KNOWLEDGE OF CHEMOTHERAPY AND OCCUPATIONAL SAFETY MEASURES AMONG UNDERGRADUATE NURSING STUDENTS IN UNIVERSITI SAINS MALAYSIA (USM)

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by

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LIST OF ABBREVIATIONS

CDs	- Chemotherapy Drugs
HBM	- Health Belief Model
HUSM	- Hospital Universiti Sains Malaysia
OHS	- Occupational Health and Safety
OHSAS 18001	- OHS Advisory Services 18001
SHS	- School of Health Sciences
USM	- Universiti Sains Malaysia

PENGETAHUAN MENGENAI KEMOTERAPI DAN LANGKAH KESELAMATAN PEKERJAAN DALAM KALANGAN PELAJAR KEJURURAWATAN PRASISWAZAH DI UNIVERSITI SAINS MALAYSIA (USM)

ABSTRAK

Kemoterapi adalah rawatan kanser yang menggunakan ubat-ubatan untuk menghalang atau memperlambat pertumbuhan sel bagi pesakit kanser. Kanser telah menjadi salah satu masalah kesihatan utama kerana ia adalah salah satu penyakit yang paling banyak membunuh di dunia. Oleh itu, peningkatan pesakit kanser juga akan meningkatkan penggunaan ubat kemoterapi untuk rawatan kemoterapi yang mana berisiko dan memerlukan perhatian lebih mengenai langkah keselamatan pekerjaan ketika menangani ubat berbahaya ini. Kajian keratan rentas dilakukan untuk mengkaji pengetahuan tentang kemoterapi dan langkah keselamatan pekerjaan dalam kalangan pelajar kejururawatan pra-siswazah di USM. Soal selidik yang digunakan dalam kajian ini adalah soal selidik yang dikendalikan sendiri, dan ia diadopsi dan disesuaikan dari Verstrate (2015) dan Nwagbo et. al. (2017). Seramai 76 pelajar kejururawatan yang memenuhi kriteria pengambilan dan pengecualian sampel dipilih secara rawak. Data yang dikumpulkan dianalisa secara statistik menggunakan perisian SPSS versi 26.0. Ujian tepat Fisher digunakan untuk analisa data. Bagi tahap pengetahuan mengenai kemoterapi dan langkah keselamatan pekerjaan, hasilnya menunjukkan 45 (59.2%) untuk pengetahuan yang baik tentang kemoterapi dan 74 (97.4%) untuk pengetahuan yang baik mengenai langkah keselamatan pekerjaan. Kemudian tahap kesedaran menunjukkan 75 (98.7%) dengan tahap kesedaran yang baik tentang langkah pencegahan kemoterapi dan langkah keselamatan pekerjaan. Seterusnya tidak ada hubungan antara tahap pengetahuan kemoterapi dan langkah keselamatan pekerjaan dengan ciri sosio-demografi terpilih (tahap

pendidikan dan tahun pengajian); (p = 0.316), (p = 0.805), (p = 1.000) dan (p = 0.553) masing-masing. Kesimpulannya, tahap pengetahuan perlu ditingkatkan dan ditambah baik dalam kalangan pelajar kejururawatan kerana mereka akan lebih berpengetahuan dan mahir dalam memberikan rawatan kepada pesakit kemoterapi.

KNOWLEDGE OF CHEMOTHERAPY AND OCCUPATIONAL SAFETY MEASURES AMONG UNDERGRADUATE NURSING STUDENTS IN UNIVERSITI SAINS MALAYSIA (USM)

ABSTRACT

Chemotherapy is a cancer treatment that uses drugs that inhibit or slow down the growth of cells for a cancer patient. Cancer has become one of the main health problems as it is one of the most killing diseases in the world. Thus, increasing patients with cancer will also increase the use of chemotherapy drugs for chemotherapy treatment where there will be risk and need more concern about occupational safety measures when handling hazardous drugs. A cross-sectional study was carried out to study the knowledge of chemotherapy and occupational safety measures among undergraduate nursing students in USM. The questionnaire used in this study was self-administered, and it was adopted and adapted from Verstrate (2015) and Nwagbo et. al. (2017). A total of 76 nursing students who fulfilled the inclusion and exclusion criteria were selected randomly. Data collected were statistically analyzed using the SPSS software version 26.0. Fisher's exact test was used for data analysis. As for the level of knowledge of chemotherapy and occupational safety measures, the results show 45 (59.2%) for good knowledge of chemotherapy and 74 (97.4%) for good knowledge of occupational safety measures respectively. Then the level of awareness results shows 75 (98.7%) with a good level of awareness about prevention measures of chemotherapy and occupational safety measures. Next is there is no association between level of knowledge of chemotherapy and occupational safety measures with selected socio-demographic characteristics (level of education and year of study) (p=0.316), (p=0.805), (p=1.000), and (p=0.553) respectively. In conclusion, the level of knowledge needs to be increased and

improved among nursing students as they will be more knowledgeable and skillful in delivering care to chemotherapy patients.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Chemotherapy also referred to as "chemo," is most commonly for cancer treatment that used drugs that inhibit or slow down the growth of cells. There are several chemotherapy medications, and some are also administered together. Chemotherapy might cure cancer, slow down or prevent its spread, or make its symptoms better depending on the type of cancer, its size, and whether it has spread (Sugerman, 2013)

More than 11 million cases of cancer are diagnosed annually. It is projected or expected to increase worldwide to 16 million by the year 2020. Increasing in patient's number indicates that the use of chemotherapy drugs (CDs) will be increase and can lead to many possibilities of exposure to the healthcare workers to these drugs. In addition, the widespread use and complexity of chemotherapy has increased concerns about the risks to health care workers involved in the preparation and administration of these drugs and the care of patients receiving treatment (Mohsen & Fareed, 2013)

According to Nwagbo et. al. (2017), nurses are among the healthcare professionals who handle these agents regularly, so their expertise and occupational safety habits are a concern. Besides, the other factors such as the practitioners' knowledge and skills also significantly determine the level of contamination and risk. In addition, the Health and Safety Executives also have defined the occupational risk and hazard as the results of improper use of control measures. Furthermore, nurses play an important role in cancer treatment and

knowledge about chemotherapy is essential, either from nursing schools or continuing education programs. Thus, it is of most importance that nurses' knowledge of handling and safety measures is assessed.

Moreover, it is important to follow the chemotherapy safety protocol in handling, administration, and as well as care the patient after the treatment. The health care workers especially nurses must make sure that all the personnel protective equipment is provided, available, and enough for them to prevent direct contact with drugs. When handling excrement from patients, safety protection should also be emphasized. Since excreta from the treated patient can contain unchanged cytotoxic drugs or active metabolites, health care workers should wear suitable personal protective barriers while handling these wastes (Mohsen & Fareed, 2013)

As stated by the study from Hosen et al., (2019), increasing the nurse's knowledge will increasing the obey to the use of safety measures to care of the patient which increases the chances of healthy living. The study found that patients who received chemotherapy agents and those in the care chain both suffered side effects depending on the medications and personal protective measures. Precautions, drug toxicity, individual exposure, and lack of proper knowledge can bring on the health risks of an occupationally exposed person. However, there were obstacles to the use of required precautionary materials and equipment due to inconvenience and limited time, uncomfortable positions, unavailability, and access to the equipment. Furthermore, the study also found that due to unnecessary job pressure, lack of knowledge and understanding of health risks, including the handling of chemotherapy agents, not feeling comfortable using them, and believing that there was also no need to use such safety equipment (Hosen et al., 2019).

Based on the study from Nwagbo et al. (2017), they observed that most of the nurses understood the meaning of chemotherapy, which is more than 90%; however, only 40 % had better knowledge of classification and types. Besides that, the respondents had good knowledge of the meaning, classification, types, and adverse effects of chemotherapy, which are 99%, 41%, 24%, and 64% respectively. Hence, Nwagbo et al. (2017) summarize that good knowledge of the meaning, classification, types, risk, and side effects of drugs were demonstrated by only 55 percent of respondents. This indicates less than optimal knowledge of the study cohort in this particular area, which may put individual nurses at risk of adverse effects.

1.2 Problem Statement

Treatment of cancer with chemotherapeutic drugs started in the early 20th century. Chemotherapy, rather than localized therapy, is a systemic treatment. Since the 1940s, the toxicity of chemotherapeutic agents has been well known because these agents are non-selective in their mode of action and affect both non-cancerous and cancerous cells, resulting in chromosomal damage, skin rashes, itching, and dyspnea. Besides, more than 11 million new cases of cancer are diagnosed annually worldwide and are expected to increase to 16 million by the year 2020 (Kaur, 2017).

In addition, based on the study from Chaudhary & Karn (2012), this lack of awareness about prevention measures is of concern because it raises the unhealthy behavior of health staff. While there has been an increased understanding and concern about the issue of safe

handling of CDs, many nurses in hospital environments still do not obey the protocols and procedures and do not use the recommended safety equipment (Chaudhary & Karn, 2012).

The level of contamination and risk also depends significantly on the practitioner's knowledge and realization about their safety (Hosen et al., 2019). The findings from Nwagbo et al. (2017) also concluded that there are most of the nurses still do not adhere to the guideline of protective measures. This is because it may be due to inadequate supplying of personal protective equipment (PPE) and may be due to low enforcement to use it by the employers. Moreover, when coping with chemotherapy, some nurses cannot completely understand their own health risk or may have perceptions of a low likelihood of immediate injury. In addition, Connor and Eisenberg clarified that the insufficient use of preventive measures by nurses represents the perceptions of their low risk of immediate harm in the care of these agents Nwagbo et al. (2017).

Furthermore, this study is conducted because based on my reading from the previous study, there has been no study conduct among nursing students. Most of the research is doing among the staff nurse. Besides, as mentioned by Nwagbo et al. (2017), to ensure the safety of patients, themselves, and the community, nurses who provide treatment for patients undergoing chemotherapy need advanced knowledge. It is also supported by the results of this research showed that 41% of the nurses had a fair knowledge of chemotherapy. So, they may get advanced information regarding chemotherapy so that they can strengthen their skills and understanding. It is also important for students to know and be aware of the occupational safety measures as they will be going practical in the oncology unit and they will be exposed to the chemotherapy drugs. This is because my knowledge about

chemotherapy and occupational safety is low based on my experiences when going practical in the oncology unit.

1.3 Research Question

Guiding the research study and informing the researcher, the following research questions were formulated:

i. What is the level of knowledge about chemotherapy and occupational safety measures among undergraduate nursing students in USM?

ii. What is the level of awareness about prevention measures of chemotherapy and occupational safety measures among undergraduate nursing students in USM?

iii. Is there any association between knowledge of chemotherapy and occupational safety measures with socio-demographic characteristics (level of education and year of study) among undergraduate nursing students in USM?

1.4 Research Objectives

The research objective is an architectural framework that enables the researcher to come out with a worthy research project.

1.4.1 General Objective

This study aims to assess the knowledge of chemotherapy and occupational safety measures among undergraduate nursing students in USM and factor affecting.

1.4.2 Specific Objectives

i. To determine the level of knowledge of chemotherapy and occupational safety measures among undergraduate nursing students in USM.

ii. To determine the level of awareness about prevention measures of chemotherapy and occupational safety measures among undergraduate nursing students in USM.

iii. To examine the association between knowledge of chemotherapy and occupational safety measures with socio-demographic characteristics (level of education and year of study) among undergraduate nursing students in USM.

1.5 Research Hypothesis

The research of this study will be presented as follow:

Null hypothesis, HO: There is no association between knowledge of chemotherapy and occupational safety measures socio-demographic factors (level of education and year of study) among undergraduate nursing students in USM.

Alternative hypothesis, HA: There is an association between knowledge of chemotherapy and occupational safety measures socio-demographic factors (level of education and year of study) among undergraduate nursing students in USM.

1.6 Conceptual and Operational Definition

Definitions for the operational terms used in this research proposal are as shown below:

Table 1.1: Conceptual and Operational Definitions

Terms	Conceptual	Operational
Knowledge	Information, understanding and skills that obtained through education or experience (Oxford University Press, 2020).	In this study, knowledge is the information, facts or familiarity towards chemotherapy and occupational safety measures acquired by respondents.
Chemotherapy	Chemotherapy, also referred to as "chemo," is most commonly for cancer treatment that used drugs that inhibit or slow down the growth of cells (Sugerman, 2013)	In this study, chemotherapy is the clinical term that respondents must know and understands.
Occupational safety measures	Actions that can be taken to reduce or minimize the potential of exposure to the hazard and protect workers from workplace hazards (USDL, n.d.).	In this study, occupational safety measures are the thing that students must understand and concern to prevents health workers from hazard in the workplace.
Nursing students	The Nurses Act describes a student nurse as "any person enrolled in an accredited nursing education program''. (Virgil Guitard, 2014)	In this study, a nursing student is referring to a participant who is respondent in this research population which are nursing students in USM.

1.7 Significance of the Study

Knowledge is an important aspect that a person, especially a student must have to fully understand the fact or information about some ideas. In this study, the nursing students need to know about chemotherapy and occupational safety measures as they can increase their understanding of chemotherapy and occupational safety measures. Besides, nursing students also will be more understand and concern about safety in the workplace. In addition, this study also will increase nursing students' awareness about chemotherapy and occupational safety measures. Therefore, this will increase their knowledge and apply it in the clinical area. Moreover, the significance of this study is it will be strengthening the nursing students' knowledge and skills, and the preparation of their minds when they were going practical in the oncology unit. This is because when they have enough knowledge, they will be more ready and alert about the safety measures that must be taken. However, the school or lecturer from nursing can expand their students' knowledge by doing talks or seminars before they are entering their practical sessions in Hospital Universiti Sains Malaysia (HUSM). Lastly, this study will not only provide an understanding of chemotherapy, but it is also can take care of the safety of the students as well as other occupational health workers from risk or hazard of the chemotherapy treatment.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter provides a review and analysis regarding the knowledge of chemotherapy and occupational safety measures among undergraduate nursing students. The literature review focuses on the definitions of chemotherapy, types of chemotherapy drugs, definitions of occupational safety measures, the effect of chemotherapy drugs on the nurses, and knowledge regarding chemotherapy and occupational safety measures. The chapter also details the conceptual framework, Health Belief Model (HBM) guiding this study.

2.2 Definitions of Chemotherapy

Chemotherapy is referring to the treatment that uses drugs to prohibit the growth of cancer cells, either by killing or stopping the cells from dividing. Depending on the form and stage of the cancer being treated, chemotherapy may be delivered by mouth, injection, or infusion, or on the skin. Also, it may be given alone or with other treatments, for instance, surgery, radiation therapy, or biological therapy (National Cancer Institute, n.d.).

Based on their special pharmacological properties that interfere with cell division, these drugs are potentially hazardous. The definition of hazardous drugs by The American Society of Health-System Pharmacists in which those drugs that present genotoxicity, carcinogenicity, teratogenicity, fertility impairment, serious organ, or any toxic manifestation at low doses in animals and humans (Nwagbo et al., 2017). Besides, in the

treatment of cancer, chemotherapy is the use of cytotoxic drugs to provide a cure, control, and palliation (Kaur, 2017). Hence, chemotherapy is also the main cancer treatment regimen, and about 50% of cancer patients undergo chemotherapy (DM, EA, & DA, 2019).

23 Types of Chemotherapy Drugs

Chemotherapy drugs can be categorized by how they act, their chemical structure, and their relationships with other drugs. Besides, some drugs function in more than one way and may belong to more than one group (American Cancer Society, 2020). However, it is known that certain antineoplastic medications are carcinogenic, teratogenic, and mutagenic to humans (Chaudhary & Karn, 2012). Furthermore, as stated by Mohsen & Fareed (2013), cytotoxic drugs are also known as antineoplastic, anticancer, or cancer chemotherapy drugs including a wide range of chemical compounds. Cytotoxic drugs are extensively used to treat cancer as of their ability to destroy tumor cells by interfering with cell division. Hence, anti-cancer medications face risks of toxicity and other harmful consequences for patients and health care staff.

As mentioned by the study from Ibrahim, Habiba, Zein Eldin, & Ibrahem (2018), hazardous drugs have been used in cancer care for several years. By the increasing use of these drugs, an updated list of Antineoplastic and other hazardous drugs was published. Hazardous drugs in this list were defined as drugs used for cancer chemotherapy, hormones, antiviral drugs, several bio-engineered drugs, and other miscellaneous drugs.

2.4 Definition of Occupational Safety Measures

The OHS Advisory Services 18001 (OHSAS 18001) describes Occupational Health and Safety (OHS) as "conditions and factors that affect, or may affect, the health and safety of employees, temporary workers, contract staff, visitors or any other person at work." (M. Shashi Kumar, B. Ramakrishna Goud, 2014).

Results on the safe conduct of the nurses and the use of prescribed health protection measures showed that nurses did not completely comply with them, despite the rules and regulations relating to CDs (Chaudhary & Karn, 2012). Besides, the awareness of chemotherapy hazards by nurses is correlated with improving the practice of preventive measures (Mohsen & Fareed, 2013). Furthermore, for several years, occupational health and safety have been a big concern and how to avoid employee exposure to workplace hazards is a key demand from all employers (Ibrahim, Habiba, Zein Eldin, & Ibrahem, 2018).

2.5 Effect of Chemotherapy Drugs to the Nurses

There are several effects of chemotherapy drugs that can affect health towards people who are in handling and administer it. As shown by recent studies, the possible risks attributable to occupational exposure to cytotoxic drugs (CDs) are growing. This exposure can result from direct skin or eye contact and inhalation of aerosol droplets, primarily due to improper hygienic behavior, such as eating, drinking, or smoking, during the preparation, administration, or disposal of CDs (Chaudhary & Karn, 2012).

Besides, the effect of exposure to CDs may include hair loss, headache, acute irritation as well as adverse reproductive outcomes including infertility, spontaneous abortion, and

congenital malformation (Mohsen & Fareed, 2013). In addition, there have also been cases of learning difficulties among children of nurses who have managed chemotherapeutic drugs. It is proven by the urine sample investigation taken from the nurses who handled chemotherapeutic drugs confirmed chromosomal aberrations with evidence of mutagenic and carcinogenic risks in the urine samples (Nwagbo, S. E., Ilesanmi, R. E., Ohaeri, B. M., Oluwatosin, 2017).

Furthermore, Longe showed that acute symptoms, such as skin irritation, sore throat, cough, dizziness, headache, allergic reaction, diarrhea, nausea, and vomiting, were documented by health care workers exposed to chemotherapeutic agents (Kaur, 2017). Besides that, in numerous previous research, other significant health issues have been reported, including fertility problems, cancer, and genetic effects (Ibrahim et al., 2018). Moreover, although the possible therapeutic benefits of dangerous drugs outweigh the risks for sick patients of their side effects, exposed health care staff, with no therapeutic benefit, face the same side effects (DM et al., 2019).

26 Knowledge regarding Chemotherapy and Occupational Safety Measures

The findings from the study by Chaudhary & Karn (2012) suggest that the nurses' level of knowledge about CDs and their actual usage of safety measures while handling the CDs is not sufficient. Thus, this study also reported that the nurses' level of knowledge about antineoplastic drugs is not satisfactory (Chaudhary & Karn, 2012).

According to Nwagbo et al. (2017), more than 90% of the nurses understand the meaning of chemotherapy. However, only 40% a possessed good knowledge of the

classification and types. Moreover, based on several studies, the researcher suggests that nurses' knowledge of chemotherapy was insufficient. As well as the study from Ibrahim et al. (2018) also reported that nurses' knowledge is less than 50%.

Besides, nurses with higher knowledge scores reported substantially more regular use of at least one personal protective equipment than nurses with lower knowledge scores. In addition, findings on the use of personal protective equipment revealed that none of the nurses used the four requisite protective equipment during CDs handling and risky clinical operations (Chaudhary & Karn, 2012). Thus, it is correlated with the findings from Nwagbo et al. (2017), 25% did not use PPE because they did not think they were vulnerable to danger. Furthermore, while there has been increased awareness and concern about occupational safety measures among healthcare workers, many nurses in hospital settings still do not follow the guidelines and procedures. This is in line with a report that showed that increasing the nurses' knowledge will increase their adherence to the use of protective measures in their work and this, in turn, leads to their sense of well-being (Mohsen & Fareed, 2013). Moreover, most of the studied nurses (72.6%) had a fair knowledge score concerning the knowledge evaluation score, and only (11.0%) had a strong overall score. The study also concluded that among the studied population, the toxic effects of CDs were very prevalent. While most nurses had adequate knowledge of the safe handling of CDs, their experience and the implementation of protective measures were not sufficient (DM et al., 2019).

2.7 Theoretical/ Conceptual Framework of the Study

The knowledge of chemotherapy and occupational safety measures among undergraduates nursing students, School of Health Sciences, Universiti Sains Malaysia (USM) will be guided by the Health Belief Model (HBM), which has been used to evaluate and analyze the knowledge of chemotherapy and occupational safety measures. It will aid to enlighten researcher and to understand undergraduates nursing student's level of knowledge that influences their understanding of chemotherapy and occupational safety measures.

The Health Belief Model (HBM) was founded by social scientists in the United States Public Health Service in the early 1950s. It is developed to recognize people's inability to follow disease prevention methods or screening tests for early detection of disease (La Morte, 2019). Besides, according to this model, individual beliefs about health and health status play an important part in discovering a person's health-related behaviors (Boskey, 2020).

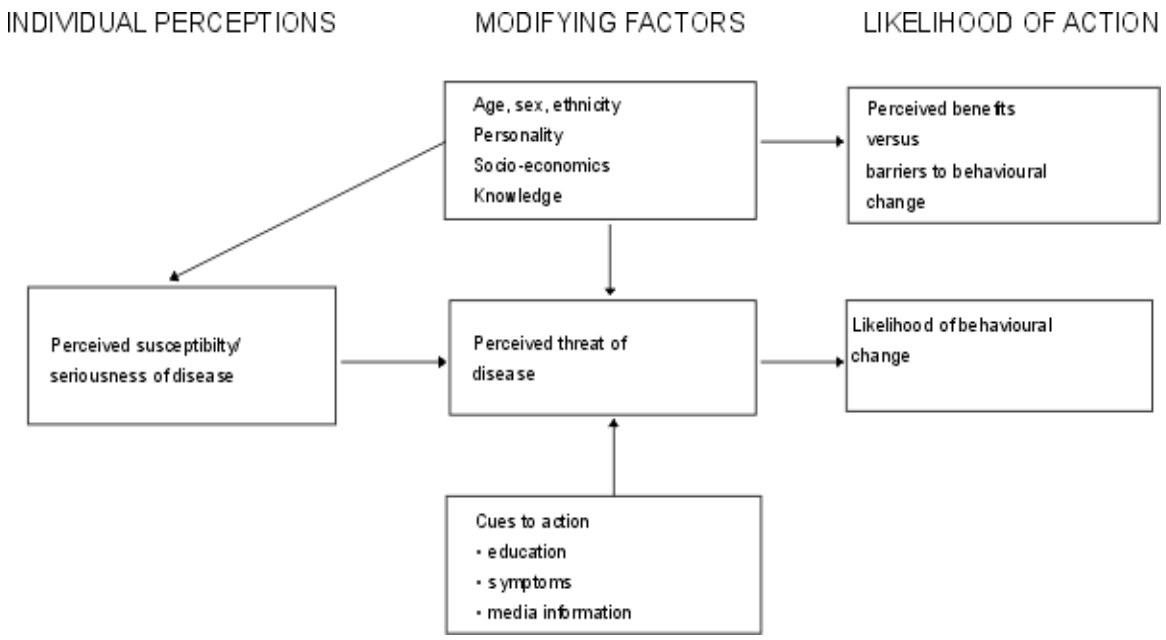

Figure 2.1: Health Belief Model

As stated by La Morte (2019), there are six elements of the HBM. It is comprising of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. The first element is perceived susceptibility, which refers to one's perception of the risk of obtaining an illness or disease. Besides, perceived severity. This refers to one's feelings on the seriousness of engaging in an illness or disease, perceived as a threat if a person lack of knowledge to overcome the situation. Next, perceived benefits which it refers to one's perception of the effectiveness of several actions to reduce the threat of illness or disease. For example, the person would accept the recommended health action if it was perceived as beneficial. In addition, perceived barriers are referring to one's feelings on the impediment to doing a recommended health action. Furthermore, cues to action. This is the stimulation needed to cause the decision-making process to consider a health action that is recommended. It can be internal, such as wheezing to relieve chest pain, or external, such as advice from others, newspaper articles, and many more. Lastly is self-efficacy, which refers to the level of one's confidence in his or her ability to successfully perform a behavior (La Morte, 2019).

Figure 2.2 shows the adopted Theory of Health Belief Model within this study. This conceptual framework will describe the readiness of undergraduates nursing students to strengthen their health-related beliefs through obtaining the undergraduates nursing student's knowledge about chemotherapy and occupational safety measures as well as an awareness campaign regarding the importance of knowledge in chemotherapy and occupational safety measures.

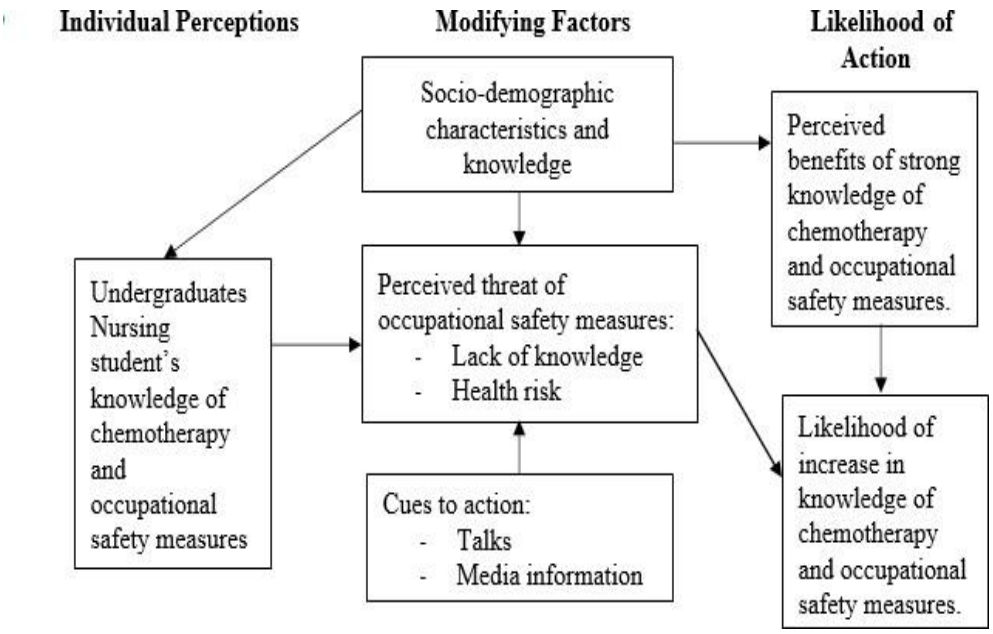

Figure 2.2: The Adapted Health Belief Model

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter explained the approach and rationale used to support the chosen research methodology. Determining and understanding a suitable research design is necessary for attaining the purpose of the study. This chapter contains an explanation of the study design and a justification of its selection.

3.2 Research Design

The study used a cross-sectional study design. A cross-sectional study is a form of observational study design used in medical research that looks at data from a population at a single point in time. In a cross-sectional study, researchers measure the study subjects' outcomes and exposures at the same time (Wang & Cheng, 2020). This study aims to assess the knowledge of chemotherapy and occupational safety measures among undergraduate nursing students in USM.

3.3 Study Setting and Population

The study was conducted at Universiti Sains Malaysia (USM), Health Campus, Kubang Kerian, Kelantan specifically on School of Health Sciences (SHS). This study was

conducted between November 2020 and June 2021. The data collection was collected from December 2020 until January 2021.

The study population in this study was undergraduate nursing students in Health campus, USM. This study was involved diploma and degree nursing from year 3 of diploma nursing and year 3 and year 4 of degree nursing.

3.4 Sampling Plan

3.4.1 Sample Criteria – Inclusion and Exclusion Criteria

The inclusion criteria:

1) Undergraduate nursing students of the School of Health Sciences, USM who had learned oncology in Medical-Surgical subject.
2) Able to understand English.

The exclusion criteria:

1) Nursing students that are registered nurses.

3.4.2 Sample Size Estimation

One of the essential aspects of planning research is the calculation of the sample size. Sample size calculation aims to outline a representative sample from the population, hence the outcome of examining the sample could then, generalized back to the population. It is also for attaining suitable statistical significance for a given hypothesis. The overall number of undergraduate nursing students in USM is 166. Hence, the sample size calculation for a study is important to assure it will constitute the population.

Single proportion formula:

$$\mathbf{n=(z/\Delta)^2\ p(1-p)}$$

Whereby,

n = Required sample size

z = Value representing the desired confidence level, 95% (Z-Score = 1.96)

Δ = Desired level of precision, +/- 5%

p = Anticipated population proportion

Double proportion formula:

$$n = \left(\frac{p1(1-p1) + p2(1-p2)}{p1 - p2)^2}\right) (Z\alpha + Z\beta)^2 (p1$$

Whereby,

n = Required sample size

p = Anticipated population proportion from the previous study

Zα = Value of the standard normal distribution curve cutting of probability alpha (α) in one-tail for a one-sided alternative or α/2 in each tail for a two-sided alternative (ZA= 1.96)

Zβ = Power of the study [Zβ=80% (0.84)]

For the first objective (to determine the level of knowledge of chemotherapy and occupational safety measures among undergraduate nursing students in USM), the previous study shows that 24% (0.24) of the nurses possessed a fair knowledge of chemotherapy. (Nwagbo, S. E., Ilesanmi, R. E., Ohaeri, B. M., Oluwatosin, 2017).

Calculation:

$$n = (1.96/0.05)2 \times 0.24 (1-0.24)$$

$$n = 280$$

The minimal sample size was 280 and after considering 10% drop out, the calculated sample size was 308.

$$n = 280 \times 10\% \text{ drop out } n = 308$$

The total calculated sample size for the first objective was 308 respondents.

For the second objective (to determine the level of awareness about prevention measures of chemotherapy and occupational safety measures among undergraduate nursing students in USM), the previous study shows that 92% of the nurses used gloves.

Calculation:

$$n = (1.96/0.05)2 \times 0.92 (1-0.92)$$

$$n = 113$$

The minimal sample size was 113 and after considering 10% drop out, the calculated sample size was 124.

$$n = 113 \times 10\% \text{ drop out } n = 124$$

The total calculated sample size for the second objective was 124 respondents.

For the third objective (to examine the association between knowledge of chemotherapy and occupational safety measures with socio-demographic characteristics (level of education and year of study) among undergraduate nursing students in USM). According to the previous study Simegn, Dagnew, & Dagne, (2020), 58.6% (0.59) were male while 45.8% (0.46) were female (P1 = 0.59, P2 = 0.46).

Calculation:

$$n = \left(\frac{0.59(1-0.59) + 0.46(1-0.46)}{(0.59-0.46)^2}\right)(1.96 + 0.84)^2$$

n = 227

The minimal sample size was 227 and after considering 10% drop out, the calculated sample size was 250.

n = 227 x 10% drop out n = 249.7

n = 250

The total calculated sample size for the third objective was 250 respondents.

Then, based on the three-sample size calculation, the sample size in objective 2 is convenient and realistic to do within the time frame. Therefore, the total number of participants in this study is 124.

3.4.3 Sampling Method

This study used a simple random sampling method. This method is being applied because it is easy for the researcher to assemble the sample and it was considered as a fair way of selecting a sample from the population where every participant is given an equal chance of being selected. Besides, this method was also free from bias and prejudice towards participants. To conduct this study, a list of undergraduate nursing students in the School of Health Sciences (SHS), USM from the selected year based on the inclusion criteria was obtained from the SHS academic office. Furthermore, each member of the larger population was assigned a number. Next, using a randomizer website, a set of random numbers was obtained based on the website. The list of students' names in alphabetical order was coded. Those coded numbers match with a randomized number from a randomizer and were included as a study subject. Then, the online version of the informed consent form (refer to Appendix B) was taken and obtained for those who agreed to participate in this study. The link to the questionnaire was given to them to answer and if they have difficulties, they can clarify with the researcher through WhatsApp.

3.5 Instrumentation

In this study, data from undergraduate nursing students were obtained using self-administered questionnaires. A set of questionnaires were used to collect the data from the undergraduate nursing students to assess the knowledge of chemotherapy and occupational safety measures. The questionnaire was adopted and adapted from the previous study, which is Verstrate (2015) and Nwagbo et. al. (2017).

3.5.1 Instrument

The questionnaire was divided into 4 sections.

Section A: Socio demographic data

Section A consisted of five questions of socio-demographic data of the nursing students, which included age, gender, race, level of education, and year of study. It is categorized as an independent variable of this study.

Section B: Knowledge of chemotherapy

This section comprises 11 questions in the form of true, false, or “don’t know” options. Every question is provided with 3 choices of answers and the respondents must choose one correct answer. This part aims to determine the respondents’ knowledge about chemotherapy.

Section C: Knowledge of occupational safety measures

This section comprises 9 questions in response to students’ knowledge about occupational safety measures. The questions are measured using true, false, and “don’t know” options. The respondents must choose one correct answer in this section.

Section D: Awareness about prevention measures of chemotherapy and occupational safety measures

This section comprises 7 questions in which the respondents are required to give an opinion of awareness about prevention measures of chemotherapy and occupational safety measures. This section measures all the questions through the Likert scale responses strongly agree, agree, disagree, and strongly disagree.

3.5.2 Translation of Instrument

The original version of the questionnaire used in this study is in the English version. Education in nursing program in USM used the English language. Therefore, no translation will be needed. The instrument is administered in the English language as USM nursing students are expected to be able to understand and complete the questionnaire.

3.5.3 Validation and Reliability of Instrument

Validity and reliability are important in the data collection instrument. The content was validated by three experts in the field, from Health Campus, USM. After the validation was done by the experts, corrections were done based on the comments and then sent back to the experts. It is to ensure that the instrument used in this study was capable to provide an accurate and valid measurement aspect and the participants able to understand the questions.

A pilot study was carried out to pre-test the questionnaire to determine problems related to the questions and to estimate the length of time required to complete the questionnaire. In this study, 10-15 respondents who fulfilled the inclusion criteria of the study were eligible to take part in the pilot study. Hence, 10-15 undergraduate nursing students in USM, Health Campus were invited to take part in the pilot study. Modifications were done on the instrument after the pilot study was conducted.