UNIVERSITI PUTRA MALAYSIA

KNOWLEDGE AND PRACTICE OF HAND HYGIENE AMONG MEDICAL AND NURSING STUDENTS IN FACULTY OF MEDICINE AND HEALTH SCIENCES, UNIVERSITI PUTRA MALAYSIA

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ABSTRACT

KNOWLEDGE AND PRACTICE OF HAND HYGIENE AMONG MEDICAL AND NURSING STUDENTS IN FACULTY OF MEDICINE AND HEALTH SCIENCES, UNIVERSITI PUTRA MALAYSIA

Noor Fazlina Abdul Halim Shah, Hng Siew Hong, Dr Muhammad Hibatullah

Background: Hand hygiene is widely recognized as the most important strategy to prevent and reduce health-related infections (HAI) and is critical to the safety of patients and clinicians. The primary method of transmission of nosocomial infections is through the hands of healthcare personnel. The most common nosocomial infections are surgical wound infections, urinary tract infections, and lower respiratory tract infections. **Objective:** This study aims to determine the level of Knowledge and Practice of hand hygiene among medical and nursing students in Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor. **Methodology:** This study using a self-administrated hand hygiene questionnaire and WHO Observation Form as the main instruments. Total participants of 103 students were selected using stratified random sampling. Participants were acquired to answer the questionnaire and their hand hygiene practice were observed. Data analyzed in SPSS version 27. **Data Analysis:** The statistical measure Pearson Correlation was used to determine the association between level of knowledge and practice of hand hygiene. **Result:** 103 participants had participated in this study. About 79.6% (82) of the respondents were having good knowledge and 20.4% (21) having poor knowledge. Besides, 71.8% (N=74) had good practice and 28.2% (N=29) had poor practice. The findings showed that there was no statistically significant association between level of knowledge and level of practice of hand hygiene where p value is (p=0.800). A total of 334 hand hygiene opportunities were observed during the study using the WHO Observation tool with overall hand hygiene compliance rate was 74.55%. **Conclusion:** From the research, it shows that there was no association between level of knowledge and level of practice of hand hygiene among medical and nursing students in Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

Keywords: Knowledge, Practice, Hand Hygiene, Nosocomial Infections and Student.

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Thank you for the cooperation and kindness from all of you. I can only pray to Almighty and may Allah give you all the best in return.

DECLARATION

Declaration by graduate student

I hereby confirm that:

- This thesis is my original work; quotations, illustrations and citations have been duly referenced.
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CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter will discuss the background of study, the problem statement, significance of study, research objectives and research questions.

1.1 Background of Study

Hand hygiene is a milestone of infectious disease control, and promotion of improved hand hygiene has been recognized as an important public health measure. Hand hygiene is widely recognized as the most important strategy to prevent and reduce health-related infections (HAI) and is critical to the safety of patients and clinicians. “Health-related infection” is used as a type of infection resulting from long-term hospitalization and is a major risk factor for serious health problems leading to death (Khan et al., 2017). The most common nosocomial infections are surgical wound infections, urinary tract infections, and lower respiratory tract infections (Organization, n.d.). Therefore, the practice evolved through time as evidence of its usefulness accumulated, nosocomial infections can be prevented by maintaining good hygiene in hospitals and public health centers (Jayarajah et al., 2019).

The prevalence of health-care-associated infection varies between 5.7 percent and 19.1 percent in low- and middle-income countries at any one time. However, it has been reported that at least 20% of all nosocomial infections can be avoided by implementing infection-control measures in the workplace (Ciofi Degli Atti et al., 2011). Hand hygiene such as handwashing with simple or antiseptic soap and water or alcohol-based solutions is commonly recognized as the single most significant way of avoiding infectious agent transmission.

Healthcare workers can pass infections on to patients. Hand disinfection with appropriate hand disinfectants is required following interactions with sick patients (Khan et al., 2017). Therefore, the extent of knowledge and practice of hand hygiene among the students is an important aspect that needs to be addressed to prevent the spread of nosocomial infections that can pose significant health risks to patients.

The primary method of transmission of nosocomial infections is through the hands of healthcare personnel. The physiological flora colonizes them permanently ("resident flora"), and certain pathogens that do not belong to the physiological flora colonize them briefly ("transient flora"), depending on the nature of the employee's tasks. Staphylococcus aureus, for example, may live on the hands for more than two hours (Kampf et al., 2009). Hand cleanliness is thus the most crucial precaution to take to prevent the spread

of hazardous bacteria and health-care-associated diseases.

Despite the procedure's relative simplicity, compliance with hand-washing instructions is extremely poor, frequently much below 50%. Lack of appropriate equipment, low staff-to-patient ratios, allergies to hand-washing products, insufficient knowledge of risk and procedures among healthcare personnel, the time required, and casual attitudes toward biosafety among healthcare personnel are all reasons for poor hand-washing compliance (Ekwere & Okafor, 2013). Hospital- acquired infections can exacerbate a person's dysfunction and emotional stress, and, in some cases, it leads to a disability that reduces the quality of life (Organization, n.d.).

1.2 Problem Statement

Hand hygiene practices have become an important public health measure. Hand hygiene practice has been recognized as the key to lower the prevalence of infectious illnesses (World Health Organization, 2009). However, healthcare workers are less likely to comply in handwashing due to lack of knowledge, poor practice, stressful work environments, and misinterpretation of hand hygiene (Ahmed et al., 2020).

Research on the reasons for and consequences of this practice has focused on objective measures of working hours and employment conditions, but there have been a few studies exploring students' hand hygiene practices

(Prater et al., 2016). In a same study by Prater et.al (2016) found that university students have been observed to improperly wash their hands, which elevates their risks of developing infectious diseases. A meta-analysis on hand hygiene intervention studies found that improvements in handwashing reduced the incidence of upper respiratory tract infections by 21% and gastrointestinal illnesses by 31% (Sultana et al., 2016).

To gain a better understanding of how students engage in the hand hygiene practice, in-depth research is required. Observing students' hand hygiene practices can help to identify various methods of hand hygiene as well as helping in developing hospital policy in making sure hand hygiene is compliant.

Limited studies have been conducted in local settings that focused on university students. Therefore, this study is carried out to assess the knowledge and practices of hand hygiene among medical and nursing students in hospital settings.

1.3 Significance of study

The study's goal is to figure out what was preventing respondents from washing their hands. The finding of this study will supply the evidence to support or dispute the claim that knowledge affects the practices of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences. In addition, the findings of this study will assist the hospital's management and infection control unit in applying appropriate measures to increase hand hygiene compliance, with the goal of lowering the hospital acquired infection prevalence. Furthermore, the hospital management can use the evidence as a reference in formatting any policies and strategies that can help in reducing noncompliance to hand hygiene by students, which eventually can contribute to preventing potential health risks among the patients.

1.4 Research Objectives

1.4.1 General Objectives

The main objective of this study is to determine the level of knowledge and practice of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

1.4.2 Specific Objectives

The specific objectives are as below:

1. To determine the level of knowledge of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

2. To determine the level of practice of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

3. To identify relationship between the level of knowledge and practice of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

4. To identify the association between level of knowledge and practice towards socio- demographic data of medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

1.5 Research Questions

The present study has several research questions that need to be answered namely:

1. What is the level of knowledge of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia?

2. What is the level of practice of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia?

3. Is there any significant relationship between the level of knowledge and practice of hand hygiene of medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia?

4. What is the association between level of knowledge and practice towards socio-demographic data of medical and nursing students in Faculty of Medicine and Health Sciences, Universiti Putra Malaysia on hand hygiene?

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter presented a literature review that critically focused on existing studies related to this proposed study. The reviews are completed by referring to other researchers' studies to understand and investigate the problem of study. In this chapter, following the sections will further discuss the importance of hand hygiene, level of knowledge of hand hygiene, level of practice of hand hygiene, association between knowledge and practice of hand hygiene, association between knowledge of hand hygiene and socio-demographic factors, association between practice of hand hygiene and socio-demographic factors, factors affecting practice of hand hygiene, effects of poor practice of hand hygiene and conclusion.

2.1 Importance of hand hygiene

Many health care personnel consider hand hygiene to be the single most significant technique in reducing the spread of health-care-associated illnesses among patients. Hand hygiene, whether washing hands or wiping hands with disinfectants, helps to reduce the entry of temporary flora on

hands, prevents the transmission of microorganisms, and reduces the rate of human-related infections to medical personnel (Barrett & Randle, 2008). Hand hygiene alone is the most effective method to prevent cross-contamination and reduce hospital-acquired infections (Al Kadi & Salati, 2012). Studies have shown that proper hand washing reduces the incidence of diarrhea by about 30-40% and the incidence of respiratory infections by 6-44% (Eshetu et al., 2020).

According to the CDC, the importance of hand hygiene and its influence on the pathogenic spread of microbes is best appreciated when one understands the anatomy of the skin. Water loss, heat loss, germs, and other environmental risks are all protected by the skin (Hoang et al., 2018). Healthcare personnel frequently acquire transient bacteria via direct, close contact with patients or infected inanimate items or surrounding surfaces. The amount of these microorganisms varies depending on body location. These temporary microbes are the source of healthcare-associated illnesses (Korhonen et al., 2019). It is easier to eliminate that resident flora with regular handwashing (Kapil et al., 2015).

According to recent studies conducted in the United Kingdom and the Netherlands, the estimated prevalence of health-care-associated infections among hospital inpatients ranges from 4.3 percent to 6.7 percent (Ceylan et al., 2020). These infections are the most common hospitalization adverse events affecting about 5-10% of inpatients in developed countries and are

burdensome in developing countries (Al Kadi & Salati, 2012).

Hand hygiene, a relatively simple task, is widely recognized as one of the most effective ways to reduce HCAI and improve patient safety (World Health Organization, 2009). Proper hand washing also significantly reduces infections with conjunctivitis, trachoma, and bacterial-related respiratory illnesses (Eshetu et al., 2020).

2.2 Level of knowledge of hand hygiene

While several studies have investigated university students' hand hygiene practices, few have investigated their knowledge and beliefs about these practices (Miko et al., 2012). According to Suen et al. (2019), the level of knowledge of the respondents was relatively low because it was misunderstood that keeping hands clean at all times could lower the body's defense mechanism. Less than 50% of undergraduate students, including medical students, dentists, and nurses, were aware that unhygienic hands in health care workers were the primary route of transmission of potentially harmful germs, and less than 35% of students knew that patients were the primary source of germs in HCAI (Thakker & Jadhav, 2015). However, Lymer et al. (2017) found that the knowledge and practice of hand hygiene that experienced medical staff shared with students certainly improved their hand hygiene compliance (Barrett & Randle, 2008).

2.3 Level of practice of hand hygiene

According to research conducted in the United States, hand hygiene compliance among healthcare workers in the United States ranges from 25% to 51% (Ceylan et al., 2020). According to Gould et.al (2017), review research shows compliance with routine hand hygiene measures in the healthcare sector is often inadequate. Health-care personnel wash their hands an average of 5 to 30 times while on duty, according to observational studies conducted in hospitals (WHO, 2009). Moreover, studies have shown that students do not demonstrate effective handwashing behavior, and that the handwashing training they receive does not result in a change in behavior (Ceylan et al., 2020).

In a study conducted in Bangladesh to assess university students' knowledge and behavior in handwashing, it was discovered that their hand hygiene was insufficient in preventing infection, with the students washing their hands just 3 to 5 times each day (Sultana et al., 2016). Research conducted in University of Mississippi by (Carradine, 2014) among nursing students mentioned that although students have sufficient knowledge of hand hygiene, they do not apply it. Finally, Barrett & Randle (2008) reported that nurses and especially medical students described the existence of negative role models such as experienced nurses or doctors citing their non-compliance as reasons for not practicing hand hygiene.

2.4 Association between knowledge and practice of hand hygiene

This concept is used appropriately to improve the understanding, training, monitoring, and reporting of healthcare professionals' hand hygiene (Al Kadi & Salati, 2012). 4 literatures showed that there is no significant relationship between knowledge and practice of hand hygiene among students. According to Sharma et al. (2021), the level of knowledge of the participants had no relationship with hand washing practices. In the same way, having good knowledge does not mean that the participants have good hand washing practices.

Research conducted among the students by Manandhar & Chandyo (2018) from Kathmandu Medical College showed that hand washing knowledge may not always convert into practice and regularity. In addition, research conducted by Al-Khawaldeh et al. (2015) mentioned that a higher level of knowledge about hand washing does not necessarily mean better hand washing practices. However, inadequate knowledge about hand washing is a factor that can negatively impact hand washing behavior. Finally, a study by Okgün Alcan & Dolgun (2019) agreed that establishing the beliefs and practices of hand hygiene for nursing students is the basis for improving behavior before the workforce.

2.5 Association between knowledge of hand hygiene and socio-demographic factors

Previous study agreed socio-demographic characteristics are the strongest contributing factor that influence knowledge of hand hygiene. Socio-demographic characteristics that mainly influence the knowledge of hand hygiene are gender, age, course of study and year of study. To the best of my knowledge, there is no research conducted to investigate the relationship between ethnicity and knowledge of hand hygiene. Below are the findings from previous study:

Gender

3 literatures mentioned the relationship between gender and knowledge of hand hygiene. Study conducted among nursing students in Turkish showed that female students had much greater knowledge about hand hygiene, were better at using those skills, and had more favorable attitudes toward the practice (Ceylan et al., 2020). However, a descriptive study conducted among nursing students from Faculty of Nursing, Izmir, Turkey, showed that **t**here was no statistically significant relationship between the gender of student nurses and their belief in hand hygiene (Okgün Alcan & Dolgun, 2019). Research conducted in Hong Kong mentioned that overall, the women interviewed had a significantly better understanding of hand hygiene than men, and many of them misunderstood that a 40% alcohol-based hand

sanitizer was enough to disinfect hands. The respondents' misconceptions regarding hand hygiene were identified and the results of this cross-sectional study contributed to the understanding of the public's lack of knowledge and behavior towards hand hygiene and gender disparities related to this issue (Suen et al., 2019).

Age

3 literatures mentioned that there is a relationship between age and knowledge of hand hygiene. Research conducted by Suen et al. (2019) mentioned that compared to the reference group (18–29 years old), respondents aged 30–49 years old had a significant high knowledge score of hand hygiene. Therefore, age 30-49 and high level of education are protective factors for increasing household knowledge. According to Azlan et al. (2020), the hand hygiene knowledge scores of people over the age of 50 were higher. However, 1 literature mentioned that there was no statistically significant relationship between the age of the student nurses and their belief in hand hygiene (Okgün Alcan & Dolgun, 2019).

Ethnicity

To the best of my knowledge, there is no large, well-studied research available to describe the effect of ethnicity in knowledge of hand hygiene and

thus future studies are needed to evaluate the relationship between ethnicity and knowledge of hand hygiene.

Course of study

3 literatures mentioned that there is a relationship between course of study and knowledge of hand hygiene. Research conducted by Ariyarathne et al. (2013) mentioned that in 26 out of 289 nursing students, only 9% of them had good knowledge about hand hygiene and nursing students have much better knowledge than medical students. Interestingly, this result is consistent with a descriptive study conducted among medical and nursing students in Navodaya Medical College (NMC) which mentioned 9% of nursing students have better knowledge compared to medical students (Nair et al.,2014). However, a study by Mehta % Tripathi (2019) mentioned that 75% of the nursing students have moderate knowledge of hand hygiene.

Year of study

3 literatures mentioned about the relationship between year of study and knowledge of hand hygiene among students. Research conducted by Suen et al. (2019) in Hong Kong mentioned that respondents with secondary or higher education also showed a significant increase in knowledge, equivalent to 1,825 and 2,482, respectively, compared to low education levels. This result is consistent with a descriptive study conducted among nursing students

in Turkey which mentioned the highest levels of hand hygiene convictions were found in fourth grade nursing students (Okgün Alcan & Dolgun, 2019). Interestingly, a study conducted in University of Mississippi by (Carradine, 2014) among nursing students mentioned that students enrolled in the second semester had a high overall knowledge of hand hygiene techniques during the semester. As for fourth year students, higher levels of knowledge about proper hand hygiene were expected, but not because of longer school education and longer clinical training hours. According to Miko et al. (2012), freshmen reported greater personal hygiene than sophomores, juniors, or seniors, implying that personal hygiene may deteriorate over the college years.

2.6 Association between practice of hand hygiene and socio-demographic factors

Previous study agreed socio-demographic characteristics are the strongest contributing factor that influence practice of hand hygiene. Socio-demographic characteristics that mainly influence the practice of hand hygiene are gender, age, ethnicity, course of study and year of study. Below are the findings from previous study:

Gender

6 literatures mentioned about the relationship between gender and practice of hand hygiene among students. A cross-sectional study conducted in Ethiopia showed that women wash their hands more regularly than males, and science majors wash their hands more frequently than non- science majors (Miko et al., 2012). This study is also supported by the study conducted among nursing students in Turkish which mentioned that the frequency with which women wash their hands daily was found to be substantially higher than that of males, indicating that male students had lower hand hygiene than their female counterparts (Ceylan et al., 2020). Besides that, a study conducted by Suen et al. (2019) also mentioned that women were more likely than men to wash their hands after adjusting for clustering effects related to toilet characteristics and social norms. However, a literature review of 2 studies in India (India GSHS and Chennai study) suggests that gender differences may not be universal, and that males and females are at risk of not adopting these personal hygiene behaviors (Che Salleh et al., 2019). This study is also supported by the study conducted among nursing students in Private Universities of Bangladesh which mentioned the gender of the participating students is not an important predictor of hand-washing practices (Sultana et al., 2016). Finally, a descriptive study conducted among nursing students in Turkey mentioned gender was not found to affect self-reported hand hygiene compliance (Okgün Alcan & Dolgun, 2019).

Age

3 literatures mentioned about the relationship between age and practice of hand hygiene among students. Research conducted among nursing students in Private Universities of Bangladesh mentioned age negatively impacts hand hygiene practices, as older students score lower than younger students (Sultana et al., 2016). Finally, a cross-sectional study conducted in Malaysia showed that people aged 18-29 and school children were more likely to practice hand hygiene (Azlan et al., 2020). However, according to Okgün Alcan & Dolgun (2019), there was no statistically significant difference between the ages of nursing students and their hand hygiene practice inventory values.

Ethnicity

There is limited literature on the relationship between ethnicity and practice of hand hygiene among students. Only 3 literatures mentioned about the relationship between ethnicity and practice of hand hygiene among students. According to Che Salleh et al. (2019), more adolescents of Chinese descent reported washing their hands after using the toilet always or "most of the time" compared with Malays and other ethnic groups. On the other hand, adolescents of Malay descent were more likely to always or "most of the time" to wash their hands after using the toilet compared with Chinese and

Indians In contrast, a descriptive study conducted among nursing students in Turkey mentioned that hand hygiene compliance rate was lower than the compliance rate (88.17%) of Chinese nursing students (Okgün Alcan & Dolgun, 2019).

Course of study

3 literatures mentioned that there is a relationship between course of study and practice of hand hygiene. Research conducted by Nair et.al (2014) showed that 62.1% of nursing students have better practice of hand hygiene compared to medical students. This result is consistent with a study conducted among medical and nursing students in University of Sri Jayewardenepura which mentioned nursing students have better practices of hand hygiene than medical students (Ariyarathne et al., 2013). However, research conducted by Mehta & Tripathi (2019) in a tertiary health care center of Central India mentioned that most of the nursing students showed moderate level of hand hygiene practice**.**

Year of study

3 literatures mentioned about the relationship between year of study and practice of hand hygiene among students. According to Sultana et al. (2016), participants' higher education levels had a substantial influence on handwashing routines when compared to those with lower education levels.

Research conducted among Turkish nursing students mentioned that there was no obvious variation in the frequency with which the students washed their hands based on their classes. The difference was between second- and third-year students as the third year students' average score was much higher than the second year students' average score (Ceylan et al., 2020). This study also supported the study conducted among nursing students in Turkey which mentioned third-year students scored higher than first-year students, but practice rates fell among fourth-year students. (Okgün Alcan & Dolgun, 2019). A study conducted among adolescents in Malaysia mentioned that the proportion of Form 5 students who reported washing their hands after using the toilet always or "most of the time" was significantly higher than that of Form 1 and Form 2 adolescents (Che Salleh et al., 2019).

2.7 Factors of practice of hand hygiene

Hand hygiene compliance is also influenced by several factors, including personal knowledge of hand hygiene, professional experience, gender, awareness of the benefits and barriers of hand hygiene, severity of the epidemic, intensity of work, and availability of role models (Barrett & Randle, 2008).

One of the most critical factors influencing health-care employees' compliance with hand hygiene is their workload (Hugonnet et al., 2007). The

availability of access to hand hygiene item impacts the health care professionals' compliance when their workload is heavy (Sacar et al., 2006). Another possible cause for non-compliance is the cost of time for health-care workers. The amount of hand hygiene options available in any one hospital is nearly endless.

Hand hygiene is, in the end, a selfless effort on the part of health care professionals because the person who bears the burden does not reap the advantages. The patient is the one who receives the advantages (Limper et al., 2017). Many of these factors are personal, such as knowledge, attitudes, practices, beliefs, and identifying them will help improve hand hygiene compliance (Barrett & Randle, 2008). In addition, the identification of factors influencing student hand hygiene compliance provides an opportunity to fill in the gaps in knowledge and practice before students graduate and enter the medical community (Barrett & Randle, 2008).

2.8 Effects of poor practice of hand hygiene

Approximately 80% of illnesses in developing countries are associated with poor hygiene, with more than 2 million people dying from diarrhea each year and mortality rates rising (Eshetu et al., 2020). Hand hygiene is critical in preventing microorganism cross-transmission, hospital- acquired infections, and occupational exposure to infectious illnesses. However, studies have

shown that the level of hand hygiene compliance among healthcare workers is still low (Barrett & Randle, 2008). Because infections cannot be seen, health care professionals are unaware that they are carrying them on their hands. Another factor is that they are unable to relate their contact with a patient, during which germs may be transmitted from their contaminated hands to an infection that may develop days or months later (Limper et al., 2017). Hence, hospital- acquired illnesses increase mortality and morbidity (Widmer et al., 2010). Therefore, maintaining good hand hygiene is critical to providing safe, cost-effective, and high-quality treatment to the patients (Widmer et al., 2010).

2.9 Conclusion

From the literature, it can be concluded that students possess a slight poor level of knowledge and practice of hand hygiene. Therefore, this study will be carried out to determine the level of knowledge and practice of medical and nursing students in the Faculty of Medicine and Health Sciences. A more complete understanding of the hygiene determinants in undergraduates could improve our ability to design and implement effective sanitation interventions in academia (Miko et al., 2012).

2.10 Conceptual framework

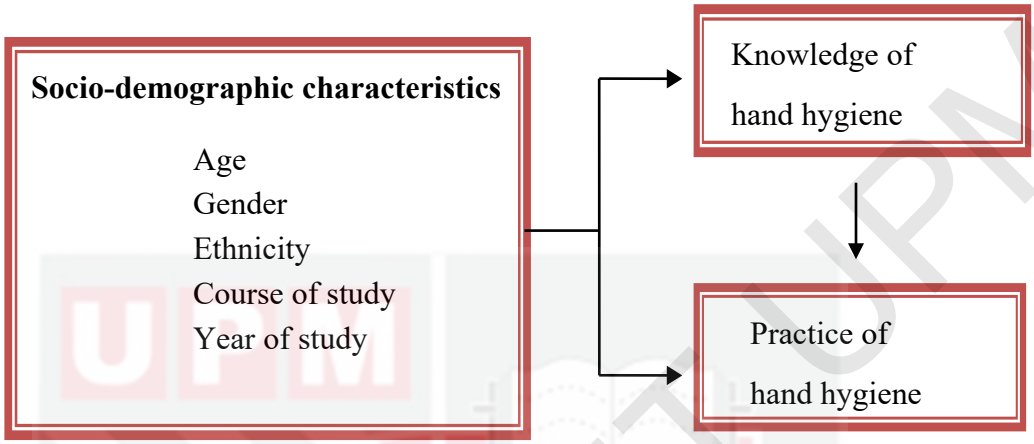

Figure 1: Conceptual framework

Figure 1 shows all the variables that will be included in this study. The population that will be studied are medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. Based on Figure 1, the figure shows that knowledge of hand hygiene and socio-demographic characteristics are the independent variables. Knowledge of hand hygiene is the primary independent variable while the socio-demographic characteristics that include age, gender, ethnicity, course of study, and year of study are the secondary independent variable. Then, practice of hand hygiene is a dependent variable as it will be the outcome of this study. Results, the conceptual framework concludes this study is to study the contributing factor based on primary independent variables (knowledge of hand hygiene) that

influence the dependent variable (practice of hand hygiene).

2.11 Operational Definition

No.	Variable	Conceptual Definition	Operational Definition
1.	Socio-demographic	Social demographics are the resolution of the characteristics of people (Lenormand et al., 2015).	In this study, the socio-demographic refer to age, gender, ethnicity, course of study and year of study.
2.	Knowledge	Knowledge is defined as an adequate understanding of handwashing (Jemal, 2018).	Knowledge will be defined on understanding of hand hygiene. The knowledge components will be assessed with 3 responses (yes/no/do not know). The final score was calculated by adding the scores (Jayarajah et al., 2019). Scores were graded as

			follows (good knowledge of hand hygiene ≥4, poor knowledge of hand hygiene ≤ 3)
3.	Practice	A practice is defined as the act of performing a given procedure in accordance with established standards (Jemal, 2018).	Practice will be defined on the adherence to hand hygiene during clinical practice. Practice (P) components were assessed using a 5-point Likert scale where 0 = never and 4 = always (Jayarajah et al., 2019). The final score was calculated by adding the scores. Scores were graded as follows (good practice of hand hygiene ≥36, poor practice of hand hygiene ≤ 35).

4.	University student	University students can vary between individuals and have different interests and priorities (Wong & Chiu, 2021).	In this study, university student refers to undergraduate students studying in Faculty of Medicine and Health Sciences and posting at Serdang Hospital for clinical practice.

CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter illustrated the study design, study setting, study population, sampling method, sampling frame, sample size, study instrument, validity and reliability, pilot study, data collection, data analysis and ethical consideration.

3.1 Study Design

In this research study, cross-sectional study was carried out to determine the perception of medical and nursing students regarding hand hygiene. In cross-sectional studies, researchers simultaneously measured outcomes and impacts on study participants (Setia, 2016). The advantage of this study design was, it is not expensive to execute and does not require a lot of time. However, this study design may not be able to determine the causal-effect relationship. Since the purpose of this study is to find the association rather than causal-effect relationship, hence this method is suitable for this study.

3.2 Study Setting

This study was conducted at the Faculty of Medicine and Health Sciences in Universiti Putra Malaysia (UPM). This faculty was established on 1 August 1996. The faculty is located adjacent to Serdang Hospital and the Seventeen College, a residential college of UPM. The department included in this faculty are medicine, nursing, dietetic, nutrition, biomedical sciences, and environmental and occupational health.

3.3 Study Population

Study population consists of medical and nursing students in the Faculty of Medicine and Health Sciences which are 437 students. The other 4 courses of study in the Faculty of Medicine and Health Sciences which are Bachelor of Science Nutrition, Bachelor of Science Dietetics, Bachelor of Biomedical Sciences and Bachelor of Science Environmental & Occupational Health were excluded from this study.

3.4 Sampling Method

This study involved stratified random sampling of medical and nursing students in Faculty of Medicine and Health Sciences. The reason of choosing medical and nursing students in this study is because, they are the only courses that attend patients during clinical practice in hospital settings. This method is a sampling process that involves the division into smaller sub-groups known as strata of a population. The strata were created based on the characteristics of members in stratified random sampling. In addition, there are some advantages and disadvantages of this sampling method. The advantages of this sampling are, it provides greater precision, and the stratified subgroup will have the equal chance to be selected. However, the disadvantage of stratified random sampling is, it requires more labor and effort. Students were randomly selected according to the sample size of the strata. After dividing the population into the stratum, table 1 below represents the strata in this study.

Table 3.1: Number of students in each stratum

Strata (Course of study)	Total number of students in strata
Doctor of Medicine	336
Bachelor of Nursing	101
Total	437

3.5 Sampling Frame

Sampling frame is a list of elements from which a sample may be drawn. In this study, the detailed information regarding the medical and nursing students in the Faculty of Medicine and Health Sciences were obtained from the Dean of the Faculty of Medicine and Health Sciences.

Table 3.2: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• Studying in Faculty of Medicine and Health Sciences	• Students from course of study other than Doctor of Medicine and Bachelor of Nursing
• Aged 18 – 26 years old	• Year 1 and Year 2 Doctor of Medicine students
• Posted to Serdang Hospital for clinical practice	• Undergraduate students under long medical leave

The inclusive and exclusive criteria of this study as stated above is very crucial to be determined prior to an active participation of respondents as the respondents' characteristics, especially exclusive criteria will affect the result of this study on the determination of the level of knowledge and practice of hand hygiene among medical and nursing students.

3.6 Sample Size

The sample size calculation was determined according to the objectives of the study. The sample size was calculated within 5% of the true prevalence with 95% confidence. The estimated total number of students practicing in Serdang Hospital, Selangor were recruited in this study is 437 which is considered as the population size, N.

Thus, the sample size for this study was calculated using the Raosoft sample size calculator. The formula used to determine the sample size is derived from the following format (www.raosoft.com).

$$n = \frac{N \times x}{(x + N - 1)}$$

where

$$x = \frac{z2p\,(1-p)}{d2}$$

Where

n = sample size

N = population size which is 437

Z = value corresponding to a 95% level of significance = 1.96

p proportion of students 50% q = (1-p) = (1-0.5) = 0.5

d = margin of error, 9% based on a clinical research study by Suresh & Chandrashekara (2012)

Based on the formula above, the calculation of the sample size will be calculated as,

$$x = \frac{(1.96)2(0.5)(1-0.5)}{(0.09)2}$$

$$x = 118.6$$

$$x = 119$$

$$n = \frac{N \times x}{(x + N - 1)}$$

$$n = \frac{437 \times 119}{(119 + 437 - 1)}$$

$$n = 93.70$$

$$n = 94$$

Therefore, the number of participants needed for this study is 94 medical and nursing students from the Faculty of Medicine and Health Sciences, UPM who meet the eligibility criteria.

By considering of 10% for non-response, missing data, unavailability of subjects or refusal to participate, the sample size of this study was calculated as below:

$$n = 94 + \left(94 \times \frac{10}{100}\right)$$

$$n = 103.4$$

$$n \approx 103$$

In conclusion, after considering 10% of dropouts, the sample size of the participants needed in this study were 103 subjects.

To get the sample size for each stratum, first, the population size for each stratum will be divided by the size of the entire population then multiplied by the size of the entire sample (Neyman, 1934).

Stratified random sampling formula, $n_h = (N_h / N)^* n$

Where:

n_h: Sample size for hth stratum

N_h: Population size for hth stratum

N: Size of entire population

n: Size of entire sample

After the stratification of the population, the number of students at sample in each stratum shown in the following table:

Table 3.3: Total number of students in sample

Strata (Course of study)	Total number of students in strata	Number of students in sample
Doctor of Medicine	336	(336/437) x 103 = 79
Bachelor of Nursing	101	(101/ 437) x 103 = 24
Total	437	103

3.7 Study Instrument

Data were collected through two methods which are the self-administered questionnaire and WHO Hand Hygiene Observation Form. Therefore, two study instruments were used in this study. For the self-administered questionnaire, each item in the questionnaire was developed in accordance with the research objectives of this proposed study to determine the level of knowledge and practice of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences. The questionnaire consists of three sections: (A) Demographics (B) Knowledge of Hand Hygiene which is to determine knowledge of hand hygiene among students and (C) Practice of Hand Hygiene to determine the practice of hand hygiene.

3.7.1 Socio-demographic

In this section A, the items include socio-demographic such as age, gender, ethnicity, course of study, and year of study.

3.7.2 Knowledge of Hand Hygiene

Section B consists of 6 questions on knowledge, technique of hand washing such as factors influencing transmission of nosocomial infections to patients. Knowledge (K) components were assessed with 3 responses (yes/no/do not know). The final score was calculated by adding the scores (Jayarajah et al., 2019). Scores were graded as follows (good knowledge of hand hygiene ≥4, poor knowledge of hand hygiene ≤ 3).

3.7.3 Practice of Hand Hygiene

In section C, respondents were asked about practice of hand hygiene which includes duration of hand washing, technique of hand washing, cleanliness of hand, and method attempted to maintain hand hygiene. Practice (P) components were assessed using a 5-point Likert scale where 0 = never and 4 = always (Jayarajah et al., 2019). The final score was calculated by adding the scores. Scores were graded as follows (good practice of hand hygiene ≥36, poor practice of hand hygiene ≤35).

3.8 Validity and Reliability

The data were collected in pilot study and tested for reliability and internal consistency using the Cronbach's alpha correlation coefficient. The Cronbach's alpha values are described as reliable (0.84- 0.90), good (0.71 - 0.91), and relatively high (0.70 - 0.77) (Taber, 2018). The tool that had been used in this study was adapted from the study by Jayarah (2019) and the Cronbach's alpha score ranged from 0.728 to 0.786 (Jayarajah et al., 2019). Another tool was the WHO Hand Hygiene Observation Form adopted from a study by Maniriho (2019). The Cronbach's alpha score for this study was 0.73 (Maniriho et al., 2019). Both instruments were reviewed for face validity by two medical lecturers.

3.9 Pilot Study

A pilot study was conducted before data collection. The pilot study is to determine whether the questionnaire is easy to comprehend and to eliminate any unfamiliar words. The pilot study was carried out to 30 students to calculate the reliability of the tool adapted. The questionnaires were distributed among students in the Faculty of Medicine and Health Science, Universiti Putra Malaysia. The Cronbach alpha value for knowledge of hand hygiene is 0.65 and for practice of hand hygiene is 0.85.

3.10 Data Collection

Further process on data collection procedures is illustrated on Figure 2: Data Collection Procedures.

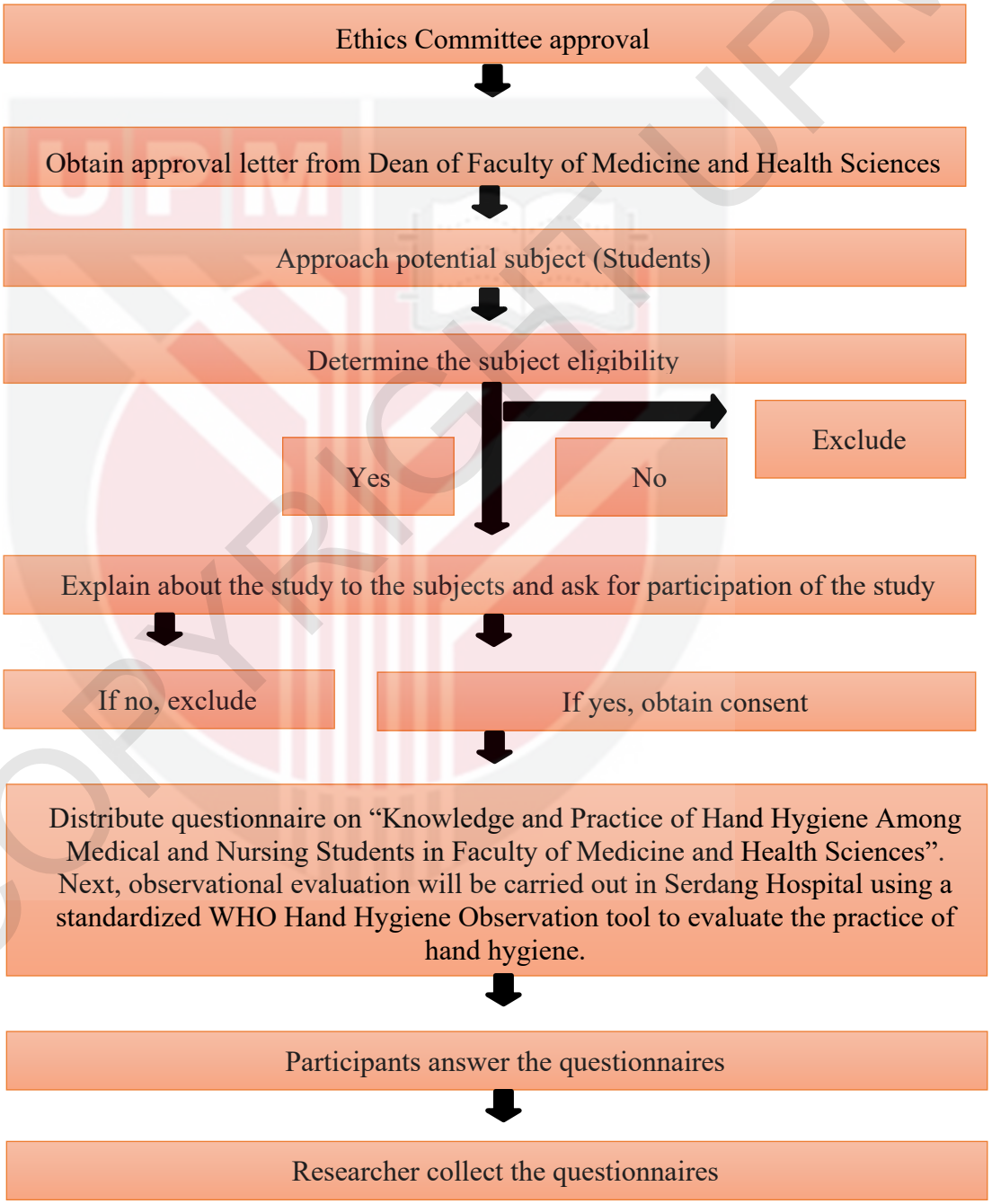

Figure 2: Data Collection Procedure

This study began after receiving approval from The University Ethics Committee Involving Human Subjects of Universiti Putra Malaysia (JKEUPM-2022-355) and approval from the Dean of Faculty of Medicine and Health Sciences. Then, the following step of data collection were performed by distributing questionnaires to medical and nursing students in faculty. The data were collected online through a Google form without any physical encounters due to the endemic in Malaysia. The Google Forms link was shared with medical and nursing students who are studying in the Faculty of Medicine and Health Sciences and currently doing practical work at Serdang Hospital in Selangor. The questionnaire was shared on social networks such as WhatsApp. The first page of the online survey is designated to provide a complete Participant Information Sheet to ensure that participants meet the inclusion and exclusion criteria. In addition, participants will click the button after reading the information and meeting all the criteria to indicate their willingness to participate in the study. As such, consent is automatically received when a participant clicks on and submits the survey. All responses were saved and updated in the researcher's Google Drive account. To maintain privacy, the Google Drive account password is only available to researcher and cannot be accessed by others without the password. Next, direct observation was carried out using the

WHO Hand Hygiene Observation Form to collect data about medical and nursing students' adherence to the WHO five moments of hand hygiene.

3.11 Data Analysis

The data that has been collected will be analyzed by using the statistical computer software (Statistical Package Service and Solution-SPSS Version 27) in accordance with objectives of this study. Table 3 below shows the summary of statistical analysis with respective objectives in this study.

Table 3.4 : Summary of statistical analysis with respective objectives in this study

Objectives	Independent variable (type)	Dependent variable (type)	Statistical measurement
1.To determine the level of knowledge of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.	Knowledge		Descriptive Statistic (Frequency and percentage)
2. To determine the level of practice of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra		Practice	Descriptive Statistic (Frequency and percentage)

Malaysia.			
3. To identify relationship between the level of knowledge and practice of hand hygiene of medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.	Knowledge (continuous)	Practice (continuous)	Pearson Correlation
4. To identify the association between level of knowledge and practice towards socio-demographic data of medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.	Level of knowledge (categorical)	Level of practice (categorical)	Pearson Chi Square
	Gender (categorical)		Independent t-test
	Ethnicity (categorical)		One-way independent ANOVA
	Age (categorical)		One-way independent ANOVA
	Course of study (categorical)		Independent t-test
	Year of study (categorical)		One-way independent ANOVA

3.12 Ethical Consideration

Ethical approval plays a crucial part in the research process as it is used to protect both researcher and the participants. In this study, the

approval will initially be obtained from Jawatankuasa Etika Untuk Penyelidikan Melibatkan Manusia (JKEUPM-2022-355).

Every participant in this study will be given a participation information sheet and written consent form which are attached to the questionnaire before participating in the study. The participation information sheet and written consent form together with the questionnaire were shared in the form of Google form and spread through WhatsApp. In the participation information sheet, details regarding this study were explained one by one and participants are requested to read and understand it before participating in this study. In addition, each participation from the respondent must be voluntary and they have the right to withdraw themselves from the study anytime without providing any reason. Next, participants were required to click "Agree to participate" in the Google Form if they agree to participate in the study.

Regarding the information obtained, it will be treated as strictly confidential, and the questionnaire will be kept in the researcher's Google Drive account after the submission. Besides that, the researcher's Google Drive account is only available to the researcher. Information regarding the participant's identity such as name, identity card number and house address will not be obtained. Then, the data collected will be transferred to the computer to perform statistical analysis, hence, the computer will be protected by password and all data

will only be accessed by anyone related to this study which includes researcher, qualified monitors and auditors, the sponsors, and its affiliates and governmental or regulatory authorities. Furthermore, the data that the researcher key into the computer were uploaded to Google Drive and protected with a password. These data will be destroyed permanently after five years of storage.

CHAPTER 4

RESULT

4.0 Introduction

This chapter provides the findings and analysis according to the research objectives. The overall of this study is to find relationship between knowledge and practice of hand hygiene among medical and nursing students. Sample of 103 respondents were sampled and answered the questionnaire that was distributed during the period of data collection. This accounting for 100 percent response rate of this study.

4.1 Level of knowledge of hand hygiene among medical and nursing students

It is shown that 20.4% from the respondents in this study have poor knowledge of hand hygiene which is range between 0 to 3 and 79.6% have good knowledge of hand hygiene which is range between 4 to 6. The skewness and kurtosis for level of knowledge of hand hygiene were -0.238 and 0.707 respectively which is normally distributed and the mean of level of knowledge of hand hygiene is 4.12 (SD=0.96).

Table 4.1: Frequency (n) percentage (%) and mean (SD) of level of knowledge of hand hygiene

Level of knowledge of hand hygiene	Frequency, n	Percentage, %	Mean (SD)
Poor knowledge	21	20.4	4.12 (0.963)
Good knowledge	82	79.6	

Table 4.1.1: Comparison of correct answers to knowledge questions in medical and nursing students

No.	Knowledge Question	Medical students (N=45)	Nursing students (N=58)
1	It is necessary to wash hands after removing gloves.	35(77.8%)	51(87.9%)
2	It is recommended to wash hands regularly.	45(100%)	57(98.3%)
3	When washing hands, it is necessary to rub the hands together for **at least 20 seconds.**	40(88.9%)	54(93.1%)
4	It is necessary to wash hands after contact with body fluids.	38(84.4%)	52(89.7%)
5	It is necessary to wash hands after direct patient contact.	42(93.3%)	55(94.8%)
6	It is necessary to wash hands with soap rather than hand rub when caring for patients with vomiting or diarrhea.	42(93.3%)	55(94.8%)

4.2 Level of practice of hand hygiene among medical and nursing students

Based on the table, 28.2% of the respondents have poor practice of hand hygiene which is range between 0 to 35 while 71.8% has good practice of hand hygiene which is range between 36 to 40. The mean for level of practice of hand hygiene is 36.29 (SD=4.23).

Table 4.2: Frequency (n) percentage (%) and mean (SD) of level of practice of hand hygiene

Level of practice of hand hygiene	Frequency, n	Percentage, %	Mean (SD)
Poor practice	29	28.2	36.29 (4.226)
Good practice	74	71.8	

Table 4.2.1: Comparison of good hand hygiene practice among medical and nursing students

No.	Hand hygiene practice	Medical students (N=45)	Nursing students (N=58)
1	I keep my fingernails short and clean.	31(68.9%)	42(72.4%)
2	I wash my hands prior to direct patient contact.	35(77.8%)	41(70.7%)
3	I wash my hands with soap rather than hand rub when the hands are visibly soiled.	36(80.0%)	46(79.3%)
4	I wash my hands prior to an aseptic procedure.	37(82.2%)	47(81.1%)

5	I wash my hands after direct patient contact.	36(80.0%)	30(63.3%)
6	I wash hands with soap rather than hand rub when caring for patients with vomiting or diarrhea.	31(68.9%)	46(79.3%)
7	I rub the hands together for **at least** 20 seconds when washing my hands.	32(71.1%)	35(60.3%)
8	I wash my hands after removing gloves.	25(55.6%)	24(41.4%)
9	I practiced the steps of hand washing.	26(57.8%)	43(74.1%)
10	I wash my hands after contact with body fluids.	39(86.7%)	49(84.5%)

4.3 The relationship between level of knowledge and practice of hand hygiene

Table 4.3 shows that 14 respondents have poor level of knowledge but score good practice of hand hygiene, while 60 of the respondents who scores for good knowledge also have good practice of hand hygiene. Based on the Pearson Correlation result, Pearson' r is 0.025 and there were no significant association (p=0.800) where p value is higher than 0.05.

Table 4.3: The relationship between level of knowledge and practice of hand hygiene

		Level of knowledge	Level of practice
Level of knowledge	Pearson Correlation	1	.025
	Sig. (2 tailed)		.800
	N	103	103

4.4 The association between level of knowledge and level of practice of hand hygiene towards socio-demographic characteristics

Table 4.4 shows that 14 respondents have poor level of knowledge but score good practice of hand hygiene, while 60 of the respondents who scores for good knowledge also have good practice of hand hygiene. Based on the Chi Square result, the value of the chi square statistic is 0.350 and there were no significant association (p=0.554) where p value is higher than 0.05.

Table 4.4: The relationship between level of knowledge and practice of hand hygiene

Level of knowledge of hand hygiene	Level of practice of hand hygiene	
	Poor practice	Good practice
Poor knowledge	7	14
Good knowledge	22	60

4.5 The association between gender and level of practice of hand hygiene

Table 4.5 shows that the effect of gender on the level of practice of hand hygiene, t=-1.108. The mean for male respondents is 35.38 (SD=3.879) and mean for female respondents is 36.52 (SD=4.301). Based on the independent t-test result, there were no significant association (p=0.271) where p value is higher than 0.05.

Table 4.5: The relationship between gender and practice of hand hygiene

Gender	Level of practice of hand hygiene		Mean	SD	t value	p value
	Poor practice	**Good practice**				
Male	9	12	35.38	3.879	-1.108	0.271
Female	20	62	36.52	4.301		

4.6 The association between ethnicity and level of practice of hand hygiene

Table 4.6 shows the mean for Malay and Chinese respondents is 36.00 with (SD=4.305 and SD=4.528) respectively. The mean for Indian respondents is 38.83 (SD=1.947) and the mean for respondents from other ethnicity is 35.20 (SD=4.226). Based on the One-way independent ANOVA result, F=1.731 and there were no significant association (p=0.165) where p value is higher than 0.05.

Table 4.6: The relationship between ethnicity and practice of hand hygiene

	Ethnicity				F	Significance level
	Malay	**Chinese**	**Indian**	**Others**		
Mean (SD)	36.00 (±4.305)	36.00 (±4.528)	38.83 (±1.947)	35.20 (±4.226)	1.731	0.165

4.7 The association between age and level of practice of hand hygiene

One-way ANOVA test was conducted to compare the effect of age on level of practice of hand hygiene. The result showed that the effect of age, F=0.629, p=0.535. This concluded that there was no significant different effect of age on level of practice of hand hygiene.

Table 4.7 : The relationship between age and practice of hand hygiene

	Age			F	Significance level
	20-21	**22-23**	**24-25**		
Mean	36.31	36.02	37.43		
(SD)	(±4.036)	(±4.575)	(±2.875)	0.629	0.535

4.8 The association between course of study and level of practice of hand hygiene

Table 4.8 shows that the effect of course of study on the level of practice of hand hygiene, t=-.192. The mean for medical students is 36.20 (SD=4.485) and mean nursing students is 36.36 (SD=4.051). Based on the independent t-test result, there were no significant association (p=0.848) where p value is higher than 0.05.

Table 4.8: The relationship between course of study and practice of hand hygiene

Course of study	Level of practice of hand hygiene		Mean	SD	t value	p value
	Poor practice	**Good practice**				
Doctor of Medicine	15	30	36.20	4.485	-.192	0.848
Bachelor of Nursing	14	44	36.36	4.051		

4.9 The association between year of study and level of practice of hand hygiene

One-way ANOVA test was conducted to compare the effect of year of study on the level of practice of hand hygiene. The result showed that the effect of year of study, F=0.601, p=0.663. This concluded that there was no significant different effect of year of study on level of practice of hand hygiene.

Table 4.9: The relationship between year of study and practice of hand hygiene

	Year of Study					F	Significance level
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**		
Mean	35.33	37.62	35.69	36.55	36.00		
(SD)	(±4.082)	(±4.036)	(±3.641)	(±5.221)	(±4.372)	.601	.663

4.10 Observational study of hand hygiene compliance

A total of 334 hand hygiene opportunities were observed during the study. Overall hand hygiene compliance rate was 74.55% (95% CI: 8.60–91.40). Better levels of compliance were found after body fluid exposure (85.90%; 95% CI: 76.44–98.78), after touching patient surroundings (78.31%; 95% CI: 63.58–83.88) and after touching patient (78.18%; 95% CI: 69.24–95.10) whereas levels of compliance were lower before touching patient (73.08%; 95% CI: 46.31–80.86) and before aseptic procedure (72.09%; 95% CI: 60.92–85.81). Handwashing with soap and water was more frequent after body fluid exposure compared with other indications. (52.56%; 95% CI: 43.9–68.9). Hand rubbing was performed in 132, (47.0%; 95% CI: 51.2–73.9), out of the 249 hand hygiene actions. Hand rubbing was frequently performed after touching patient surroundings (51.81%; 95% CI: 45.6-75.5).

Table 4.10: Overview of hand hygiene compliance

Healthcare workers	Number of subjects	Opportunities of hand hygiene	Compliance (%)
Doctor of Medicine students	45	131	43.70
Bachelor of Nursing students	58	203	56.30

Table 4.10.1: Observed hand hygiene compliance

WHO's 5 moments	Observation (A)	Opportunity (B)	Percentage compliance (A/B) x 100%
Before touching a patient	38	52	73.08
Before aseptic procedure	62	86	72.09
After body fluid exposure	67	78	85.90
After touching a patient	43	55	78.18
After touching patient surroundings	65	83	78.31

CHAPTER 5

DISCUSSION

5.0 Introduction

The main objective of this study is to find the relationship between level of knowledge and practice among medical and nursing students in Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. In this chapter, results from the analyzed data will be discussed according to the specific objective of this study.

5.1 Level of knowledge of hand hygiene among medical and nursing students

Based on the results, from the total 103 respondents, 79.6% (N=82) of the respondents have high level of knowledge of hand hygiene while 20.4% (N=21) has low level of knowledge of hand hygiene. Based on Table 1, the results show that nursing students had the greatest number of correct responses (82.8%) on hand hygiene knowledge questions compared to medical students (75.6%). Besides, hand hygiene knowledge was high in a study done with Korean students, with a mean percentage of accurate answers to hand hygiene knowledge questions being 68.1% (Jeong & Kim 2016). According to Okgün Alcan &

Dolgun (2019), mean ± standard deviation of student nurses' hand hygiene knowledge during the clinical practice was 85.404 (±8.20). Moreover, a study by Van de Mortel et al. (2012) showed the mean ± standard deviation of nursing students' knowledge of hand hygiene was 3.27 (±0.37), while medical students was 3.36 (±0.34), and the difference was not statistically significant. While in the study conducted by Mbroh (2019), the mean ± standard deviation for the level of knowledge of hand hygiene score obtained by the total 103 respondents was 8.59 (±1.33). 80.9% of the respondents scored high level of knowledge and 19.1% of them scored low level of knowledge of hand hygiene.

5.2 Level of practice of hand hygiene among medical and nursing students

The result show that for level of practice of hand hygiene, majority of the students scored high level of practice which is 71.8% (N=74) and only 28.2% (N=29) of the respondents have poor practice of hand hygiene. Nursing students had better practices (75.9%) compared to medical students (66.7%). According to Okgün Alcan & Dolgun (2019), mean ± standard deviation of student nurses' hand hygiene practice during the clinical practice was 84.42 (±12.64). Moreover, a study by Van de Mortel et al. (2012) showed the mean ± standard deviation of nursing students' practice of hand hygiene was 4.57 (±0.40), while

medical students was 4.10 (±0.82), and the difference was statistically significant. Based on the study from Sultana et al. (2016), the mean ± standard deviation for the level of practice of hand hygiene score obtained by the total 103 respondents was 50.81 (±4.79). 72.9% of the respondents scored high level of practice and 27.1% of them scored low level of practice of hand hygiene.

5.3 The relationship between level of knowledge and practice of hand hygiene

Based on the result in this study, there were no significant between level of knowledge and level of practice of hand hygiene where (r:0.025 p>0.05) whereby the coefficient correlation, r indicates a very weak positive correlation. According to Okgün Alcan & Dolgun (2019), student nurses' hand hygiene practice showed significant positive correlations (r:0.436 p:0.0001). On the other hand, a study by Jeong & Kim (2016) mentioned that hand hygiene knowledge had no correlation with hand hygiene practice. A study by Gurung et al. (2018) showed that majority of the students, 36 (72%) had good knowledge of hand hygiene and 38 (75%) was considered to have good practice regarding hand hygiene. However, a study from Rahim (2022) found that no significant relationships between knowledge scores and hand washing habits were discovered, proving that knowledge does not automatically

equate to improved hand washing habits. Based on the study from Okgün Alcan & Dolgun (2019), the mean ± standard deviation for hand hygiene knowledge and practice score obtained by the total 103 respondents were 85.04 (±8.20) and 65.90 (±5.54) respectively.

5.4 The association between gender and level of practice of hand hygiene

From the results in this study, it showed that there were not a significant between gender and level of practice of hand hygiene where the $p>0.05$. Total male respondents were 21 and total female respondents were 82. Based on the table 4.5, female respondents are more likely to experience high level of practice of hand hygiene (N=62) compared to male respondents (N=12). The mean for respondents with poor practice of hand hygiene is 1.69 (SD=0.471) and mean for respondents with good practice of hand hygiene is 36.52 (SD=0.371). Sultana et al. (2016) in their study also found that there was a small variation in the practice score among male (50.64) and female (51.17) students, but there was no statistically significant difference between the gender and level of practice of hand hygiene where $p>0.05$. However, Suen et al. (2019) found that there is a relationship between gender and level of practice where percentages in female respondents are slightly higher than those in males (F=14.9%, M= 7.8%, p=0.003). Moreover, Anderson et al. (2008) in their study also found there is a significant association

between gender and practice of hand hygiene where the female students had a higher rate of hand hygiene practice (F=59%, M= 32%, p=0.001). While in study from Anderson et al. (2008), mean and standard deviation for female is 0.62 (SD=0.48) and male is 0.35 (SD=0.47).

5.5 The association between ethnicity and level of practice of hand hygiene

From the results in this study, it showed that they were no significant between ethnicity and level of practice of hand hygiene where the p value is $p>0.05$. Total Malay respondents (N=69), total Chinese respondents (N=17), total Indian respondents (N=12) and respondents from other ethnicity (N=5). Based on table 4.6, high level of practice of hand hygiene experienced according to ethnicity were as following. Malay 72.5% (N=50), Chinese 58.5% (N=10), Indian 91.7% (N=11) and other ethnicity 60.0% (N=3). However, Malay respondents also score highest on poor level of practice of hand hygiene which is N=19. There is limited literature on the relationship between ethnicity and practice of hand hygiene among students. However, a study from Barrett (2021) found that there is no relationship between ethnicity and level of practice where p= 0.879.

5.6 The association between age and level of practice of hand hygiene

From the results in this study, it showed that there was no significant between age and level of practice of hand hygiene where the p value is $p>0.05$. Based on the table 4.7, age group between 22-23 years old are more likely to experience high level of practice of hand hygiene (N=52) compared to age group 20-21 years old (N=27) and age group 24-25 years old (N=14). Majority of the respondents age between 22-23 years old also experience low level of practice of hand hygiene (N=8) compared to age group between 20-21 years old (N=2) and age group 24-25 years old (N=0). Okgün Alcan & Dolgun (2019) in their study also found that there was no statistically significant difference between the students' age where (r:-0.049 p: 0.462). While in study from Sultana et al. (2016), the mean and standard deviation age of the participants was 20.4 (±1.8) years. On the other hand, mean and standard deviation for age group 20-21 years old is 53.2 (±5.06), age group 22-23 years old is 51.5 (±4.61) and age group 24-25 years old is 51.4 (±4.8).

5.7 The association between course of study and level of practice of hand hygiene

Based on the independent t-test result, there were no significant association between course of study and level of practice of hand hygiene where $p>0.05$. Based on the result, it shown that majority of the nursing students 75.9% (N=44) experienced high level of practice of hand hygiene compared to medical students 66.7% (N=30). Moreover, a study done by Nair et al. (2014) found that nursing students had significantly better practices (62.1%) compared to medical students (19.6%). Furthermore, a study done by Van de Mortel et al. (2012) stated that hand hygiene practices were higher in nursing students 3.92 (±0.05) than that of medical students 3.52 (±0.08). Upon researcher knowledge, there was no literature finding no significant in associating between course of study and practice of hand hygiene. While in study from Van de Mortel et al. (2012), the mean and standard deviation of the participants based on their course of study was 2.12 (±0.18) for nursing students and 1.57 (±0.37) for medical students.

5.8 The association between year of study and level of practice of hand hygiene

Based on the One-Way ANOVA result, there were no significant association between year of study and level of practice of hand hygiene where $p>0.05$. Based on the result from this study, respondents from Year 4 and Year 3 experience high level of practice of hand hygiene with 73.8% (N=39) and 68.8% (N=27) respectively followed by Year 2 84.6% (N=13), Year 5 60.0% (N=9) and Year 1 66.7% (N=5). Majority of the respondents from Year 3 scored for low level of practice of hand hygiene (N=5). A study from Gurung et al. (2018) comparing between respondents of Year 1 (0%) and Year 3 (2%) also found poor practice on hand hygiene among Year 3 respondents. Lau et al. (2014) in their study also found that there was no statistically significant difference between the students' year of study and practice of hand hygiene where $p= 0.489$ for medical students and $p=0.483$ for nursing students. While in study Van de Mortel et al. (2012), the mean and standard deviation year of study of the nursing students Year 2 and Year 3 were 2.53 (±0.50) whereas for medical students Year 1 until Year 5 were 3.46 (±1.90). On the other hand, according to Sultana et al. (2016), mean and standard deviation for Year 1 is 51.6 (±5.2), Year 2 is 53.4 (±4.90), Year 3 is 52.7 (±4.6) and Year 4 is 52.0 (±4.6).

5.9 Observational study of hand hygiene compliance

The World Health Organization (WHO) had developed the 5 Moments of Hand Hygiene, which are (1) washing hands before touching a patient, (2) before performing an aseptic or clean procedure, (3) after body fluids exposure, (4) after touching a patient, and (5) after touching the patient's surroundings (Kolola, 2017). Hand hygiene generally includes hand washing (HW) which is the act of washing hands with water and soap and hand rubbing (HR) with the use of alcohol-based alcohol hand rub.

The result of this study provides insights about hand hygiene compliance level of medical and nursing students in Universiti Putra Malaysia. The medical and nursing students had an overall hand hygiene compliance of 74.55% which is lower compared to the WHO's hand hygiene compliance rate. According to Sandbekken (2022), WHO's hand hygiene recommendations at a rate of at least 80%. Various results regarding students' hand hygiene compliance rate were achieved from previous studies conducted by Kristofina & Peneyayambeko (2016) (33.33%), Paudel et al. (2016) (56.0%), Foote & El-Masri (2016) (74.8%) and Hernández-García & Cardoso (2013) (82.1%).

Observation was conducted from Monday to Friday from 8am until 5pm. Researcher observed 3 students simultaneously for at least 15 minutes with each student was set up for one observation session only. Total of 45 medical students and 58 nursing students were observed and they were unaware of being observed. The staff were also unaware of the observation due to researcher being part of the group of students posting for clinical practice.

Data were collected using the World Health Organization (WHO)'s hand hygiene observation tool. Every time one of the occasions for hand hygiene arises, an opportunity for hand hygiene exists. Every chance correlate to a hand hygiene action (Kolola, 2017).

Data analysis was done using SPSS version 27. Descriptive analyses were performed, including crosstabs and Pearson Chi-Square (to assess differences between group of students).

A total of 334 hand hygiene opportunities were observed during the study with 117 hand washing actions and 132 hand rubbing actions performed. Total hand hygiene opportunities recorded by the medical students were 131 with 80 hand hygiene actions whereas nursing students had 203 opportunities with 169 hand hygiene actions performed.

Total compliance was calculated by dividing the total number of hand hygiene opportunities by the number of hand hygiene actions performed. Medical students were reported to have lower compliance of hand hygiene (43.70%) compared to nursing students (56.30%).

Students have a better compliance for moments (3) after body fluids exposure (85.90%), (4) after touching a patient (78.18%), and (5) after touching the patient's surroundings (78.31%). However, low compliance was reported for moments (1) before touching a patient (73.08%) and (2) before performing an aseptic or clean procedure (72.09%). The five hand hygiene indicators revealed irregular hand hygiene compliance, which might be another factor contributing to the low compliance. This shows that rather than doing so to protect patients, students are more likely to wash their hands to protect themselves from infection and microbial contamination.

Nursing students reported better overall compliance at moments 1 (41.2%), moments 2 (45%) and moments 3 (68.2%) compared to medical students. Medical students fared better at moments 4 (75%) and moments 5 (50%).

The only approach used in this investigation was direct observation. The study's cross-sectional findings could not accurately reflect hand hygiene compliance throughout the year. In order to lessen the "Hawthorne effect," the students were also not aware that they were being observed. The lack of a 24-hour observation period may have led to selection bias. The low compliance in this study may have been influenced by the absence of hand hygiene monitoring and the inability to provide students with performance feedback. According to studies, employing a multimodal strategy is the most efficient way to ensure hand hygiene compliance in health-care settings.

5.10 Conclusion

This research aimed to identify if there is a relationship between level of knowledge and practice among medical and nursing students in Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. Based on quantitative analysis in this study, it can be concluded that level of knowledge of hand hygiene has no relationship with level of practice of hand hygiene among medical and nursing students. The students had an overall hand hygiene compliance of 74.55% which is lower compared to the WHO's hand hygiene compliance rate recommendations at a rate of at least 80%. The findings of this study indicate that hand hygiene compliance needs further improvement.

CHAPTER 6

LIMITATION AND RECOMMENDATION

6.0 Limitation

There may be some possible limitations in this study. First, this survey was restricted to the undergraduate students in Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. It does not reflect Malaysian population as a whole and also does not represent all university students of the country. Besides, researcher has limited access to directly observe some of the respondents' hand hygiene compliance in Serdang Hospital. Hence, some of the observations were done in other health care setting such as community clinics.

6.1 Recommendations

The Faculty of Medicine and Health Sciences should step up their efforts to improve student understanding and behavior regarding hand hygiene. Faculty should make hand hygiene facilities available to students on campus. Therefore, facilities such as handwashing stations and hand sanitizers should be provided throughout the campus. General instructions for healthcare workers should be posted at all handwashing stations by hospital management.

It is critical to provide appropriate hand hygiene facilities so that students may learn excellent hand hygiene habits. These students are more prone to skip hand hygiene precautions when faced with situations needing immediate patient care if facilities are not close by. Fighting poor hand hygiene habits means boosting institutional support and the materials needed for hand washing. Therefore, it is advised that a quantitative assessment of hand hygiene facilities be carried out in order to better access the available resources and make the required corrections in accordance.

It may be possible to enhance students' hand hygiene knowledge, attitudes, and behaviours and promote a positive practice culture by giving hand hygiene more focus through frequent hand hygiene instruction and evaluation, especially in the clinical environment. These findings require confirmation by study involving a broader and more varied population. Finally, researcher suggest doing additional research on this topic.

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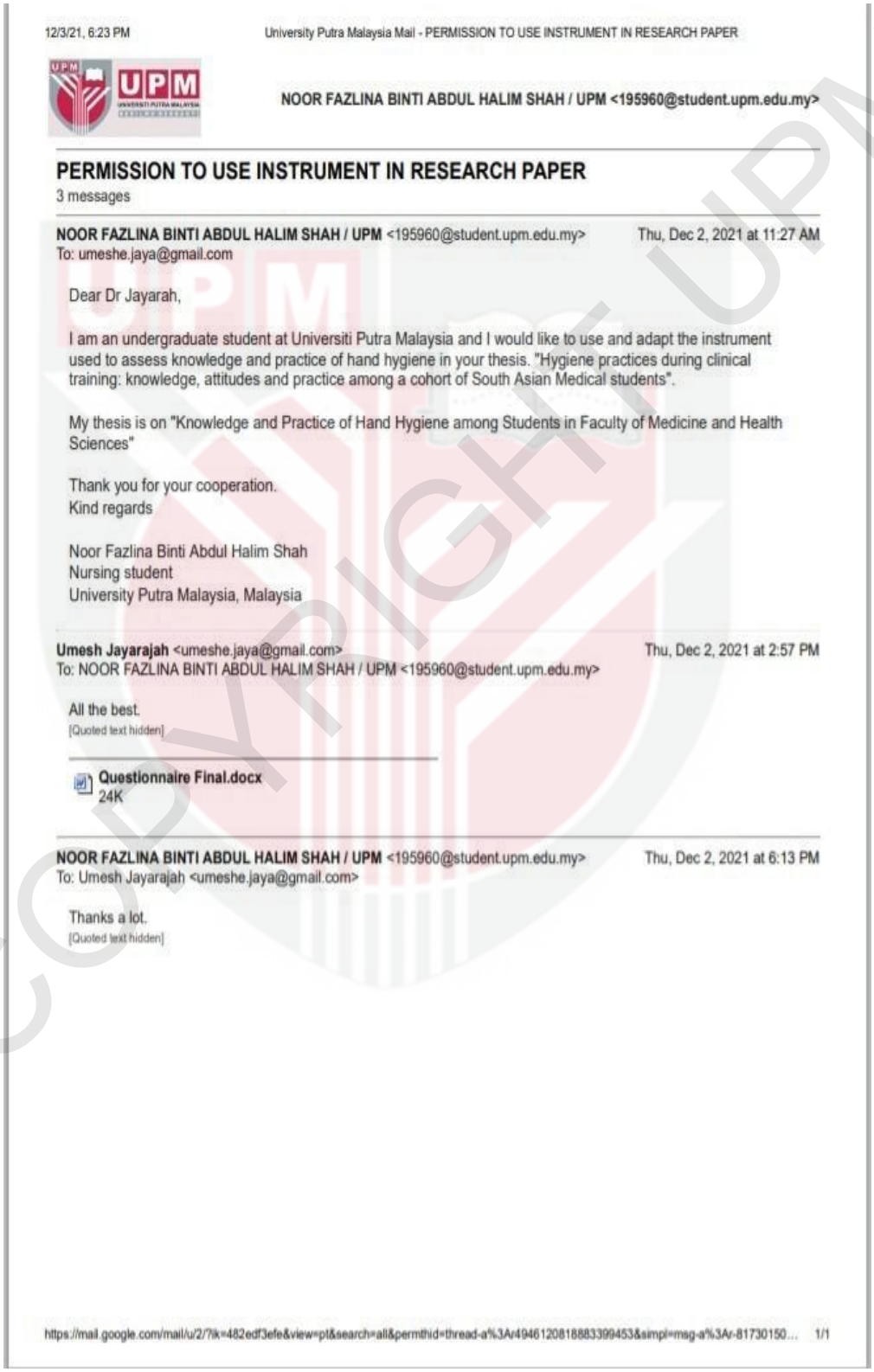
APPENDICES

Appendix A: Gantt Chart

Project	2021		2022								
	NOV	DEC	JAN	FEB	MAC	APRIL	MAY	JUNE	JULY	AUG	SEPT
Identify the research problem											
Discussion with supervisor regarding the research title											
Review of the article for literature review											
Select an appropriate questionnaire											
Proposal presentation											
Submit proposal											
Obtain permission from the relevant party											
Conduct a pilot study											
Conduct the research and data collection											
Data analysis and discussion											
Thesis presentation											
Submit the research report											

Appendix B: Written permission for instrument



12/3/21, 6:23 PM University Putra Malaysia Mail - PERMISSION TO USE INSTRUMENT IN RESEARCH PAPER

NOOR FAZLINA BINTI ABDUL HALIM SHAH / UPM <195960@student.upm.edu.my>

PERMISSION TO USE INSTRUMENT IN RESEARCH PAPER

3 messages

NOOR FAZLINA BINTI ABDUL HALIM SHAH / UPM <195960@student.upm.edu.my> Thu, Dec 2, 2021 at 11:27 AM
To: umeshe.jaya@gmail.com

Dear Dr Jayarah,

I am an undergraduate student at Universiti Putra Malaysia and I would like to use and adapt the instrument used to assess knowledge and practice of hand hygiene in your thesis. "Hygiene practices during clinical training: knowledge, attitudes and practice among a cohort of South Asian Medical students".

My thesis is on "Knowledge and Practice of Hand Hygiene among Students in Faculty of Medicine and Health Sciences"

Thank you for your cooperation.
Kind regards

Noor Fazlina Binti Abdul Halim Shah
Nursing student
University Putra Malaysia, Malaysia

Umesh Jayarajah <umeshe.jaya@gmail.com> Thu, Dec 2, 2021 at 2:57 PM
To: NOOR FAZLINA BINTI ABDUL HALIM SHAH / UPM <195960@student.upm.edu.my>

All the best.
[Quoted text hidden]

Questionnaire Final.docx
24K

NOOR FAZLINA BINTI ABDUL HALIM SHAH / UPM <195960@student.upm.edu.my> Thu, Dec 2, 2021 at 6:13 PM
To: Umesh Jayarajah <umeshe.jaya@gmail.com>

Thanks a lot.
[Quoted text hidden]

https://mail.google.com/mail/u/2/?ik=482edf3efe&view=pt&search=all&permthid=thread-a%3Ar4946120818883399453&simpl=msg-a%3Ar-81730150... 1/1

Written permission for WHO Hand Hygiene Observation Form

Fazlina Shah 4 minutes ago

Dear Dr Chironda,

I am an undergraduate student at Universiti Putra Malaysia and I would like to use the instrument "WHO Hand Hygiene Observation Form" used to assess practice of hand hygiene in your thesis "Assessment of nurses' perceptions and adherence to five moments of hand hygiene in selected units at a University Teaching Hospital in Rwanda".

My thesis is on "Knowledge and Practice of Hand Hygiene among Medical and Nursing Students in Faculty of Medicine and Health Sciences".

At first place, I was going to reach out to Mr Maniriho but I am unable to find his email address. However, since you are also one of the researchers for this research, I am glad if you could give your permission on behalf of him.

Thank you for cooperation.
Kind regards,

Noor Fazlina Binti Abdul Halim Shah
Nursing student

Geldine Chironda to you Just now

Greetings Fazlinah. Hope you are well. Yes, you can utilize the the instrument "WHO Hand Hygiene Observation Form" . Good luck in your study.

Kind regards

Geldine

Appendix C: Participant Information Sheet and Informed Consent Form

JAWATANKUASA ETIKA UNIVERSITI UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM) UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE:
Knowledge and practice of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

2. INTRODUCTION:
The rate of nosocomial infections remains higher despite advances in treatment and technology. Thus, hand hygiene becomes a hot topic to be discussed. The increase in infections also increased the prevalence of mortality and morbidity which is a big challenge for the healthcare workers. Therefore, this study aims to assess the knowledge and practice of hand hygiene among medical and nursing students in the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

3. WHAT WILL YOU HAVE TO DO?
Participants will have to fulfill the inclusion criteria and give approval and consent to participate in this study voluntarily. Participant may answer the questions in this research study in 5 minutes anytime and anywhere.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?
Undergraduate students are unwilling to participate or give informed consent.

5. WHAT WILL BE THE BENEFITS OF THE STUDY?

a) TO YOU AS THE SUBJECT?
From this study, participants will be aware regarding their level of knowledge of hand hygiene and their practice on hand hygiene. Hence, they will be able to improve the quality of hand hygiene before attending patients. No compensation will be given to the participants of this study.

b) TO THE INVESTIGATOR?

The data and information from this research study will allow the researcher to assess the knowledge and practice of hand hygiene among medical and nursing students. Besides, the findings from the study can suggest for any improvement to be done so that the students are able to know the needs of hand hygiene on patients and improve the quality of hand hygiene by posing a positive practice towards hand hygiene.

6. WHAT ARE THE POSSIBLE RISKS?

There is no possible risk or side effects in participating in this research study.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL? Yes. All of the information from the participants will be kept confidential. Only researchers and supervisors will be allowed to access the data collected.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

If you have any inquiries or want to know further information regarding this research study, do contact us at:

Truthfully,

Principal Investigator (supervisor)	Madam Hng Siew Hong	Department of Nursing, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia	+60397 692429	hngsiewhong @upm.edu.my
Co-investigator (co-supervisor)	Dr. Muhammad Hibatullah Bin Romli	Department of Rehabilitation Medicine, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia	+60397 692865	mhibatullah@ upm.edu.my
Co-investigator (student)	Noor Fazlina Binti Abdul Halim Shah	Department of Nursing, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia	011656 50274	195960@stude nt.upm.edu.my

9. CONSENT

I…… Identity Card No. ……

address……
……

……..hereby voluntarily agree to take part in the research stated above *(clinical/drug trial/video recording/focus group/interview-based/questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any reason whatsoever. I also understand that this study is confidential, and all information provided regarding my identify will remain private and confidential.

I* wish/do not wish to know the results related to my participation in the research.

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable).

*Cut if not necessary

Signature ……..…… Signature ……..…….
(*Respondent*) (*Witness*)

Date :…….. Name :……..

I/C No.: ……..…..

I confirm that I have explained to the respondent the nature and purpose of the above mentioned research.

Date ……..…… Signature ……..…….

(*Researcher*)

Appendix D: Questionnaire

UNIVERSITI PUTRA MALAYSIA
FACULTY OF MEDICINE AND HEALTH SCIENCES
DEPARTMENT OF NURSING BACHELOR OF NURSING

RESEARCH TITLE:

KNOWLEDGE AND PRACTICE OF HAND HYGIENE AMONG MEDICAL AND NURSING STUDENTS IN FACULTY OF MEDICINE AND HEALTH SCIENCES, UNIVERSITI PUTRA MALAYSIA: A CROSS-SECTIONAL STUDY

QUESTIONNAIRE

RESEARCHER: NOOR FAZLINA BINTI ABDUL HALIM SHAH (195960)

SUPERVISOR: MADAM HNG SIEW HONG

INSTRUCTION:

This study is conducted for academic purposes. All information will be kept private and confidential. Thank you for your cooperation in answering this questionnaire.

Part A: Socio-demographic Information

Instruction:
All the answers given are to complete your background information. Please answer each question appropriately by ticking (√) or writing down in the box or at the space provided respectively.

1. Age: ☐ 21-22 ☐ 23-24 ☐ 25-26

2. Gender:

☐ Male ☐ Female

3. Ethnicity:

Malay ☐ Chinese ☐ Indian ☐

Others: ……

4. Course of study:

☐ Doctor of Medicine

☐ Bachelor of Nursing

5. Year of study :

☐ Year 1

☐ Year 2

☐ Year 3

☐ Year 4

☐ Year 5

Part B: Knowledge of Hand Hygiene Among Students

Instruction:
This questionnaire is designed to assess your level of knowledge about hand hygiene. Please choose the most appropriate answer and answer by ticking (√) in the column provided.

No	Questions	True	False	Do not Know
1	It is necessary to wash hands after removing gloves.			
2	It is recommended to wash hands regularly.			
3	When washing hands, it is necessary to rub the hands together for **at least 20 seconds.**			
4	It is necessary to wash hands after contact with body fluids.			
5	It is necessary to wash hands after direct patient contact.			
6	It is necessary to wash hands with soap rather than hand rub when caring for patients with vomiting or diarrhea.			

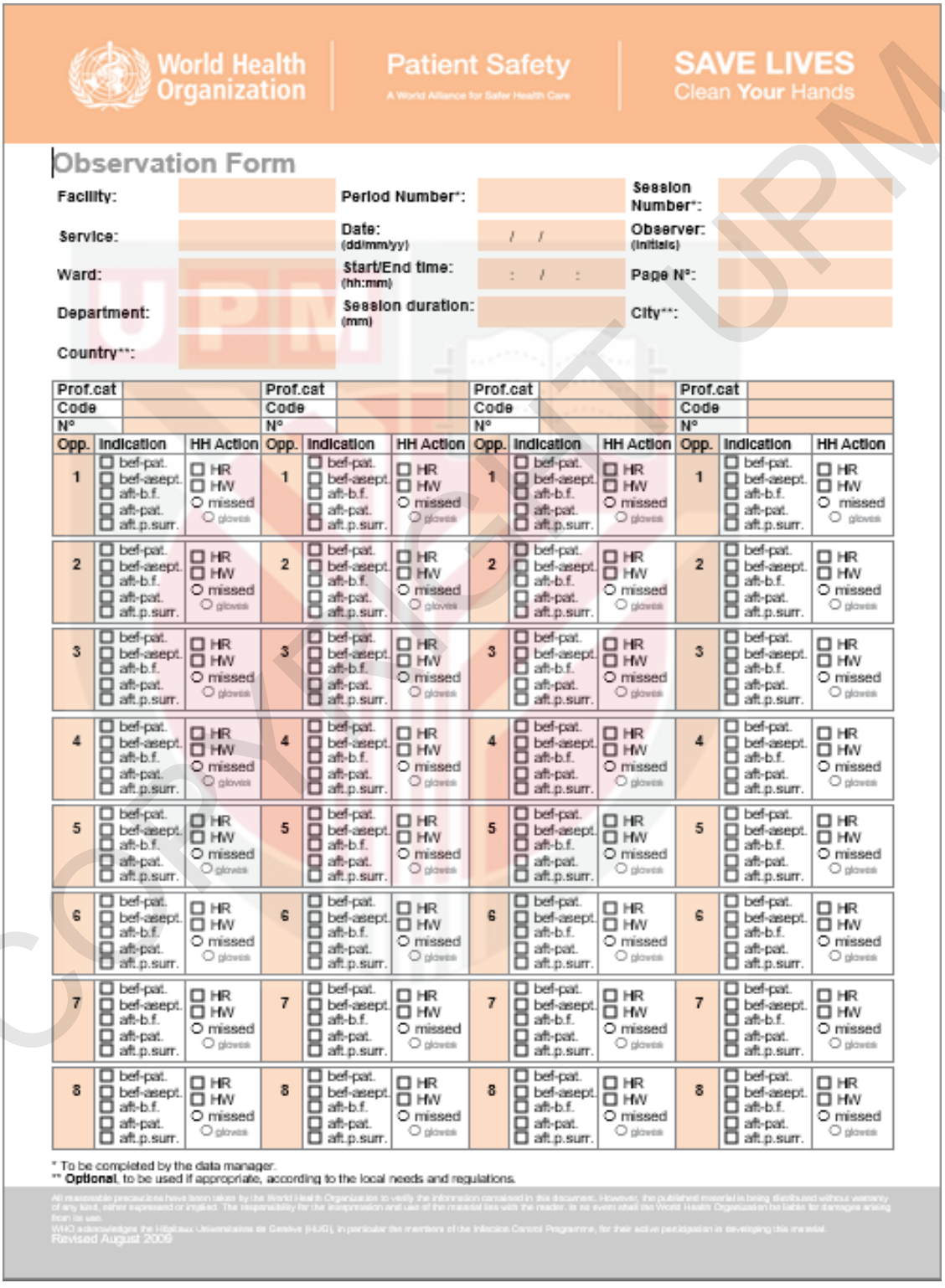
Part C: Practice of Hand Hygiene Among Students

Instruction:
This questionnaire intends to measure your practice of hand hygiene.
Please read the following statements and tick (√) on the scale column that is closest to your opinion.

Scale	**0**	**1**	**2**	**3**	**4**
Response	Never	Seldom	Sometimes	Frequently	Always

No	**Questions**	**0**	**1**	**2**	**3**	**4**
1	I keep my fingernails short and clean.					
2	I wash my hands prior to direct patient contact.					
3	I wash my hands with soap rather than hand rub when the hands are visibly soiled.					
4	I wash my hands prior to an aseptic procedure.					
5	I wash my hands after direct patient contact.					
6	I wash hands with soap rather than hand rub when caring for patients with vomiting or diarrhea.					
7	I rub the hands together for **at least** 20 seconds when washing my hands.					
8	I wash my hands after removing gloves.					
9	I practiced the steps of hand washing.					
10	I wash my hands after contact with body fluids.					

Appendix E: WHO Hand Hygiene Observation Form



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Observation Form

Facility:		Period Number*:		Session Number*:	
Service:		Date: (dd/mm/yy)	/ /	Observer: (initials)	
Ward:		Start/End time: (hh:mm)	: / :	Page N°:	
Department:		Session duration: (mm)		City**:	
Country**:					

Prof.cat			Prof.cat			Prof.cat			Prof.cat		
Code			Code			Code			Code		
N°			N°			N°			N°		
Opp.	Indication	HH Action	Opp.	Indication	HH Action	Opp.	Indication	HH Action	Opp.	Indication	HH Action
1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves

* To be completed by the data manager.
** **Optional**, to be used if appropriate, according to the local needs and regulations.

WHO acknowledges the Hôpitaux Universitaires de Genève (HUG), in particular the members of the Infection Control Programme, for their active participation in developing this material.
Revised August 2009

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General Recommendations

(refer to the Hand Hygiene Technical Reference Manual)

1. In the context of open and direct observations, the observer introduces him/herself to the health-care worker and to the patient when appropriate, explains his/her task and proposes immediate informal feed back.
2. The health-care worker, belonging to one of the main four following professional categories (see below), is observed during the delivery of health-care activities to patients.
3. Detected and observed data should be recorded with a pencil in order to be immediately corrected if needed.
4. The top of the form (header) is completed before starting data collection (excepted end time and session duration).
5. The session should last no more than 20 minutes (± 10 minutes according to the observed activity); the end time and the session duration are to be completed at the end of the observation session.
6. The observer may observe up to three health-care workers simultaneously, if the density of hand hygiene opportunities permits.
7. Each column of the grid to record hand hygiene practices is intended to be dedicated to a specific professional category. Therefore numerous health-care workers may be sequentially included during one session in the column dedicated to their category. Alternatively each column may be dedicated to a single health-care worker only of whom the professional category should be indicated.
8. As soon as you detect an indication for hand hygiene, count an opportunity in the appropriate column and cross the square corresponding to the indication(s) you detected. Then complete all the indications that apply and the related hand hygiene actions observed or missed.
9. Each opportunity refers to one line in each column; each line is independent from one column to another.
10. Cross items in squares (several may apply for one opportunity) or circles (only a single item may apply at one moment).
11. When several indications fall in one opportunity, each one must be recorded by crossing the squares.
12. Performed or missed actions must always be registered within the context of an opportunity.
13. Glove use may be recorded only when the hand hygiene action is missed while the health-care worker is wearing gloves.

Short description of items

Facility:	to complete according to the local nomenclature	
Service:	to complete according to the local nomenclature	
Ward:	to complete according to the local nomenclature	
Department:	to complete according to the following standardized nomenclature:	
	medical, including dermatology, neurology, haematology, oncology, etc.	surgery, including neurosurgery, urology, EENT, ophthalmology, etc.
	mixed (medical & surgical), including gynaecology	obstetrics, including related surgery
	paediatrics, including related surgery	intensive care & resuscitation
	emergency unit	long term care & rehabilitation
	ambulatory care, including related surgery	other (to specify)
Period N°:	1) pre- / 2) post-intervention; and then according to the institutional counter.	
Date:	day (dd) / month (mm) / year (yy)	
Start/end time:	hour (hh) / minute (mm).	
Session duration:	difference between start and end time, resulting in minutes of observation.	
Session N°:	attributed at the moment of data entry for analysis.	
Observer:	observer's initials (the observer is responsible for the data collection and for checking their accuracy before submitting the form for analysis.	
Page N°:	to write only when more than one form is used for one session.	
Prof.cat:	according to the following classification:	
	1. nurse / midwife	1.1 nurse, 1.2 midwife, 1.3 student.
	2. auxiliary	
	3. medical doctor	3.1 in internal medicine, 3.2 surgeon, 3.3 anaesthetist / resuscitator / emergency physician, 3.4 paediatrician, 3.5 gynaecologist, 3.6 consultant, 3.7 medical student.
	4. other health-care worker	4.1 therapist (physiotherapist, occupational therapist, audiologist, speech therapist), 4.2 technician (radiologist, cardiology technician, operating room technician, laboratory technician, etc), 4.3 other (dietician, dentist, social worker and any other health-related professional involved in patient care), 4.4 student.
Number:	number of observed health-care workers belonging to the same professional category (same code) as they enter the field of observation and you detect opportunities.	
Opp(ortunity):	defined by one indication at least	
Indication:	reason(s) that motivate(s) hand hygiene action; all indications that apply at one moment must be recorded	
	bef.pat: before touching a patient	aft.b.f: after body fluid exposure risk
	bef.asept: before clean/aseptic procedure	aft.pat: after touching a patient
		aft.p.surr: after touching patient surroundings
HH action:	response to the hand hygiene indication(s); it can be either a positive action by performing handrub or handwash, or a negative action by missing handrub or handwash	
	HR: hand hygiene action by handrubbing with an alcohol-based formula HW: hand hygiene action by handwashing with soap and water	Missed: no hand hygiene action performed

WHO acknowledges the Hôpitaux Universitaires de Genève (HUG), in particular the members of the Infection Control Programme, for their active participation in developing this material.

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Observation Form – Optional Calculation Form

(Indication-related compliance with hand hygiene)

	Facility:						Period:			Setting:					
	Before touching a patient			Before clean/ aseptic procedure			After body fluid exposure risk			After touching a patient			After touching patient surroundings		
Session N°	Indic (n)	HW (n)	HR (n)	Indic (n)	HW (n)	HR (n)	Indic (n)	HW (n)	HR (n)	Indic (n)	HW (n)	HR (n)	Indic (n)	HW (n)	HR (n)
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
Total															
Calculation	Act (n) = / Indic1 (n) =			Act (n) = / Indic2 (n) =			Act (n) = / Indic3 (n) =			Act (n) = / Indic4 (n) =			Act (n) = / Indic5 (n) =		
Ratio act / indic*															

Instructions for use

1. Define the setting outlining the scope for analysis and report related data according to the chosen setting.
2. Check data in the observation form. Hand hygiene actions not related to an indication should not be taken into account and vice versa.
3. If several indications occur within the same opportunity, each one should be considered separately as well as the related action.
4. Report the session number and the related observation data in the same line. This attribution of session number validates the fact that data has been taken into count for compliance calculation.
5. Results per indication (indic) and per session (vertical):
   4.1 Sum up indications per indication in the observation form: report the sum in the corresponding cell in the calculation form.
   4.2 Sum up positive hand hygiene actions related to the total of indications above, making the difference between handwash (HW) and handrub (HR): report the sum in the corresponding cell in the calculation form.
   4.3 Proceed in the same way for each session (observation form).
   4.4 Add up all sums per each indication and put the calculation to calculate the ratio (given in percent)

***Note:** This calculation is not exactly a compliance result, as the denominator of the calculation is an indication instead of an opportunity. Action is artificially overestimated according to each indication. However, the result gives an overall idea of health-care worker's behaviour towards each type of indication.

Appendix F: Questionnaire Validation Form

FACULTY OF MEDICINE AND HEALTH SCIENCE

DEPARTMENT OF NURSING

BACHELOR OF NURSING

QUESTIONNAIRE'S CONTENT VALIDATION FORM

RESEARCH TITLE*:*

KNOWLEDGE AND PRACTICE OF HAND HYGIENEAMONG MEDICAL AND NURSING STUDENTS IN FACULTY OF MEDICINE AND HEALTH SCIENCES,UNIVERSITI PUTRA MALAYSIA

INSTRUCTION*:*

This questionnaire's content validation form consists of TWO part which is PART A and PART B.

Please read the instruction and answer all the questions. Thank you for your cooperation.

PART A: KNOWLEDGE OF HAND HYGIENE AMONG STUDENTS

INSTRUCTION*:*

This part is designed to assess level of knowledge of hand hygiene among medical and nursingstudents. Please rate the most appropriate score for each of the question by using the scale provided below. You may answer by ticking (/) in the column provided.

Score	**1**	***2***	***3***	***4***
Degree of relevance	Not relevant	Somewhat relevant	Quite relevant	Highly relevant

No.	**Question**	**Relevance**			
		1	**2**	**3**	**4**
1.	It is necessary to wash hands after removing gloves?				/
2.	It is recommended to wash hands regularly?				/
3.	When washing hands, it is necessary to rub the hands together for **at least 20 seconds?**				/
4.	It is necessary to wash hands after contact with body fluids?			/	
5.	It is necessary to wash hands after direct patient contact?				/
6.	It is necessary to wash hands with soap rather than hand rub when caring for patients with vomiting or diarrhea?				/

PART B: PRACTICE OF HAND HYGIENE AMONG STUDENTS

INSTRUCTION*:*

This part is designed to measure practice of hand hygiene among medical and nursing students. Please rate the most appropriate score for each of the question by using the scale provided below. You may answer by ticking (/) in the column provided.

Score	**1**	***2***	***3***	***4***
Degree of relevance	Not relevant	Somewhat relevant	Quite relevant	Highly relevant

No.	**Question**	**Relevance**			
		1	**2**	**3**	**4**
1.	I keep my fingernails short and clean.				/
2.	I wash my hands prior to direct patient contact.				/
3.	I wash my hands with soap rather than hand rub when the hands are visibly soiled.				/
4.	I wash my hands prior to an aseptic procedure.				/
5.	I wash my hands after direct patient contact.				/
6.	I wash hands with soap rather than hand rub when caring for patients with vomiting or diarrhea.				/
7.	I rub the hands together for **at least** 20 seconds when washing my hands.				/
8.	I wash my hands after removing gloves.				/
9.	I practiced the steps of hand washing.				/

10.	I wash my hands after contact with body fluids.				/

THE END

Thank you for your cooperation

Validated by:

Name:

Tengku Zetty Maztura Tengku Jamaluddin (Dr.)
MBChB (Sheffield), PhD (Infection Control) (Juntendo)
Kepakaran:Kawalan Jangkitan

Date: 29/6/2022

PART A: KNOWLEDGE OF HAND HYGIENE AMONG STUDENTS

INSTRUCTION:

This part is designed to assess level of knowledge of hand hygiene among medical and nursingstudents. Please rate the most appropriate score for each of the question by using the scale provided below. You may answer by ticking (/) in the column provided.

Score	**1**	***2***	***3***	***4***
Degree of relevance	Not relevant	Somewhat relevant	Quite relevant	Highly relevant

No.	**Question**	**Relevance**			
		1	**2**	**3**	**4**
1.	It is necessary to wash hands after removing gloves?			/	
2.	It is recommended to wash hands regularly?			/	
3.	When washing hands, it is necessary to rub the hands together for **at least 20 seconds?**			/	
4.	It is necessary to wash hands after contact with body fluids?				/
5.	It is necessary to wash hands after direct patient contact?				/
6.	It is necessary to wash hands with soap rather than hand rub when caring for patients with vomiting or diarrhea?			/	

PART B: PRACTICE OF HAND HYGIENE AMONG STUDENTS

INSTRUCTION*:*

This part is designed to measure practice of hand hygiene among medical and nursing students. Please rate the most appropriate score for each of the question by using the scale provided below. You may answer by ticking (/) in the column provided.

Score	**1**	***2***	***3***	***4***
Degree of relevance	Not relevant	Somewhat relevant	Quite relevant	Highly relevant

No.	**Question**	**Relevance**			
		1	**2**	**3**	**4**
1.	I keep my fingernails short and clean.			/	
2.	I wash my hands prior to direct patient contact.				/
3.	I wash my hands with soap rather than hand rub when the hands are visibly soiled.				/
4.	I wash my hands prior to an aseptic procedure.				/
5.	I wash my hands after direct patient contact.				/
6.	I wash hands with soap rather than hand rub when caring for patients with vomiting or diarrhea.			/	
7.	I rub the hands together for **at least** 20 seconds when washing			/	

	my hands.				
8.	I wash my hands after removing gloves.			/	
9.	I practiced the steps of hand washing.				/
10.	I wash my hands after contact with body fluids.			/	

THE END

Thank you for your cooperation

Validated by:

Name:
Siti Zulaikha Zakariah (Dr.)
MB BCH BAO, MPath (UKM)
Kepakaran:Mikrobiologi Klinikal

Date: 29/6/2022

Appendix G: Approval from the *Jawatankuasa Etika Untuk Penyelidikan Melibatkan Manusia (JKEUPM)*

Ref. no: UPM/TNCPI/RMC/JKEUPM/1.4.18.2 (JKEUPM)
Date: 21 June 2022

Dear Prof./Dr./Mr./Ms.,

APPLICATION FOR JKEUPM ETHICAL CLEARANCE: APPROVED

With reference to the above, I am pleased to inform you that your application for ethical clearance for the research project entitled **'KNOWLEDGE AND PRACTICE OF HAND HYGIENE AMONG MEDICAL AND NURSING STUDENTS IN FACULTY OF MEDICINE AND HEALTH SCIENCES, UNIVERSITI PUTRA MALAYSIA.'** has been approved.

The approval is **valid from 21 JUNE 2022 until 21 JUNE 2023**.

Please note that the official letter of approval will be issued as soon as possible. However, the ethical clearance is considered effective from the date of this email, and you may now proceed with your research.

Kindly remind the ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.

Researchers should also complete a Study Final Report upon study completion. The form can be obtained from the Ethics Committee for Research Involving Human Subjects (JKEUPM) website (http://www.tncpi.upm.edu.my/faildokumen).

If you have any enquiries, please contact at number 03-97691244/1602.

Note: Please use this reference number for any transaction:- **JKEUPM-2022-355**

Thank you.

Yours faithfully,

Prof. Dr. Zamberi Sekawi
Chair
Ethics Committee for Research Involving Human Subjects
Universiti Putra Malaysia

Appendix H: Turnitin

KNOWLEDGE AND PRACTICE OF HAND HYGIENE AMONG MEDICAL AND NURSING STUDENTS IN FACULTY OF MEDICINE AND HEALTH SCIENCES, UNIVERSITI PUTRA MALAYSIA

ORIGINALITY REPORT

29%	19%	15%	17%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universiti Putra Malaysia Student Paper	2%
2	Submitted to Universiti Teknologi MARA Student Paper	2%
3	sites.kowsarpub.com Internet Source	1%
4	Submitted to International Islamic University Malaysia Student Paper	1%
5	Submitted to Western Governors University Student Paper	1%
6	ir.unilag.edu.ng Internet Source	1%
7	Burcu Ceylan, Ulku Gunes, Leyla Baran, Huri Ozturk, Gul Sahbudak. "Examining the hand hygiene beliefs and practices of nursing students and the effectiveness of their	1%