instrument

The questionnaire for this study was divided into three sections, which were categorised as Section A, Section B, and Section C (see Appendix F). Prior to the questionnaire being reused for this study, or modified and added to better fit the current study, consent was sought from the original author.

Section A presented questions regarding the participants' socio-demographic information, including age, gender, and academic year.

On the other hand, section B focused on the knowledge level towards AI in healthcare by using the modified Scale of Artificial Intelligence Literacy for All (SAIL4ALL) tool, which was initially developed by Soto-Sanfiel et al. (2024), with an initial total of 131 items across 13 competencies, each of which was contained within four areas of themes. Following several analyses and tests, the questionnaire was reduced to 52 items across four subscales, including “What is AI?”, “What can AI do?”, “How does AI work?” and “How should AI be used?”. The subscale “What is AI?” is about recognising AI, understanding intelligence, and being interdisciplinary. Meanwhile, “What can AI do?” is about the ability of AI, “How does AI work?” is about the functions of AI, and “How should AI be used?” is about the way AI can be utilised.

The questionnaire then was reduced again to 20 items across two subscales “What is AI?” and “How should AI be used?” and the subscale was modified to “Understanding AI in Healthcare” and “Application of AI in Healthcare” to fit the researcher’s field of study.

Each subscale consists of 10 items.

This scale was quantified using a 5-point Likert scale of 1 (false with high confidence), 2 (false with moderate confidence), 3 (unsure), 4 (true with moderate confidence), and 5 (true with high confidence). Both subscales, “Understanding AI in Healthcare” and “Application of AI in Healthcare,” presented good structural validity and internal consistency, with the values of Cronbach's alpha of 0.82 and 0.88, respectively (Soto-Sanfiel et al.,2024).

The overall score for knowledge level ranged from 20 to 100. The overall level of knowledge was categorised using the visual binning feature via SPSS, using two cut-off points. Respondents scoring between 80-100 were classified as having good knowledge. Meanwhile, those scoring between 75-79 were considered moderate knowledge, and those scoring between 20-74 were categorised as having poor knowledge.

Finally, in section C, the modified General Attitudes Towards Artificial Intelligence Scale (GAAIS) was utilised in order to assess the attitude of AI in healthcare among UNIMAS undergraduate nursing students. The questionnaire was initially developed by Schepman and Rodway (2022). This scale was a multidimensional tool comprised of 20 items and was employed by using a 5-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree, to analyse responses. This scale showed good internal consistency, with Cronbach alpha values of 0.88 for Positive GAAIS (12 items) and 0.82 for Negative GAAIS (8 items) (Schepman & Rodway, 2022). Likewise, GAIIS also displayed good convergent and divergent validity with a related scale (Schepman & Rodway, 2020, 2022).

The overall score of attitudes ranged from 20 to 100. The level of attitude was categorised into three groups: positive, neutral, and negative, using visual binning features via SPSS with two cut-off points. Respondents scoring between 72-100 were classified as positive attitudes. Meanwhile, those scoring between 66-71 were considered neutral attitudes, and those scoring between 20-65 were categorised as negative attitudes.

Formal authorisation was granted from the corresponding authors of both scales for their utilisation, thus guaranteeing compliance with copyright regulations. Table 3.1 shows the Cronbach's alpha for the reliability of the questionnaire for the past study and the pilot study.

Table 3. 1

Cronbach's Alpha for Reliability of Questionnaire

Questionnaire	Subscale	No of items	Cronbach's alpha (α)	
			Past study	Pilot study
SAIL4ALL	"Understanding AI in Healthcare"	10	.82	.82
	"Application of AI in Healthcare"	10	.88	.92
GAAIS	Positive GAAIS	12	.88	.89
	Negative GAAIS	8	.82	.90

3.6 Ethical Consideration

Ethical approval for this study was obtained from the Research Ethics Committee of FMHS, UNIMAS, as per the approval letter dated 24th of February 2025, with reference number UNIMAS/NC-21.05/03-03 Jld. 8(145) (see Appendix A). The respondents' voluntary participation in completing the questionnaire was acquired. Prior to employing questionnaires for this study, permission to use, modify and adapt the questionnaires was sent to the original authors via email (see Appendix E). Formal authorisation was granted from the corresponding authors of both scales for their utilisation, thus guaranteeing compliance with copyright regulations. The Participant Information Sheet (PIS) was distributed to the respondents to read through before agreeing and signing the informed consent (see Appendix C and D). The PIS included an overview of the research, research objectives, and explanations concerning the anonymity and confidentiality of the data collection. Respondents were informed that involvement in this research is solely voluntary, and the respondents have the right to decide whether to refuse or withdraw from this study for any reason at any time. Every data collection, including the privacy and anonymity of the respondents, was safeguarded and stored on password-protected devices and remained undisclosed. The data evaluation was only conducted by the researcher and supervisor.

3.7 Pilot Study

A pilot study was conducted prior to the actual research. The pilot study was usually conducted on a smaller scale. The initial phase of the overall research etiquette aids in modifying and planning the actual study and highlighting the obstacles and study limitations (In, 2017). The pilot study evaluated the questionnaire's validity and assisted the researcher in clearly defining the specific research objectives and questions. The researcher acquired the respondents' feedback on the clarity of questionnaires for potential improvement and modification. To ensure the clarity of questionnaires, amendments were made, such as modifying response scales and rephrasing the items. Besides, logistical concerns, including the time required to complete the questionnaire, were managed by improving the questionnaire distribution processes. The respondent's input from the pilot study also guided the finalisation of research instruments to guarantee reliability and validity. The pilot study was essential to improve the effectiveness and calibre of the main research.

The duration to perform the pilot study was around March 2025. 10% out of the total sample size (n= 163) was taken as a pilot study, which was 17 participants. Seventeen students who meet the inclusion criteria were randomly chosen for the pilot study. The nursing students who were involved in the pilot study were omitted from the actual research. The internal consistency reliability of the questionnaire was determined by analysing the collected data from the pilot study. This reliability measured the degree of interrelatedness between a group of items (Middleton, 2019). Cronbach's Alpha was employed to assess the instruments' reliability and values greater than 0.7 were regarded to indicate acceptable reliability (Taber, 2018).

The data obtained from the pilot study were keyed in and interpreted on a personal

laptop by utilising the Statistical Package for Social Sciences (SPSS) version 27 to measure the reliability and validity of the research tools. The reliability test was conducted in two sections: section B (SAIL4ALL) and section C (GAAIS). Section B (SAIL4ALL) subscales "Understanding AI in Healthcare" and "Application of AI in Healthcare" presented good structural validity and internal consistency with the value of Cronbach's alpha of 0.82 and 0.88, respectively (Soto-Sanfiel et al., 2024). Meanwhile, GAIIS showed good internal consistency, with the value of Cronbach's alpha of 0.88 for Positive GAAIS (12 items) and 0.82 for Negative GAAIS (8 items) (Schepman & Rodway, 2022). After confirmation of the reliability of the questionnaire in the pilot study, the new Cronbach's alpha values were obtained from the SPSS after the pilot study.

Face validity was carried out for both research instruments in sections B (SAIL4ALL) and C (GAAIS). Face validity was used because it is a straightforward initial way to measure the overall validity of the research tools. Besides, face validity was also a simple, fast and relatively intuitive approach to determine whether the tools appear to be beneficial at first glance (Bhandari, 2022). Both research tools were relevant and suitable for the objectives of this study, and appropriate to the participants. For section B, SAIL4ALL was measured using a 5-point Likert scale of 1 (false with high confidence), 2 (false with moderate confidence), 3 (unsure), 4 (true with moderate confidence), and 5 (true with high confidence). Both subscales, "Understanding AI in Healthcare" and "Application of AI in Healthcare", presented good structural validity (Soto-Sanfiel et al., 2024). Meanwhile, GAAIS was also employed by using a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree, to analyse responses and displayed good convergent and divergent validity with a related scale (Schepman & Rodway, 2020, 2022).

3.7.1 Reliability Analysis

An analysis of the reliability of the data was conducted using Cronbach's Alpha. According to Taber (2018), values greater than 0.7 are regarded as indicating acceptable reliability. Table 3.2 revealed that the Cronbach's coefficient value exceeds 0.70 for all variables. Hence, the results confirmed consistency in the development of all variables. The reliability for knowledge towards Artificial Intelligence (AI) in healthcare scale is found to be acceptable (20 items; α = .778). Meanwhile, the reliability for attitude towards Artificial Intelligence (AI) in healthcare is found to be acceptable (20 items; α = .754).

Table 3. 2

Cronbach's Alpha of Knowledge and Attitude Towards Artificial Intelligence (AI) in Healthcare (n=163)

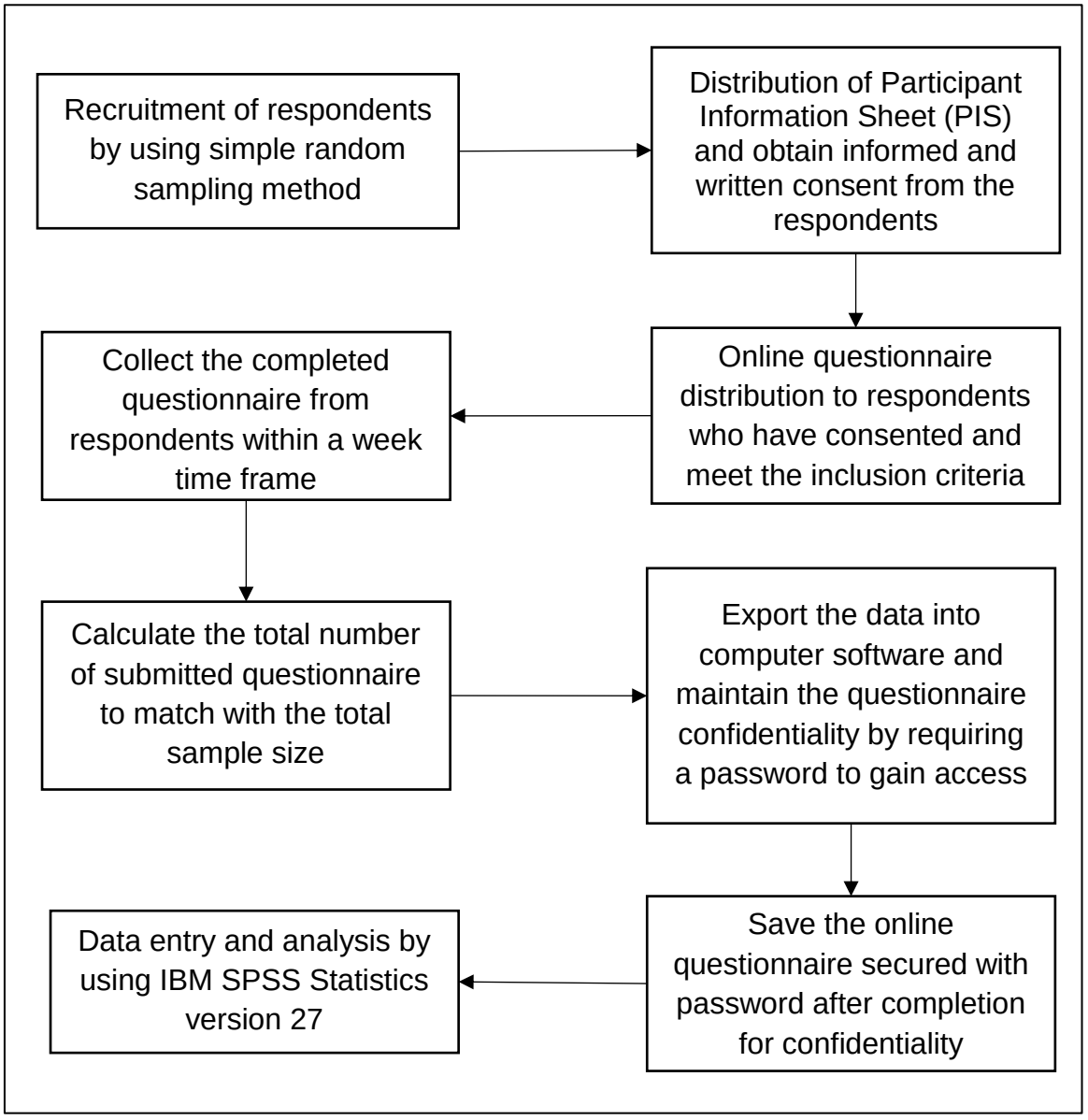
Variables	No. of items	Cronbach's Alpha (α)
Knowledge towards AI in healthcare	20	.778
Attitude towards AI in healthcare	20	.754

3.8 Data Collection Procedure

Data collection began following authorisation from the FMHS Research Ethics Committee, UNIMAS. Respondents were recruited according to the inclusion and exclusion criteria. Respondents under the inclusion criteria were given explanations and details of the research objectives, and written consent was acquired from the respondents through the respondents' informed consent. The questionnaires were modified and written in English. The questionnaires were dispensed to the respondents through a Google Form link and collected after they completed the survey. Figure 3.2 shows the data collection procedure from recruiting respondents until data entry and analysis.

Figure 3. 2

Data Collection Procedure



3.9 Data Analysis

The data were analysed using IBM SPSS version 27. The acquired data were cleansed and processed based on the research objectives. Descriptive and inferential statistical approaches were employed to analyse the results.

In descriptive statistical analysis, the results were presented in the form of mean, percentage, frequency and frequency distribution. These included the socio-demographic data, knowledge level and attitude on AI in healthcare of the participants. Normality tests were conducted using the Kolmogorov-Smirnov (KS) test, as the sample size exceeded 50. The results were displayed in the form of mean and standard deviation for normally distributed continuous data, where $p > 0.05$. Meanwhile, non-normally distributed and continuous data were presented in the form of median and interquartile range, where $p < 0.05$. Furthermore, categorical data were presented in the form of frequency, percentage and frequency distribution.

The statistical difference and relationship between the knowledge and attitude towards AI in healthcare amongst the respondents were analysed using inferential statistics. A normality test was conducted to observe the data distribution and determine the suitable inferential statistics that will be used. The Spearman correlation coefficient test, a non-parametric test, will be applied when the data shows a significant departure from normality. Whereas the Pearson correlation test, a parametric approach, will be utilised when the data showed a significant normal distribution.

The result of the data revealed a *p*-value less than 0.05, which indicated the data were not normally distributed. The relationship between knowledge and attitude on Artificial Intelligence (AI) in healthcare among UNIMAS undergraduate nursing students were analysed by using Spearman rho correlation coefficient.

3.10 Summary

This chapter provided a comprehensive description of the methodology used to assess the level of knowledge and attitude towards AI among UNIMAS undergraduate nursing students. The study employed a descriptive cross-sectional quantitative research design. This research was conducted at the Faculty of Medicine and Health Sciences, UNIMAS. This study involved a total of 163 undergraduate nursing students as respondents. A three-section self-administered questionnaire makes up the research instrument. Data collection began following ethical approval. The data that has been collected was measured and analysed by utilising both descriptive and inferential statistics through IBM SPSS version 27. Spearman's correlation test was utilised to evaluate the relationship between the knowledge and attitude towards AI among UNIMAS undergraduate nursing students.

CHAPTER 4

RESULTS

4.0 Introduction

This section presents the study's findings regarding knowledge and attitude towards Artificial Intelligence (AI) in healthcare among 163 UNIMAS undergraduate nursing students. A total of 163 questionnaires were disseminated through an online survey. Therefore, all 163 questionnaires were returned, achieving a 100% response rate. All of the data were cleaned, and there was no missing data. The results for the respondents' sociodemographic characteristics and their level of knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students are presented in this chapter. This chapter also covers the relationship between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students.

4.1 Socio-demographic Variables of UNIMAS Undergraduate Nursing Students

4.1.1 Age

A total of 163 undergraduate nursing students in FMHS UNIMAS were recruited. There are no outliers and no extreme values noted from the box plot for age. The skewness value for age is .305, which is within ±1. Therefore, the data can be assumed to be symmetrical. Likewise, the kurtosis value for age is within ±1 with the value of -.433. Hence, the data can be assumed to be mesokurtic.

According to Hatem et al. (2022), there is no universal guideline for determining values that indicate normality, despite the frequent use of skewness and kurtosis in practice. Furthermore, the assumption of normality was invalidated due to the presence of significant skewness and kurtosis. To prevent misinterpretations, a normality assessment through visual representation requires a tremendous degree of experience. Therefore, it is advisable to assess normality using numerical approaches if one lacks proficiency (Mishra et al., 2019). A confirmatory test of normality is performed using a statistical method, specifically the Kolmogorov-Smirnov test.

A Kolmogorov-Smirnov test showed a significant departure from normality, $D(163) = .173$, $p < .001$. The median age among the participants is 22 years old (*IQR* = 2 years old). The maximum age is 26 years old, while the minimum age is 19 years old. The range is 7 years old. The mode age is 21 years old (see Figure 4.1).

Table 4. 1

Normality Test for Age

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Age (years)	.173	163	< .001

Note: a: Lilliefors Significance Correction

Table 4. 2

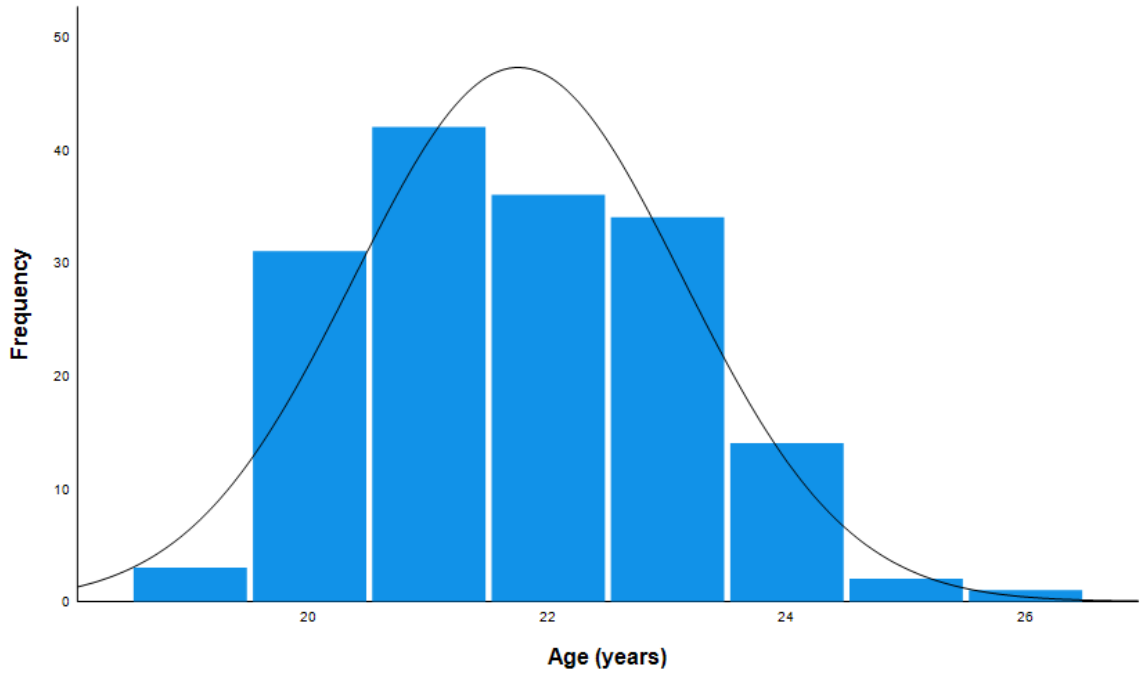
Age of UNIMAS Undergraduate Nursing Students (n = 163)

Characteristics	*Mdn*	*IQR*
Age	22	2

Note: Median (Mdn), Interquartile Range (IQR)

Figure 4. 1

Histogram of Participants by Age (n = 163)

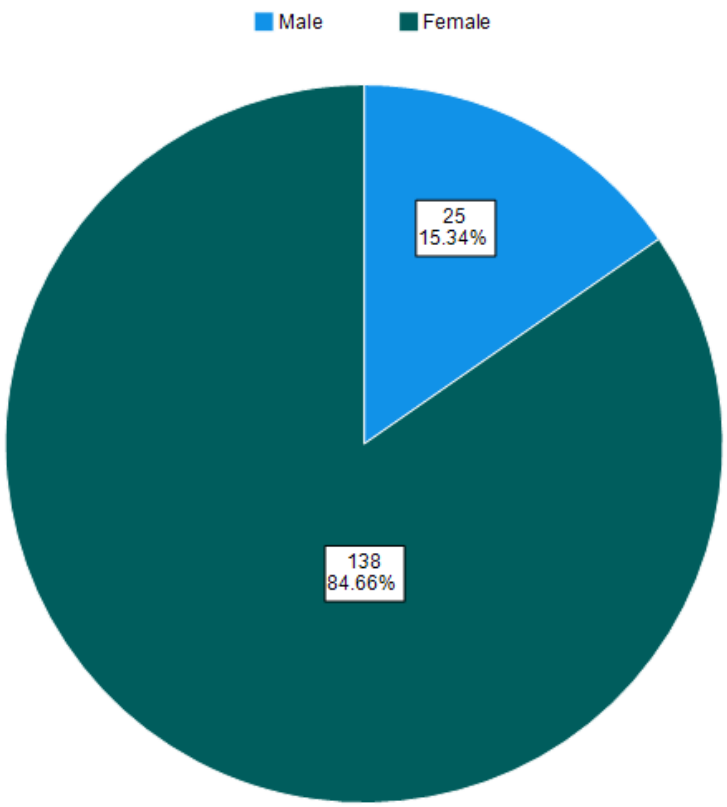


4.1.2 Gender

There are no outliers and no extreme values noted from the box plot for gender. Out of 163 participants, 25 (15.3%) were male and 138 (84.7%) of them were female (see Figure 4.2).

Figure 4. 2

Pie Chart of Participants by Gender (n = 163)



4.1.3 Academic Year

There are no outliers and no extreme values noted from the box plot for the academic year. The analysis for academic year shows an almost equal level of participation percentage, where out of 163 participants, 39 (23.9%) were Year 1 students, 42 (25.8%) were Year 2 students, 42 (25.8%) were Year 3 students, and another 40 (24.5%) were Year 4 students (see Figure 4.3).

Figure 4. 3

Pie chart of Participants by Academic Year (n = 163)

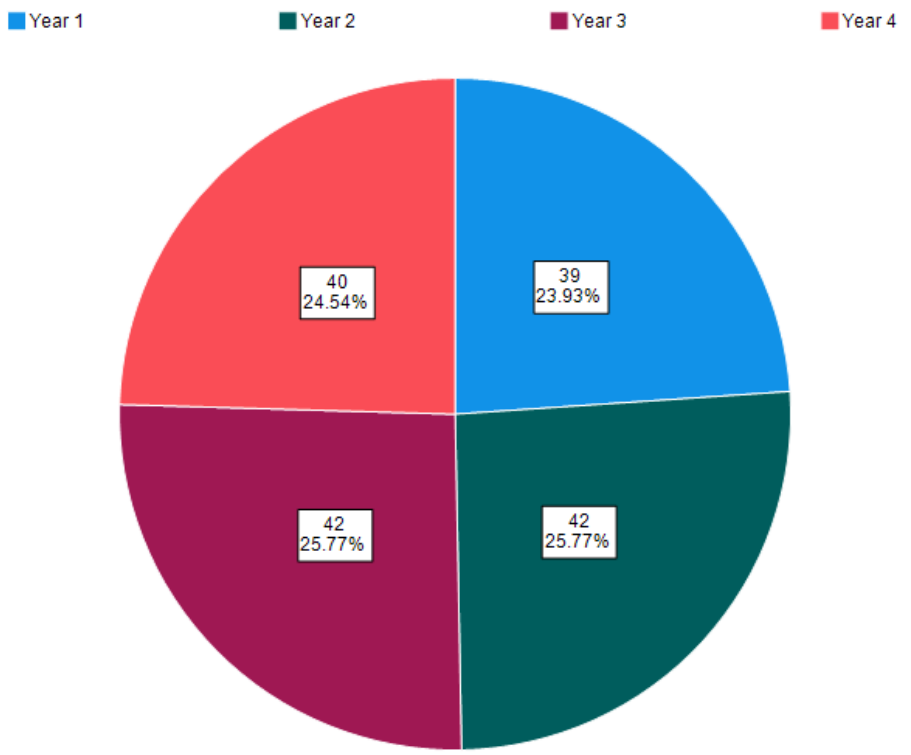


Table 4.3 shows the frequency and percentage for gender and academic year of UNIMAS undergraduate nursing students.

Table 4. 3

Gender and Academic Year of UNIMAS Undergraduate Nursing Students (n = 163)

Characteristics	*n*	*%*
Gender		
Male	25	15.3
Female	138	84.7
Academic Year		
Year 1	39	23.9
Year 2	42	25.8
Year 3	42	25.8
Year 4	40	24.5

Note: n: frequency, %: percentage

4.2 The Level of Knowledge on Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students

There are outliers noted from the box plot for the total score of knowledge towards AI in healthcare. The outliers were retained in the boxplot for the total score of knowledge to maintain the sample's integrity. The skewness value for the total knowledge score is .044, which is within ±1. Therefore, the data can be assumed to be symmetrical. Likewise, the kurtosis value for total knowledge score is within ±1, with the value of .780. Hence, the data can be assumed to be mesokurtic.

According to Hatem et al. (2022), there is no universal guideline for determining values that indicate normality, despite the frequent use of skewness and kurtosis in practice. Furthermore, the assumption of normality was invalidated due to the presence of significant skewness and kurtosis. To prevent misinterpretations, a normality assessment through visual representation requires a tremendous degree of experience. Therefore, it is advisable to assess normality using numerical approaches if one lacks proficiency (Mishra et al., 2019). A confirmatory test of normality is performed using a statistical method, specifically the Kolmogorov-Smirnov test.

A Kolmogorov-Smirnov test showed a significant departure from normality, $D(163) = .071$, $p = .041$ (see Table 4.4). The median knowledge score among the participants was 77.00 points ($IQR = 9.00$). The maximum knowledge score is 97 points, while the minimum knowledge score is 57 points. The range is 40 points. The mode knowledge score is 74 points.

Table 4. 4

Normality Test for Total Knowledge Score

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Total Knowledge Score	.071	163	.041

Note: a: Lilliefors Significance Correction

Table 4.5 displays the results of the knowledge of Artificial Intelligence (AI) in healthcare among UNIMAS undergraduate nursing students. About more than half, 65.6% (n = 107) of these participants think that AI is able to assist in diagnosing diseases via analysing medical imaging data, are true with moderate confidence, which is an accurate understanding, as AI is already used in radiology and diagnostic purposes. Only 1 participant (0.6%) rated false with high confidence that AI can assist in diagnosing diseases by analysing medical imaging data, indicating a misperception.

The majority of the participants, 66.3% (n = 108) rated true with moderate confidence that AI can be programmed to conduct a variety of tasks with accuracy and consistency, such as helping in managing hospital workflows, improving efficiency and reducing medical errors. This reflects an accurate understanding of AI's operational capabilities. Most of the participants rated true with high confidence that the development of AI in healthcare needs to be in line with human rights and values, avoiding harm to the patients 50.9% (n = 83), indicating a correct and ethically grounded position.

Besides, out of 163 participants, 81 participants (49.7%) rated true with high confidence that reliable AI systems in healthcare require constant monitoring, updates and assessments to ensure long-term safety and accuracy, which indicates the understanding of AI as an evolving technology rather than a static tool. Meanwhile, only 15 participants (9.2%) rated unsure and no participant rated false with moderate and high confidence that reliable AI systems in healthcare require constant monitoring, updates and assessments to ensure long-term safety and accuracy, indicating a low level of misconception regarding this critical safety principle.

Table 4. 5

Section B: Knowledge towards Artificial Intelligence in Healthcare. Questionnaire Adapted and Modified from Scale of Artificial Intelligence Literacy for all (SAIL4ALL) by Soto-Sanfiel et al. (2024)

Item	False with high confidence	False with moderate confidence	Unsure	True with moderate confidence	True with high confidence
	n(%)	*n(%)*	*n(%)*	*n(%)*	*n(%)*
1. AI is able to assist in diagnosing diseases via analysing medical imaging data	1(0.6)	13(8.0)	21(12.9)	107(65.6)	21(12.9)
2. AI algorithms improve the precision of detecting medical abnormalities when trained with large patient datasets.	0	8(4.9)	33(20.2)	100(61.3)	22(13.5)
3. AI is utilised to identify human speech, where voice recognition AI is used to transcribe doctor-patient interactions for medical records	1(0.6)	8(4.9)	36(22.1)	96(58.9)	22(13.5)

4. Machine learning in healthcare systems enables adaptive decision-making according to previous patient outcomes	0	10(6.1)	29(17.8)	100(61.3)	24(14.7)
5. Human intelligence is the only form of intelligence that is able to provide safe and ethical healthcare decisions	3(1.8)	22(13.5)	34(20.9)	69(42.3)	35(21.5)
6. AI technologies in healthcare can incorporate both clinical expertise and computational algorithms	0	6(3.7)	29(17.8)	103(63.2)	25(15.3)
7. AI can be programmed to conduct a variety of tasks with accuracy and consistency, such as helping in managing hospital workflows, improving efficiency and reducing medical errors	0	11(6.7)	11(6.7)	108(66.3)	33(20.2)
8. The ethics and humanities have no position in developing AI systems for healthcare	14(8.6)	23(14.1)	60(36.8)	54(33.1)	12(7.4)

9. AI is a single technology limited to particular tasks	12(7.4)	40(24.5)	26(16.0)	67(41.1)	18(11.0)
10. An interdisciplinary approach such as combining AI technology with nursing practice improve health outcomes	0	3(1.8)	26(16.0)	94(57.7)	40(24.5)
11. AI systems in healthcare should accomplish better transparency in terms of algorithms, data utilisation, and limitations to build trust with patients and healthcare professionals	0	4(2.5)	22(13.5)	106(65.0)	31(19.0)
12. AI development in healthcare must consider the ethical implications of its applications, such as patient autonomy and consent	0	4(2.5)	12(7.4)	86(52.8)	61(37.4)
13. It is essential to establish and reinforce laws and regulations such as the right to appeal, or redress for AI-driven healthcare decisions	0	2(1.2)	16(9.8)	95(58.3)	50(30.7)

14. AI systems utilised in treatment or diagnosis planning must disclose potential harm and their underlying decision-making processes	1(0.6)	4(2.5)	20(12.3)	99(60.7)	39(23.9)
15. Healthcare professionals should be responsible for the actions of AI	6(3.7)	12(7.4)	22(13.5)	69(42.3)	54(33.1)
16. AI tools in healthcare should guarantee data confidentiality and implement safeguards against unauthorised access to sensitive patient information	1(0.6)	5(3.1)	13(8.0)	77(47.2)	67(41.1)
17. The development of AI in healthcare needs to be in line with human rights and values, avoiding harm to the patients	0	1(0.6)	14(8.6)	65(39.9)	83(50.9)
18. Reliable AI systems in healthcare require constant monitoring, updates and assessments to ensure long-term safety and accuracy	0	0	15(9.2)	67(41.1)	81(49.7)

19. The AI integration in healthcare should preserve, respect and enhance patient care instead of replace the human touch in treatment	0	3(1.8)	21(12.9)	72(44.2)	67(41.1)
20. The advantages of AI in healthcare must respect potentially vulnerable patient groups, ensuring equitable access to care while fostering trust and inclusivity in nursing practices	0	1(0.6)	14(8.6)	88(54.0)	60(36.8)

Note: n: frequency, %: percentage

To describe the level of knowledge, visual binning features via SPSS were used with two cut-off points. Hence, the knowledge level was categorised into three categories: good knowledge, moderate knowledge, and poor knowledge (see Table 4.6).

Table 4. 6

Level of Knowledge

Level of Knowledge	Score Range
Poor knowledge	20-74
Moderate knowledge	75-79
Good knowledge	80-100

Figure 4.4 presents the respondents' level of knowledge towards Artificial Intelligence (AI) in healthcare. Overall, it can be concluded that 36.2% (n = 59) of the respondents have a poor knowledge level of AI in healthcare. There were 32.5% (n = 53) of the respondents who had a good level of knowledge of AI in healthcare, and only 31.3% (n = 51) of the respondents had a moderate knowledge level of AI in healthcare. The result below shows the frequency and percentage of the level of knowledge on AI in healthcare among UNIMAS undergraduate nursing students (see Table 4.7).

Figure 4. 4

Level of Knowledge on Artificial Intelligence in Healthcare Among UNIMAS Undergraduate Nursing Students (n = 163)

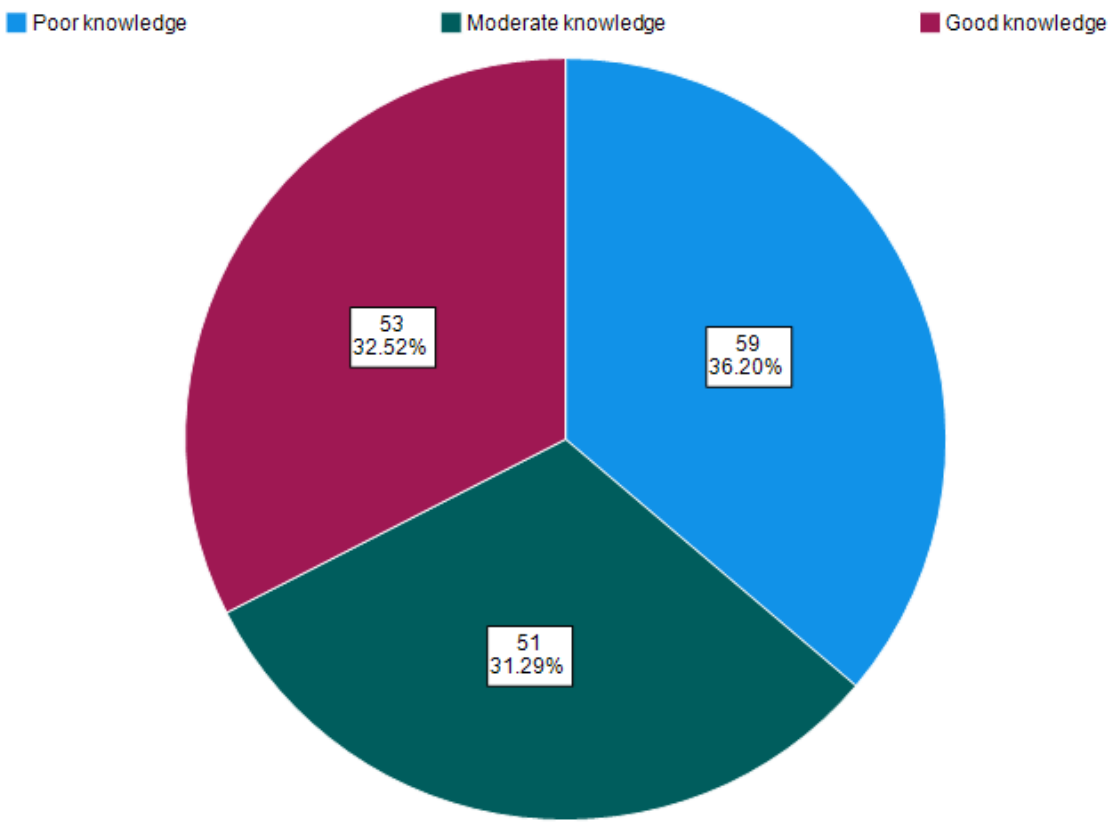


Table 4. 7

Frequency and Percentage on Knowledge Level of Artificial Intelligence in Healthcare (n = 163)

Knowledge Level	*n*	*%*
Poor knowledge	59	36.2
Moderate knowledge	51	31.3
Good knowledge	53	32.5
Total	163	100

Note: n: frequency, %: percentage

4.3 The Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students

There are outliers noted from the box plot for the total score of attitude towards AI in healthcare. The outliers were retained in the box plot for the total score of attitude to maintain the sample's integrity. The skewness value for the total attitude score is .148, which is within ±1. Therefore, the data can be assumed to be symmetrical. Likewise, the kurtosis value for the total attitude score is not within ±1, with the value of 1.484. Hence, the data can be assumed to be leptokurtic.

According to Hatem et al. (2022), there is no universal guideline for determining values that indicate normality, despite the frequent use of skewness and kurtosis in practice. Furthermore, the assumption of normality was invalidated due to the presence of significant skewness and kurtosis. To prevent misinterpretations, a normality assessment through visual representation requires a tremendous degree of experience. Therefore, it is advisable to assess normality using numerical approaches if one lacks proficiency (Mishra et al., 2019). A confirmatory test of normality is performed using a statistical method, specifically the Kolmogorov-Smirnov test.

A Kolmogorov-Smirnov test revealed a significant departure from normality, $D(163) = .080$, $p = .013$ (see Table 4.8). The median attitude score among the respondents was 67.00 points ($IQR = 9.00$). The maximum attitude score is 95 points, while the minimum attitude score is 43 points. The range is 52 points.

Table 4. 8

Normality Test for Total Attitude Score

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Total Attitude Score	.080	163	.013

Note: a: Lilliefors Significance Correction

Table 4.9 displays the results of the attitude toward Artificial Intelligence (AI) in healthcare among UNIMAS undergraduate nursing students. The majority of the respondents, 43.6% (n = 71), agreed that AI is capable of providing new opportunities for nursing professions in healthcare, indicating a positive attitude. However, 70 participants (42.9%) disagreed that the use of AI in healthcare is unethical. This response is appropriate, as it reflects an understanding that AI can be utilised responsibly in clinical settings when appropriately regulated and ethically applied.

There was a mixed perception on attitude towards AI in healthcare, where 29.4% (n = 48) agreed that AI systems outperform nurses, physicians and medical technicians in terms of efficiency, while 28.8% (n = 47) disagreed that AI systems efficiency outperforms nurses, physicians and medical technicians. This item suggests lack of clarity or varying degrees of awareness regarding the ability of AI in handling specific routine, or data-driven tasks without necessarily displacing the roles of the healthcare professionals. This statement requires intricate interpretation, as AI may outperform in specific tasks, but not in holistic clinical decision-making or empathetic care.

Contrarily, more than half of the participants 64.4% (n = 105) agreed that AI systems in healthcare can benefit the patient's health and contribute to better patient outcomes, but only 3.1% (n = 5) disagreed with the statement, indicating that most participants recognise the potential benefits of AI in healthcare sector. Furthermore, most of the participants, 62% (n = 101), agreed that there is a wide range of beneficial applications of AI in healthcare, which is a perspective that is substantiated by evidence. Meanwhile, only 6 participants (3.7%) disagreed that the application of AI in healthcare has a broad range of benefits, suggesting that misconceptions about the usefulness of AI are limited among the participants.

Table 4. 9

Section C: Attitude Towards Artificial Intelligence in Healthcare. Questionnaire Adapted and Modified from General Attitude Towards Artificial Intelligence Scale (GAAIS) by Schepman and Rodway (2020)

Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	n(%)	*n(%)*	*n(%)*	*n(%)*	*n(%)*
1. For routine administrative tasks in healthcare, I would rather utilise an artificially intelligent system rather than a human	6(3.7)	33(20.2)	60(36.8)	51(31.3)	13(8.0)
2. AI is able to provide new opportunities for nursing professions in healthcare	1(0.6)	21(12.9)	46(28.2)	71(43.6)	24(14.7)
3. The utilisation of AI in healthcare is unethical	11(6.7)	70(42.9)	61(37.4)	18(11.0)	3(1.8)
4. AI systems in healthcare can benefit the patient's health and contribute to better patient outcome	2(1.2)	5(3.1)	29(17.8)	105(64.4)	22(13.5)

5. I am fascinated by what AI can perform in healthcare	1(0.6)	3(1.8)	34(20.9)	89(54.6)	36(22.1)
6. I think AI systems in healthcare make many mistakes that might compromise patient safety	4(2.5)	19(11.7)	71(43.6)	55(33.7)	14(8.6)
7. I am interested in using artificially intelligent systems in healthcare for my daily nursing tasks	1(0.6)	10(6.1)	41(25.2)	84(51.5)	27(16.6)
8. I find AI sinister	17(10.4)	41(25.2)	80(49.1)	20(12.3)	5(3.1)
9. AI in healthcare has the ability to take control of people	13(8.0)	43(26.4)	57(35.0)	42(25.8)	8(4.9)
10. I think that utilising AI in healthcare is dangerous	10(6.1)	40(24.5)	68(41.7)	40(24.5)	5(3.1)
11. AI can have positive impacts on the patient's wellbeing	1(0.6)	7(4.3)	37(22.7)	98(60.1)	20(12.3)
12. Potential applications of AI in nursing are exciting	1(0.6)	8(4.9)	37(22.7)	93(57.1)	24(14.7)

13. An artificially intelligent agent can perform numerous routine tasks in healthcare better than a nurse or physicians	15(9.2)	42(25.8)	56(34.4)	44(27.0)	6(3.7)
14. There are a wide range of beneficial applications of AI in healthcare	1(0.6)	6(3.7)	30(18.4)	101(62.0)	25(15.3)
15. The idea of employing AI in healthcare in the future makes me uneasy	7(4.3)	39(23.9)	62(38.0)	43(26.4)	12(7.4)
16. AI systems outperform nurses, physicians and medical technicians in terms of efficiency	9(5.5)	47(28.8)	52(31.9)	48(29.4)	7(4.3)
17. Future applications of AI will be more advantageous for the healthcare professions	3(1.8)	8(4.9)	50(30.7)	84(51.5)	18(11.0)

18. I would like to utilise AI in my future work as a healthcare professional	3(1.8)	8(4.9)	52(31.9)	81(49.7)	19(11.7)
19. The growing application and adoption of AI in healthcare will negatively impact the roles and job security of nurses and physicians	10(6.1)	31(19.0)	63(38.7)	46(28.2)	13(8.0)
20. AI in healthcare is utilised to spy on the patients	34(20.9)	50(30.7)	51(31.3)	25(15.3)	3(1.8)

Note: n: frequency, %: percentage

To describe the attitude, visual binning features via SPSS were used with two cut-off points. Hence, the attitude was categorised into three categories: negative attitude, neutral attitude, and positive attitude (see Table 4.10).

Table 4. 10

Attitude

Attitude	Score Range
Negative attitude	20-65
Neutral attitude	66-71
Positive attitude	72-100

Figure 4.5 presents the respondents' attitudes towards Artificial Intelligence (AI) in healthcare. Overall, it can be concluded that the majority of the respondents have a negative attitude towards AI in healthcare (n = 58, 35.6%). There were 34.4% (n = 56) of the respondents who have a neutral attitude towards AI in healthcare and only 30.1% (n = 49) of the respondents having a positive attitude on AI in healthcare. The result below shows the frequency and percentage on attitude of AI in healthcare among UNIMAS undergraduate nursing students (see Table 4.11).

Figure 4. 5

Attitude on Artificial Intelligence in Healthcare Among UNIMAS Undergraduate Nursing Students (n = 163)

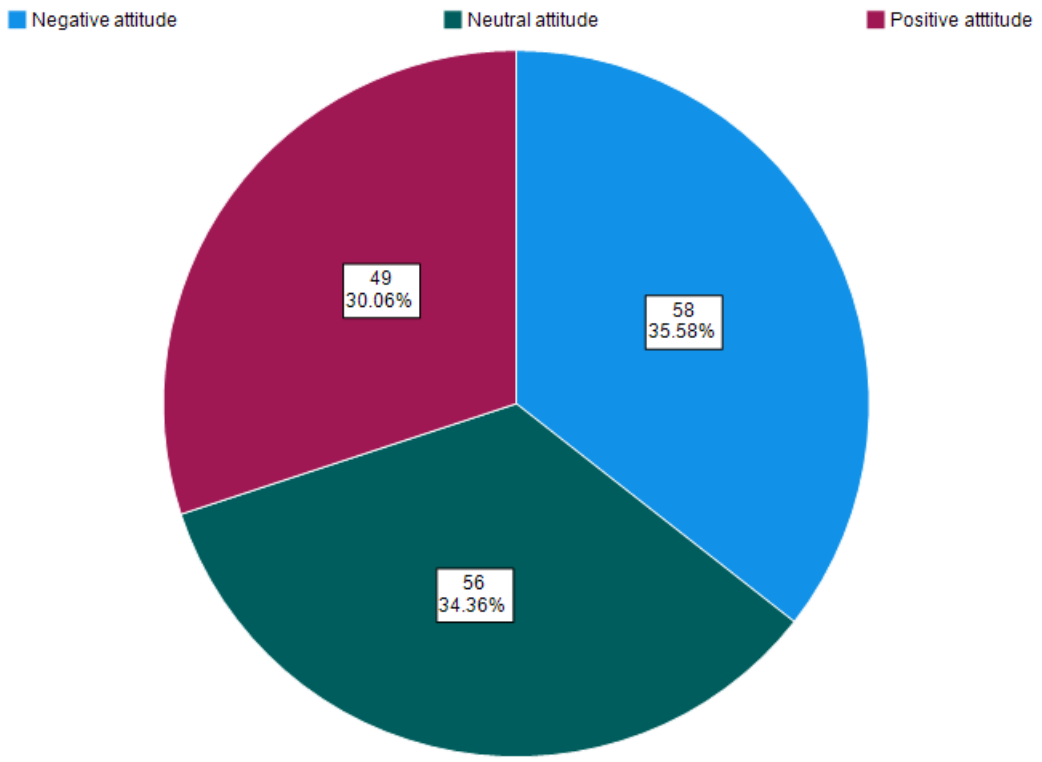


Table 4. 11

Frequency and Percentage on Attitude of Artificial Intelligence in Healthcare (n = 163)

Attitude	*n*	*%*
Negative attitude	58	35.6
Neutral attitude	56	34.4
Positive attitude	49	30.1
Total	163	100

Note: n: frequency, %: percentage

4.4 The relationship between knowledge and attitude towards artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students

The normality test showed that the data distribution for both the total knowledge score and the total attitude score were not normally distributed. Therefore, a non-parametric test was used for this test. The relationship between total knowledge score and total attitude score towards AI in healthcare was investigated using the Spearman correlation coefficient. Preliminary analyses were performed, and there was a violation of the assumptions of normality for total knowledge score, $D(163) = .071$, $p = .041$ and total attitude score, $D(163) = .080$, $p = .013$ (see Table 4.4 and Table 4.8). There are outliers, and no extreme values were detected from the boxplot. The outliers were retained in the box plot for the total score of knowledge and attitude to maintain the sample's integrity. The Spearman's coefficient correlation strength by Leclezio et al. (2015) was shown in Table 4.12.

Table 4. 12

Spearman's Coefficient Correlation Strength by Leclezio et al. (2015)

Spearman (r_s)	Correlation
> .70	Very Strong Relationship
.40 - .69	Strong Relationship
.30 - .39	Moderate Relationship
.20 - .29	Weak Relationship
.01 - .19	No or Negligible Relationship

Note: r_s: Spearman's Rank Correlation Coefficient

The relationship between total knowledge and attitude was investigated using a Spearman correlation coefficient (see Table 4.13). Analysis showed that there was a strong, statistically significant positive correlation between the two variables, $r_s(163) = .448$, $p < .001$, with high levels of knowledge (*Mdn* = 77) associated with higher levels of attitude (*Mdn* = 67).

Table 4. 13

The Relationship Between Knowledge and Attitude Towards Artificial Intelligence (AI) in Healthcare Among UNIMAS Undergraduate Nursing Students (n = 163)

Correlations				
			Total Knowledge Score	Total Attitude Score
Spearman's rho	Total Knowledge Score	Correlation coefficient	1.000	.448**
		Sig. (2-tailed)	.	<.001
		N	163	163
	Total Attitude Score	Correlation coefficient	.448**	1.000
		Sig. (2-tailed)	<.001	.
		N	163	163

*Note: **: Correlation is significant at the 0.01 level (2-tailed).*

4.5 Summary

In this study, the findings revealed that the percentage of respondents with poor knowledge of AI in healthcare was the highest, while the percentage of good knowledge of AI in healthcare was nearly equal to those with moderate knowledge. Similarly, there are more respondents with a negative attitude compared to those with a positive attitude towards AI in healthcare. Statistical analysis indicated a strong, statistically significant positive correlation between the total score of knowledge and attitude of AI in healthcare among UNIMAS undergraduate nursing students. The participants' responses will be discussed in depth in the following chapter, supported by appropriate literature and previous studies.

CHAPTER 5

DISCUSSION

5.0 Introduction

This chapter presented the findings on the level of knowledge and attitude, as well as the correlation between the knowledge and attitude towards Artificial Intelligence (AI) in healthcare among UNIMAS undergraduate nursing students. In this chapter, a summary of the findings, implications, and limitations of this study will be presented, followed by the conclusion.

5.1 The Level of Knowledge on Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students

In this study, the level of knowledge of AI in healthcare among undergraduate nursing students at UNIMAS found that the median knowledge score among participants was 77.00 points (*IQR* = 9.00). The maximum knowledge score is 97 points, while the minimum knowledge score is 57 points. The range is 40 points. The mode knowledge score is 74 points. Scores exceeding the median value indicate that the participant scored above the central value, that is, higher than at least 50% of the participants, while scores that do not exceed the median value indicate that the participant's total knowledge score is lower than the central value. This study showed that a total knowledge score exceeding 77.00 points suggested that the participant had better knowledge than more than half of the participants. Contrarily, a total knowledge score of less than 77.00 points indicated that the participants

had poorer knowledge than more than half of the participants.

The findings of this study revealed that the majority of the respondents have a poor knowledge level of AI in healthcare (36.20%, n = 59). Meanwhile, 32.50% (n = 53) of the respondents have a good level of knowledge of AI in healthcare, and only 31.30% (n = 51) of the respondents have a moderate knowledge level of AI in healthcare. The level of knowledge distribution suggested that although the undergraduate nursing students are aware of AI in healthcare, disparity is abundant in their understanding of its applications in healthcare settings. The diverse range of the knowledge level on AI in healthcare results from a complex interplay of factors, such as ethical concerns, potential advantages and societal ramifications (Khan et al., 2023).

The results of this study align with the study by Wang et al. (2024), which found that nursing students, encompassing both undergraduate and postgraduate levels, as well as nurses, and other healthcare workers in China, presented a low knowledge level regarding AI and lacked knowledge towards AI in nursing compared with the AI-related professionals. Wang et al. (2024) revealed that minority of the undergraduate nursing students (35.1%, n = 119) and postgraduate nursing students (30.4%, n = 31) showed a complete or nearly complete understanding of AI, and only 19.3% (n = 65) reported a complete or nearly complete understanding of the application of AI in nursing. Similarly, Ahmed et al. (2022) found that the majority of the medical students and doctors in Pakistan lack specific knowledge of AI and its applications in healthcare where majority of the participants (64.7%, n = 304) had no knowledge about ML and DL, and majority of them were also unaware of any application of AI in the medical field (76.8%, n = 361).

Additionally, Alahmari et al. (2022) also showed that out of 218 participants, the majority of dental students in Saudi Arabia (77.1%,) did not have a fundamental understanding of the working principles of AI, and 63.3% (n = 138) of them were unaware of the application of AI in dentistry. Likewise, a research by Allam et al. (2023) reported that among 4492 participants, most of the participants (87.1%, n = 3914) had a low knowledge level towards AI.

In opposition to the findings of this study, Kalaimani et al. (2023) found that more than half of the participants demonstrated good knowledge and awareness towards AI (63.5%, n = 635). Besides, a study by Swed et al. (2022) revealed that 70% of the participants (n = 1055) portrayed a good comprehension of the fundamental concepts of AI and the application of its subtypes, including deep learning (DL) and machine learning (ML), with a mean knowledge score of 1.82 (*SD* = 1.83). A good knowledge and understanding of AI is frequently associated with exposure to pertinent information, continuous education such as attending discussion forums and conferences, and professional networking.

In this study, poor knowledge of AI in healthcare is related to insufficient knowledge, exposure and awareness, poor training in healthcare, and no introduction of an AI course in nursing curricula. Therefore, in response to the poor level of knowledge in this study, the level of knowledge can be improved by including AI into nursing school coursework or by increasing AI-related training during clinical attachments. It is also important to incorporate AI in healthcare-related topics during continuous nursing education (CNE) for registered nurses, which can also be applied to other healthcare professionals to enhance their understanding and implementation of AI in healthcare.

5.2 The Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students

In this study, the attitude towards AI in healthcare among undergraduate nursing students at UNIMAS was found that the median attitude score among participants was 67.00 points (*IQR* = 9.00). The maximum attitude score is 95 points, while the minimum attitude score is 43 points. The range is 52 points. This study showed that a total attitude score exceeding 67.00 points suggested that the participant had a more positive attitude than more than half of the participants. Conversely, a total attitude score of less than 67.00 points suggested that the participants had a more negative attitude than more than half of the participants.

The findings of this study revealed that the majority of participants have a negative attitude towards AI in healthcare (35.60%, n = 58). Meanwhile, 34.40% (n = 56) of the participants had a neutral attitude toward AI in healthcare, and only 30.10% (n = 49) of the participants had a positive attitude toward AI in healthcare. Hence, the results indicated a slight skewness towards negative attitudes towards AI in healthcare. These results demonstrated that the participants have mixed perceptions. The attitude distribution highlights a significant difference in attitudes, indicating that while some participants supported the idea and recognised the potential benefits of AI in healthcare, a majority of the participants were against the idea and still sceptical of AI in healthcare, especially when it involves ethical consequences, safety issues and possibility to replace human roles in healthcare (Khan et al., 2023).

The findings of this study align with the research by Daher et al. (2024), where out of 365 medical students in Lebanon, 75.3% (n = 275) of respondents do not agree with the

notion that AI would replace doctors in the future. Another study by El-Maksoud (2024) revealed that from a total sample size of 220 nursing students, 21.8% (n = 48) of the respondents doubt that AI helps in diagnosing and assessing patients, its ability to take over the nurses' job (30.0%, n = 66) and the respondents also do not agree on the reliability of AI in healthcare (29.1%, n = 64).

In addition, Boillat et al. (2022) showed that the medical students perceived that the utilisation of AI in healthcare enhanced the risks for both the medical community and the patients. Similarly, out of 101 participants, more than half of the medical students (52.5%) reported that they perceived AI as posing a danger to the radiology employment market (Brandes et al., 2020). Meanwhile, research by Dahmash et al. (2020) found that the majority of participants (58.8%) were sceptical of the influence of AI in radiology, and their opinions of radiology as a career were negatively impacted by worries that AI could substitute radiologists in the future. Likewise, Jussupow et al. (2022) also found that medical students experienced stronger identity threats and were more resistant to AI than the medical professionals.

Contrary to the findings of this study, Qin et al. (2024) revealed that among 53 medical students at Quest International University, Perak, 90.6% (n = 48) portrayed positive attitudes towards AI regarding its importance in the medical area, the inclusion of AI in the medical school program and specialist training (83.0%, n = 44), and the implementation of AI in early diagnosis and assessment of the disease severity (75.5%, n = 40). Besides, a research by Ahmed et al. (2022) also portrayed a positive attitude towards AI and reported that the majority of the participants agreed to include AI in the medical program (76.7%, n = 237) and acknowledged the importance of AI in radiology (78.3%, n = 368). A positive

attitude is closely related to their knowledge of AI itself, perception towards the usefulness of AI and the contribution of implementing AI in healthcare. For instance, studies among healthcare workers worldwide suggest that the knowledge of AI promotes acceptance and implementation into clinical practice.

In this study, a negative attitude towards AI in healthcare arises from the perceived usefulness of AI and the perception that AI has the potential to replace healthcare workers' roles. Thus, it is significant to conduct further research and education on AI, addressing the healthcare workers' concerns and the possible advantages of AI in the healthcare industry, as further understanding of AI can clarify misconceptions about its impact on their roles and influence a healthcare worker's attitude toward AI in healthcare.

5.3 The relationship between knowledge and attitude towards artificial intelligence (AI) in healthcare among UNIMAS undergraduate nursing students

This study examines the relationship between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students using a Spearman correlation coefficient. In this study, the results reveal a strong positive correlation and statistically significant relationship between the knowledge and attitude, as indicated by the correlation coefficient of $r_s(163) = .448$, $p < .001$, with high levels of knowledge ($Mdn = 77$) associated with higher levels of attitude ($Mdn = 67$). These findings implied that students with higher levels of knowledge were more expected to have positive attitudes towards AI in healthcare. Contrarily, participants with a lower knowledge level were more likely to have neutral or negative attitudes towards AI in healthcare.

The findings of this research correspond with a study by Mariano et al. (2025) among 349 nurses, students and nursing faculty in Saudi Arabia. Mariano et al. (2025) found a statistically significant positive correlation of $r_s(349) = .451$, $p < .001$, with high levels of knowledge associated with higher levels of attitude. This implies that people with a better understanding of AI are inclined to possess more positive attitudes regarding its applications and utilisation. The results highlight the importance of educating individuals and assisting them to understand the principles of AI in order to promote positive attitudes and behaviours. Similarly, a research by Khaled and Elborai (2024) identified a strong positive association between the two variables, which are the nursing students' total knowledge towards AI and their total attitudes of AI ($r = 0.64$, $p < .01$). The researchers believe that this outcome might result from the evolution of AI, which has altered the technology and society's perspective, and necessitates updates in education to match these advancements.

Additionally, a study by Elsayed and Sleem (2021) among 130 nurse managers at Mansoura University Hospitals found a strong positive correlation between nurse managers' attitudes and perceptions on the use of AI in nursing practices, further emphasising the impact of knowledge on the attitude of AI in healthcare settings. Likewise, a research by Ranbhise et al (2023) revealed a very strong, statistically significant positive correlation coefficient of $r(98) = .96$, $p < .05$, with high knowledge score associated with higher attitude score. Hence, the findings showed a strong positive correlation between knowledge and attitude towards AI in healthcare. This suggested that the knowledge and attitude were related to each other.

Other than that, a study by Hasan et al. (2024) reported a positive correlation between knowledge of AI and attitudes towards AI among 875 faculty members and pharmacy students ($r = 0.824$, $p < .001$). This indicates that raising the awareness and understanding of AI may lead to greater adoption and acceptance of AI devices in pharmacy settings.

The relationship between knowledge and attitude towards AI in healthcare is a multifaceted issue. In order to enhance the undergraduate nursing students' knowledge of AI in healthcare, educational institutions, especially nursing programs, can develop specific measures and include AI in healthcare coursework, which will have a positive impact on the participants' attitudes and behaviours in their studies. By improving the relationship between knowledge and attitude, the students are able to maximise the potential of AI and accelerate the development across AI in healthcare.

5.4 Summary of Findings of the Study

Overall, this study assessed the level of knowledge on AI in healthcare, assessed the attitude of AI in healthcare and examined the correlation between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students.

Firstly, the level of knowledge on AI in healthcare reported an overall poor knowledge among the UNIMAS undergraduate nursing students (36.2%, n = 59), followed by good knowledge of AI in healthcare (32.5%, n = 53), and moderate knowledge on AI in healthcare (31.3%, n = 51).

Secondly, the attitude toward AI in healthcare revealed an overall negative attitude among the UNIMAS undergraduate nursing students (35.6%, n = 58), followed by a neutral attitude towards AI in healthcare (34.4%, n = 56) and a positive attitude towards AI in healthcare (30.1%, n = 49).

Finally, the relationship between knowledge and attitude of AI in healthcare among UNIMAS undergraduate nursing students showed a strong positive correlation and statistically significant relationship between the knowledge and attitude, as indicated by the correlation coefficient of $r_s(163) = .448$, $p < .001$, with high levels of knowledge ($Mdn = 77$) associated with higher levels of attitude ($Mdn = 67$). Hence, the study rejects the null hypothesis.

5.5 Implication of Study

The study revealed that the level of knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students was both poor and negative, respectively. This research emphasises several important significances for the nursing theory and practice. Firstly, the apparent discrepancies in knowledge highlight the possibility that the current nursing programs may not fully address technological developments, especially artificial intelligence, and its applications in healthcare. As AI becomes progressively implemented into patient care, it is crucial that nursing students are prepared and equipped with the skills required in order to efficiently interact with and operate systems driven by AI before they work as future registered nurses.

Secondly, the apparent gaps in attitude highlight the need for further professional development and continuous education among the undergraduate nursing students and future registered nurses to ensure that they are equipped to learn, educate and implement the emerging topics in healthcare technology.

Overall, the findings from this study emphasise the importance of contributing as a framework and body of literature for future research and education, as there have been few scholarly articles on knowledge and attitude towards AI in healthcare among undergraduate nursing students, particularly in Malaysia. When this study has been utilised for future studies, this research can be beneficial in boosting and providing information on the comprehension and perception of AI, not only among undergraduate nursing students in UNIMAS, but also nursing students across Malaysia, therefore improving their knowledge of the use of AI and its benefits in healthcare settings.

5.5.1 Recommendation for This Study

In accordance with the findings of this study, it is suggested that AI should be implemented into the nursing programme. The students' knowledge and acceptance of AI technology in healthcare could be enhanced by introducing AI in nursing coursework as a module or embedded within existing subjects such as health informatics. Besides, early exposure to AI-powered tools during clinical simulation class can offer experiential learning, hence closing the knowledge gap between theory and practice. Furthermore, an awareness campaign focusing on the ethical, legal, and practical aspects of AI in healthcare through webinars, conferences, seminars, and workshops may help reduce negative attitudes and perceptions among nursing students. These initiatives may improve students' attitudes by explaining AI and highlighting its role in enhancing human judgment and clinical decision-making in healthcare rather than replacing it.

5.5.2 Recommendations for Future Research

Future research should utilise longitudinal studies to investigate at how exposure to and education of AI in healthcare affect the nursing student's knowledge and attitude over time, especially after educational interventions or clinical placements involving AI technologies. Additionally, it was suggested that comparative research between healthcare institutions in Malaysia across different levels of education could provide an expanded and deeper perspective of Malaysian nursing students' readiness towards AI in healthcare. Furthermore, qualitative interviews or focus group research designs can be employed to gain a greater understanding of students' attitudes and perceptions of AI in healthcare. Qualitative

research can capture the complex perspectives and personal views that underpin the statistical trends, while quantitative research offers useful broad patterns from a population.

5.6 Limitations of the Study

The findings of this research might not accurately reflect the actual outcomes due to the small sample size of 163 participants. This is because the findings have insufficient generalizability, as this study only focuses on the undergraduate nursing students in UNIMAS and have limited heterogeneity exploration to a broader nursing student population in other healthcare education institutions in Malaysia, which may affect the overall precision and reliability of the study instruments (Yang & Berdine, 2023). Besides, self-reported measures may lead to response bias, as participants may have overestimated or underestimated their knowledge and attitude of AI in healthcare. Additionally, the participant's age range (19-26 years old) may not accurately reflect the overall knowledge and attitude towards AI in healthcare of postgraduate nursing students and experienced health professionals. This was the first time the researcher conducted this study, and the research process may face some constraints in terms of time, funding and personnel. The scope of the study may also not be as broad as the research conducted by an experienced researcher. To overcome these limitations, rigorous methodology, open results reporting and thorough research designs are required. Therefore, in order to enhance the diversity and representativeness of the research population and to make better utilisation of the available resources, the researcher can consider collaborating with different healthcare education institutions in Malaysia.

5.7 Conclusion

In conclusion, this study offered valuable insights into the knowledge and attitudes towards AI in healthcare among UNIMAS undergraduate nursing students. The study revealed an overall poor knowledge and negative attitudes towards AI in healthcare. Nonetheless, the relationship between knowledge and attitude revealed a strong, statistically significant positive correlation, which implies that focused educational programs might encourage greater readiness and acceptance of AI in healthcare. Thus, the study rejects the null hypothesis. Although there are limited existing studies on the relationship between knowledge and attitude towards AI in healthcare, especially in Malaysia, it is important to explore the intrinsic factors, including age, gender and academic year, to obtain a comprehensive understanding of the interaction between the variables. More improvements could be made to deliver higher-quality and more distinctive research in the future. Therefore, it is crucial to incorporate AI into nursing education in order to equip future registered nurses for the evolving digital healthcare environment.

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APPENDICES

Appendix A: Ethical Approval

Pejabat Akademik
Fakulti Perubatan dan Sains Kesihatan
Academic Office
Faculty of Medicine & Health Sciences
☎: 581000 samb 7768
🖷: 665152

UNIVERSITI MALAYSIA
SARAWAK
94300 Kota Samarahan

MEMORANDUM

Reference	:	UNIMAS/NC-21.05/03-03 Jld. 8(145)
To	:	Haziqah Binti Ahmad Zaini (78021) Bachelor of Nursing with Honours Faculty of Medicine and Health Sciences
From	:	Dean Faculty of Medicine and Health Sciences
Date	:	05 March 2025
Subject	:	**Final Year Project - Research Approval: Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students**

The above matter is referred.

The Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak (UNIMAS) has granted the **RESEARCH APPROVAL** for this Final Year Project research based on the appraisal by the Department of Nursing, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak (UNIMAS) on 24 February 2025. The Final Year Project research details stated below:

Student Name	:	**Haziqah Binti Ahmad Zaini**
Student ID	:	**78021**
Programme	:	**Bachelor of Nursing with Honours**
Research Title	:	***Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students***
Supervisor Name	:	**Madam Shalin Lee Wan Fei**
Supervisor H/P	:	**+60 16-878 4825**

All records and data are to be kept strictly **CONFIDENTIAL** and can only be used for the purpose of this study. All precautions are to be taken to maintain data confidentiality. Permission from the all relevant heads of departments/units where the study will be carried out must be obtained prior to the study.

Please note that the approval is valid from **February 2025** to **November 2025** only. The reference number for this letter must be stated in all correspondence related to this study to facilitate the process.

Thank you with regards and well wishes.

Yours sincerely,

Professor Dr. Asri bin Said
Dean

c.c : Deputy Dean of Undergraduate
: Head of Nursing Department
: Bachelor of Nursing with Honours
: MDJ4653 Final Year Project 1 Course Coordinator

Appendix B: Ethical Approval Application Cover Letter

Haziqah Binti Ahmad Zaini,

Faculty Medicine and Health Sciences,

Universiti Malaysia Sarawak,

94300 Kota Samarahan,

Sarawak.

The Chairman,

Medical Research Ethics Committee,

Faculty Medicine and Health Sciences,

Universiti Malaysia Sarawak,

94300 Kota Samarahan,

Sarawak. 15th December 2024

Professor/Associate Professor/Dr/Sir/Madam,

REQUEST FOR APPROVAL TO CONDUCT RESEARCH PROJECT

I am a final-year student pursuing a Bachelor of Nursing with Honours at the Faculty of Medicine and Health Sciences, UNIMAS. I enrolled in MDJ 4653 Final Year Project I, in which the course is coordinated by Madam Shalin Lee Wan Fei. Please find my details as follows:

Full name: Haziqah Binti Ahmad Zaini

Matrix number: 78021

IC No.: 020726-13-0508

I would like to request for the kind approval from the Faculty of Medicine and Health Sciences Medical Research Ethics Committee to conduct the following study:

Research title: Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students.

Supervisor's name: Madam Shalin Lee Wan Fei

Email address: lwfshalin@unimas.my

Supervisor's HP number: +6016-878 4825

Please find the required documents as appended for your kind consideration and approval.

Thank you.

Yours sincerely,

(HAZIQAH BINTI AHMAD ZAINI)

Appendix C: Participant Information Sheet for Intervention Phase

PARTICIPANT INFORMATION SHEET

1. **Title of the study** : Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students

2. **Main Researcher** : Haziqah Binti Ahmad Zaini

3. **Supervisor** : **a) Course coordinator:** Miss Feryante Rintika Belansai
   b) Main research supervisor: Madan Shalin Lee Wan Fei

4. **Institution** : Department of Nursing, Faculty of Medicine and Health Sciences, University Malaysia Sarawak

5. **Name of sponsor** : No external funding

6. Introduction

It is essential that you understand why the research is conducted and what it will include. Please take your time to read through and consider this information carefully before determining if you are willing to participate. Ask the main researcher if you have any inquiries or would like additional information. After you are properly convinced that you understand this study and that you wish to participate, you must sign this informed consent form.

Your participation in this research is voluntary. You do not have to be in this study if you do not want to. You may also decline to respond to any inquiries you do not wish to answer. If you volunteer to be in this study, you may withdraw from it at any moment. If you withdraw, any data gathered from you up to your withdrawal will remain used for the research. Your decision to withdraw or not participate will not impact any medical or health benefits to which you are otherwise entitled.

7. What is the purpose of the study?

The main purpose of this study is to investigate the knowledge and attitude towards Artificial Intelligence (AI) in healthcare among UNIMAS undergraduate nursing students. This research is necessary to improve the understanding and perception of AI among nursing students in UNIMAS, registered nurses and other healthcare providers.

This research will be conducted for duration of 6 months (27/01/2025 till 29/06/2025). Printed questionnaires will be disseminated to participants and collected shortly after completion. The expected total number of 163 respondents ranging from Year 1 until Year 4 will be selected for this study

8. Who can participate in this research?

This research targets undergraduate nursing students from the Faculty of Medicine and Health Sciences (FMHS), UNIMAS. The inclusion and exclusion criteria have been meticulously outlined to identify eligible participants. The inclusion criteria for this research comprise of undergraduate nursing students in Year 1 through Year 4 from the UNIMAS. The students were chosen as respondents based on their voluntary participation in the survey, while the exclusion criteria for this study consist of students who are unwilling or refuse consent to engage in the survey, postgraduate and post-registration nursing students and those who will be selected for pilot study.

9. What are my responsibilities when taking part in this research?

You will be given a survey form to be answered. This form comprises 3 sections which will enquire about the socio-demographic data, knowledge towards AI in healthcare and attitude towards AI in healthcare. It is essential that you respond openly to the inquiries in the questionnaire, a process expected to consume approximately 15-20 minutes of your time to answer all the questionnaire. You are required to return the questionnaire to the researcher upon completion.

10. What are the potential risks and side effects of being in this research?

Your involvement in this research is entirely voluntary. The study's level of risk is mostly associated to time consumption, otherwise minimal. You have the right to refuse to answer any questions that may make you feel uncomfortable, and you can choose to withdraw from the study at any time without facing any penalties.

11. What are the benefits of being in this research?

There may or may not be any direct benefits to you. However, this research holds the potential influence of healthcare education's academic fundamentals on the knowledge and attitude towards AI in healthcare among future healthcare professionals. Additionally, you may obtain a deeper understanding of AI applications in healthcare and improve your critical thinking by discovering innovative technologies in healthcare. However, it is essential to note that no feedback regarding study findings will be given at the end of the study.

12. Who is funding this research?

This research does not receive any external funding, and is fully funded by the study researcher. You will not be paid for taking part in this research. There are also no plans to develop commercial products through this research.

13. Will my information be kept confidential?

Your autonomy and privacy are highly protected during this study process. Your data will only be employed for the purposes of this research, gathered using the hardcopy questionnaire by the researcher. Subsequently, the information will be converted into a softcopy format for analysis. All information gathered in this research will be managed with strict confidentiality, in accordance with relevant laws and regulations, and will be stored securely until December 31, 2030, by the study's researcher. Your identity will remain confidential, and your permission will be obtained before disclosing any data in presentation or research publications. You have the right to decline in the future whether the information that has been collected requires to be stored or utilise further, protecting your privacy and autonomy. Individuals involved in this research, qualified monitors and auditors, and governmental or regulatory authorities may inspect the study data, where appropriate and necessary.

14. Who should I contact if I have inquiries?

If you have any inquiries concerning the research, please contact the study researcher, Haziqah Binti Ahmad Zaini at 014-288 2327 or email at 78021@siswa.unimas.my.

15. Ethical review of the research

This research has been authorised by the Medical Research Ethical Committee of University Malaysia Sarawak. The Medical Research Ethical Committee of University Malaysia Sarawak can be reached by email at medicalethics@unimas.my.

Appendix D: Informed Consent Form for Intervention Phase

INFORMED CONSENT FORM

Title of Study: Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students

By signing below, I confirm the following:

- I have received written and verbal details for the above study and have read and understood the information.
- I have had sufficient time to consider participation in the study and have had the chance to ask questions and all my questions have been answered satisfactorily.
- I understand that my participation is voluntary, and I can freely withdraw from the study without explanation, which will not affect my future treatment. I am not involved in any other research study at this time. I understand the risks and benefits and voluntarily provide my informed consent to participate under the stated conditions. I understand that I must follow the study researcher's instructions related to my participation in the study.
- I will receive a copy of this informed consent form signed and dated to bring home.
- While the information obtained in this research may be utilised in a conference presentation and published in journal articles, I will not be identified and all data concerning me will remain STRICTLY CONFIDENTIAL.

Subject:

Signature: I/C number:

Name: Date:

Investigator conducting informed consent:

Signature: I/C number:

Name: Date:

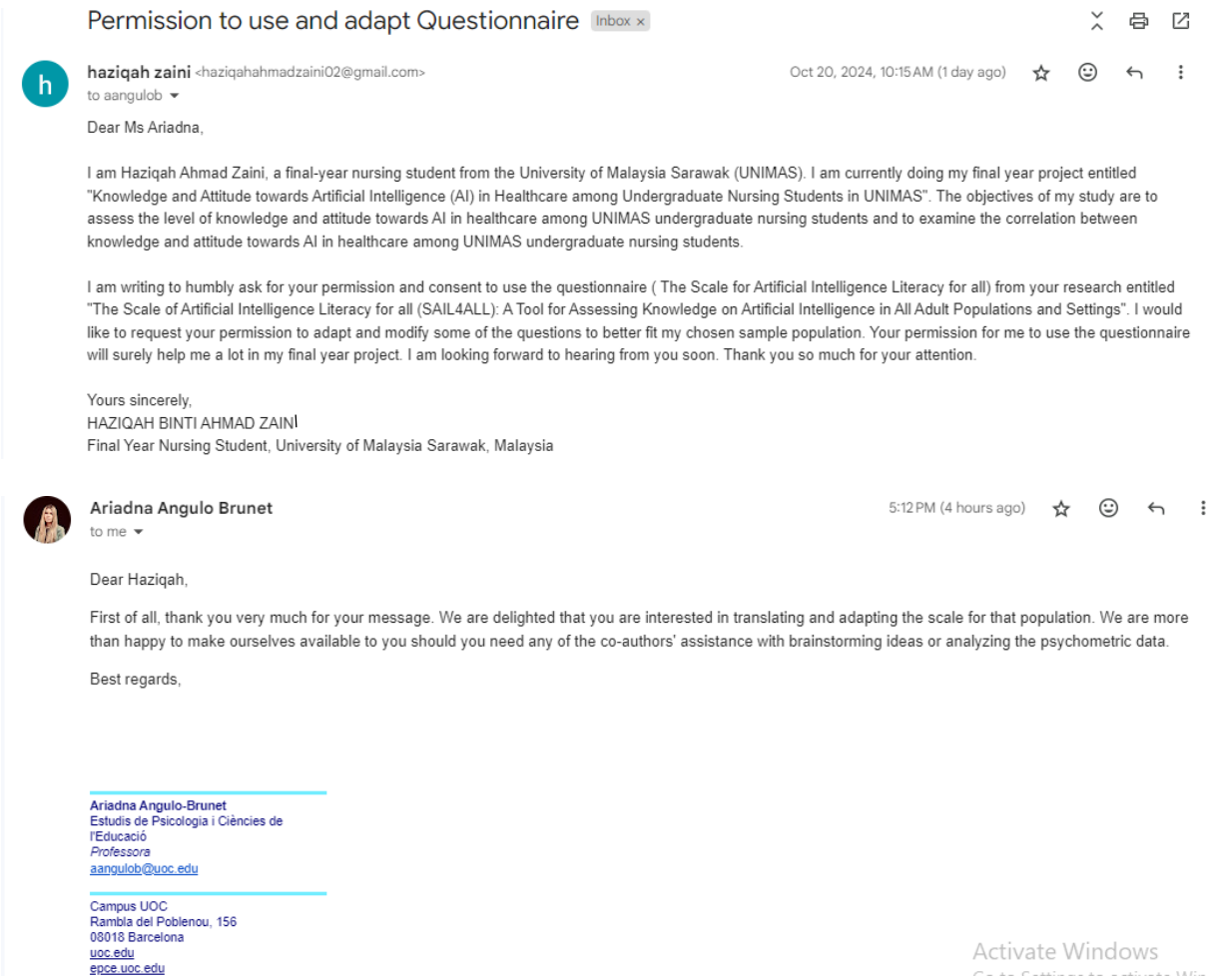
Impartial witness:

Signature: I/C number:

Name: Date:

Appendix E: Permission to Use Questionnaire

1. Scale of Artificial Intelligence Literacy for All (SAIL4ALL) by Soto-Sanfiel et al. (2024).



Permission to use and adapt Questionnaire Inbox ×

haziqah zaini <haziqahahmadzaini02@gmail.com> Oct 20, 2024, 10:15 AM (1 day ago)
to aangulob

Dear Ms Ariadna,

I am Haziqah Ahmad Zaini, a final-year nursing student from the University of Malaysia Sarawak (UNIMAS). I am currently doing my final year project entitled "Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among Undergraduate Nursing Students in UNIMAS". The objectives of my study are to assess the level of knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students and to examine the correlation between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students.

I am writing to humbly ask for your permission and consent to use the questionnaire (The Scale for Artificial Intelligence Literacy for all) from your research entitled "The Scale of Artificial Intelligence Literacy for all (SAIL4ALL): A Tool for Assessing Knowledge on Artificial Intelligence in All Adult Populations and Settings". I would like to request your permission to adapt and modify some of the questions to better fit my chosen sample population. Your permission for me to use the questionnaire will surely help me a lot in my final year project. I am looking forward to hearing from you soon. Thank you so much for your attention.

Yours sincerely,
HAZIQAH BINTI AHMAD ZAINI
Final Year Nursing Student, University of Malaysia Sarawak, Malaysia

Ariadna Angulo Brunet 5:12 PM (4 hours ago)
to me

Dear Haziqah,

First of all, thank you very much for your message. We are delighted that you are interested in translating and adapting the scale for that population. We are more than happy to make ourselves available to you should you need any of the co-authors' assistance with brainstorming ideas or analyzing the psychometric data.

Best regards,

Ariadna Angulo-Brunet
Estudis de Psicologia i Ciències de l'Educació
Professora
aangulob@uoc.edu

Campus UOC
Rambla del Poblenou, 156
08018 Barcelona
uoc.edu
epce.uoc.edu

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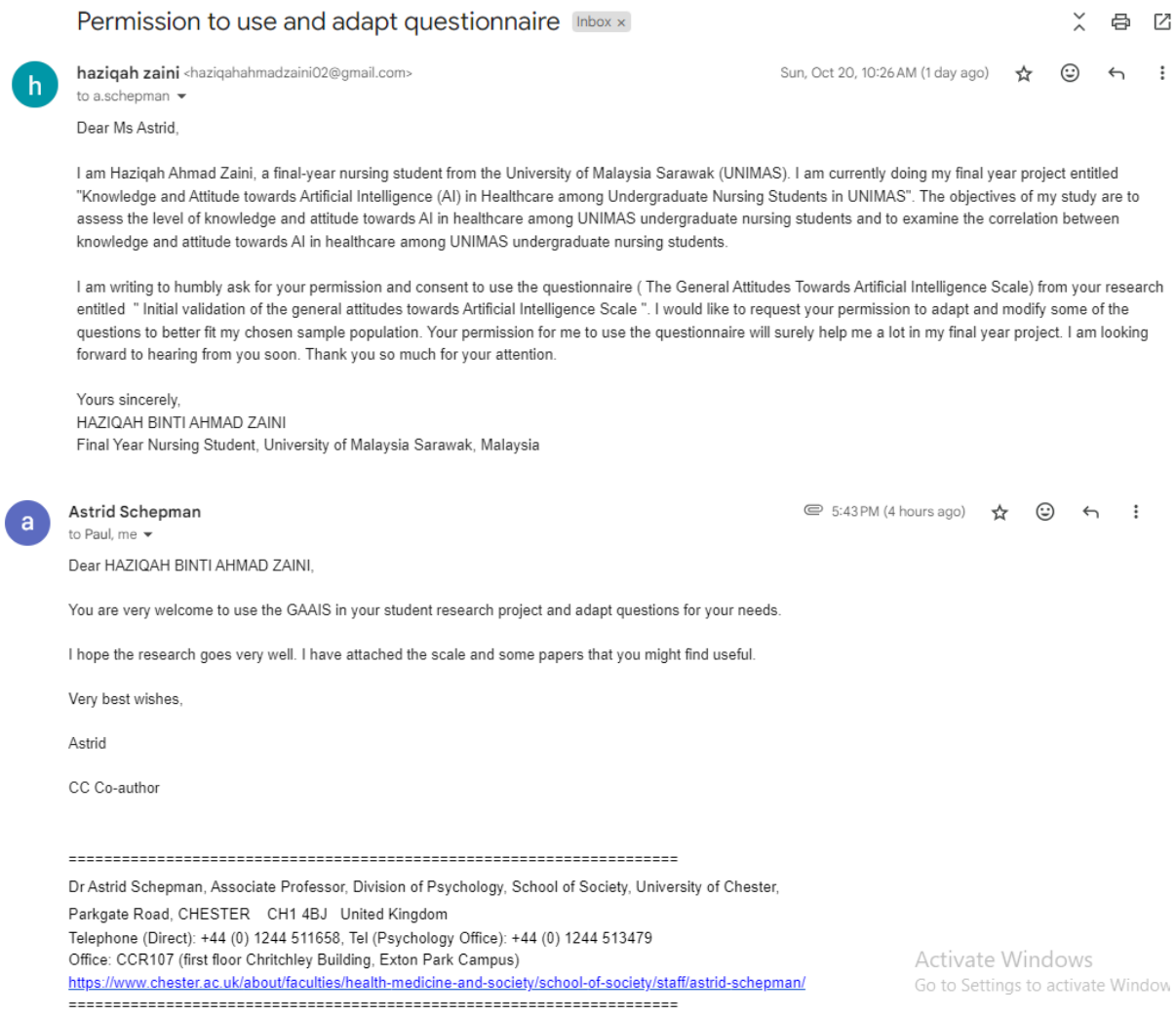
2. General Attitude towards Artificial Intelligence Scale (GAAIS) by Schepman & Rodway (2022).



Permission to use and adapt questionnaire Inbox ×

haziqah zaini <haziqahahmadzaini02@gmail.com> Sun, Oct 20, 10:26 AM (1 day ago)
to a.schepman

Dear Ms Astrid,

I am Haziqah Ahmad Zaini, a final-year nursing student from the University of Malaysia Sarawak (UNIMAS). I am currently doing my final year project entitled "Knowledge and Attitude towards Artificial Intelligence (AI) in Healthcare among Undergraduate Nursing Students in UNIMAS". The objectives of my study are to assess the level of knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students and to examine the correlation between knowledge and attitude towards AI in healthcare among UNIMAS undergraduate nursing students.

I am writing to humbly ask for your permission and consent to use the questionnaire (The General Attitudes Towards Artificial Intelligence Scale) from your research entitled " Initial validation of the general attitudes towards Artificial Intelligence Scale ". I would like to request your permission to adapt and modify some of the questions to better fit my chosen sample population. Your permission for me to use the questionnaire will surely help me a lot in my final year project. I am looking forward to hearing from you soon. Thank you so much for your attention.

Yours sincerely,
HAZIQAH BINTI AHMAD ZAINI
Final Year Nursing Student, University of Malaysia Sarawak, Malaysia

Astrid Schepman 5:43 PM (4 hours ago)
to Paul, me

Dear HAZIQAH BINTI AHMAD ZAINI,

You are very welcome to use the GAAIS in your student research project and adapt questions for your needs.

I hope the research goes very well. I have attached the scale and some papers that you might find useful.

Very best wishes,

Astrid

CC Co-author

==========

Dr Astrid Schepman, Associate Professor, Division of Psychology, School of Society, University of Chester,
Parkgate Road, CHESTER CH1 4BJ United Kingdom
Telephone (Direct): +44 (0) 1244 511658, Tel (Psychology Office): +44 (0) 1244 513479
Office: CCR107 (first floor Chritchley Building, Exton Park Campus)
https://www.chester.ac.uk/about/faculties/health-medicine-and-society/school-of-society/staff/astrid-schepman/
==========

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Appendix F: Data Collection Instrument

Section A: Socio-demographic data

Complete the information below accordingly. Please tick (✓) your answers in the boxes provided below or fill in the relevant information in the blanks provided:

1. Age: _____(years)

2. Gender

Male ☐

Female ☐

3. Academic Year

Year 1 ☐

Year 2 ☐

Year 3 ☐

Year 4 ☐

Section B: Knowledge towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students.

Questionnaire adapted and modified from Scale of Artificial Intelligence Literacy for all (SAIL4ALL) by Soto-Sanfiel et al. (2024)

Kindly select and circle the relevant option to indicate your opinion about each statement's veracity (1 = False with high confidence; 2 = False with moderate confidence; 3 = Unsure; 4 = True with moderate confidence; 5 = True with high confidence)

Subscale 1: Understanding AI in Healthcare

	False with high confidence	False with moderate confidence	Unsure	True with moderate confidence	True with high confidence
AI is able to assist in diagnosing diseases via analysing medical imaging data	1	2	3	4	5
AI algorithms improve the precision of detecting medical abnormalities when trained with large patient datasets.	1	2	3	4	5
AI is utilised to identify human speech, where voice recognition AI is used to transcribe doctor-patient interactions for medical records	1	2	3	4	5
Machine learning in healthcare systems enables adaptive decision-making according to previous patient outcomes	1	2	3	4	5

Human intelligence is the only form of intelligence that is able to provide safe and ethical healthcare decisions	1	2	3	4	5
AI technologies in healthcare can incorporate both clinical expertise and computational algorithms	1	2	3	4	5
AI can be programmed to conduct a variety of tasks with accuracy and consistency, such as helping in managing hospital workflows, improving efficiency and reducing medical errors	1	2	3	4	5
The ethics and humanities have no position in developing AI systems for healthcare	1	2	3	4	5
AI is a single technology limited to particular tasks	1	2	3	4	5
An interdisciplinary approach such as combining AI technology with nursing practice improve health outcomes	1	2	3	4	5

Subscale 2: Application of AI in Healthcare

	False with high confidence	False with moderate confidence	Unsure	True with moderate confidence	True with high confidence
AI systems in healthcare should accomplish better transparency in terms of algorithms, data utilisation, and limitations to build trust with patients and healthcare professionals	1	2	3	4	5
AI development in healthcare must consider the ethical implications of its applications, such as patient autonomy and consent	1	2	3	4	5
It is essential to establish and reinforce laws and regulations such as the right to appeal, or redress for AI-driven healthcare decisions	1	2	3	4	5
AI systems utilised in treatment or diagnosis planning must disclose potential harm and their underlying decision-making processes	1	2	3	4	5
Healthcare professionals should be responsible for the actions of AI	1	2	3	4	5
AI tools in healthcare should guarantee data confidentiality and implement safeguards against unauthorised access to sensitive patient information	1	2	3	4	5

The development of AI in healthcare needs to be in line with human rights and values, avoiding harm to the patients	1	2	3	4	5
Reliable AI systems in healthcare require constant monitoring, updates and assessments to ensure long-term safety and accuracy	1	2	3	4	5
The AI integration in healthcare should preserve, respect and enhance patient care instead of replace the human touch in treatment	1	2	3	4	5
The advantages of AI in healthcare must respect potentially vulnerable patient groups, ensuring equitable access to care while fostering trust and inclusivity in nursing practices	1	2	3	4	5

Section C: Attitudes Towards Artificial Intelligence (AI) in Healthcare among UNIMAS Undergraduate Nursing Students

Questionnaire adapted from General Attitude towards Artificial Intelligence Scale (GAAIS) by Schepman and Rodway (2020)

Please indicate your level of agreement with the items below using the following scale accordingly. Kindly tick (✓) your answers in the boxes provided below:

Scoring / Questions	**1 Strongly Disagree**	**2 Disagree**	**3 Neutral**	**4 Agree**	**5 Strongly Agree**
1. For routine administrative tasks in healthcare, I would rather utilise an artificially intelligent system rather than a human					
2. AI is able to provide new opportunities for nursing professions in healthcare					
3. The utilisation of AI in healthcare is unethical					
4. AI systems in healthcare can benefit the patient's health and contribute to better patient outcome					
5. I am fascinated by what AI can perform in healthcare					
6. I think AI systems in healthcare make many mistakes that might compromise patient safety					
7. I am interested in using artificially intelligent systems in healthcare for my daily nursing tasks					
8. I find AI sinister					

9. AI in healthcare has the ability to take control of people					
10. I think that utilising AI in healthcare is dangerous					
11. AI can have positive impacts on the patient's wellbeing					
12. Potential applications of AI in nursing are exciting					
13. An artificially intelligent agent can perform numerous routine tasks in healthcare better than a nurse or physicians					
14. There are a wide range of beneficial applications of AI in healthcare					
15. The idea of employing AI in healthcare in the future makes me uneasy					
16. AI systems outperform nurses, physicians and medical technicians in terms of efficiency					
17. Future applications of AI will be more advantageous for the healthcare professions					
18. I would like to utilise AI in my future work as a healthcare professional					
19. The growing application and adoption of AI in healthcare will negatively impact the roles and job security of nurses and physicians					
20. AI in healthcare is utilised to spy on the patients					

Appendix G: Gantt Chart

ACTIVITY	MONTH										
	2024				2025						
	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY
Determination of Research Title											
Literature review											
Meeting with supervisor											
Submit oral defence slide											
Submission of first draft											
Ethical Approval											
FYP 1: Submission of research proposal											
Data Collection											
Data Analysis											
Write up report											
Submit final draft											
FYP 2: Submission of final project											

Appendix H: Expenditure

Expenditure	**Unit Price (RM)**	**Quantity**	**Total (RM)**
Internet Data Plan Hotlink Prepaid Unlimited	40.00/month	11	440
SPSS Software	5.00	1	5
Printing	0.50/page	400	200
Transportation Grab Bus	 8.00/trip 1.00/trip	 5 8	48
Material and Supplies Binding Plastic A4 transparent covers	 5.00/ring 1.00/sheet	 2 4	14
Poster printing A0: Glossy	39.00/each	39	39
		Grand Total (RM):	746

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