

**KNOWLEDGE AND PERCEPTION OF RISK
FACTORS FOR PHLEBITIS AMONG NURSING
STUDENTS AT SCHOOL OF HEALTH SCIENCE,
USM**

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2025

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by

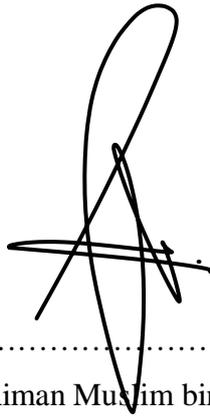
NUR AIMAN MUSLIM BIN NOR SUHIMI

**Dissertation submitted in partial fulfilment of the
requirements
for the degree of
Bachelor in Nursing**

August 2025

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.



.....

Nur Aiman Muslim bin Nor Suhimi

Date: 3 August 2025

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LIST OF ABBREVIATIONS

USM	Universiti Sains Malaysia
IV	Intravenous
PIVC	Peripheral Intravenous Catheter
HAIs	Healthcare-Associated Infections
VIP Score	Visual Infusion Phlebitis Score
LOS	Length of Stay
MoH	Ministry of Health
RN	Registered Nurse

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**TAHAP PENGETAHUAN DAN PERSEPSI PELAJAR
KEJURURAWATAN TERHADAP FAKTOR RISIKO FLEBITIS DI PUSAT
PENGAJIAN SAINS KESIHATAN, USM**

ABSTRAK

Kajian ini dijalankan bagi menilai tahap pengetahuan dan persepsi pelajar kejururawatan terhadap faktor risiko flebitis di Pusat Pengajian Sains Kesihatan, Universiti Sains Malaysia. Flebitis ialah keradangan pada vena yang sering berlaku akibat terapi intravena, dan merupakan komplikasi klinikal yang biasa tetapi boleh dicegah. Reka bentuk kajian keratan rentas deskriptif telah digunakan, dan data dikumpulkan daripada 183 pelajar kejururawatan melalui kaedah persampelan mudah. Satu soal selidik yang sah dan dikendalikan sendiri digunakan, merangkumi 15 item pengetahuan dan 20 item persepsi. Dapatan menunjukkan bahawa 52.5% pelajar mempunyai tahap pengetahuan yang rendah, 46.4% tahap sederhana, dan hanya 1.1% mempunyai tahap pengetahuan yang tinggi. Dari segi persepsi, 46.4% menunjukkan tahap persepsi yang tinggi, 33.9% sederhana, dan 19.7% rendah. Ujian Khi Kuasa Dua menunjukkan terdapat hubungan yang signifikan secara statistik antara tahap pengetahuan dan persepsi ($\chi^2(4, N = 183) = 25.768, p < 0.001$), menunjukkan bahawa pelajar yang mempunyai pengetahuan yang lebih tinggi cenderung mempunyai persepsi yang lebih baik. Dapatan ini menekankan keperluan untuk memperkukuh strategi pendidikan dalam kurikulum kejururawatan agar dapat meningkatkan pengetahuan teori dan kesedaran praktikal dalam terapi intravena, sekali gus mempertingkatkan kompetensi klinikal dan keselamatan pesakit.

**KNOWLEDGE AND PERCEPTION OF RISK FACTORS FOR
PHLEBITIS AMONG NURSING STUDENTS AT SCHOOL OF HEALTH
SCIENCE, USM**

ABSTRACT

This study aimed to assess the knowledge and perception regarding risk factors for phlebitis among nursing students at the School of Health Science, Universiti Sains Malaysia. Phlebitis, an inflammation of the vein often resulting from intravenous therapy, is a common yet preventable clinical complication. A descriptive cross-sectional design was utilized, and data were collected from 183 nursing students using convenience sampling. A validated, self-administered questionnaire comprising 15 knowledge items and 20 perception items was used to assess participants' understanding. The findings revealed that 52.5% of students had a low level of knowledge, 46.4% had moderate knowledge, and only 1.1% had a high knowledge level. In contrast, 46.4% of participants demonstrated high perception, 33.9% moderate, and 19.7% low. A statistically significant association was found between knowledge and perception levels ($\chi^2(4, N = 183) = 25.768, p < 0.001$), indicating that students with higher knowledge were more likely to have better perception. These results highlight the need for improved educational strategies in nursing curricula to strengthen both theoretical knowledge and practical awareness in IV therapy, thereby enhancing students' clinical competence and patient safety.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This research proposal aims to assess level of knowledge and perception of risk factors for phlebitis among nursing students at School of Health Science, USM. This chapter would discuss the background of the study, followed by problem statement, researched question and objectives, the hypothesis of the studied, the significance of the study and lastly the conceptual and operational of key terms used in this study.

1.2 Background of Study

Peripheral venous catheters were among the most frequently used medical devices in hospitals. They were essential for administering medications, fluids, and blood products. Despite their importance, this invasive procedure carried significant risks, one of which was the development of phlebitis. Phlebitis was one of the most common Healthcare-Associated Infections (HAIs), as it occurred at least 72 hours after intravenous treatment had been administered (Rahayu et al., 2017). It was defined as inflammation of the tunica intima of the vein caused by chemical, mechanical, or bacterial factors. The symptoms included pain, erythema (redness), oedema (swelling), induration (hardened mass or formation), palpable venous cord, and pyrexia (NT Contributor, 2011).

The incidence of phlebitis varied widely across different geographical regions. Among developing nations in Southeast Asia, the Centers for Disease Control and Prevention (CDC) found that the rates of phlebitis were highest in Malaysia (12.70%), followed by the Philippines (10.10%) and Indonesia (9.80%) in 2017. These findings were detailed in a study by Nito and Dewi Wulandari (2020). It was also noted that

phlebitis was more common in public hospitals (50.11%) than in private hospitals (32.70%), according to 2017 data from the Indonesian Ministry of Health (Rahmawati, Marliany, and Sukmawati, 2020).

The development of phlebitis had been linked to several factors, including the size of the catheter used, the site of insertion, and an increased risk among women and individuals over 60 years of age (Raghu and Mandal, 2019). Risk factors for phlebitis due to peripheral IV therapy were classified into four groups: cannula-related, drug-related, patient-related, and healthcare-related (Milutinovic et al., 2015). Improper cannula size and location, pharmacological properties (such as pH and osmolality), the presence of associated diseases in patients, and poor aseptic techniques increased the risk (Milutinovic et al., 2015; Li et al., 2016). Other contributing factors included patients' age, weight, prolonged immobility, and the duration of IV therapy (Nabili and Shiel, 2019).

Phlebitis could result in serious consequences for hospitalized patients. Adverse outcomes included disability, extended hospital admissions, and in severe cases, death. Patients might also lose the ability to perform critical roles (Solano, 2014). Additional impacts included loss of income, emotional stress on families, and higher out-of-pocket expenses due to prolonged treatment (Weston, 2013). Patients diagnosed with phlebitis experienced an increased length of hospital stay. Length of Stay (LOS) referred to the time patients spent receiving care in the emergency room or ward, beginning upon registration and ending upon discharge or transfer (Muhammad Fasya Aminullah et al., 2023).

A study conducted in 2018 found that phlebitis increased treatment duration by five days (Ohannessian et al., 2018). In contrast, research conducted in Indonesia at

the Inpatient Room of RSU X Manado reported that the presence of phlebitis extended patient care to 11 days, despite the normal LOS ranging from 7 to 9 days (Langingi et al., 2022).

A 2021 study explained that factors influencing nurses in preventing phlebitis included knowledge, attitudes, and personal motivation (Hamdayani and Adha, 2021). Nurses' responsibilities in IV therapy included initiating, monitoring, maintaining, and discontinuing IV infusions. They were expected to be competent in all aspects of IV therapy, including the recognition and prevention of phlebitis. Efforts to prevent phlebitis included assessing its incidence using the Visual Infusion Phlebitis (VIP) Score, recording the patient's infusion start date, and regularly changing the site of the infusion needle. However, it is not only practicing nurses who play a role—nursing students, as future healthcare providers, are equally important. Their clinical training and understanding of phlebitis prevention during their education will directly influence their competency and patient safety once they enter professional practice. Therefore, examining nursing students' knowledge and awareness regarding phlebitis prevention is vital in ensuring safe and effective intravenous therapy.

1.3 Problem Statement

Peripheral intravenous (IV) catheters are among the most frequently used medical devices in hospital settings and are essential for administering medications, fluids, and blood products. Despite their critical role, these devices carry a significant risk of complications—most notably phlebitis, which remains one of the most common and preventable adverse events related to IV therapy. The prevalence of phlebitis is particularly concerning in developing countries, with reported rates ranging from 7% to 17% in Pakistan over a ten-year period (Khosro et al., 2021).

While nurses and nursing students are expected to have adequate knowledge regarding phlebitis prevention, recent evidence reveals ongoing deficiencies in their understanding of risk factors. Daud and Zaki (2024) found that although 75.8% of nurses acknowledged phlebitis as a major issue, over half lacked awareness of key clinical contributors, such as cannula size and fluid characteristics. Likewise, Nordin et al. (2023) noted that despite good general perception, many nurses lacked in-depth knowledge of technical factors like infusion duration and catheter dwell time.

This knowledge gap is also evident in other regions. In Karachi, Bibi et al. (2023) reported that only 17.0% of nurses had high knowledge levels, with most demonstrating moderate or poor understanding of phlebitis-related practices. Similarly, Lisnadiyahanti et al. (2022) found that 38.5% of Indonesian nurses exhibited poor knowledge, highlighting that limited awareness of prevention measures remains a widespread concern across different healthcare settings.

This knowledge gap is not limited to practicing nurses. Among nursing students, similar deficiencies have been reported. Bibi et al. (2022) found that while some students recognized certain risk factors, such as the acidity of IV medications, many were unaware of the influence of cannula gauge or replacement frequency on phlebitis development. Chong, Yusuf, and Keng (2020) likewise found that, despite a generally positive perception, knowledge of specific risk factors remained insufficient among Malaysian nurses.

These findings suggest a disconnect between perception and actionable knowledge, which may lead to inconsistent clinical practices and increased patient risk. Without targeted interventions and curriculum enhancement, future nurses may enter the workforce underprepared to prevent this common complication. Addressing

this issue is essential to improving IV therapy outcomes and patient safety in both academic and clinical settings.

1.4 Research Questions

The research questions for this study are as follows:

1. What is the level of knowledge about the risk factors of phlebitis among nursing students at School of Health Science, USM?
2. What is the perception regarding risk factors for phlebitis among nursing students at School of Health Science, USM?
3. Is there any association between knowledge and perception about risk factors for phlebitis among nursing students at School of Health Science, USM?

1.5 Research Objectives

A research objective describes what researchers hope to accomplish at the conclusion of a research project or study (Polit D & Beck C., 2010).

1.5.1 General Objective

To determine knowledge and perception regarding risk factors for phlebitis among nursing students at School of Health Science, USM.

1.5.2 Specific Objectives

The specific objectives for this study are as follows:

1. To determine the level of knowledge about risk factors for phlebitis among nursing students at School of Health Science, USM.
2. To determine the level of perception about risk factors for phlebitis among nursing students at School of Health Science, USM.
3. To determine the association between knowledge and perception about risk factors for phlebitis among nursing students at School of Health Science, USM.

1.6 Research Hypothesis

Null hypothesis (H_0)

There is no association between the level of knowledge and perception of risk factors for phlebitis among nursing students at School of Health Science, USM.

Alternative hypothesis (H_1)

There is an association between the level of knowledge and perception regarding risk factors of phlebitis among nursing students at School of Health Science, USM.

1.7 Significance of study

The study aimed to determine knowledge and perceptions regarding the risk factors of phlebitis among nursing students at School of Health Science, USM. The study findings were significant because they could help to identify the level of knowledge and perception among nursing students at School of Health Science, USM regarding risks factors of phlebitis. In addition, by understanding nursing students' perceptions of phlebitis risk factors, the study can identify knowledge gaps that may contribute to the incidence of phlebitis. This knowledge is crucial for developing strategies to enhance patient safety and reduce complications associated with intravenous therapy.

30/7/2025

1.8 Definitions of Operational Terms

The operational terms used in this research proposal are shown below:

Table 1.1 Conceptual and Operational Definitions

	Conceptual Definition	Operational Definition
Knowledge	Understanding information about a subject that can be by experience or study, either known by one person or by people generally (Cambridge Dictionary, 2024).	In this study, the knowledge of nursing students at School of Health Science, USM will be assessed using self-administered questionnaire adapted from (Kuş et al., 2024).
Perceptions	Perception refers to the belief, views and understanding nurses have regarding the image of the	In this study, the perceptions of nursing students at School of Health Science, USM will

	nursing profession because of their past and present experiences during their training (Wangdi, 2019)	be assessed using self-administered questionnaire adopted from (Ying et al., 2020).
Nursing students	An individual who enrolled in a nursing education program and training to be a nurse at a nursing school or hospital (Law Insider, n.d.).	In this study, Diploma and Degree nursing students at School of Health Science, USM are the target population for this research study.
Phlebitis	Phlebitis is defined as inflammation of the tunica intima of the vein caused by chemical, mechanical, or bacterial factors (NT Contributor, 2011).	In this study, the risk factors for phlebitis are the main focus of this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter provided a general review of the literature about the prevalence of phlebitis, the knowledge of student nurses regarding the risk factors for phlebitis, the perception of student nurses regarding the risk factors for phlebitis, and the association between knowledge and perception. The final section of this chapter described the theoretical and conceptual framework used in this study.

2.2 Prevalence of Phlebitis

According to Khoso et al. (2021), inadequate detection or delayed reporting contributed to 20% to 80% of phlebitis cases. Numerous studies also found that healthcare professionals' skills not only reduced the incidence of phlebitis but also decreased the hospital's legal and clinical responsibilities. In the study by Khoso et al. (2021), the incidence of phlebitis in Pakistan was reported to be 7% in 2006 and had increased to 17% by 2016.

A meta-analysis of 35 studies involving over 20,000 catheters revealed that classic phlebitis occurred in 30.7% (95% CI: 27.2%–34.2%), with severe cases present in 3.6% of instances (Lv & Zhang, 2019). This analysis also identified key risk factors, including longer catheter dwell time, antibiotic infusions, female gender, and the use of Teflon cannulas

In broader inpatient populations, non-critically ill patients experienced phlebitis rates of approximately 7–44%, with a mean prevalence of 19.3% (Yasuda et al., 2021). A recent descriptive study in a Turkish emergency department reported a 31% incidence

of PIVC-related phlebitis (29.7% grade 1, 1.3% grade 2) (Özgü Bakcek Akcelik & Hatice Ayhan, 2024). Meanwhile, a large international registry of older inpatients reported 7% evidence of phlebitis among 2,179 patients, with failures more common in those receiving IV medications or placements outside the forearm.

2.3 Knowledge of Risk Factors for Phlebitis

The study by Bibi et al. (2023) highlighted the importance of nurses being knowledgeable about the risk factors for phlebitis, which was essential for the effective prevention and management of the condition. A recent study conducted at Tabba Kidney Institute in Karachi evaluated the knowledge of 53 nurses regarding phlebitis risk factors. The findings revealed that only 17.0% of the participants demonstrated a high level of knowledge, while the vast majority (83.0%) exhibited a moderate level of understanding (Bibi et al., 2023).

Knowledge regarding the risk factors of phlebitis varied widely across different geographical regions. A study by Ying, Yusuf, and Keng (2020) found that 56.8% of participants in Malaysia had good knowledge of phlebitis risk factors, including awareness of infusion drug properties such as acidity, osmolality, and concentration. Similarly, a study by Karadeniz et al. (2003) reported that most nurses possessed good knowledge, with 90% recognizing that hand washing was the simplest and most effective measure to prevent hospital-acquired infections.

In contrast, a study conducted in India showed that more than half of the participants had only a moderate level of knowledge regarding phlebitis risk factors (Muhammad Hasnain Shaikh et al., 2023). Furthermore, research by Bibi et al. (2022) revealed that most nurses in Pakistan had a poor understanding of these risk factors.

Likewise, a study conducted in Indonesia found that 38.5% of participants demonstrated poor knowledge about the risk factors for phlebitis (Lisnadiyanti et al., 2022).

2.4 Perception of Risk Factors for Phlebitis

Despite the fact that the Malaysian Ministry of Health's Registered Nurse Division approved and published the Recommendations on Secure Mode of Operation for Administering Total Parenteral Nutrition (Bolus) Treatments for Nursing Staff in 2017, only 56.8% of participants in a related study reported having a clear understanding of phlebitis risk factors, including acidity, osmolality, and the concentration of the infused drug (Health Ministry Malaysia Registered Nurse Division, 2017). Although nurses were generally expected to be well-versed in peripheral venous therapy, this finding revealed significant knowledge gaps.

For instance, although several studies highlighted that cannula size influenced the development of phlebitis, 57.3% of nurses in one study were unaware that using a 16G cannula increased the risk. Martinho and Rodrigues (2018) explained that artificial phlebitis occurred when a catheter was too large for the selected vein, exerting excessive pressure on the vein wall and causing inflammation. Furthermore, 56.3% of nurses did not consider that failing to replace the catheter within 72 to 96 hours (3 to 4 days) could increase the likelihood of phlebitis. This finding was inconsistent with standardized guidelines by O'Grady et al. (2011), which recommended that peripheral venous catheters should not remain in place for longer than 72 to 96 hours to minimize inflammation and traumatic phlebitis. However, 84.9% of the nurses did acknowledge that leaving a cannula in place for more than 96 hours could elevate the risk.

Phlebitis remained a common complication associated with peripheral venous catheterization in hospital settings. While nurses were generally knowledgeable about

the clinical consequences of phlebitis, their awareness of its specific risk factors appeared to be insufficient. In some institutions, nurses were strongly encouraged to engage in extended nursing practice and continuing education programs to improve their competence in peripheral IV catheter care. However, many nurses failed to recognize the risks posed by cannula material, size, frequency of replacement, and inadequate aseptic techniques. On the other hand, risk factors related to the patient and the infused medication were more widely understood. Nurses demonstrated awareness that certain underlying health conditions, as well as specific medications such as Ceftriaxone, Benzyl penicillin, Magnesium Glubionate, Theophylline, and Monotherapy Carbamazepine, could increase the incidence of phlebitis (Bibi et al., 2022).

2.5 Association between knowledge and perception

A study by Bibi et al. (2022) highlighted that while nursing students recognized certain risk factors associated with phlebitis, there were notable gaps in their knowledge that may have influenced their perceptions and clinical practices. For instance, the study found that a significant number of nursing students were aware that the infusion of acidic drugs increased the risk of phlebitis, with 70.2% responding affirmatively to that item. However, there was a marked lack of awareness regarding other contributing factors, such as the impact of cannula size, where 60% of the students were unaware that using a larger gauge cannula (16G) could elevate the risk of phlebitis. This gap suggested that while some foundational knowledge was present, it may not have been sufficient to effectively shape accurate perception or safe clinical decision-making. The findings emphasized the importance of enhanced education and training to address these deficiencies, thereby improving both knowledge and perception among nursing

students. Such improvements were considered essential for reducing the incidence of phlebitis in clinical environments.

Similarly, a study by Ying, Yusuf, and Keng (2020) indicated that although the nurses demonstrated a generally good level of perception, there were still clear knowledge gaps concerning specific risk factors, including the effects of cannula size and the recommended frequency of cannula replacement. This further underscored the need for targeted educational interventions to bridge the divide between perception and actual knowledge, ensuring that nurses not only recognized risk factors but also understood the underlying mechanisms contributing to those risks.

The association between knowledge and perception in this context suggested that improving knowledge through structured and targeted educational efforts could positively influence perception. This, in turn, was expected to lead to safer clinical practices in managing intravenous therapy and in the prevention of phlebitis.

2.6 Conceptual framework of the study

The Health Belief Model (HBM) serves as the conceptual framework for this study. The HBM was developed in the 1950s by psychologist at the United States Public Health Service to help explain why so many people refused to participate in disease prevention and detection campaigns. The model's theoretical foundation is reviewed here to help readers understand its rationale for certain concepts and their relationships, as well as its strengths and weaknesses. Although the model evolved gradually in response to very practical public health concerns, it did not in accordance with psychological theory (Glanz et al., 2008).

HBM is composed of some elements that are perceived to be susceptible. A few things to think about include perceived severity, perceived rewards, perceived hurdles, prompt to action, and personal efficacy. Perceived susceptibility refers to an individual's belief of how susceptible they are to a particular illness or condition. Perceived severity refers to an individual's assessment of the importance of their illness or lack of care. Next, perceived barriers are beliefs about the financial and psychological effects of the suggested action plan, and perceived rewards are beliefs about the effectiveness of healthy behaviour. A cue to action, on the other hand, is the readiness to act in reaction to the sense of benefit and receptivity. Lastly, self-efficacy is the conviction that one can act on one's own behalf (Glanz et al.,2008).

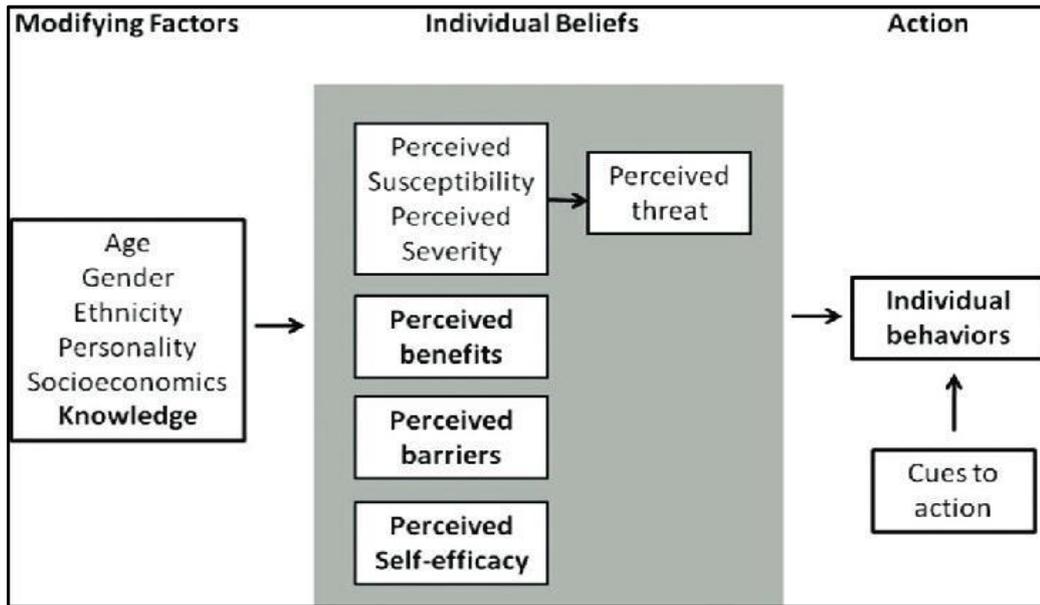


Figure 2.1 Structure of the Health Belief Model (Glanz et al. 2008)

The conceptual framework of this study was adapted based on the HBM above. Based on the figure below, HBM explores the modifying factors of the study which clinical experience. Based on individual beliefs, the level of knowledge and perception of risk factors for phlebitis among nursing students in School of Health Science, USM will be assessed, the prevalence of risk factor for phlebitis, consequences of phlebitis and the need to follow the protocol and hands-on practice.

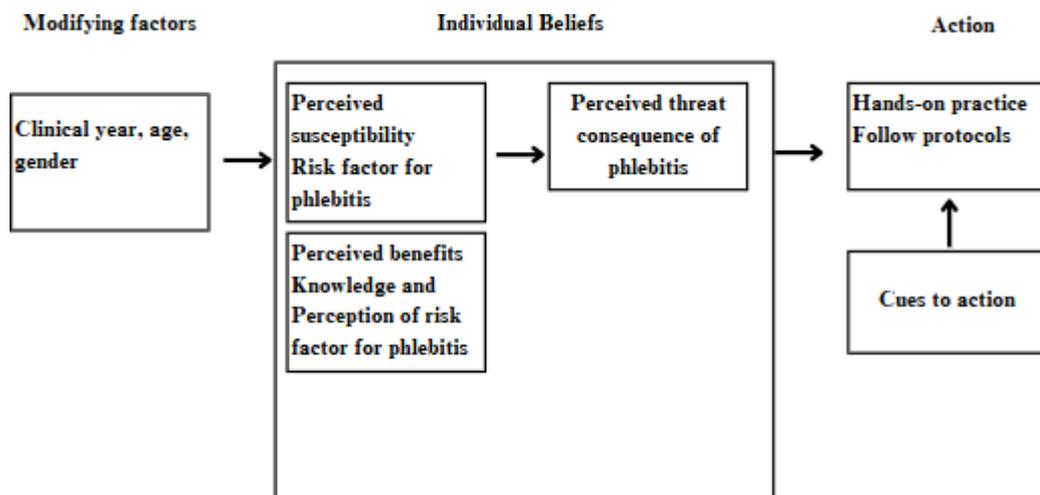


Figure 2.2: The Health Belief Model adapted from (Glanz et al. 2008)

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter explained the approach and rationale used to support the chosen research methodology. Determining and understanding an appropriate research design was crucial for achieving the aims of the study.

3.2 Research Design

This study applied a cross-sectional study design to assess the knowledge and perception of risk factors for phlebitis among nursing students at the School of Health Science, Universiti Sains Malaysia (USM). The cross-sectional design measured both the outcome and the exposures of the study participants simultaneously. This design was chosen for its practicality and efficiency. One of the main advantages of a cross-sectional study was that it was relatively low in cost, required less time to conduct, and could be carried out at a single point in time or over a short period (Levin, 2006). This made it a suitable approach for exploring the relationship between knowledge and perception within a defined population during the study period.

3.3 Study Setting and Population

The study was conducted at Universiti Sains Malaysia (USM), which comprises seven campuses: the Main Campus (Minden, Penang), the Engineering Campus (Nibong Tebal, Penang), the Health Campus (Kubang Kerian, Kelantan), the IPPT Campus (Kepala Batas, Penang), USM@KL (MoF Inc. Tower, Persiaran KLCC), and the KLE Campus (Belgaum, India). For the purpose of this research, the study was carried out at the Health Campus, which consists of three schools: the School of Medical

Sciences, the School of Dental Sciences, and the School of Health Sciences. This study specifically involved nursing students under the School of Health Sciences, as they were the target population relevant to the research objectives.

3.3.1 Sample criteria

Several criteria were specified and set to ensure that the subject's data were suitable for research purposes and can attain the targeted goals at the end of the study to meet the research's objective.

3.3.1(a) Inclusion criteria

The specific eligibility requirements for inclusion in this study required that each participant must be:

- Nursing students who experienced clinical posting

3.3.1(b) Exclusion criteria

Subjects are excluded from this study if they:

- Nursing students who are registered nurse

3.4 Sampling Plan

Sampling was the process used in statistical analysis to select respondents who represented the larger population. The sampling plan was developed to ensure that the results accurately reflected the target population and enabled all research questions to be addressed. Several inclusion criteria were established to ensure that the selected participants provided data that were appropriate for the research objectives and aligned with the purpose of the study. These criteria were intended to guarantee that the sample was suitable for achieving the study's aims and to ensure the validity and relevance of the findings.

3.4.1 Sample Size Estimation

For each study objective, the sample size was calculated. At the end of the calculation, the researcher has chosen a relatively greater number of respondents to complete the research objectives.

For objective 1 and objective 2, the sample size was determined using a single proportion formula.

Single formula proportion:

$$n = \left(\frac{z}{\Delta}\right)^2 p(1 - p)$$

n = sample size

p = anticipated population proportion

z = value of standard normal distribution = 1.96

Δ = precision = 0.05

Objective 1:

The level of knowledge about risk factors for phlebitis was 90.5% (good knowledge) (Osti et al., 2019).

Thus.

$$p = 90.5\% = 0.905$$

$$n = \left(\frac{1.96}{0.05}\right)^2 0.91(1 - 0.91)$$

$$n = 126$$

After considering 10% of drop out,

$$126 \times 10\% = 12$$

$$n = 126 + 12$$

$$n = 138$$

Therefore, total sample size for an objective 1 will be 138 samples

Objective 2:

The perception about risk factors for phlebitis was 75.8% (good perception) (Daud and Noor, 2024)

Thus.

$$p = 75.8\% = 0.758$$

$$n = \left(\frac{1.96}{0.05}\right)^2 (0.76)(1 - 0.76)$$

$$n = 281$$

After considering 10% drop out

$$281 \times 10\% = 28.1$$

$$n = 281 + 28$$

$$n = 309$$

Therefore, the total sample for objective 2 will be 309 samples.

Objective 3:

For the third objective (To determine the association between the level of knowledge and perception of risk factors for phlebitis among nursing students at School of Health Science, USM). The sample size was determined using Pearson's correlation formula from the Wan Arifin sample size calculator website. (Since the article did not mention the association, the researcher assumed that ($R=.5$))

Pearson's Correlation - Hypothesis Testing¹

Expected correlation (r):	<input type="text" value="0.5"/>
Significance level (α):	<input type="text" value="0.05"/> Two-tailed
Power ($1 - \beta$):	<input type="text" value="80"/> %
Expected dropout rate:	<input type="text" value="10"/> %
<input type="button" value="Calculate"/> <input type="button" value="Reset"/>	
Sample size, $n =$	<input type="text" value="29"/>
Sample size (with 10% dropout), $n_{drop} =$	<input type="text" value="33"/>

The total sample for objective 3 will be 33 samples.

Therefore, the biggest sample size of all objectives, which is 309 participants, will be taken as the study sample.

3.4.2 Sampling Methods

To recruit participants for this study, convenience sampling was used. This method was chosen because it best met the requirements of the study, allowing for the selection of respondents who were most accessible and available to represent the target population (Chua, 2020). Convenience sampling was deemed appropriate given the study's time constraints, accessibility to participants, and the specific focus on nursing students within the School of Health Sciences.

3.5 Instrumentation

The instrument used in this study was a self-administered questionnaire. One set of questionnaires was employed to obtain relevant data on the knowledge and perception of risk factors for phlebitis among nursing students at the School of Health Science, USM (see appendix). The questionnaire for Section B was adapted from Kuş et al. (2024), while the questionnaire for Section C was sourced from Ying et al. (2020). Permission to use and adapt both questionnaires was granted.

3.5.1 Instrument

The questionnaire was divided into parts as follows:

The questionnaire comprises 3 sections.

- Section A consisted of socio-demographic information like age, gender and educational level (3 questions).
- Section B contained questions designed to assess the level of knowledge about risk factors for phlebitis (15 questions)
- Section C included questions aimed at evaluating perceptions of risk factors for phlebitis (20 questions)

3.5.2 Translation of instrument – if necessary

The original version of the questionnaire was established in English. As the population were university students, it was assumed that the respondents can understand the questions. Thus, the questionnaires were kept into the English version

3.5.3 Validation and reliability of instruments

The content of the questionnaire had been validated by the original authors. A Cronbach's alpha coefficient of 0.84 was reported for the questionnaire, indicating a high level of reliability (Ying et al., 2020). However, a pilot study was conducted because the original authors of Section B, which contains questions related to knowledge about risk factors for phlebitis, did not report a Cronbach's alpha for that part of the questionnaire. The adapted questionnaire underwent pilot testing involving 10% of the target population. Consequently, a small group of 23 nursing students was selected to participate in the pilot study and the Cronbach's alpha was 0.794

3.6 Variables

Variables were those attributes that were measured or manipulated in a study. The independent and dependent variables in this research study were as shown in Table 3.1.

Table 3.1 Independent and dependent variables

Independent variable	<ul style="list-style-type: none">• Knowledge of risk factors for phlebitis
Dependent variable	<ul style="list-style-type: none">• Perception of risk factors for phlebitis

3.6.1 Measurement of Variables and Variable Scoring

Section A included age, gender, and clinical year. Section A did not require scoring.

Section B consisted of 15 knowledge assessment questions. Participants were required to answer all questions; one point was awarded for each correct answer, and zero points for incorrect answers. The total possible score was 15. Scores below 50% were considered indicative of low-level knowledge, scores between 50% and 80% indicated moderate-level knowledge, and scores above 80% indicated high-level knowledge. The total points were converted into a percentage using the formula: $(\text{raw score} \times 100) / 15$. The level of knowledge was interpreted based on the percentage scores obtained (Bibi et al., 2023).

Section C contained 20 perception assessment questions. Participants responded to statements with 'Yes,' 'No,' or 'Unsure.' The 'Unsure' option was included to minimize forced guessing between 'Yes' and 'No.' One point was awarded for each correct response, while zero points were given for wrong or unsure responses. The total score was converted into a percentage using the formula: $(\text{raw score} \times 100) / 20$. The