KNOWLEDGE OF LUNG EXPANSION IMPLEMENTING INCENTIVE SPIROMETRY AMONG NURSING STUDENTS IN UNIVERSITI SAINS MALAYSIA

ATIRAH SYAFIKAH BINTI ABD RAHMAN

SCHOOL OF HEALTH SCIENCES

UNIVERSITI SAINS MALAYSIA

2022

KNOWLEDGE OF LUNG EXPANSION IMPLEMENTING INCENTIVE SPIROMETRY AMONG NURSING STUDENTS IN UNIVERSITI SAINS MALAYSIA

by

ATIRAH SYAFIKAH BINTI ABD RAHMAN

Dissertation submitted in partial fulfilment of the requirements for the Degree of Bachelor of Nursing (Honours)

June 2022

ACKNOWLEDGEMENT

In the name of Allah the most Gracious, the Most Merciful.

First and foremost, I would like to express my gratitude towards my parents and family who have my back during ups and downs, giving unconditional supports and patience in completing this dissertation.

A special thanks go to my Supervisor, Ms Norazliah Binti Haji Samsudin for the endless guidance, supervision and encouragement given from the beginning of proposal preparation until the completion of my dissertation. Also, I would like to thank my Co-Supervisor, Dr. Nur Syahmina Binti Rasudin for her guidance in completing my dissertation.

I take this opportunity to thank the course coordinator of GTJ 401, Dr Norhasmah bt Mohd Zain for her help and assistance with this subject. I would like to thank Deans of the School of Health Science. I am especially grateful to the nursing students who were selected as respondents in this study for their excellent cooperation.

Lastly, I would like to thank my friends and colleagues for providing my source for this study and guidance before and after the completion of this dissertation.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

$\bar{x}$	-	Mean
n	-	Frequency
ACS	-	Acute chest syndrome
COPD	-	Chronic obstructive pulmonary disease
Covid-19	-	Coronavirus Disease 2019
HBM	-	Health Belief Model
SPSS	-	Statistical Package for Social Sciences
SD	-	Standard Deviation
SOP	-	Standard of protocol

PENGETAHUAN PENGEMBANGAN PARU-PARU MELAKSANAKAN SPIROMETRI INSENTIF DI KALANGAN PELAJAR KEJURURAWATAN DI UNIVERSITI SAINS MALAYSIA

ABSTRAK

Spirometri insentif adalah alat yang digunakan untuk mengukur isipadu udara yang disedut ke dalam paru-paru semasa inspirasi. Kajian keratan rentas telah dilakukan untuk menentukan pengetahuan pengembangan paru-paru yang melaksanakan spirometri insentif. Kajian ini juga mengkaji perbezaan skor pengetahuan mengenai spirometri insentif antara ijazah dan diploma pelajar kejururawatan dan korelasi antara pengalaman klinikal dan skor pengetahuan mengenai spirometri insentif antara ijazah dan diploma pelajar kejururawatan. Ujian-t sampel tidak bersandar digunakan untuk mengenal pasti perbezaan skor pengetahuan mengenai spirometri insentif antara ijazah dan diploma pelajar kejururawatan. Ujian korelasi Pearson digunakan untuk menentukan korelasi antara pengalaman klinikal dan skor pengetahuan mengenai spirometri insentif antara ijazah dan diploma pelajar kejururawatan. Seramai 181 pelajar kejururawatan, 76 pelajar adalah Sarjana Muda Kejururawatan, dan 105 pelajar adalah Diploma Kejururawatan direkrut melalui persampelan berstrata. Data dikumpulkan dari bulan Mac 2022 hingga Mei 2022 dengan menggunakan borang google dan dianalisis menggunakan SPSS versi 26.0 untuk tetingkap. Hasil kajian menunjukkan ijazah dan diploma pelajar kejururawatan mempunyai pengetahuan yang sama mengenai spirometri insentif kerana tidak ada perbezaan min unutk skor pengetahuan mengenai spirometri insentif (p - nilai = 0.166). Tidak ada korelasi yang dapat dijumpai antara pengalaman klinikal dan skor pengetahuan mengenai spirometri insentif antara ijazah dan diploma pelajar kejururawatan (p - nilai = 0.091). Kesimpulannya, pelajar ijazah dan diploma kejururawatan mempunyai pengetahuan yang bagus mengenai spirometri insentif.

KNOWLEDGE OF LUNG EXPANSION IMPLEMENTING INCENTIVE SPIROMETRY AMONG NURSING STUDENTS IN UNIVERSITI SAINS MALAYSIA

ABSTRACT

Incentive spirometry is a device used to measure the volume of the air inhaled into the lungs during inspiration. A cross-sectional study has been conducted to determine the knowledge of lung expansion implementing incentive spirometry. This study also examines the difference of knowledge of score of incentive spirometry between degree and diploma of nursing students and the correlation between clinical experience and knowledge of score of incentive spirometry among degree and diploma of nursing students. Independent t-test was used to identify the difference of knowledge of score of incentive spirometry between degree and diploma of nursing students. Pearson's correlation test was used to determine correlation between clinical experience and knowledge of score of incentive spirometry among degree and diploma of nursing students. A total of 181 nursing students, 76 students were Bachelor of Nursing, and 105 students were from Diploma in Nursing were recruited through stratified sampling. Data were collected from March 2022 until May 2022 using google form and analyzed using SPSS version 26.0 for a window. The results revealed degree and diploma of nursing students have same knowledge regarding incentive spirometry as there was no mean difference in knowledge of score of incentive spirometry (p-value=0.166). There was no correlation to be found between clinical experience and knowledge of score of incentive spirometry between degree and diploma of nursing students (p-value= 0.091). In conclusion, both degree and diploma of nursing students has good knowledge regarding incentive spirometry.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Incentive spirometry is a device used to measure the volume of the air inhaled into the lungs during inspiration (Franklin & Anjum, 2021). Incentive spirometry has been widely prescribed to prevent postoperative pulmonary complications (Eltorai et al., 2018a). Depending on the patient population and the criteria used to define a complication, the reported incidence of postoperative pulmonary complications ranges from 5 to 80 % (Conde & Adams, 2020). The postoperative pulmonary complications that can happen are atelectasis, pneumonia, and respiratory failure (Restrepo et al., 2011). Usually, incentive spirometry is combined with deep breathing exercises to help prevent postoperative pulmonary complications. Besides, it also can reduce pleural pressure, allowing for more lung expansion and improved gas exchange (Restrepo et al., 2011). Furthermore, incentive spirometry also aids in recovering the lungs from lung illness by keeping them free of fluid and active, improving lung function, and reducing the chance of developing lung infections (Yetman, 2021).

95% of hospitals report prescribing postoperative incentive spirometry in the United States. The indication of incentive spirometry is for patients at risk for postoperative complications, patients with pulmonary atelectasis, patients with lung problems or conditions that will develop the pulmonary atelectasis. The examples of the condition's states are thoracic or abdominal surgery, coronary artery bypass graft surgery, and patients with chronic obstructive pulmonary disease (COPD). Besides, prolonged bed rest, lack of pain control, presence of thoracic or abdominal binders, patients with neuromuscular disease, inspiratory capacity <2.5 L, spinal cord injury, and sickle cell

patients with acute chest syndrome are also examples of conditions that will develop pulmonary atelectasis (Restrepo et al., 2011; Eltorai et al., 2018a).

Incentive spirometry is used at several different times following the surgery. There is a specific time set for the incentive spirometry to be ordered. Usually, it has been ordered for the first three days after surgery and recommended to use incentive spirometry starting 4-72 hours after surgery. Some studies report the procedure change during patients' hospitalization, such as increasing the inspiratory target volume and breath-hold duration and reducing the frequency (Eltorai et al., 2018a).

The American Thoracic Society does not give any incentive spirometry guidelines (Eltorai et al., 2018a). Gaffney's (2019) study shows that educational sessions related to incentive spirometry can affect nurses' patient perspectives. However, the results revealed a decrease in agreement, indicating that the nurses now understand the current evidence concerning incentive spirometry. The results also supported the previous research findings and optimized nurses' need for endorsed guidelines on the proper use of incentive spirometry to prevent postoperative pneumonia (Gaffney, 2019).

The knowledge of incentive spirometry is very essential in reducing postoperative pulmonary complications and reducing the risk to develop lung infections. When the healthcare and the patient themselves have strong knowledge regarding incentive spirometry, it can enhance patients' well-being and decrease the risk of postoperative pulmonary complications. The knowledge of incentive spirometry is vital for nurses and nurses in training. They are responsible for teaching the patient the correct way to use incentive spirometry. When the patient lengthened a proper way, the incentive spirometry therapy will improve patients' compliance (Martin et al., 2018).

The nurses and nursing students are very close to the patient in the hospital (Asifah & Wani, 2018). Nurses and nursing students need to master incentive spirometry techniques to teach patients the correct way. Restrepo et al. (2011) state that instruction in the technique of incentive spirometry for parents, guardians, and other health providers may help to facilitate the patient's appropriate use of the technique and encourage adherence to therapy. Hence, knowledge of lung expansion implementing incentive spirometry among nursing students in Universiti Sains Malaysia (USM) is crucial (Asifah & Wani, 2018). They can help patients in HUSM prevent postoperative pulmonary complications and improve lung function.

1.2 Problem Statement

Incentive spirometry is a mechanical device that helps to improve lung function and reduces the risk of postoperative pulmonary complications. However, 25-50% of patients after major abdominal surgery still experience postoperative pulmonary complications, leading to postoperative morbidity and mortality (Westwood et al., 2007). In addition, these patients experienced discomfort, length of duration hospitalization, and others. Besides, 17% to 88% of people still have decreased lung volume after surgery and other complications (Batra & Kalyani, 2014).

The cases of pulmonary complications remain increased due to no preventive action taken and lack of knowledge in implementing incentive spirometry among patients, nurses, or nurses in training. Lack of knowledge in applying the theory of incentive spirometry is the major problem and barrier in reducing postoperative pulmonary complications and improving lung function. The level of knowledge regarding incentive spirometry among student nurses in Kashmir remains low (Asifah & Wani, 2018). This

will influence the delivery of information to patients. Hence, the patient will lack knowledge regarding how to use incentive spirometry. So, they will use them incorrectly and decrease the effectiveness of the treatment. The training and self-administration of incentive spirometry among patients were insufficient and caused a lack of resolution of postoperative pulmonary complications (Restrepo et al., 2011). Lack of knowledge among patients will influence patient adherence towards incentive spirometry.

Studies conducted by Eltorai et al. (2018c) reported that 86% of providers admit that patients lack the commitment to incentive spirometry and 95.4% believe it should be improved. However, the patient continues to remain lack adherence. Various factors cause incentive spirometry adherence. The most common reasons were that patients forgot to use incentive spirometry devices, failed to use them effectively, and did not use them often (Eltorai et al., 2018c). This will affect preventing postoperative pulmonary complications and improving lung function. Martin et al. (2018) state that adherence and correct usage of incentive spirometry are the critical components of incentive spirometry therapy and patient-administered therapy. Thus, patient adherence towards incentive spirometry is important in preventing postoperative pulmonary complications and improving lung function.

Lastly, there is a lack of data assessing knowledge of lung expansion implementing incentive spirometry among nursing students. Therefore, it is essential to conduct this study to determine the knowledge of lung expansion implementing incentive spirometry among nursing students in Universiti Sains Malaysia.

1.3 Research Question

The research questions are as follows:

1. What is the mean score of knowledge of lung expansion implementing incentive spirometry among degree and diploma of nursing students in USM?
2. Is there any difference in knowledge of score of incentive spirometry between degree and diploma of nursing students in USM?
3. Is there any correlation between clinical experience and knowledge of score of incentive spirometry among degree and diploma of nursing students in USM?

1.4 Research Objective

Research objectives are divided into general objectives and specific objectives.

1.4.1 General Objective

The general objective is to determine the knowledge of lung expansion implementing incentive spirometry among nursing students in Universiti Sains Malaysia, USM.

1.4.2 Specific Objectives

The specific objectives of the study are:

1. To identify the mean score of knowledge of lung expansion implementing incentive spirometry among degree and diploma of nursing students in USM.
2. To examine the differences of knowledge of score of incentive spirometry between degree and diploma of nursing students in USM.
3. To examine the correlation between clinical experience and knowledge of score of incentive spirometry among degree and diploma of nursing students in USM.

1.5 Research Hypothesis

The hypothesis for this study is as follows:

1. H_0 1 = There is no significant differences in knowledge of score of incentive spirometry between degree and diploma of nursing students in USM

   H_A 1 = There is significant differences in knowledge of score of incentive spirometry between degree and diploma of nursing students in USM.

2. H_0 1 = There is no significant correlation between clinical experiences and knowledge of score of incentive spirometry among degree and diploma of nursing students in USM.

   H_A 1 = There is a significant correlation between clinical experiences and knowledge of score of incentive spirometry among degree and diploma of nursing students in USM.

1.6 Conceptual and Operational Definitions

Table 1.1 Definitions for the operational terms used in this research proposal

Terms	Conceptual	Operational
Knowledge	A collection of experiences, relevant information, and expert insight provides a framework for estimating and integrating new information and experiences (Mohajan, 2016).	This study will assess knowledge of lung expansion implementing incentive spirometry among nursing students using a self-administered questionnaire adopted from Eltorai et al. (2018a).
Lung expansion	The size of the lung is from normal to large (Winegardner, 2008).	In this study, incentive spirometry promotes lung to expand.
Incentive spirometry (IS)	Disposable plastic devices are used to prevent postoperative pulmonary complications by allowing for the development of sustained maximal inspiration (Martin et al., 2018).	The knowledge about incentive spirometry can positively impact the knowledge of lung expansion implementing incentive spirometry and will be measured by using socio-demographic data, knowledge on incentive spirometry, and knowledge of incentive spirometry procedure.

Nursing students	An individual who is enrolled in a nursing program (Medical Dictionary, n.d.)	A person who takes a diploma or degree course in nursing at Universiti Sains Malaysia (USM) and already learned about the theory of incentive spirometry.

1.7 Significance of The Study

Incentive spirometry has been introduced in the medical field for a long time. However, there are still has some cases related to postoperative pulmonary complications and lung collapse. The most closely with the patient is usually nurses and nursing students in training. Lack of knowledge regarding incentive spirometry among the nurses and the nursing students will become a barrier in reducing postoperative pulmonary complications and lung collapse. Therefore, by conducting this study, we can collect data on the knowledge of lung expansion implementing incentive spirometry among nursing students in USM and can obtain their level of understanding.

Besides, the data for this study can be used as a teaching guideline to nursing students and improve the structure used for patient health education. Thus, it can lead to patients appropriately using incentive spirometry. The effective use of incentive spirometry can help patients to prevent postoperative pulmonary complications and improve lung functions. After that, through the findings of this study, the nursing students can get more knowledge regarding incentive spirometry and can implement them into their nursing care. Furthermore, the nursing students can also know the benefits of incentive spirometry and optimize the utilization to postoperative patients. Other than that, the nursing students become more aware to correctly use incentive spirometry as one of the lung expansions therapies for the postoperative patient and patient who have lung

problems. Therefore, it can help in reducing postoperative pulmonary complications and improving lung functions of patients in hospital USM, and increasing the effectiveness of surgical and medical department services.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter aims to explore the study to a broader spectrum of the theories and clinical methods available in the literature. This chapter also presents information on nurses' and nursing students' knowledge based on previous studies. Lastly, it describes the theoretical framework selected for this study: Health Belief Model (HBM) that will guide this study.

2.2 Review of Literature

2.2.1 Incentive Spirometry

Incentive spirometry is defined as a disposable, plastic device that will help to reduce postoperative pulmonary complications by achieving sustained maximal inspiration (Martin et al., 2018; Restrepo et al., 2011). Sustained maximal inspiration is a breathing technique consisting of a deep breath after holding breath for 3 or 4 seconds (Malone & Adler, 2004). They believe that when the inspired oxygen is contained within the alveoli for a long duration, it will result in a bit longer time for oxygen uptake by the pulmonary circulation. Besides, the collateral ventilation might be improved due to alveolar interdependence via the pores of Kohn and Lambert's canals, thus leading to increased lung expansion (Malone & Adler, 2004). However, Restrepo et al. (2011) state that when the patient inhales at a predetermined flow or volume and maintains inflation for at least 5 seconds, sustained maximal inspiration is attained.

Incentive spirometry was developed by Bartlett, Gazzaniga and, Geraghty after they observed that yawning might provide an excellent pulmonary advantage for

postoperative patients (Eltorai et al., 2018b). They establish the devices as they believe that the inspiration of yawning grants the benefits. In the study by Eltorai et al. (2018b), the device is created to teach patients by mimicking a yawning-like sustained maximal inspiration to prevent atelectasis, pneumonia, and other postoperative pulmonary complications. The Bartlett-Edwards incentive spirometry device was developed in 1973 to stimulate deep breathing by supplying visual light feedback patients achieved inspiratory target volume. Then, the incentive spirometry devices were being improved in 1975. The Spirocare device was introduced in 1975 further advanced by putting the display lights on a scale in the electronic incentive spirometry device to indicate the larger inspiratory volumes. Thus, it will enhance patient adherence and engagement on incentive spirometry devices. The electronic incentive spirometry device has been replaced by disposable units and low cost, although it was used for many years (Eltorai et al., 2018b).

There are two types of incentive spirometry devices: flow-oriented and volume-oriented (Eltorai et al., 2018b). The flow-oriented incentive spirometry devices consist of lightweight plastic floats seated in a chamber with three corresponding columns. Then, the chamber is connected to a mouthpiece through a flexible tube. The flow-oriented incentive spirometry works when the patient inhales, the negative intrathoracic pressure will create the inspiratory flow and cause the floats to rise. In contrast, the volume-oriented incentive spirometry devices contain a chamber with volume measurement present and connected to a flexible tube with a mouthpiece. So, when the patient inhales, the piston or plate in the chamber will rise to the maximum volume of air movement, followed by breath-holding of maximal inspiratory effort (Eltorai et al., 2018b; Gaffney, 2019). Clinical practice guidelines recommend volume-oriented devices because of the lower force for breathing (Eltorai et al., 2018b).

The incentive spirometry has its technique to use and will benefit patients if they apply it correctly. The nurses, nursing students in training, and other providers need to properly understand the method to instruct the patients who need to use incentive spirometry. Restrepo et al. (2011) state in their study that the instruction of relatives and health caregivers will result in the patient's appropriate use of the technique and adherence to therapy. The instruction of using incentive spirometry is also stated in the study. To use the incentive spirometry, first, the patient needs to hold the spirometer in an upright position (Restrepo et al., 2011). Second, the patient needs to exhale normally and then place the lips around the mouthpiece and ensure to fit in tightly. Third, patients need to inhale slowly to raise the ball or the piston in the chamber to the set goal. Lastly, the mouthpiece will be removed, followed by a patient's need to hold breath and normal exhalation after achieving maximal inhalation (Restrepo et al., 2011).

The incentive spirometry has always been used in various cases. For example, it has been used for any general surgery requiring more than one day of hospital admission. However, it is not appropriately used by itself to prevent postoperative pulmonary complications. Restrepo et al. (2011) concluded in their study that incentive spirometry is recommended to be used with deep breathing techniques, directed coughing, optimal analgesia, and early mobilization to prevent postoperative pulmonary complications. Besides, deep breathing assists in opening lung spaces that might have collapsed and supported the movement of secretion (Franklin & Anjum, 2021). Then, it also can be used in cases like rib fractures. Following rib fractures, several complications can happen, such as pneumothorax, atelectasis, respiratory failure, and death. Thus, by using incentive spirometry, pulmonary complications in patients with rib fractures can be decreased, and pulmonary function can be improved. Besides, incentive spirometry is also included in

managing acute chest syndrome (ACS) for children with sickle cell disease (Franklin & Anjum, 2021).

Patient compliance can be increased if they see the feedback of the therapy. Therefore, incentive spirometry can be a favorable tool in rehabilitation as it shows visual feedback to the patient. Besides, it is easy to handle with no known side effects and affordable. Furthermore, Franklin & Anjum (2021) states that incentive spirometry is simple to train, and once a patient has known the method to use it properly, they do not need any assistance. So, they will be able to prevent postoperative pulmonary complications and improve lung function if they fully commit to the incentive spirometry therapy.

2.2.2 Theory of Knowledge

Knowledge can be defined as familiarity, awareness, or understanding of someone or something, including descriptive knowledge known as facts, procedural knowledge known as skills, or acquaintance knowledge known as objects (Davis, 2020). Knowledge can also be considered consciousness, identification, and implementation for humankind development. Furthermore, knowledge has become a vital part of every organization because of the present development of science and technology (Mohajan, 2016). In organizations, knowledge can be deemed a storehouse of organization development intelligence. The process of knowledge management includes knowledge sharing, knowledge acquisition, and knowledge used to provide a positive impact on innovation (Rezael, Khalizadeh and Soleimani, 2021).

Some factors that affect knowledge management to success and practical which are structure, strategy, technology, culture, leadership, and trust (Rezael et al., 2021). It

is shown that to build a thriving organization, knowledge management must be effective and have a good strategy, leadership, and other factors that can influence knowledge management. For example, nursing organizations need to have good leadership and a firm structure to provide good care for patients. However, some barriers hold up the flow of knowledge among teammates (Hubert & Lopez, 2013). The knowledge sharing barrier as the following: 1) Relationship, 2) Awareness, 3) Trust, 4) Cultural, 5) Time, 6) Distance, 7) Experience, 8) Knowledge hoarding, 9) Sponsorship, 10) Measures that will impact the behaviour of people's knowledge-sharing.

Many sources can obtain knowledge. The primary source of knowledge can be divided into five categories: experience, authority, deductive reasoning, inductive reasoning, and the scientific approach Ary, Jacobs & Sorensen (2010; as cited in Tuong, 2016). Davis (2020) states that someone can gain knowledge by reading books, watching the news, and exploring the Internet. Knowledge is fundamental to all humankind as it can provide many benefits in the development of humankind.

2.2.3 Knowledge of Lung Expansion Implementing Incentive Spirometry

2.2.3.1 Knowledge of Incentive Spirometry

Adequate knowledge in incentive spirometry can provide a successful therapy for patients with lung conditions. The individuals who have the responsibility to have enough knowledge are nurses, nurses in training, other healthcare members, and the patient itself. Incentive spirometry is widely prescribed to prevent or reduce the risk of postoperative pulmonary complications. However, Eltorai et al. (2018a) states that in their study, previous studies show that incentive spirometry has repeatedly failed to prove lung volume improvement or decrease postoperative pulmonary complications, but it is

continued widespread usage. Patient compliance to incentive spirometry might be one of the factors to unsuccessful use of incentive spirometry. Narayanan, Hamid & Supriyanto (2016) conclude that from their study, only 16.7% reports on patient compliance from 36 randomized controlled trials that evaluate incentive spirometry from 1972 to 2015. However, Martin et al. (2018) argued that if the patient's device use is wrong, they cannot be compliant with incentive spirometry therapy. Thus, it shows that patient knowledge on incentive spirometry is essential in preventing postoperative pulmonary complications.

The study conducted by Eltorai et al. (2018a) and the respondents vary from years of practice shows that nurses have different perspectives toward incentive spirometry. Still, most respondents agree that incentive spirometry is needed for patient care. They also admit that they have received adequate education and training toward incentive spirometry. Thus, it shows that different years of practice have a different perspective regarding incentive spirometry, although they receive an adequate education. On the other hand, a study by Gaffney (2019) on knowledge of nurses toward prevention of pneumonia by implementing incentive spirometry shows that all the nurses agree in the pretest that their education and training regarding incentive spirometry was adequate, but after the educational session conducted by the author, their level of agreement decreased. Thus, it shows that nurses need to improve their knowledge regarding incentive spirometry.

2.2.3.2 Measurement

The measurement tools used in this study were the questionnaire adopted from Eltorai et al. (2018a). The questionnaire consists of two parts which have 23 items. Part A is about socio-demographic data, and part B is about knowledge regarding lung

expansion implementing incentive spirometry. In addition, part B will cover the knowledge on incentive spirometry and knowledge of incentive spirometry procedures. The knowledge on incentive spirometry will cover the following: 1) the importance of incentive spirometry (1 item), 2) the utility of incentive spirometry (2 items), 3) the effectiveness of incentive spirometry in reducing atelectasis and pneumonia (4 items), 4) the effectiveness of incentive spirometry compared to other therapy (3 items), 5) the time when incentive spirometry should be used (2 items), 7) the nursing students' education and training (1 item). The knowledge of incentive spirometry procedures has seven questions. Questions 14-16 are multiple-choice answers, and questions 17-20 are open-ended questions.

This questionnaire is also used in Gaffney (2019) study regarding registered nurses' knowledge of pneumonia prevention implementing incentive spirometry in adult hospitalized postoperative patients. The purpose of the study is to evaluate the registered nurses' knowledge regarding incentive spirometry in the prevention of non-ventilated hospital-acquired pneumonia.

Another questionnaire developed by Asifah & Wani (2018) regarding knowledge of incentive spirometry was also considered in this study. However, the questionnaire was not chosen for this study due to not being suitable since the study conducted skills training programs. Thus, the questionnaire developed by Eltorai et al. (2018a) is chosen for this study.

2.2.4 Knowledge of Lung Expansion Implementing Incentive Spirometry and Related Factors

Knowledge is a result of knowing something and knowing is one of the major human processes (Bolisani & Bratianu, 2018). Knowledge can provide a lot of benefits to the individual as it is one of the essential components in the development of humankind. Knowledge can be influenced by individual characteristics such as educational level and experiences. If the individuals have a higher educational level, they will have a higher level of knowledge than individuals who only have a primary education level. Besides, it can reduce their need for health care as education is vital in improving the health and well-being of the individual. A study finds that an additional year of schooling can decrease the risk of bad health by 18.5% for the cohort of Swedish men born between 1945 and 1955 (Spasojevic, 2003 as cited in Feinstein, Sabates, Anderson, Sorhaindo & Hammond, 2005). The theory is similar to experiences. For example, if the nurses have been working in the nursing field for a long time, they might have a high level of knowledge compared to the nurses who started their carrier. There is lack of study regarding knowledge of incentive spirometry among student nurses. A study conducted in Hong Kong that assesses the factor affecting nurses' knowledge, attitude, and skills in the clinical management system shows that higher educational levels and working experience are significant factors that can increase nurses' knowledge, attitudes, and skill (Chan, 2009). Thus, it is shown that educational level and working experiences really can impact the individual's level of knowledge.

2.3 Theoretical and Conceptual Framework of the Study

The theoretical framework of the study

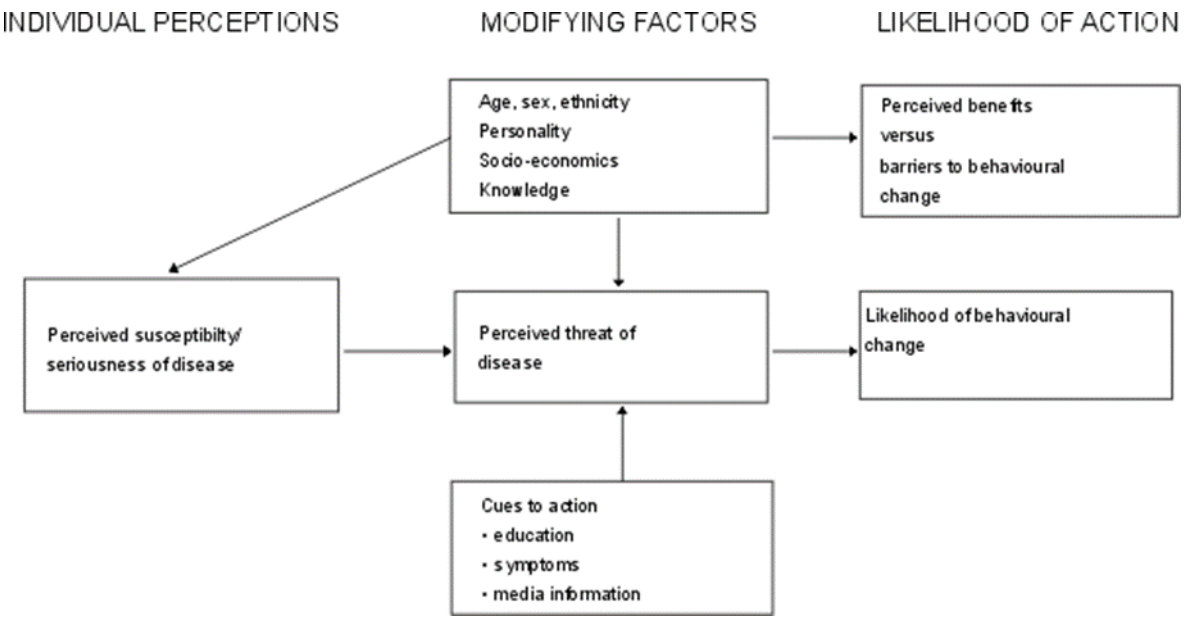

Figure 2.1 The Health Belief Model from Glanz, Rimer & Lewis, 2002

The theoretical framework for this study is based on the Health Belief Model (HBM). Health Belief Model was initially developed by United States public health researchers in the 1950s to increase the effectiveness of health education programmed Hochbaum (1958 as cited in Abraham & Sheeran, 2005). Two aspects of individuals' representations of health and health behaviour, behavioural evaluation, and threat perception, are the focus of the Health Belief Model. The Health Belief Model is the most frequently used theory in health education and health promotion to describe change and continuity of health-related behaviours and conduct a framework for health behaviour interventions (Saha et al., 2008).

The crucial components which constructed the Health Belief Model are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to

action (Becker, Maiman, Kirscht, Haefner & Drachman, 1977). Health Belief Model postulates that messages will sustain the maximal behaviour change if they successfully target perceived barriers, benefits, self-efficacy, and threats (Jones, Jensen, Scherr, Brown, Christy & Weaver, 2014).

If people's perceived susceptibility is high, they will take action to prevent illness. People would believe that the condition could cause a severe consequence in perceived severity. Besides, people will adopt behaviour changes if they believe that the action would decrease the severity and lead to other positive outcomes, known as perceived benefits. People discover few negative features related to health action for the perceived barriers that would prevent the desired behaviour change (Jones et al., 2014).

Self-efficacy is defined as the trust that an individual can complete the behaviour of interest without considering the barriers (Rosenstock, Stretcher, Becker, 1998 as cited in Jones et al., 2014). While for the cues to action, it is referred to the stimulus needed to trigger someone in the decision-making process to accept the suggested health action (LaMorte, 2019).

The conceptual framework for this study has been developed based on the Health Belief Model. Perceived susceptibility is the opinion of nursing students on lung expansion implementing incentive spirometry with related variables consisting of educational level, year of study and clinical experiences. Their perception of postoperative pulmonary complications and lung infection will be discovered as a threat to postoperative pulmonary complications and lung infection, resulting in the student's knowledge score.

This outcome can show that nursing students either benefit from their perception of lung expansion implementing incentive spirometry or have a barrier. The higher the

outcome, the higher mean score of knowledge, shows that students get sufficient knowledge regarding lung expansion implementing incentive spirometry, but the lower mean score of knowledge will conclude that they need some lung expansion implementing incentive spirometry's education.

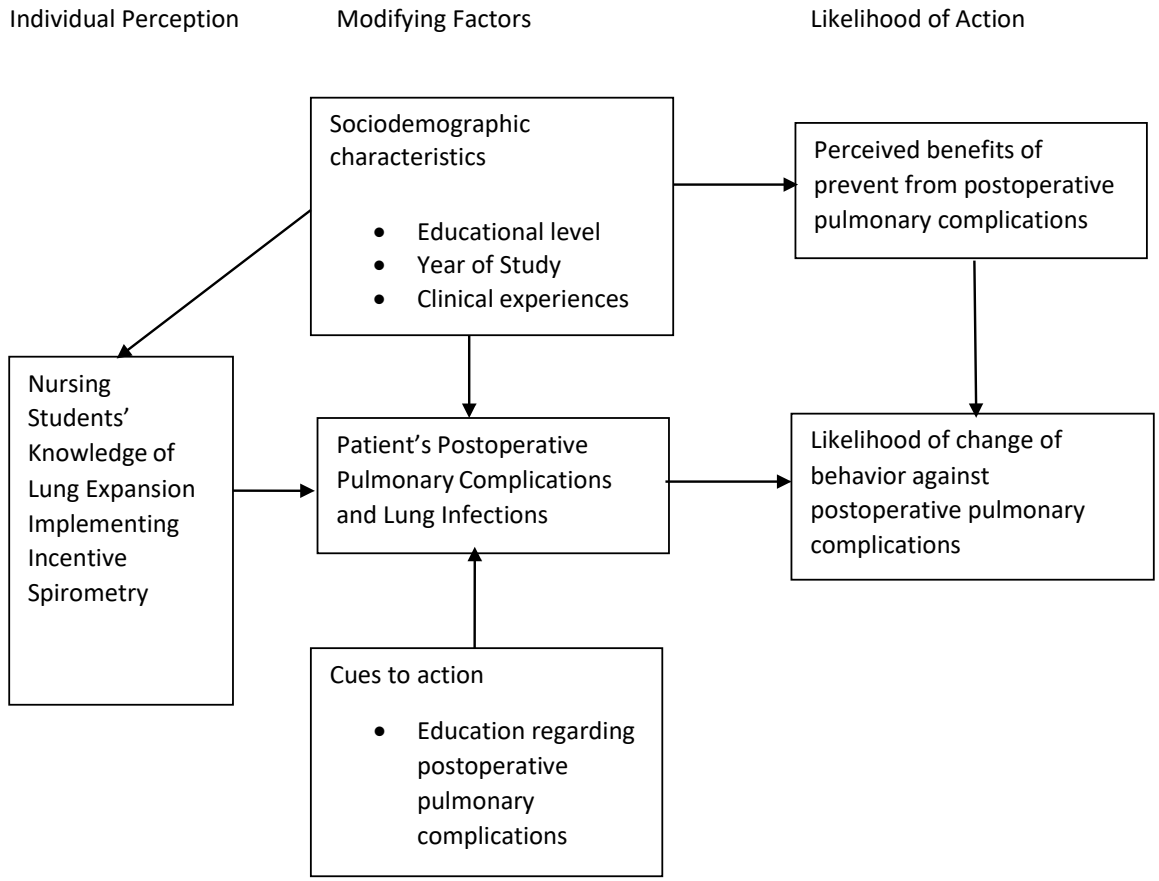

Figure 2.2 Conceptual framework of knowledge of lung expansion implementing incentive spirometry (Adapted from Glanz, Rimer & Lewis, 2002)

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter explains the method and the rationale used to support the chosen research methodology. Understanding and adequately determining a suitable research design is required to achieve the study's goal.

3.2 Research Design

This study used a cross-sectional study design. A cross-sectional study is a type of research design in which data is collected from many people at one time (Thomas, 2020). In this study, the researcher aimed to analyze the nursing students' knowledge of lung expansion by implementing incentive spirometry.

3.3 Study Setting and Population

This study was entirely conducted in Health Campus, Universiti Sains Malaysia (USM). This study involved nursing students from the School of Health Sciences, Universiti Sains Malaysia who have already learned about the respiratory system and nursing management of a patient with respiratory disorders, the theory of incentive spirometry and have clinical experiences in the Hospital USM. All the data from the respondents were collected from March 2022 until May 2022.

Table 3.1 Total number of nursing students with degree and diploma

Course	Year of study	Total number of nursing students
Degree	Year 2	35
	Year 3	31
	Year 4	27
Diploma	Year 1	55
	Year 2	51
	Year 3	69

3.4 Sampling Plan

Sampling is the process of selecting respondents from a large population and is usually used in statistical analysis. Sampling established that the chosen sample will represent the studied population, ensure study validity and reliability, and decrease measuring errors.

3.4.1 Sample Criteria

Inclusion Criteria

Participants must meet the following criteria to be included in the study:

1. Nursing students who have already learned about the theory of incentive spirometry in the respiratory system include:
   - Degree nursing year two until year four
   - Diploma nursing year one until year three
2. Nursing students who have clinical experiences at Hospital Universiti Sains Malaysia include:
   - Degree nursing year two until year four
   - Diploma nursing year one until year three

Exclusion Criteria

Participants are excluded from the study if they are fulfilled the following:

Individuals who refused to give informed consent.

3.4.2 Sample Size Estimation

The study sample size is calculated for objective 1, 2 and 3. The sample size for this study used a larger sample size of 220 participants to help create a more significant result. Objective 1 is calculated using a single proportion calculation formula. Based on the previous study conducted by Martin et al. (2018), 84.6% of the participants have a good knowledge of incentive spirometry. With a 10% of dropout rate, the total participants required for this study are as follows:

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

$$n = [\frac{1.96}{0.05}]^2 (0.846) (1\text{-}0.846)$$

n = 200

n of nursing students in USM = 200 ± dropout 10%

200 ± 20 = 220 participants

For Objective 2, the sample size is calculated using the two-mean comparison (independent) from a web-based sample size calculator by Arifin (2022). The sample size calculation using the standard deviation and expected differences of knowledge of incentive spirometry based on the previous study by Gaffney (2019), 2.56 and 0.88, respectively. Figure 3.1 shows the sample size of 133 participants and with 10% dropout, the sample size is 148 participants.

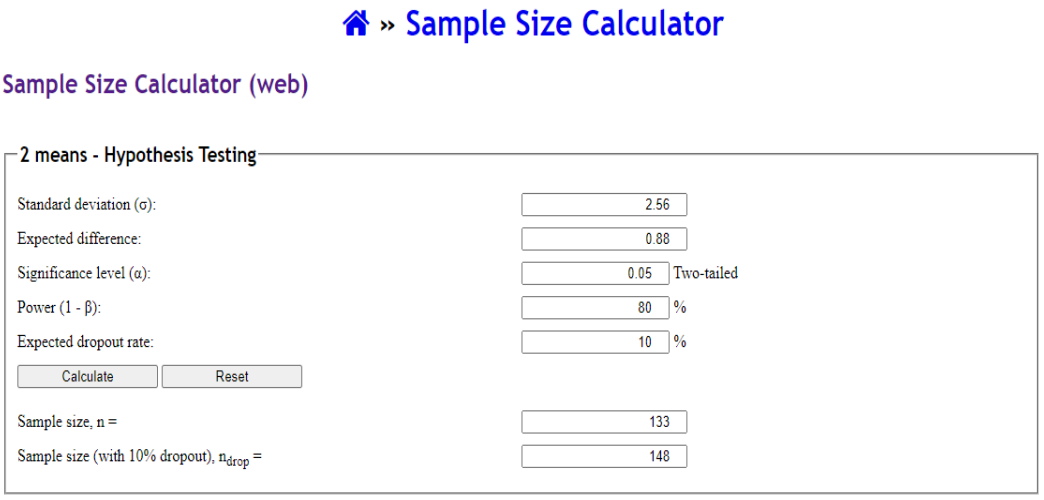

Figure 3.1 Sample size estimation

For Objective 3, the sample size is calculated using the Pearson's Correlation from a web-based sample size calculator by Arifin (2022). The sample size calculation using the correlation coefficient between knowledge and clinical experience (r=0.469) from a previous study by Asifah & Wani (2018). Figure 3.2 shows the sample size of 33 participants and with a 10% dropout, the sample size is 37 participants.

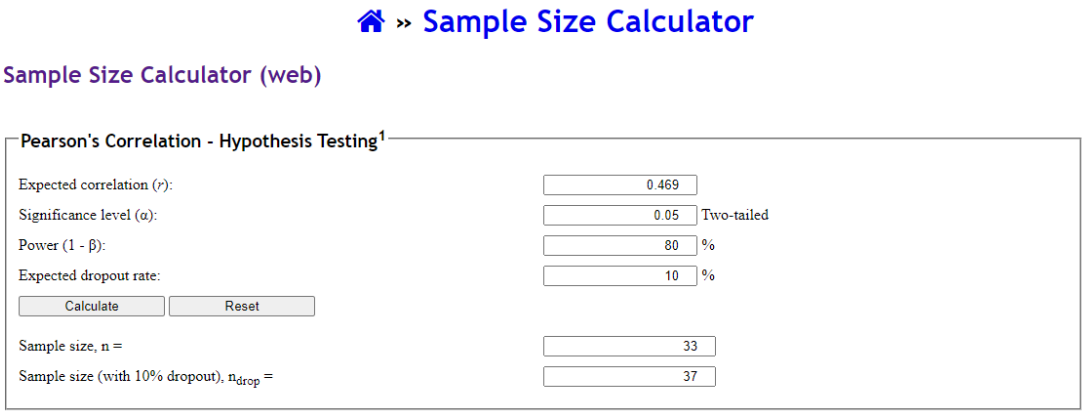

Figure 3.2 Sample size estimation

3.4.3 Sampling Method

The sampling method used in this study to select the sample from the population of interest is a stratified random sampling method based on their year of study. Stratified