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nursing students**

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KNOWLEDGE AND COMPLIANCE WITH INFECTION PREVENTION AND
CONTROL PRACTICES AMONG UNIVERSITI MALAYSIA SARAWAK
UNDERGRADUATE NURSING STUDENTS

AT
UNIMAS

MUS'AB BIN MOHD NARAWI

This project is submitted in partial fulfilment of
The requirements for the degree of
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DECLARATION

I hereby declare that the work embodied into this final year project entitled 'Knowledge and compliance with infection prevention and control practices among UNIMAS undergraduate nursing students' has been executed by me in Faculty of Medicine and Health Sciences (FMHS), UNIMAS, during the period of year 2024 to 2025. I further declare that this research has not been submitted to any other university or institute for the award for any degree or diploma programme.

Signature

A handwritten signature in black ink, consisting of a large loop followed by a horizontal line and a small flourish.

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In the name of Allah, the Most Gracious, the Most Merciful, for showering me with endless blessings and strength through the completion of my research up until the end.

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ABSTRACT

Introduction: Infection prevention and control (IPC) is a practical, evidence-based approach preventing patients and health workers from being harmed by avoidable infections (WHO, 2021). These practice guidelines not only help to minimize the spread of infection among patients but also help to avoid healthcare workers from contracting infections when caring for patients. Nursing students are equally at risk to exposure to infections during their clinical attachments in the healthcare setting.

Objectives: This study aimed to assess the level of knowledge, to assess the level of compliance and to examine the relationship between knowledge and compliance on infection prevention and control (IPC) practices among UNIMAS undergraduate nursing students.

Methodology: Descriptive cross-sectional quantitative study was conducted among the undergraduate nursing students in Universiti Malaysia Sarawak. A total of 140 participants were selected using simple random sampling method. The data collection tool consisted of 42 item self-administered questions which divided into 3 parts; socio-demographic, level of knowledge and level of compliance on IPC practices. Data collection from this study was analysed using IBM SPSS version 27.

Results: Most of the nursing students demonstrated an optimum level of knowledge (75.0%) and compliance (86.4%). Further analysis revealed significant correlation between knowledge and compliance ($r = .326, p = 0.001$).

Conclusion: UNIMAS undergraduate nursing students showed an optimal level of both knowledge and compliance with infection prevention and control (IPC) practices. However, there is a need for regular assessment and feedback sessions to continuously improve the curriculum and training methods.

Keywords: knowledge, compliance, infection prevention and control (IPC), nursing students

**PENGETAHUAN DAN PEMATUHAN TERHADAP AMALAN PENCEGAHAN DAN
KAWALAN JANGKITAN DALAM KALANGAN PELAJAR KEJURURAWATAN
PRASISWAZAH UNIMAS**

ABSTRAK

Pengenalan: Pencegahan dan kawalan jangkitan (IPC) merupakan pendekatan praktikal berasaskan bukti bagi mengelakkan pesakit dan petugas kesihatan daripada terdedah kepada jangkitan yang boleh dicegah (WHO, 2021). Garis panduan amalan ini bukan sahaja membantu mengurangkan penularan jangkitan dalam kalangan pesakit, malah melindungi petugas kesihatan daripada dijangkiti semasa memberikan rawatan. Pelajar kejururawatan juga terdedah kepada risiko jangkitan semasa menjalani latihan klinikal di fasiliti kesihatan.

Objektif: Kajian ini bertujuan untuk menilai tahap pengetahuan, menilai tahap pematuhan, dan mengkaji hubungan antara pengetahuan dan pematuhan terhadap amalan pencegahan dan kawalan jangkitan (IPC) dalam kalangan pelajar kejururawatan prasiswazah UNIMAS.

Metodologi: Kajian keratan rentas kuantitatif telah dijalankan dalam kalangan pelajar kejururawatan prasiswazah di Universiti Malaysia Sarawak. Seramai 140 orang peserta telah dipilih menggunakan kaedah persampelan rawak mudah. Instrumen pengumpulan data terdiri daripada 42 soalan soal selidik sendiri yang dibahagikan kepada tiga bahagian: sosiodemografi, tahap pengetahuan, dan tahap pematuhan terhadap amalan IPC. Data yang dikumpulkan telah dianalisis menggunakan perisian IBM SPSS versi 27.

Keputusan: Kebanyakan pelajar kejururawatan menunjukkan tahap pengetahuan (75.0%) dan tahap pematuhan (86.4%) yang optimum. Analisis lanjut menunjukkan terdapat hubungan yang signifikan antara pengetahuan dan pematuhan ($r = .326, p = 0.001$).

Kesimpulan: Pelajar kejururawatan prasiswazah UNIMAS menunjukkan tahap pengetahuan dan pematuhan yang optimum terhadap amalan pencegahan dan kawalan jangkitan (IPC). Namun begitu, penilaian dan sesi maklum balas secara berkala perlu dijalankan bagi mempertingkatkan lagi kurikulum dan kaedah latihan.

Kata kunci: pengetahuan, pematuhan, pencegahan dan kawalan jangkitan (IPC), pelajar kejururawatan

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LIST OF ABBREVIATIONS

CAUTI	Catheter Associated Urinary Tract Infection
CDC	Centers for Disease Control and Prevention
CLBSI	Central Line Associated Bloodstream Infection
HAI	Hospital Associated Infection
IPC	Infection Prevention and Control
PPE	Personal Protective Equipment
SSI	Surgical Site Infection
UNIMAS	Universiti Malaysia Sarawak
VAP	Ventilator Associated Pneumonia
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

1.0 Introduction

In this chapter, the introduction and for this research study will be discussed thoroughly and explained into few sections which are (1.1) background of study, (1.2) problem statements, (1.3) research questions, (1.4) research aim, (1.5) research objectives, (1.6) hypotheses, (1.7) significance of the study, (1.8) the definitions of key terms, and (1.9) summary of the chapter.

1.1 Background of study

Infection prevention and control (IPC) is a critical aspect of nursing practice that aims to reduce the transmission of infections within healthcare settings. This includes protecting patients from getting sick while they are receiving care and protecting themselves from getting ill so that they can provide excellent care. The WHO (2021) defines infection prevention and control (IPC) as an evidence-based approach that shields patients and healthcare workers from avoidable infections. It also defines IPC as the implementation of policies and guidelines in healthcare settings to mitigate and limit the risk of infection transmission, thereby lowering the infection rate (Habboush et al., 2020). According to WHO (2021), the basic principles of infection control include handwashing and utilisation of personal protective equipment such as gloves, masks, gowns, and eyewear to prevent contact with potentially infectious materials, as well as safe handling of sharps. There are three main precautions highlighted by CDC (2014) that highly related to IPC which includes standards, contact, droplet and airborne.

The most common adverse effects in health care worldwide are healthcare-associated infections (HAIs), which endanger the health of both patients and health care staff. Examples

of hospital-acquired infections (HAIs) that can happen to patients during hospitalization are central line-associated bloodstream infections (CLBSI), catheter-associated urinary tract infections (CAUTI), surgical site infections (SSI), and ventilator-associated pneumonia (VAP), according to the CDC (2014). Nurses, as healthcare providers, frequently come into contact with the infectious environment while providing care to patients. This is because nursing interventions often require touching the patients, which can facilitate cross-contamination if they fail to comply with proper infection prevention guidelines. Nursing students are not immune to the high risk of workplace exposure to biological hazards and the expectation to treat patients with uncertain infection status. In order to develop their skills during clinical practice training, nursing students have direct contact with patients and perform diverse procedures that may involve contacting the patient's bodily fluids.

Being compliance to IPC is important as it can reduce the risk for infectious among the nurses and nursing students. Previous study shows that nursing students generally report moderate to high compliance with IPC practices, including the use of personal protective equipment (PPE), waste disposal, and equipment decontamination (Bouchoucha et al., 2021; Kim & Park, 2021). However, there are variations in specific areas, with some students showing lower compliance in the use of protective devices. Identifying key factors that influencing IPC practices is necessary as it can increase the level of compliance among the nursing students. Goni-Fuste et al. (2021) suggested that to ensure students have adequate education and skills when delivering care safely, we need to enhance nurse education in infection prevention and control. Hence, this study is conduct to assess the compliance towards PC among UNIMAS undergraduate nursing students.

1.2 Problem Statement

Infection prevention and control (IPC) are foundational to ensuring patient safety and minimizing the risk of healthcare-associated infections. Among healthcare workers, nursing students are particularly vulnerable to lapses in IPC compliance due to their inexperience and developing clinical skills. This gap not only endangers the patients they care for but also puts the students themselves at a heightened risk of exposure to infectious agents. Studies show that while nurses often possess basic theoretical knowledge of IPC guidelines, their practical application in real-world scenarios remains inconsistent, largely due to limited hands-on experience, confidence, and the challenging clinical environments they encounter (Mansuri & Mansuri, 2020). The consequences of inadequate IPC compliance are far-reaching, affecting not only immediate patient outcomes but also the reputation and operational efficiency of healthcare institutions. Non-compliance with IPC protocols among nursing students may contribute to higher incidences of hospital-acquired infections, increased patient morbidity, and longer hospital stays, ultimately burdening the healthcare system with preventable costs (Abd Rahim & Ibrahim, 2022). Given the role nursing students will play as frontline healthcare providers, ensuring that they possess robust IPC competencies and consistently adhere to these standards is critical to fostering a culture of patient safety.

A cross-sectional study from Malaysia involving 301 nursing students reveals inadequate attitudes (41.7%) and insufficient practice (37.3%) regarding infection prevention and control measures (Rahiman et al., 2018). The findings indicate that nursing students continue to exhibit a low level of adherence to IPC precautions. Lack of understanding and compliance with infection prevention and control protocols lead to increased rates of healthcare-associated infections (HAIs) and hinder the recovery processes of patients. Nurses play an important role in addressing these challenges by spearheading

the implementation of evidence-based practices. This proactive approach not only reduces healthcare costs but also reduce the patient hospital stay (Desta et al., 2018). Understanding infection prevention and control measures is crucial for preventing hospital acquired infection (HAIs) (Suleyman et al., 2018).

1.3 Research Question

1.3.1 What is the level of knowledge on infection prevention and control (IPC) practices among nursing students?

1.3.2 What is the level of compliance on infection prevention and control (IPC) practices among nursing students?

1.3.3 What is the relationship between knowledge and compliance on infection prevention and control (IPC) practices among nursing students?

1.4 Research Aim

To evaluate the knowledge and compliance levels of nursing students regarding infection prevention and control (IPC) practices and to explore the relationship between their knowledge and compliance.

1.5 Research Objective

1.5.1 To assess the level of knowledge on infection prevention and control (IPC) practices among nursing students.

1.5.2 To assess the level of compliance on infection prevention and control (IPC) practices among nursing students.

1.5.3 To determine the relationship between knowledge and compliance on infection prevention and control (IPC) practices among nursing students.

1.6 Hypotheses

Null hypothesis (H_0): There is no significant relationship between the level of knowledge and compliance with IPC among nursing students.

Alternative hypothesis (H_a): There is a significant relationship between the level of knowledge and compliance with IPC among nursing students.

1.7 Significance of The Study

Despite the clear importance of IPC, limited research has focused specifically on nursing students' compliance to these protocols, and even fewer studies explore the underlying factors influencing compliance levels. This study aims to investigate the extent of IPC compliance among undergraduate nursing students, identify key factors that hinder adherence, and offer recommendations to enhance compliance training in nursing curricula. The insights from this study will contribute to more effective IPC training interventions and potentially reduce infection rates, benefiting patients, students, and healthcare institutions alike.

1.8 Definitions of Key Terms

Table 1

Conceptual and operational definitions of key terms

Terms	Operational	Conceptual
Knowledge	The level of understanding and a clear awareness about infection prevention and control (IPC) practices when providing care to the patients. 21 questions of knowledge will be assessed in this section with dichotomous scale (1 = yes, 0 = no).	Knowledge is defined as a highly esteemed state in which an individual is in cognitive contact with reality. It is, therefore, understood as a relational concept (Zagzebski, 2017).
Compliance	The assessment of actual implementation on infection prevention and control (IPC) when providing care to patients. 22 questions will be assessed in this section with 4-point adjectival scale (0=never, 1=seldom, 2=sometimes, and 3=always).	A practical protocol that healthcare workers should follow during clinical care to prevent exposure to infection, antimicrobial resistance, and occupational infections from patients, healthcare workers, and the community (Senbato et al., 2024).

Infection prevention and control (IPC)	In this study, the infection prevention and control (IPC) will be measure by using questionnaire adapted from Senbato et al. (2024).	A practical, evidence-based approach that prevents patients and healthcare workers from being harmed by avoidable infection and antimicrobial resistance (Senbato et al, 2024).
Nursing students	Refers to undergraduate students who pursuing a nursing degree at Universiti Malaysia Sarawak.	Defined as an individual who is currently enrolled in a Bachelor of Nursing course at a university (Dungen, 2021).

1.9 Summary

This chapter highlighted definitions as well as the main components in standard precautions of infection prevention and control (IPC). Problem statements were also discussed in this chapter which describe the issues raised about compliance with IPC practices. The significance of the study was also discussed in this chapter to review the benefits of this study for the future. The definitions of terms that will be used throughout the study such as compliance, infection prevention and prevention (IPC) and nursing students were defined and will be further constructed through literature review.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In the following chapter, the literature review will be further discussed to demonstrate the general idea of this study. Section (2.1) describes the knowledge on infection prevention and control (IPC) practices. Section (2.2) describes the compliance with infection prevention and control (IPC) practices. Section (2.3) describes the relationship between knowledge and compliance on infection prevention and control (IPC) practices. Section (2.4) shows the conceptual framework of this study. Finally, the summary of this chapter can be found in section (2.5). The sources adopted for the literature review were obtained from several online databases via search engines such as ResearchGate, Google Scholar, and PubMed. The articles reviewed were filtered via their publishing year within the range of 2010 – 2024 to acquire the most updated and recently published literature. The keywords used to find the relevant information are “compliance”, “infection prevention and control”, “nursing students”.

2.1 Knowledge on infection prevention and control (IPC) practices.

A descriptive study conducted by Olorunfemi et al. (2020) found that the knowledge level among student nurses will statistically predict the practice of infection prevention and control among them. As a nurse, having a high level of knowledge and positive attitudes towards infection prevention and control is crucial as it reflects one's compliance in the clinical setting with IPC. Knowledge levels about IPC among nursing students can vary, with some studies indicating low knowledge and poor practice, particularly in specific units like burns and medical-surgical units. While attitude of the nursing students can influence the way how they perceived and care about infection prevention and control (IPC) practices.

In Malaysia, a previous study found that nursing students have adequate knowledge as well as good attitudes toward infection prevention and control (IPC) practices. Findings also suggested that there is a significant relationship between knowledge and attitudes toward PC practices, which eventually impact their level of compliance (Yahaya et al., 2023). The understanding that nursing students acquire regarding PC significantly impacts their compliance to critical practices aimed at preventing infection transmission in healthcare environments. A solid foundational understanding of PC, encompassing hand hygiene, proper use of personal protective equipment (PPE), and compliance with sterilization protocols, equips students to execute these tasks accurately while emphasizing the significance of each step in safeguarding both patient and personal safety. Nursing students who comprehend the rationale for each PC measure are more adept at identifying the consequences of non-compliance, including the heightened risk of healthcare-associated infections (HAIs). Structured and regular PC training in nursing programs is essential for developing knowledge that supports compliance with these critical practices.

Addressing knowledge gaps in nursing students about infection prevention and control could strengthen their dedication to infection management, therefore fostering a safer healthcare setting for patients and professionals alike. A South Korean research (Kim & Hwang, 2020) indicated that 63.48% (n=112) of nursing students needed more instruction on coping following exposure. Prior to commencing their clinical practice training, nursing students should have instruction on significant pathogens that may infect them through occupational exposure, methods for preventing such infections, strategies for managing exposure, and protocols for reporting incidents (Kim & Hwang, 2020). This will augment their understanding and foster favourable attitudes towards PC measures, hence amplifying the effectiveness of curtailing the transmission of infectious illnesses (Sugathan et al., 2018; Yahaya et al., 2023).

However, this not align with another study conducted by Rosli et al. (2022) showed a poor knowledge on PC practices during clinical attachment at International Islamic University Malaysia (IIUM). 55 out of 83 participants indicated the poor knowledge on PC practices while 28 participants indicated moderate knowledge and none of the participants demonstrated good knowledge. However, all the participants agreed that hand hygiene was the best way to perform PC practices which wash hand before and after contact with the patients. Hence, insufficient of understanding of PC may result in the neglect of necessary practices (Nwozichi et al., 2018). This show that the students lacked information regarding the PC and consequently will impact their attitudes and compliances. Therefore, the risk of hospital acquired infection (HAIs) will increase and will prolong the patient's hospital stay f they are infected.

A study by Permana & Hidayah (2017) also did report a contrasting finding where students reported low level of knowledge and negative attitudes towards the implementation standard precautions of infection prevention and control (IPC) practices. Permana and Hidayah (2017) further reiterated that the attributable reasons could be the lack of guidelines in the application of standard precautions and the lack of equipment provided by the hospital. Further according to Permana and Hidayah (2017), improvement in attitude among nursing students is compulsory in order to prevent the spread of hospital-acquired infection. Therefore, nursing students can enhance knowledge and improve their attitudes by getting used to applying standard precautions when giving care to patients.

2.2 Compliance with infection prevention and control (IPC) practices.

A cross-sectional study among nursing students conducted by Kaushal & Clement (2022) showed that nursing students in Malaysia have a high compliance of the standard

precautions towards infection prevention and control. The study findings revealed that nursing students had high compliance towards standard precautions with only 1.8% of them reporting “very low compliance” towards standard precautions. This study showed that the participants possess a high knowledge as well as positive attitude towards standard precautions in clinical settings which reflecting the level of compliance. In fact, 64.7% of the students knew that transmission of the infectious organism can be reduced by adhering to standard and contact precautions. Furthermore, more than half of the students reported strongly agreed that segregation of clinical and non-clinical waste is useful to prevent transmission of infections from one to another. The participants (98.2%) also stated that hand hygiene is recommended before and after contact with patients. Thus, as a healthcare provider, recognizing the importance of hand cleanliness is crucial, given the constant presence of microorganisms on our hands.

In the same vein, Kim & Park (2021) conducted an additional study among South Korean nursing students, which found that the majority of nursing students exhibited a high level of compliance with PC practices, with a mean score of 4.09 ± 0.43 out of 5. Compliance with cross-infection prevention yielded the maximum score (4.42 ± 0.54). The handwashing and hand massages were consistently or predominantly performed by a substantial majority of participants, with a range of 87.64% to 93.82%, before and after patient contact.

According to Almoghrabi et al. (2018), hand hygiene is the simplest, and perhaps the most effective action to avoid infections linked to healthcare. Even though hand rubs are useful and convenient in healthcare settings for hand hygiene, it does not substitute hand washing completely. When hands are soiled with blood, or body fluids, hand washing with soap and water should be practised (CDC, 2018). This study has also suggested relationships between improving hand hygiene practices and reducing infection rates (Almoghrabi et al., 2018). In fact, this finding also supported by Bouchoucha et al., (2021) when it shows that

nursing students generally report moderate to high compliance with IPC practices, including the use of personal protective equipment (PPE), waste disposal, and equipment decontamination.

However, a study by Olorunfemi (2020), shows that nursing students in Nigeria exhibited a low level of compliance with PC practices. He stated that nursing students did not utilize eye shields when there was a risk of blood splashes, failed to wear gloves when touching mucous membranes, and did not wear gloves when administering injections to patients. According to CDC (2018), PC practices including hand hygiene, use of Personal Protective Equipment (PPE), safe injection practices, safe handling and cleaning of contaminated equipment, and respiratory hygiene or cough etiquette. It shows that in order to prevent the spread of infectious diseases, performing hand hygiene only is not enough as microorganisms can spread by various ways. Thus, as a student, being compliant to PC practices is crucial especially during training period as they will bring the knowledge until becoming a future staff nurse.

A study by Rahiman et al. (2018), also found that 37.3% of students exhibited inadequate IPC practices. 63.1% of students reported frequently neglecting to wear gloves and gowns when deemed necessary for contact precautions. Despite the necessity for airborne precautions, 82.7% reported not wearing a mask. The research indicated inadequate mask usage practices during procedures such as suctioning (35.4%) and care for pneumonia patients (42.5%). Although the majority of students (64.9%) recognized the effectiveness of standard precautions (SPs) in preventing the spread of infection, half of the students (50%) reported non-compliance with these precautions, such as wearing masks for airborne protection.

2.3 Relationship between knowledge and compliance towards infection prevention and control (IPC) practices.

Olorunfemi et al. (2020) conducted a study with 100 student nurses in Nigeria, which revealed inadequate knowledge and lack of practice regarding PC practices. The findings indicated a noteworthy correlation between knowledge and practices among nursing students, as determined by Spearman's correlation coefficient, with a significance level of $p < 0.001$. The author emphasizes that having a deep understanding is essential, as to improves the decision-making abilities of nursing students and affects their actions, which could help prevent infectious diseases. The statistical analysis of the study's results indicates a correlation between student nurses' compliance with PC practices and their level of knowledge.

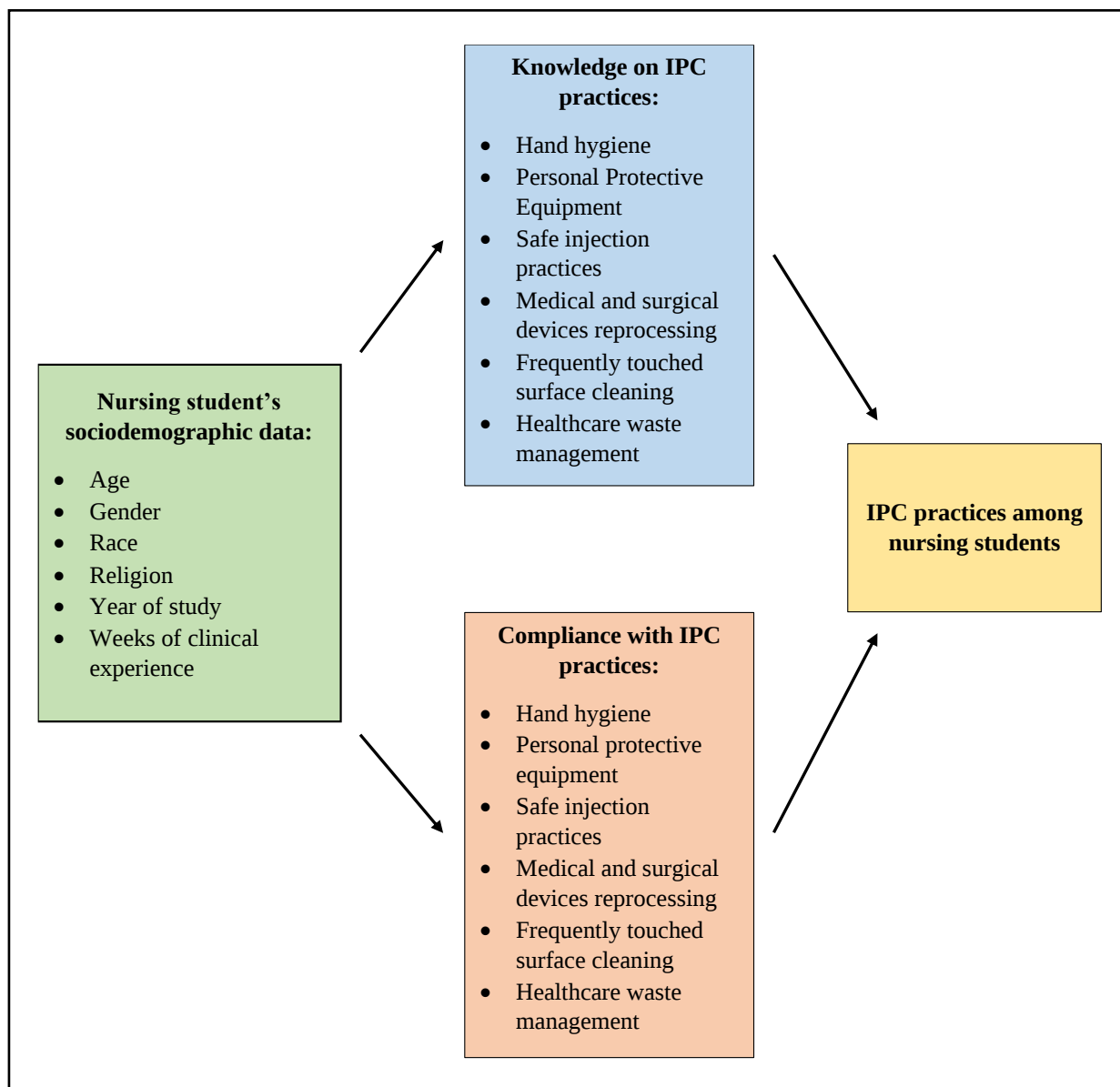
Similarly, another study by Al-Faouri et al. (2021) also found that knowledge influences compliance with PC practices. This cross-sectional study found that the participants showed a mean total knowledge score of 16.27 out of 20, which indicated a high level of knowledge and an intermediate level of compliance with a mean of 49.15/80 (61.4%). This study shows that there was a positive correlation between knowledge and compliance, with the strength being $r = 0.387$, $p \leq 0.01$. Therefore, it can be inferred that an increase in knowledge will result in higher level of compliance with PC practices, thereby improving the clinical practice of nurses. These findings align with a study by Da'seh et al. (2023), which also found a relationship between knowledge and compliance with PC practices. The study recruited a total of 302 participants from three Jordanian hospitals. The results showed the average knowledge score was 14.09 ($SD = 2.97$), which indicated a satisfactory level of knowledge, while the average compliance score was 14.46. The author found that there was a significant positive and strong relationship between the nurse's knowledge and compliance with PC practices ($r = 0.77$, $p < 0.001$).

In contrast, a cross-sectional study in Malaysia involving 194 nursing students revealed no correlation between knowledge level and compliance with PC practices (Jamiran & Ludin, 2021). The study revealed that participants demonstrated significant compliance with PC and possessed a strong level of knowledge. However, the author found no significant correlation between the level of knowledge and the level of practice in PC, indicated by a p -value of 0.756. The findings align with the study by Anuar et al. (2021), which indicated no significant correlation between compliance with PC and knowledge level ($p = 0.23$). However, a significant correlation was found between the duration of practical training and compliance with SP ($p = 0.02$). The study found that nursing students exhibited a high level of compliance (mean of 3.7 ± 0.2 and 3.6 ± 0.3) and demonstrated substantial knowledge (14.7 ± 2.5 and 15.4 ± 2.4) concerning PC practices. This research was carried out with diploma and degree nursing students. However, the author found no significant correlation between knowledge and compliance with PC among nursing students ($p = 0.23$).

2.4 Conceptual Framework

Figure 2

The conceptual framework of knowledge and compliance towards infection prevention and control (IPC) practices among nursing students.



2.5 Summary

This chapter concludes the comparison and contrast of analogous studies and their results among nursing students. Despite the extensive literature analysis, the majority of nursing students acknowledge the critical importance of infection prevention and control techniques for healthcare workers, especially during patient interactions. The majority of the study indicates that nursing students exhibited minimal compliance with IPC practices, particularly hand cleanliness, which is the simplest technique for reducing the transmission of infectious illnesses to both patients and students themselves. Compliance with infection control necessitates a holistic strategy that encompasses both teaching and training on standard measures for IPC. Therefore, enhancing knowledge, fostering a positive attitude, and reinforcing best practices among healthcare personnel, nursing students, and patients are vital elements of effective methods for infection prevention and control.

CHAPTER 3: METHODOLOGY

3.0 Introduction

In this chapter, the methodologies that are used to this study to achieve the research objective will be discussed and classified into few subheadings which are (3.1) research design, (3.2) research setting, (3.3) inclusion and exclusion criteria, (3.4) sampling method and sample size, (3.5) study instrument, (3.6) ethical consideration, (3.7) data collection procedure, (3.8) data analysis method and, (3.9) summary of the chapter.

3.1 Research Design

The objective of research design is to provide an appropriate framework for investigation (Jilcha, 2019) and to outline a study strategy. Consequently, this research utilised a quantitative and cross-sectional design. Quantitative research encompasses many methodologies that utilise statistical or numerical data to systematically examine social issues (Watson, 2015). Quantitative data was required for analytical reasons. Consequently, the quantitative study design aligns with the objectives of this research. The cross-sectional research is the most suitable design for examining the prevalence of illnesses, attitudes, knowledge as well as compliances among health professionals. A study indicated that this design incurs lower financial burdens and time limitations, as data is collected at a singular point in time (Kesmodel, 2018). In addition, the objective of this design is to analyse data from a population at a single moment in time (Wang & Cheng, 2020).

3.2 Research Setting

The study was conducted at the Faculty of Medicine and Health Sciences (FMHS), University Malaysia Sarawak (UNIMAS), Kota Samarahan, Sarawak. The main campus of UNIMAS is located approximately 16 kilometres from Kuching, the capital city of Sarawak. There are two undergraduate courses offered in FMHS, which are Bachelor of Nursing with Honours and Doctor of Medicine. This study's target population were only undergraduate nursing students (year 2 until year 4) from FMHS at the University of Malaysia (UNIMAS) which are 184 nursing students.

3.3 Inclusion & exclusion criteria

3.3.1 Inclusion Criteria

The inclusion criteria for this study are the 2nd to 4th year undergraduate nursing students from Universiti Malaysia Sarawak who are willing to participate and enrol in this study after understanding and have given their approval after reading through the study's informed consent statement.

3.3.2 Exclusion Criteria

The exclusion criteria in this study are the 1st year undergraduate nursing students from Universiti Malaysia Sarawak and students from other courses, faculties, and universities. Postgraduate and post-registration students also be excluded from this study, as this research aims to determine the knowledge and compliance only between undergraduate students regarding the research title. Moreover, students who have been recruited in the pilot study and who are not willing to participate will be exempted from the study.

3.4 Sampling Method and Sampling Size

3.4.1 Sampling method

Sample is a subset of the population that contains characteristics of that population. Participants in this study were selected using simple random sampling method. A simple random sampling was categorized under probability sampling (Hayes, 2023). Simple random sampling is frequently used in quantitative research (Rahi, 2017). Simple random sampling is to ensure that participants have an equal opportunity to be chosen and population that exhibit high homogeneity (Thomas, 2023). The population list for this study was created by the researcher using a computer program to generate random numbers and compiling a numerical list covering the entire sample size (Rahi, 2017). A name list of nursing students from year 2 to year 4 was obtained from academic office FMHS, UNIMAS. The names on the name list were arranged according to the matric number by using Excel. Then enter the formula=RAND () and press 'Enter' key. The purpose of simple random sampling is to reduce the probability of research biases (Thomas, 2023).

3.4.2 Sample size

Figure 3.1

Taro Yamane (1973) formula

$$n = \frac{N}{1 + Ne^2}$$

n = sample size

N = population size

e = error (0.05) reliability level 95%

Using the formula above,

$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{184}{1 + (184)(0.05)^2}$$

$$n = 126 \text{ participants}$$

Based on this formula, estimated sample size for this study was 126 participants. However, the researcher must consider participant's compensation such as those who refuse to participate; therefore, the researcher must add 10% to the sample size (Das et al., 2016). Therefore, to compensate for missing data in the sample, an additional 10% attrition rate was added. After adding in 10%, the total sample size for this was 140 participants. The calculation was as the following:

Calculation of sample size with attrition rate:

126 x 10% = 13, therefore 126 + 13 = 139 participants.

Pilot study: 139 x 10% = 13.9 which were 14 participants.

Actual study: 139 participants out of 169 participants (180 participants from total sample size minus 14 total participants from pilot study)

As such, total of 139 participants needed in this study.

After rounding up the total participants, the final sample size was 140 participants.

3.5 Study Instrument

The study instrument is the tool that used by the researcher to collect the data needed for the research. The questionnaire was presented in single language which are in English. In this study, a self-administered questionnaire was adopted from previous study from Senbato et al. (2024) with author permission (Appendix D). The questionnaire divides into three sections which are section A is sociodemographic data, section B is knowledge on IPC practices and section C is compliance on IPC practices.

In section A gathered information on the participant's sociodemographic, including the respondent's age, gender, race, religion, academic year and weeks of clinical experience. In this section, the participants need to tick (/) their answer in the box provided.

Section B consisted of 21 questions to assess the level of knowledge on infection prevention and control (IPC) practices among UNIMAS nursing students. This section will assess using dichotomous scale with the options 'yes' and 'no'. The participants need to tick (/) their answer in the box provided. Each question with correct answer (yes) was given score of 1 meanwhile each question with incorrect answer (no) was given score of 0. The responses to a total of 21 questions will then categorized into three different levels: optimal (total score exceed 85%), suboptimal (total score between 70% and 85%) and poor (total score below 70%).

Section C consisted of 22 questions to assess the compliance on infection prevention and control (IPC) practices among UNIMAS nursing students. This section will assess using 4-point Likert scale with options: never (0), seldom (1), sometimes (2) and always (3). The total score ranges from 0 to 22; a higher score indicates better compliance with infection prevention and control (IPC) practices. The responses to a total of 22 questions will then

categorized into three different levels: optimal (total score exceed 85%), suboptimal (total score between 70% and 85%) and poor (total score below 70%).

3.6 Ethical Consideration

A letter of ethical approval from the Research and Ethics Committee of the Faculty of Medicine and Health Sciences, University Malaysia Sarawak (UNIMAS) was obtained before conducting this study (Appendix A). A formal informed consent was obtained prior to the study to the participants that are willing to take part in this study and the participants have their rights to withdraw from this study anytime without any consequences or penalty (Appendix B). Furthermore, a formal letter of consent email was given to the author to seek permission of the questionnaire tools that were used in this study (Appendix C). All the data obtained in this study was private and confidential. No personal identifying information will be revealed. All the data obtained is only used for research purposes. The data can only be accessed by the researcher and supervisor. The principles of confidentiality and anonymity were rigorously upheld throughout the study, with no inclusion of personal details on the questionnaire, only with coding as a reference for the researcher. The confidentiality of the participants was maintained by labelling them using numbering instead of their name.

3.7 Data Collection Procedure

3.7.1 Pilot study

A pilot study was conducted before the actual study for those who meet the inclusion criteria to test the reliability and validity of the questionnaire. The goal of the pilot study is to analyse the validity before the main study. Conducting a pilot study is crucial for

enhancing the quality and efficiency of the main research. According to Whitehead et al. (2015), the pilot study involved 10% of the total sample size. The participants involved in the pilot study were excluded from the main study. Conducting a pilot study is to determine the sample size and assess different aspects of the primary study. Cronbach's alpha used to analyse the data, assessing the consistency and reliability of the instruments.

Therefore, to perform the pilot study, 10% of sample size was selected to be participated. The sample size of this study was 140 participants, therefore 10% of sample size were $14.0 \approx 14$. In conclusion, 14 of nursing students who met the inclusion criteria were chosen to participate in the pilot study by using the same sampling method as the actual study. The 14 participants were excluded in the main study. The data collected from pilot study also excluded in the data analysis of the actual study. The Cronbach Alpha value for knowledge items was 0.822, while for compliance was 0.830.

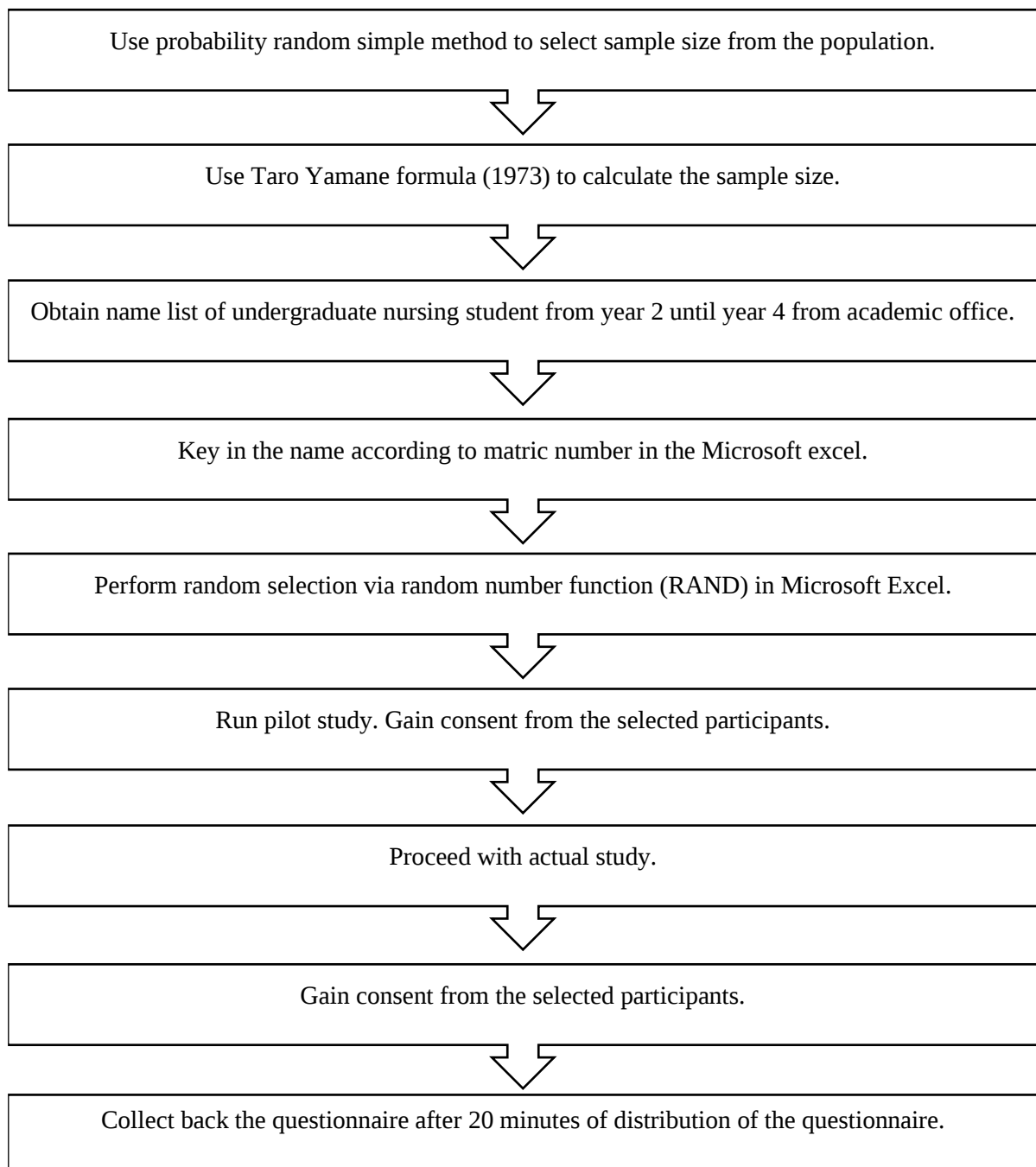
3.7.2 Actual study

This study used probability simple random sampling method to select the sample from the population. Firstly, the inclusion criteria and exclusion criteria were determined to define the target population of the study. The target population were UNIMAS undergraduate Nursing students from Year 2 until year 4 who met the inclusion criteria. The sample size was 140 after calculated by using the Taro Yamane Formula (1973). A name list of nursing students from year 2 to year 4 was obtained from academic office FMHS, UNIMAS. The questionnaire was adapted from Senbato et al. (2024) and modified to suit the purpose of this research. The participants that met criteria of this research and willing to participate in this research were recruited. The questionnaire was distributed in Google form link via WhatsApp and the participants spent about 15 – 20 minutes to complete the form. Before the commencement of the study, the participant filled the informed consent as they

are willing to participants, and they understood their right in this research study. The contact number of the researcher was provided in the consent for the participants to communicate with the researcher if they have any question on the questionnaire.

Figure 3.2

Data collection procedure



3.8 Data Analysis Method

The data collected in this study was analysed using statistical software which is Statistical Package for the Social Science (SPSS) version 27 IBM.

Descriptive statistics analysis was implemented to describe and summarise the sociodemographic data, the level of knowledge and compliance towards infection prevention and control (IPC) among UNIMAS undergraduate nursing students. The data was presented in frequency, percentages, mean, standard deviation (*SD*) and median. The frequencies and percentage were obtained for categorical data (age, gender, race, religion, year of study and weeks of clinical experience). The mean and standard deviation was obtained for continuous data.

Inferential statistics analysis was applied to examine the correlation between knowledge and compliance towards IPC among UNIMAS nursing students. The total score for knowledge and compliance of each respondent was calculated in Microsoft Excel which then transferred to SPSS. The normality of both data was analysed using Kolmogorov-Smirnov in SPSS due to the large sample size of more than 50 respondents (Mishra et al., 2019). The normality of the total score of knowledge and compliance was assessed to determine the type of inferential statistics analysis to be used. A Spearman's correlation coefficient was implemented to determine the relationship between knowledge and compliance on infection prevention and control (IPC). Also, a Mann-Whitney U test was conducted to examine the relationship between gender towards the level of knowledge and compliance.

3.9 Summary

In summary, this study was conducted quantitatively. A cross-sectional study that was conducted at the Faculty of Medicine and Health Sciences in UNIMAS where it involved year 2 until year 4 UNIMAS undergraduate nursing students. Simple random sampling was used and calculated using the Yamane formula (1973). Overall, the sample size for this study was 140 participants. This study instrument contains four sections, and the self-administered questionnaire was distributed to the participants. Ethical approval was obtained before any data collection will be gathered. Lastly, data gathered in this was analysed using IBM SPSS Statistics version 27, followed by using the descriptive and inferential statistics.

CHAPTER 4: RESULTS

4.0 Introduction

This chapter present the result obtained from 140 undergraduate nursing students in UNIMAS. All the result was acquired based on the research objectives of the study which were to assess the level of knowledge on infection prevention and control (IPC) practices, to assess the level of compliance on IPC practices and to examine the relationship between knowledge and compliance on IPC practices among the UNIMAS undergraduate nursing students. In section 4.1 presents the socio-demographic characteristics of the nursing students in UNIMAS. Section 4.2 presents the level of knowledge on IPC practices among UNIMAS nursing students. Section 4.3 presents the level of compliance on IPC practices among UNIMAS nursing students. Section 4.4 presents the relationship between knowledge and compliance towards IPC practices among UNIMAS nursing students.

4.1 Response Rate

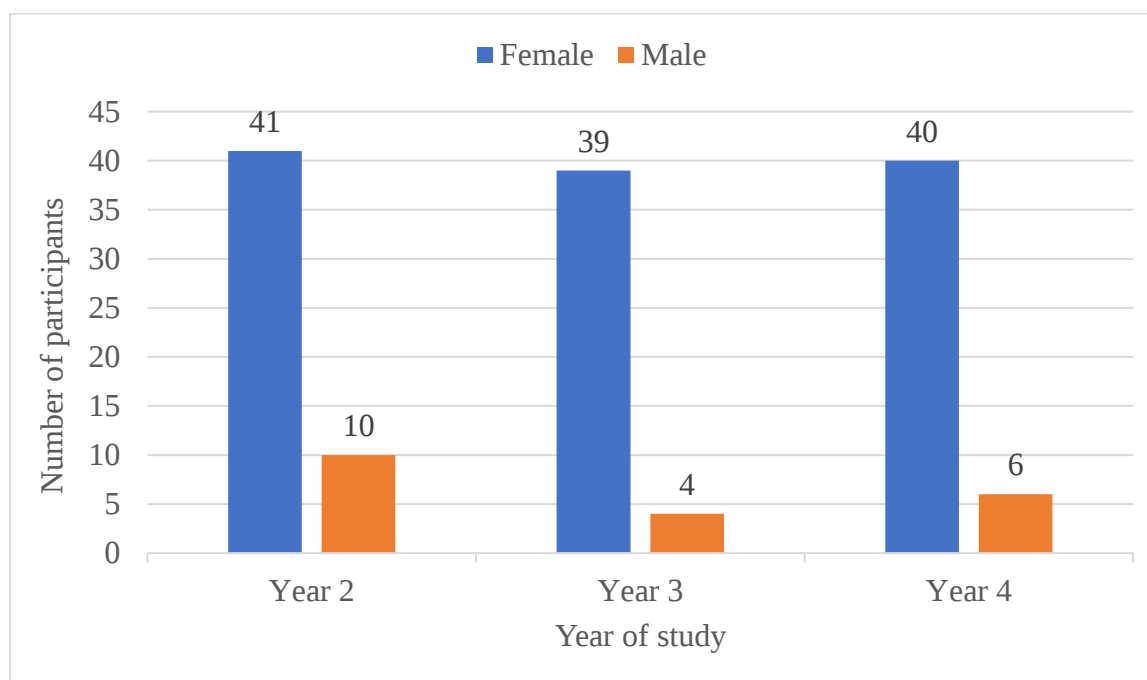
The questionnaire could be retrieved through a QR code leading to a Google form that was distributed to the class representative of each cohort, to be passed around in the class during break time. For the first round of distribution, there were only 86 respondents obtained. After the follow-up was done to each participant who had not answered the questionnaire yet, an increment was noted in the response rate, with total number of participants who completed the questionnaire to be 140.

4.2 Socio-demographic characteristics of UNIMAS nursing students.

A total of 140 undergraduate nursing students in UNIMAS were recruited. There were no outliers or extreme values screen from this data. In this study, there were 120 females (85.7%) and male 20 (14.3%). Most of the participants were from year 2 students 36.4% ($n = 51$), followed by year 4 nursing students 32.9% ($n = 46$) and year 3 students with 30.7% ($n = 43$) (Figure 4.1).

Figure 4.1

Distribution of participants by gender and year of study ($n = 140$)



Most of the participants were Malay 44% ($n = 61$), followed by Bumiputera Sarawak ($n = 48$, 34%), Bumiputera Sabah ($n = 24$, 17%) and 7 (5%) participants were Chinese. (Figure 4.2). Majority of the participants was Islam (59.3%), while Christian was 39.3% and Buddhist was 1.4% (Table 4.1).

Table 4.1

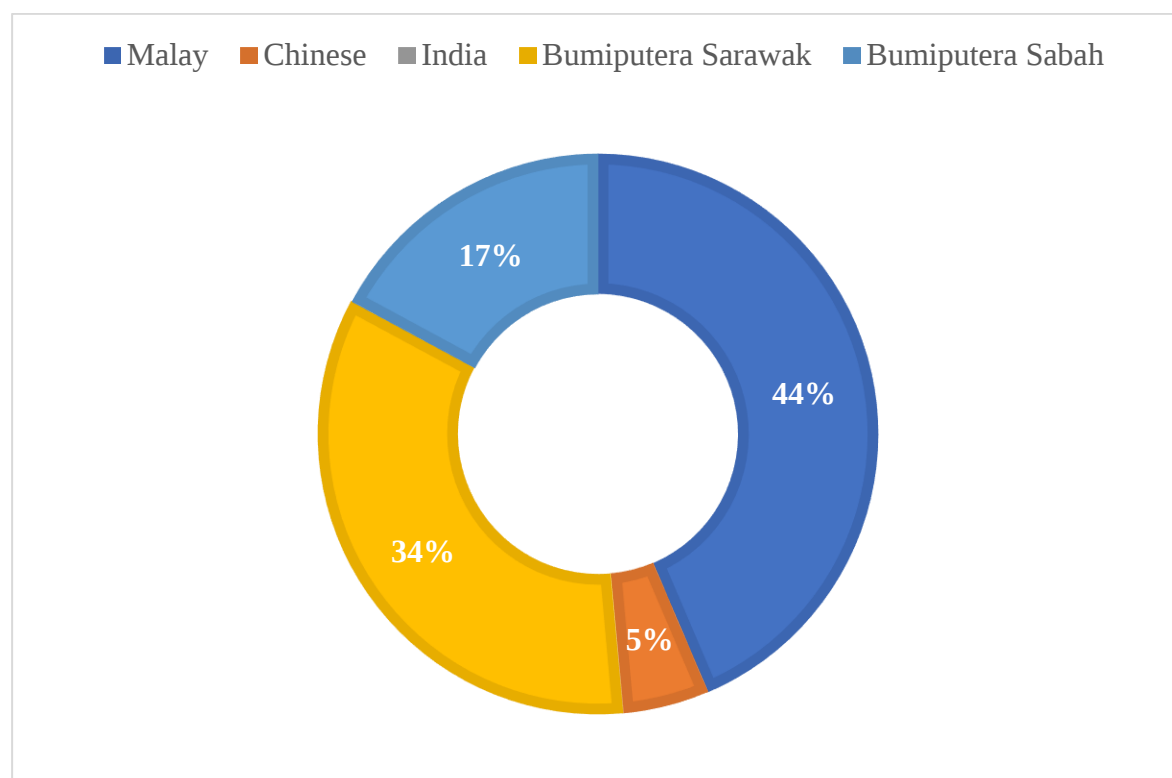
Total participants by religion ($n=140$).

Description	Frequency (n)	Percentage (%)
Religion		
Islam	83	59.3
Christian	55	39.3
Buddhist	2	1.4

Note: n : frequency, %: percentages

Figure 4.2

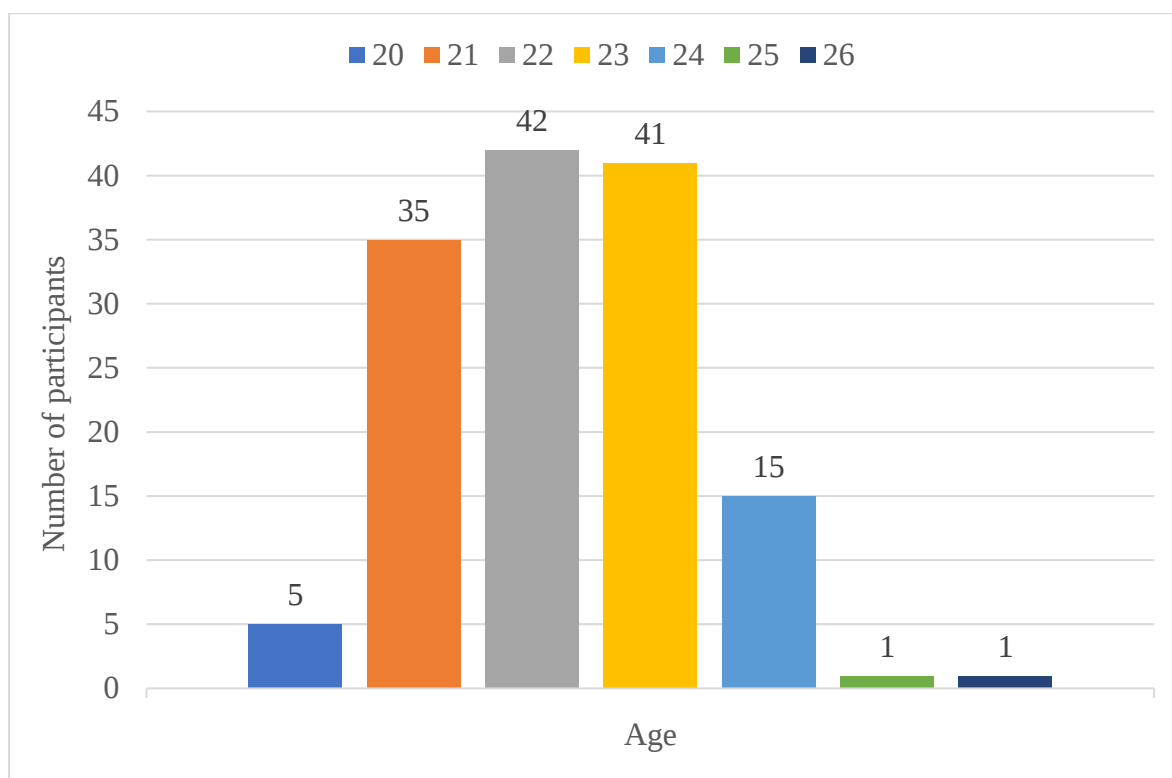
Percentage distribution of participants by race ($n = 140$)



The highest participants were in the group of 22 years old ($n = 42$, 30.0%) while the lowest participants were from 25- and 26-years old age group ($n = 1$). Participants mean age ($\bar{x}$) was 22.24 and the standard deviation (SD) was 1.116.

Figure 4.3

Frequency distribution of participants by age ($n = 140$).



A total of 53 students (37.9%) reported having clinical experience within the range of 14 to 26 weeks. This cohort likely represents students in the early stages of clinical exposure, typically aligned with their second year of study. The lowest number of students 39 students (27.9%) indicated they had accumulated between 27 and 39 weeks of clinical experience and 48 students (34.2%), reported the highest level of clinical exposure, with 40 to 52 weeks of experience. Out of 140 participants, 114 (81.4%) of them have attended Infection Prevention and Control (IPC) courses or training (Figure 4.4).

Table 4.2

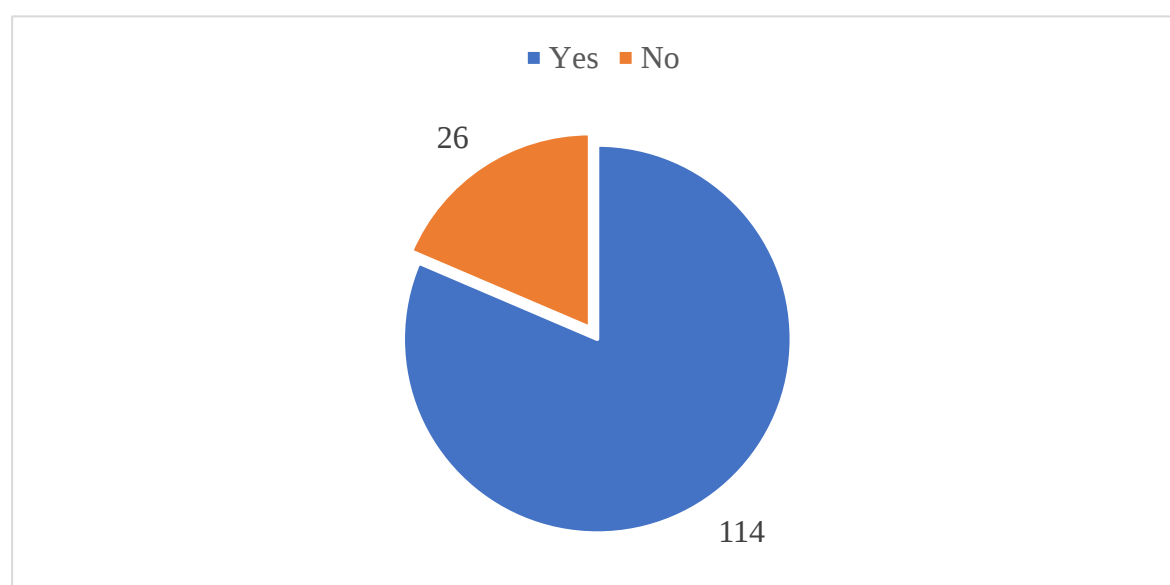
Total Weeks of Clinical Experiences (n = 140).

Description	<i>n</i>	%
Weeks of clinical experiences		
14 – 26 weeks	53	37.9
27 – 39 weeks	39	27.9
40 – 52 weeks	48	34.2

Note: *n*: frequency, %: percentages

Figure 4.4

Frequency distribution of participants who had attended any training in IPC (n = 140).



4.3 The level of knowledge on infection prevention and control (IPC) practices among UNIMAS nursing students.

Table 4.4.1 displays the total scores for the level of knowledge regarding facts about infection prevention and control (IPC) practices. Correct responses received a score of 1, while incorrect responses received a score of 0. Respondents with a total score of 14 and below were categorized as having poor knowledge, while respondents with a total score ranging from 15 – 16 were categorized as having suboptimal knowledge and participants with a total score of 18 and above were categorized as having optimal knowledge. The majority of respondents (75%) demonstrated optimal knowledge regarding IPC practices, 34 (24.3%) participants showed suboptimal knowledge, while only 1 (0.7%) participant exhibited poor level of knowledge (Table 4.3). Table 4.6 shows the level of knowledge on IPC practices among the participants.

Table 4.3

Level of knowledge on IPC practices among participants (n = 140)

	The level of knowledge regarding IPC practices, <i>n</i> (%)		
	Poor	Suboptimal	Optimal
UNIMAS undergraduate nursing students	1 (0.7%)	34 (24.3%)	105 (75.0%)

Note: *n*: frequency, %: percentage

Table 4.4

Descriptive statistics for total knowledge score on IPC practices among UNIMAS nursing students (n = 140)

		Statistic
Total knowledge score on IPC practices	<i>Mdn</i>	18.00
	<i>IQR</i>	2.00
	Maximum	21.00
	Minimum	16.00
	Range	5.00
	Mode	18.00

Note: *Mdn*: median, *IQR*: interquartile range

Table 4.5 shows the analysis of normality distribution for total score knowledge towards IPC practices. The value $p < .001$ indicated that total score for knowledge was not normally distributed.

Table 4.5

The analysis of normality distribution for knowledge towards IPC practices among UNIMAS nursing students (n = 140)

	Kolmogorov-Smirnov ^a		
	Statistic	df	Sig.
Total knowledge score on IPC practices	.153	140	<.001

a. Lilliefors Significance Correction

Table 4.6

Knowledge on infection prevention and control practices of participants (n = 140)

		n (%)	
		Yes	No
1.	Every client and patient are potentially infectious or susceptible to infection.	133 (95)	7 (5)
2.	Standard precautions should be applied to all patients and clients attending the healthcare services.	138 (98.6)	2 (1.4)

3.	Standard precaution is applied to all blood, body fluid, secretion, and excretion except sweat, mucous membranes, and in-intact skin.	111 (79.3)	29 (20.7)
4.	Hand hygiene is the single most important intervention for preventing the transmission of infections.	139 (99.3)	1 (0.7)
5.	There are 5 moments of hand washing.	126 (90)	14 (10)
6.	Hand washing is indicated between tasks and procedures on the same patient.	131 (93.6)	9 (6.4)
7.	The use of alcohol-based antiseptic for hand hygiene is more effective than hand washing with plain soap and water.	53 (37.9)	87 (62.1)
8.	The use of personal protective equipment relies on a healthcare worker's assessment of the risk of exposures/types, contact, and intensity of contact.	138 (98.6)	2 (1.4)
9.	Use gloves before touching anything wet, such as non-intact skin, mucous membranes.	138 (98.6)	2 (1.4)
10.	Hand washing should be practiced after the removal of the glove.	136 (97.1)	4 (2.9)
11.	Personal protective equipment prevents the risk of acquiring infection.	138 (98.6)	2 (1.4)
12.	The aseptic technique should be applied when preparing and delivering injections.	132 (94.3)	8 (5.7)
13.	Used sharps and needles should be safely disposed of in closed and puncture-resistant containers.	139 (99.3)	1 (0.7)
14.	Needles should be recapped after use.	19 (13.6)	121 (86.4)
15.	Patient care equipment should be cleaned between each use to prevent cross-contamination.	135 (96.4)	5 (3.6)
16.	Do you know the steps for reprocessing medical and surgical devices?	85 (60.7)	55 (39.3)
17.	The frequently touched surface of the patient zone can harbour and cause the microorganism to spread across the facility via hands and contaminated items.	139 (99.3)	1 (0.7)
18.	Do you know the different categories of waste and appropriate disposal methods at the point of waste generation?	135 (96.4)	5 (3.6)
19.	Adherence to standard precautions prevents the occurrence of healthcare-associated infections.	140 (100)	0 (0)
20.	Standard precaution contributes to preventing occupational infections among healthcare workers.	139 (99.3)	1 (0.7)
21.	Compliance with infection prevention and control standard precautions plays an important role to prevent antimicrobial resistance.	138 (98.6)	2 (1.4)

Note: n: frequency, %: percentages

4.4 The level of compliance on infection prevention and control (IPC) practices among UNIMAS nursing students.

The median score for total score of compliance was 61.0 with a mean of 60.54. Table 4.7 displays the total score for the compliance towards IPC practices. The compliance score of 70% and below was classified as ‘poor compliance’, scores ranging from 71% to 84% were categorized as ‘suboptimal compliance’ and scores above 85% were categorized as ‘optimal compliance’. The majority of respondents (86.4%) demonstrated an optimal compliance, total of 16 (11.5%) participants showed suboptimal compliance, while (2.1%) exhibited poor compliance. There was a huge gap difference between respondents who are categorized as optimal and poor compliance.

Table 4.7

Level of compliance on IPC practices among participants (n = 140)

	The level of compliance regarding IPC practices, n (%)		
	Poor	Suboptimal	Optimal
UNIMAS undergraduate nursing students	3 (2.1%)	16 (11.5%)	121 (86.4%)

Note: n: frequency, %: percentage

Table 4.8

Descriptive statistics for total compliance score on IPC practices among UNIMAS nursing students (n = 140)

		Statistic
Total compliance score on IPC practices	<i>Mdn</i>	61.00
	<i>IQR</i>	7.00
	Maximum	66.00
	Minimum	48.00
	Range	18.00
	Mode	66.00

Note: *Mdn*: median, *IQR*: interquartile range

Table 4.9 shows the analysis of normality distribution for total score of compliance towards IPC practices. The value $p < .001$ indicated that total score for compliance was not normally distributed.

Table 4.9

The analysis of normality distribution for compliance towards IPC practices among UNIMAS nursing students (n = 140)

	Kolmogorov-Smirnov ^a		
	Statistic	df	Sig.
Total compliance score on IPC practices	.157	140	<.001

a. Lilliefors Significance Correction

Table 4.10

Participant's compliance with infection prevention and control practices (n = 140)

Compliance		n (%)			
		Never	Seldom	Sometimes	Always
1.	Wash/sanitize hands before touching a patient.	0 (0)	0 (0)	6 (4.3)	134 (95.7)
2.	Wash/sanitize hands before cleaning or aseptic procedures.	0 (0)	0 (0)	3 (2.1)	137 (97.9)
3.	Wash/sanitize hands after body fluid exposure.	0 (0)	2 (1.4)	1 (0.7)	137 (97.9)
4.	Wash/sanitize hands after touching patient.	0 (0)	0 (0)	5 (3.6)	135 (96.4)
5.	Wash/sanitize hands immediately after removal of gloves.	0 (0)	1 (0.7)	6 (4.3)	133 (95)
6.	Wash/sanitize hands between patient contact.	1 (0.7)	0 (0)	19 (13.6)	120 (85.7)
7.	Wash/sanitize hands after touching the patient's surroundings.	0 (0)	2 (1.4)	26 (18.6)	112 (80)
8.	When providing care considering that all patients as potentially infectious/susceptible to infection.	0 (0)	5 (3.6)	12 (8.6)	123 (87.9)
9.	I protect myself against the body fluids of all patients regardless of their diagnosis.	0 (0)	1 (0.7)	12 (8.6)	127 (90.7)

10.	I wear clean gloves whenever there is a possibility of exposure to anybody's fluids.	0 (0)	0 (0)	7 (5)	133 (95)
11.	I change gloves between contacts with different patients.	0 (0)	2 (1.4)	23 (16.4)	115 (82.1)
12.	I avoid wearing my gown out of hospital compounds.	4 (2.9)	8 (5.7)	28 (20)	100 (71.4)
13.	I wear a waterproof apron whenever there is a possibility of body fluid splashing in my body.	1 (0.7)	3 (2.1)	12 (8.6)	124 (88.6)
14.	I wear eye goggles whenever there is a possibility of body fluid splashing in my face.	23 (16.4)	41 (29.3)	20 (14.3)	56 (40)
15.	I sterilize all reusable equipment before being used on another patient.	5 (3.6)	16 (11.4)	31 (22.1)	88 (62.9)
16.	I clean and disinfect equipment and environmental surfaces using detergents and disinfectants.	1 (0.7)	9 (6.4)	37 (26.4)	93 (66.4)
17.	I segregate non-infectious wastes in a black color-coded dust bin.	1 (0.7)	9 (6.4)	23 (16.4)	107 (76.4)
18.	I segregate infectious medical wastes in a yellow color-coded dust bin.	1 (0.7)	4 (2.9)	13 (9.3)	122 (87.1)
19.	I never bend needles with my hands.	4 (2.9)	1 (0.7)	19 (13.6)	116 (82.9)
20.	I avoid removing used needles from disposable syringes.	3 (2.1)	5 (3.6)	31 (22.1)	101 (72.1)
21.	I place used sharps in a puncture-resistant container at the point of use.	1 (0.7)	5 (3.6)	15 (10.7)	119 (85)
22.	I never recap needles.	1 (0.7)	7 (5)	36 (25.7)	96 (68.6)

Note: n: frequency, %: percentages

4.5 The relationship between knowledge and compliance on infection prevention and control (IPC) practices among UNIMAS nursing students.

The relationship between knowledge and compliance was investigated using Spearman correlation coefficient (Table 4.11). No outliers or extreme values were detected from the box plot. According to Schober et al. (2018), the strength of correlation $r = 0.00 - 0.10$ indicated negligible correlation, $0.10 - 0.39$ indicated weak correlation, $0.40 - 0.69$ indicated moderate correlation, $0.70 - 0.89$ indicated strong correlation and $0.90 - 1.00$ indicated very strong correlation.

Analysis revealed there was a correlation between the two variables $r(140)$, $p < .001$ with high level of knowledge associated with high level of compliance. The result revealed a significant correlation between knowledge and compliance. The strength of the correlation was found to be weak with a correlation coefficient of $r = .326$.

Table 4.11

The relationship between knowledge and compliance towards IPC practices among UNIMAS nursing students (n = 140)

Correlations				
Spearman's rho	Knowledge	Correlation Coefficient	Knowledge	Compliance
		Sig. (2-tailed)	1.000	.326**
		N	.	<.001
	Compliance	Correlation Coefficient	140	140
		Sig. (2-tailed)	.326**	1.000
		N	<.001	.
			140	140

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

4.6 Summary

There are 140 respondents involved in the actual study, most of whom are female. The average of age was 22.24 ($SD = 1.116$). A normality test was performed for the age using the Kolmogorov-Smirnov test. The results showed that the data was statistically significant and the data distribution was found to be not normal. The total for knowledge and compliance for every respondent were calculated and categorized in SPSS. Majority of the respondents possessed with optimal knowledge similarly with optimal compliance towards IPC practices with total score more than 85%. Lastly, the distribution data was not normally distributed, therefore non-parametric test was used which is Spearman correlation coefficient to run the relationship between knowledge and compliance and showed that there was a weak correlation.

CHAPTER 5: DISCUSSION

5.0 Introduction

This chapter presents deeper comprehension into the results, and the discussion will be divided into sections according to the research objectives. The association between knowledge and compliance with infection prevention and control (IPC) practices among UNIMAS nursing students will be further elaborated, along with the implications of the study. This chapter will also provide some recommendations, taking into account the implications and limitations.

5.1 The level of knowledge on infection prevention and control (IPC) practices.

This cross-sectional study investigated the knowledge and compliance of UNIMAS nursing students with infection prevention and control (IPC) practices. The level of knowledge showed that the UNIMAS nursing students had optimal knowledge on infection prevention and control (IPC) practices with a total score of 75.0%, while suboptimal and poor were 24.3% and 0.7%, respectively. This study is similar to a study conducted by Fatahi et al. (2019) among 119 nursing and midwifery students in Iran. This descriptive-analytical study shows that the students have good knowledge (51.3%) towards IPC. A study by Akinwaare et al. (2020) also found that the majority of the students had adequate knowledge, with a total score of 91.6% (219 out of 239), while 8.6% still lacked adequate knowledge towards IPC. This study indicates that 95.4% of the participants know that use of personal protective equipment is crucial in the care of all patients regardless of their type of illness or diagnosis. However, 69% of the students agreed that hand washing is not the most effective infection control method. A study by Kabir et al. (2018) showed that many participants understood that washing hands with soap or using alcohol-based antiseptics can greatly

lower the chances of spreading germs picked up in hospitals. The study found that 95% of the participants were aware of this fact, indicating a high level of knowledge among the healthcare professionals regarding the importance of proper hand hygiene in infection control within healthcare settings.

In this study, 86.4% of participants agreed that a needle should not be recapped after use, while 19 participants still believe that it should be recapped. This finding was in line with a study by Al Qadire et al. (2021) where 87.5% of nursing students stated that recapping needles should not be recommended and it is the most common cause of needlestick injury. Furthermore, some studies show that improvement in IPC knowledge can reduce needlestick injury risk in nursing students (Almuslami et al., 2022; Lawend et al., 2019). This result highlights the importance of enhancing infection prevention and control (IPC) training for nursing students. By equipping future healthcare professionals with the necessary knowledge and skills, the risk of needlestick injuries can be significantly reduced, ultimately leading to safer clinical practices.

In this study, 138 (98.5%) of participants were aware that the use of personal protective equipment (PPE) prevents the risk of acquiring infection. Similar to the study conducted by Bayleyegn et al. (2021), the use of PPE and frequent hand washing should be included in standard precautions (96.6%). Another study from Hussen et al. (2017) found 93% of participants understand when to use PPE. Therefore, nursing schools play a vital role in preparing future nurses to effectively prevent and manage infectious diseases (Mohd-Nor & Bit-Lian, 2019). By incorporating infection control education into the nursing school's curriculum and syllabus, nursing students had good preparation before entering the workforce and delivering safe and competent care in diverse healthcare settings.

5.2 The level of compliance towards IPC Practices.

The findings of the current study indicate that undergraduate nursing students at UNIMAS demonstrated optimal compliance with infection prevention and control (IPC) practices, with 86.4% showing good compliance and only 2.1% exhibiting poor compliance. These results align with those reported by Kim & Park (2021), whose respondents also displayed high compliance, achieving a mean score of 4.09 ± 0.43 out of 5 for IPC practices. Furthermore, this study corresponds with research conducted in Saudi Arabia, which reported 84.8% compliance rate (Tumala, 2020), and a study in Malaysia showing an 85% compliance rate (Anuar et al., 2021). Both studies suggest that nursing students generally have a strong level of adherence to IPC practices. The observed differences in compliance levels may be attributed to variations in curricula and clinical environments across different countries (Kim & Park, 2021).

In this study, over half of the participants (82.1%) reported that they constantly change gloves between interactions with different patients, with a mean score of 2.81 ± 0.431 . In comparison, a study by Yosef (2023) indicated that 78.1% of participants followed this practice. Additionally, research conducted by Sugathan et al. (2018) revealed that 115 participants (69.7%) adhered to correct glove-changing practices, while 50 participants (30.3%) did not follow proper procedures when changing gloves between tasks on the same patient, which is crucial for preventing cross-contamination. In the current study, 133 participants (95%) out of 140 consistently wore clean gloves whenever there was a risk of exposure to bodily fluids and promptly washed or sanitised their hands after removing them. This finding aligns with a study in Northwest Ethiopia, where 207 participants (87.7%) acknowledged that hand hygiene following glove removal is essential for preventing the spread of harmful infections within healthcare settings (Bayleyegn et al., 2021).

Out of 140 participants, 135 (96.4%) of the nursing students in this study consistently wash or sanitise their hands, regardless of whether they use soap or alcohol-based antiseptics, after coming into contact with a patient. A study by Kanyal & Butola (2020) found that soap and water is the most effective method for hand hygiene (73.2%), as the physical action of scrubbing and rinsing effectively removes all types of germs, dirt, and chemicals. In contrast, Rosli et al. (2022) recommended the use of antimicrobial handwash during handwashing (66.7%) due to its effectiveness against a wide range of pathogens, including bacteria and various viruses.

Despite demonstrating optimal compliance with hand hygiene practices, nursing students in this study exhibited poor adherence to the use of personal protective equipment (PPE), particularly eye goggles. Nearly half of the participants reported that they 'never' (16.4%) or 'sometimes' (29.3%) wore eye goggles when there was a risk of body fluids splashing onto their faces. According to Mohd-Nor & Bit-Lian (2019), these inadequate practices may stem from the lack of appropriate training curricula in infection control and standard precautions for nursing students in hospitals and medical training facilities. Additionally, other contributing factors may include insufficient incentives or a lack of medical equipment in hospitals, such as shortages of essential hygiene supplies like soap, alcohol-based hand sanitiser, gloves, and masks. This shortage complicates the ability of healthcare workers and nursing students to uphold proper hand hygiene and other infection control measures.

5.3 The relationship between level of knowledge and compliance on IPC practices.

The result of this study indicated that the UNIMAS undergraduate nursing students had an overall score of knowledge (mean = 18.36) and compliance (mean = 60.54). In general, the majority of the respondents demonstrated optimal knowledge and compliance. The relationship between knowledge and compliance was investigated using the Spearman correlation coefficient. The test results indicated there is a significant relationship between the overall knowledge scores and the compliance score ($p < 0.01$). The correlation between knowledge and compliance, however, revealed a weak correlation ($r = .326$). According to Schober et al. (2018), the strength of the correlation, $r = 0.10$ – 0.39 , indicated a weak correlation. This finding is similar to the study conducted by Rahiman et al. (2018), which found a significant association ($p < 0.01$) between students' level of knowledge and their practice. However, the practice ($r = 0.29$) correlation coefficients were less than 0.3, suggesting a very weak or insignificant relationship between these variables. Thus, the level of knowledge on hospital-acquired infections (HAIs) increases; practice tends to increase as well.

A study conducted in West Malaysia by Hanita et al. (2023) also found that there is an association between the level of knowledge and compliance ($p = 0.029$). In this study, the author found that the majority of the students (92.3%) agreed that hand washing is the most effective approach to decrease infectious agent transmission. This was contrary to a study conducted by Jamiran & Ludin (2021) where there is no significant association between level of knowledge and level of compliance on infection control with a ($p = 0.756$). Thus, this study found that the nursing students' level of knowledge does not influence their level of practice. Ayele et al. (2022) highlighted that having good knowledge of infection prevention measures, perceived workplace safety, and having training or a seminar in the last six months were significantly associated with being compliant with IPC practices.

5.4 Implications, recommendations and future research of the study

This study showed that the level of knowledge and compliance on infection prevention and control (IPC) practices among UNIMAS undergraduate nursing students was good. These findings validated the effectiveness of the current curriculum, indicating that it successfully imparts the necessary knowledge and fosters compliance with IPC practices. Besides that, a high score of knowledge and compliance indicates that nursing students in UNIMAS are well prepared theoretically before going to the clinical field. Therefore, enhancing the clinical teaching as well as simulation-based training with hands-on experiences is key to ensure that nursing students effectively translate their knowledge into practice.

For future research, it would be valuable to conduct long-term follow-up studies that assess whether the IPC knowledge and compliance demonstrated during simulation-based training are retained and effectively applied in real clinical settings months after graduation. Additionally, exploring the integration of immersive virtual reality modules into the UNIMAS nursing curriculum could provide insights into how advanced simulation tools influence student confidence, decision-making, and translation of IPC theory into complex clinical practice.

5.5 Limitations of the study

This study had several limitations, primarily due to the data collection being restricted to undergraduate nursing students in years 2, 3, and 4 from the Faculty of Medicine and Health Sciences at UNIMAS. Consequently, the findings have limited generalisability and do not reflect the experiences of students from other healthcare educational institutions and universities across Malaysia. Additionally, this paper was the first instance of the researcher conducting the study independently, which may have resulted in a narrower scope

of discussion compared to studies carried out by more experienced researchers. Financial and time constraints also posed challenges for this research. Finally, as this study relied on self-reported data regarding knowledge and compliance with infection prevention and control (IPC) practices, there is a potential for reporting bias.

5.6 Conclusion

The study revealed that the UNIMAS nursing students possess an optimal level of knowledge as well as compliance with infection prevention and control (IPC) practices. The relationships between knowledge and compliance were also examined, revealing a significant correlation between knowledge and compliance. Increased level of knowledge was associated with a high level of compliance, although the strength of the correlations was weak. This suggests that enhancing knowledge can positively influence compliance, but additional factors may also play a vital role, such as the behaviour of the individual. In summary, comprehensive education and practical training in nursing students with the necessary skills and attitudes is a critical role in infection prevention and control (IPC) practices. Continuous improvements in knowledge, compliance and training methods are essential to maintain high standards of infection control in healthcare settings.

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APPENDICES

APPENDIX A

Ethical Approval Application Letter

Mus'ab Bin Mohd Narawi
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/Dt/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: Mus'ab Bin Mohd Narawi

Matrix number: 78281

IC No.: 021108-10-1851

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:

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 Compliance with Infection Prevention and Control (IPC) Practices among UNIMAS Undergraduate Nursing Students

Supervisor's name: Dr T Saraswathy Thangarajoo

Email address: tsaraswathy@unimas.my

Supervisor's HP number: 013-344 8979

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

Thank you.

Yours sincerely,



(Mus'ab Bin Mohd Narawi)

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(136)

To : Mus'ab Bin Mohd Narawi (78281)
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 Compliance With Infection Prevention and Control Practice Among University Malaysia Sarawak (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 : Mus'ab Bin Mohd Narawi

Student ID : 78281

Programme : Bachelor of Nursing with Honours

Research Title : *Knowledge and Compliance With Infection Prevention and Control Practice Among University Malaysia Sarawak (UNIMAS) Undergraduate Nursing Students*

Supervisor Name : Dr. T Saraswathy A/P Thangarajoo

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

Participant's information sheet and informed consent form



- Title of the study** : Knowledge and Compliance with Infection Prevention and Control Practices among Universiti Malaysia Sarawak (UNIMAS) Undergraduate Nursing Students
- Main Researcher** : Mus'ab Bin Mohd Narawi
- Supervisor** : a) Course coordinator: Feryante Rintika anak Belansai
b) Main research supervisor: Dr T Saraswathy Thangarajoo
- Institution** : Department of Nursing
Faculty of Medicine & Health Sciences
Universiti Malaysia Sarawak
- Name of sponsor** : No external funding

PARTICIPANT'S INFORMATION SHEET AND INFORMED CONSENT FORM

1. Introduction

It is important that you understand why the research is being done and what it will involve. Please take your time to read through and consider this information carefully before you decide if you are willing to participate. Ask the study staff if anything is unclear or if you would like more information. After you are properly satisfied that you understand this study, and that you wish to participate, you must sign this informed consent form.

Your participation in this study is voluntary. You do not have to be in this study if you do not want to. You may also refuse to answer any questions you do not want to answer. If you volunteer to be in this study, you may withdraw from it at any time. If you withdraw, any data collected from you up to your withdrawal will still be used for the study. Your refusal to participate or withdrawal will not affect any medical or health benefits to which you are otherwise entitled.

2. What is the purpose of the study?

The purpose of this study is to investigate knowledge and compliance with infection prevention and control (IPC) practices among UNIMAS undergraduate nursing students. This study also aims to assess the relationship between knowledge and compliance, as well as its impact on nursing students. The study's findings provide valuable insights into the current level of knowledge and compliance, indicating the effectiveness of nursing education in UNIMAS regarding infection prevention and control (IPC) practices.

This research will be conducted for duration of 6 months (25/01/2025 till 30/06/2025). The expected number of participants is 140 individuals.

3. Who can participate in this study?

This study will involve students from the Faculty of Medicine and Health Sciences, UNIMAS. The inclusion criteria include nursing students from Year 2 to Year 4 who are enrolled in the Bachelor of Nursing with Honours program. The exclusion criteria include students who have completed less than two (2) semesters in the program and post-registration students.

4. What are my responsibilities when taking part in this study?

It is important that you answer all of the questions asked by the study staff honestly and completely which will take about 15 to 20 minutes of your time. Study team will also access your medical records for the following information. You will be given a survey form to be answered. This form contains of three section which are section A, B and C. Section A: sociodemographic data, Section B: knowledge on infection prevention and control (IPC) practices, and Section C: compliance with infection prevention and control (IPC) practices).

5. What are the potential risks and side effects of being in this study?

Participation to this study will not affect your treatment, and the risk is minimal. You are free to decline to answer any of the questions that you feel uncomfortable with.

6. What are the benefits of being in this study?

There may or may not be any benefits to you. Information obtained from this study will help identify gaps in knowledge and areas of non-compliance among nursing students. This insight enables the development of targeted training programs, workshops, and interventions to enhance IPC practices, ultimately reducing the risk of healthcare-associated infections (HAIs) during their clinical placements.

7. Who is funding the research?

This study does not receive any external funding. You will not be paid for participating in this study.

8. Will my medical information be kept private?

All your information obtained in this study will be kept and handled in a confidential manner, in accordance with applicable laws and/or regulations. When publishing or presenting the study results, your identity will not be revealed without your expressed consent. Individuals involved in this study, qualified monitors and auditors, and governmental or regulatory authorities may inspect the study data, where appropriate and necessary.

9. Who should I call if I have questions?

If you have any questions about the study or if you think you have a study related injury and you want information about this study, please contact the study doctor, Mus'ab Bin Mohd Narawi at telephone number 016-4890968 or email: musabmohdnarawi@gmail.com, or supervisor of this study, Senior Lecturer, Dr T Saraswathy Thangarajoo through the email address: ttsaraswathy@unimas.my.

INFORMED CONSENT FORM

By signing below, I confirm the following:

- I have been given oral and written information for the above study and have read and understood the information given.
- I have had sufficient time to consider participation in the study and have had the opportunity to ask questions and all my questions have been answered satisfactorily.
- I understand that my participation is voluntary and I can at any time free withdraw from the study without giving a reason and this will in no way affect my future treatment. I am not taking part in any other research study at this time. I understand the risks and benefits, and I freely give my informed consent to participate under the conditions stated. I understand that I must follow the study doctor's (investigator's) instructions related to my participation in the study.
- I understand that study staff, qualified monitors and auditors, the sponsor or its affiliates, and governmental or regulatory authorities, have direct access to my medical record in order to make sure that the study is conducted correctly and the data are recorded correctly. All personal details will be treated as STRICTLY CONFIDENTIAL
- I will receive a copy of this subject information/informed consent form signed and dated to bring home.
- I agree/disagree* for my family doctor to be informed of my participation in this study.

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 C

Data collection instruments

Answer the questions below. Please tick (/) in the box of the answer that is applicable and complete the information as required.

Section A: Sociodemographic data

1. Age: _____

2. Gender:

☐	Male
☐	Female

3. Race:

☐	Malay
☐	Chinese
☐	India
☐	Bumiputera Sarawak
☐	Bumiputera Sabah

Others: _____

4. Religion:

☐	Islam
☐	Christian
☐	Hindu
☐	Buddhist

Others: _____

5. Year of study:

	Year 2
	Year 3
	Year 4

6. Weeks of clinical experience:

	0 – 13 weeks
	14 – 26 weeks
	27 – 39 weeks
	40 – 52 weeks

7. Have you attended any training in Infection Prevention and Control (IPC)?

	Yes
	No

Section B: Knowledge on Infection Prevention and Control Standard Precautions

Instruction: Please tick your answer (/) in the box provided.

No	Questions	Yes	No
1.	Do you consider every client and patient as potentially infectious or susceptible to infection?		
2.	Standard precautions should be applied to all patients and clients attending the healthcare services.		
3.	Standard precaution is applied to all blood, body fluid, secretion, and excretion except sweat, mucous membranes, and non-intact skin.		
4.	Hand hygiene is the single most important intervention for preventing the transmission of infections.		
5.	Do you know five moments of hand washing.		
6.	Hand washing is indicated between tasks and procedures on the same patient.		
7.	The use of alcohol-based antiseptic for hand hygiene is more effective than hand washing with plain soap and water.		
8.	The use of personal protective equipment relies on an HCW's assessment of the risk of exposures/types, contact, and intensity of contact.		
9.	Use gloves before touching anything wet, such as non-intact skin, mucous membranes.		
10.	Hand washing should be practiced after the removal of the glove.		
11.	Personal protective equipment prevents the risk of acquiring infection.		
12.	The aseptic technique should be applied when preparing and delivering injections.		
13.	Used sharps and needles should be safely disposed of in closed and puncture-resistant containers.		
14.	Needles should be recapped after use.		
15.	Patient care equipment should be cleaned between each use to prevent cross-contamination.		
16.	Do you know the steps for reprocessing medical and surgical devices?		
17.	The frequently touched surface of the patient zone can harbour and cause the microorganism to spread across the facility via hands and contaminated items.		
18.	Do you know the different categories of waste and appropriate disposal methods at the point of waste generation?		
19.	Adherence to standard precautions prevents the occurrence of healthcare-associated infections.		
20.	Standard precaution contributes to preventing occupational infections among healthcare workers.		
21.	Compliance with infection prevention and control standard precautions plays an important role to prevent antimicrobial resistance.		

Section C: Compliance with Infection Prevention and Control Standard Precautions

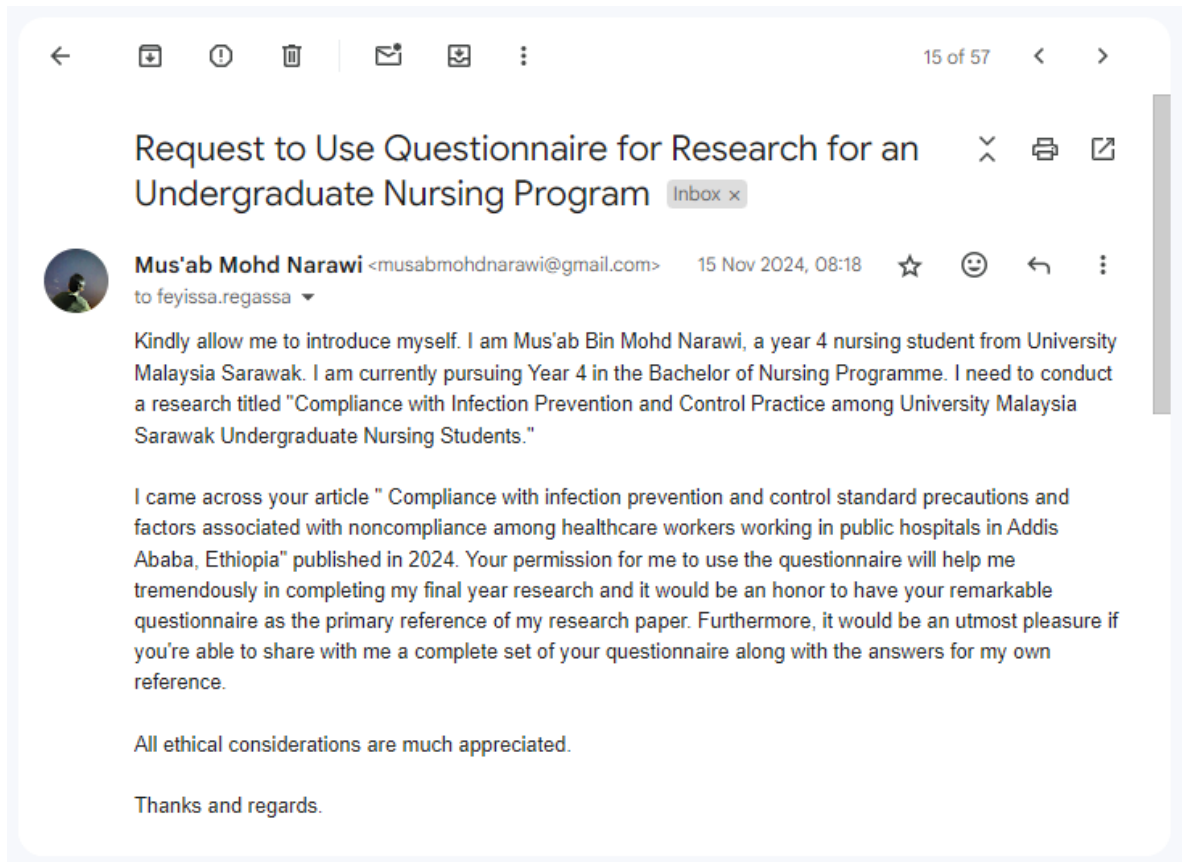
Instruction: Please tick your answer (/) in the box provided

No.	Question	Never	Seldom	Sometimes	Always
1.	Wash/sanitize hands before touching a patient.				
2.	Wash/sanitize hands before cleaning or aseptic procedures.				
3.	Wash/sanitize hands after body fluid exposure.				
4.	Wash/sanitize hands after touching a patient.				
5.	Wash/sanitize hands immediately after removal of gloves.				
6.	Wash/sanitize hands between patient contact.				
7.	Wash/sanitize hands after touching the patient's surroundings.				
8.	When providing care considering that all patients as potentially infectious/susceptible to infection.				
9.	I protect myself against the body fluids of all patients regardless of their diagnosis.				
10.	I wear clean gloves whenever there is a possibility of exposure to anybody's fluids.				
11.	I change gloves between contacts with different patients.				
12.	I avoid wearing my gown out of hospital compounds.				
13.	I wear a waterproof apron whenever there is a possibility of body fluid splashing in my body.				
14.	I wear eye goggles whenever there is a possibility of body fluid splashing in my face.				
15.	I sterilize all reusable equipment before being used on another patient.				
16.	I clean and disinfect equipment and environmental surfaces using detergents and disinfectants.				
17.	I segregate non-infectious wastes in a black color-coded dust bin.				
18.	I segregate infectious medical wastes in a yellow color-coded dust bin.				
19.	I never bend needles with my hands.				

20.	I avoid removing used needles from disposable syringes.				
21.	I place used sharps in a puncture-resistant container at the point of use.				
22.	I never recap needles.				

APPENDIX D

Permission to use questionnaire



APPENDIX E

Gantt Chart

	MONTH									
	2024				2025					
	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE
Determine research title										
Literature review										
Meeting with supervisor										
Submit oral defence slides										
Ethical approval										
Submission of first draft										
FYP 1: Submission of research proposal										
Data collection										
Data analysis										
Writing report										
Submit final draft										
FYP 2: Submission of final report										

APPENDIX F

Budget

Items	Budget (RM)
Internet data plan	RM 40
Installation of SPSS software	RM 5
Printing FYP poster	RM 39
Printing and binding FYP report	RM 50
Total	RM 134

APPENDIX G

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48 / 51
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