Knowledge and Compliance of Standard Precautions Among The Undergraduate Nursing Students

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ABSTRACT

Background: Lack of knowledge and understanding of standard precautions, and insufficient compliance with the established guidelines in nursing students will increase the risk of exposure to healthcare-associated infections (HAIs). This study aims to determine knowledge and compliance of standard precautions among the undergraduate nursing students and to identify the associated factors. **Methods**: A cross-sectional study was conducted among the undergraduate nursing students from a Malaysian public university in Pahang. A convenience sampling was used to select the participants. The participants were asked to complete an online survey consisting of questionnaire of knowledge and compliance of standard precautions. **Results**: A total of 178 undergraduate nursing students completed the questionnaires (response rate = 95%). Their mean age was 22.7 years old (SD = 1.1). The score of standard precautions knowledge was 90.9% (mean score = 16.4/18, SD = 1.5) and the score of compliance was 91.8% (mean score = 73.4/80, SD = 10.7). There were significant associations between age (p = 0.002), year of study (p = 0.032) and clinical posting experience (p = 0.010) with knowledge of standard precautions. Whilst only age (p = 0.011) was significantly associated with compliance of standard precautions. There was a significant positive association between knowledge and compliance of standard precautions (rs = 0.187, p = 0.012). **Conclusion:** Knowledge and compliance of standard precaution among the undergraduate nursing students were high and achieved the expected requirement for clinical posting. A continuous effort to improve adherence to standard precautions in nursing students is necessary to protect and prevent them from getting infected particularly during the COVID-19 pandemic.

Keywords: Compliance, Infection, Knowledge, Malaysia, Nursing, Standard Precautions

INTRODUCTION

Standard precautions are defined as "the minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infectious status of the patient, in any setting where health care is delivered" (1). According to the Ministry of Health Malaysia (2019), standard precautions consist of nine standard principles namely hand hygiene; personal protective equipment (PPE); disinfection and sterilisation, environmental hygiene; waste management; linen management; spillage management; injection safety and sharps management; and respiratory hygiene and cough etiquette. Out of these, hand hygiene is widely regarded as the single most effective method of preventing the transmission of germs. It can eliminate up to 50% of avoidable infections acquired during healthcare delivery and save up to 16 times cost of implementation in average (2). Meanwhile, the use of PPE should be guided with the risk evaluation and the extent of anticipated interaction with blood and body fluids, or pathogens.

The standard precautions were established mainly to prevent and control healthcare-associated infections (HAIs) which is infection acquired within 48 hours or more after admission in healthcare setting while receiving treatment for other conditions (3). Getting infection at healthcare setting leads to health care-associated sepsis. The mortality of health care-associated sepsis among the hospitalized adults was estimated between 20% and 30% (4). Longer hospital stay and higher

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antimicrobial resistance rates than community-acquired sepsis associated with rising rate of HAIs and sepsis (4).

Fundamentally, effective precautions practices will eliminate more than half of all cases of healthcare-associated sepsis (4). Adherence to the practices will reduce the risk of transmission of bloodborne and pathogens from the recognized and unrecognized sources as well as to break the chain of infection among the patients and healthcare providers (5,6). The increase in contact with the patients and healthcare settings increase the risk of HAIs among the nursing students if not accompanied by improvements in the knowledge and compliance to infection prevention and control (IPC) measures, particularly the standard precautions.

A pandemic of a novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that has spread rapidly worldwide since in year 2020 became a great concern. The impact on our society was profound including on the present HAI surveillance and prevention efforts. While the students actively involved in the care of the patients, the risk of becoming infected with the SARS-CoV-2 virus was still present due to lack of social distancing and personal hygiene of the people surroundings. Although these efforts have understandably taken immediate priority by the educational institution and hospitals, preventions matter remain concerning. Therefore, this study aimed to determine knowledge and compliance of standard precautions among the undergraduate nursing students, to identify socio-demographic factors that associated with their knowledge and compliance, and to assess the association between their knowledge and compliance.

METHOD

A cross-sectional study was conducted from February 2020 until May 2020. The sample was undergraduate nursing students from Kulliyyah (faculty) of Nursing, International Islamic University Malaysia (IIUM). Kulliyyah of Nursing is one of the faculties under IIUM Kuantan Campus which is one of the established public universities in Malaysia located at the East Coast of Peninsular Malaysia. The faculty provides higher education in nursing and health. The specific course related to standard precautions was taught under Fundamental Nursing Practice in the second semester of their first-year undergraduate study. The clinical placement starts in the second year of semester two and as for the students who have the diploma of nursing, their clinical posting starts in the third year.

In this study, a convenience sampling technique was applied in the recruitment of the participants. The inclusion criterion was undergraduate nursing students from year 2 to year 4. They will be excluded if they were from year 1 because of having no clinical experience or if they were postgraduate students as clinical experience or standard precautions training were not their learning requirement. Sample size of this study was calculated using Raosoft Sample Size Calculator based on the total population size of 303. The recommended sample size was 170 with margin error was determined as 5% and confidence interval of 95%. After considering the 10% drop out, the required sample size was 187. Prior to data collection, the ethical approvals were obtained from Kulliyyah of Nursing Post Graduate Research Committee (IIUM/313/G/14/3/1) and International Islamic University Malaysia Research Ethics Committee (IREC 2020-KON 32).

Data collection

An online survey was conducted by FAJ to collect the data. Brief information and invitation to participate in the study were sent to the students' personal mobile via messenger application of WhatsApp. First, the contact number of the students' representatives from each year were obtained. They were asked to distribute the invitation message of participating in the study to their batchmates. If the students agreed, they were required to click on the shared survey hyperlink to respond to the questionnaire. The online survey was designed to be completed by the participants only one time to minimize the redundancy of responses. The response rate was maximized by ensuring the survey hyperlink was maintained active for four months and the invitation message was sent three times to the students periodically throughout the data collection period.

Research Instrument

A structured closed-ended questionnaire was used to collect the data of this study and it consisted of three parts. Part I was to obtain the participant's socio-demographic information. The questions were tailored to collect data on the sex, age, hometown (state of Malaysia), marital status, year of study, clinical posting experience in weeks, and current grade point average (GPA). Part II was about knowledge of standard precautions; and Part III was about compliance with the standard precautions during clinical posting.

Knowledge of standard precautions was measured using questionnaire from AL-Rawajfah and Tubaishat (7). The questionnaire consisted of 18

items and the participants were asked to respond to the items of either "True," "False," or "I don't know." Correct answers were scored as one mark which could be either from "True" or "False" responses. "I don't know" response was scored as zero mark. Five items were negatively stated to minimize possible biased responses (item number 3, 5, 9, 17, and 18). The total knowledge score ranged from 0 to 18. The higher the score, the greater the knowledge of standard precautions of the participant had.

Compliance with standard precautions during clinical posting was measured using the questionnaire from Luo, He, and Zhou (8). The questionnaire consisted of 20 items with a scale rate between 0 and 4 points: 0 = never, 1 = seldom, 2 = sometimes, 3 = usually, and 4 = always, giving a score ranged between 0 and 80. The higher the score indicated the better that person complied with the standard precautions. Questionnaire of either knowledge or compliance of standard precautions can be divided into domains of hand hygiene, proper use of PPE, decontamination of equipment and environment, proper linen management, proper spills management, proper waste management, proper sharps management, and proper respiratory hygiene or cough etiquette. Our pilot study to among 30 of nursing students in Kuantan showed that both of the instrument were valid and reliable to be used in our population, evidenced by Cronbach's alpha between 0.91 and 0.97 and supported to the findings of the previous studies (7,8).

Data Analysis

Statistical Package Social Science (SPSS) Version 26.0 was used for data analysis. Descriptive statistic was computed to describe the participants' socio-demographic and scores of knowledges and compliance of standard precautions. Socio-demographic data were presented in the form of frequencies and percentages, except for age and clinical posting experience which were presented in the form of means and standard deviations (SD). For the standard precaution of knowledge and compliance, the scores were presented in the form of percentage based on the total mean score (SD) obtained per total score of items. Histogram and Shapiro-Wilk statistical test showed that the data exhibited non-normal distribution. Median (interquartile [IQ] range) was used to test for the hypotheses. Mann-Whitney and Kruskal Wallis were used to analyse the associated factors of the knowledge and compliance of standard precaution. Spearman Correlation was utilized to examine the relationship between knowledge and compliance of the standard precautions among the participants. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Participants

A total of 178 participants had participated in the study, which gave a response rate of 95.2%. Their mean age was 22.7 years old (SD = 1.1). About 15.7% were male and 84.3% were female, and all were single. Table 1 shows the characteristics of the participants of this study.

Variables		**Frequency (*n*)**	**Percentage (%)**	**Mean (*SD*)**
Age (years)	20 – 21	28	15.7	22.7 (± 1.1)
	22 – 23	98	55.1	
	24 – 25	52	29.2	
Sex	Male	28	15.7	-
	Female	150	84.3	
Hometown	East Coast	78	43.8	-
	Northern Region	32	18.0	
	Central Region	35	19.7	
	Others	33	18.5	
Year of study	2	33	18.5	-
	3	55	30.9	
	4	90	50.6	
Duration of clinical posting (weeks)	9	33	18.5	31.8 (± 13.9)
	22	16	9.0	
	27	39	21.9	
	40	39	21.9	
	47	51	28.7	
Current GPA	0.0 – 2.9	14	7.9	-
	3.0 – 4.0	164	92.1	

Note. GPA = grade point average, SD = standard deviation

Table 1: Socio-demographic characteristics of the undergraduate nursing students (N = 178)

Most participants were currently in the fourth year (50.6%). The mean duration of clinical posting

experience was 32 weeks (SD = 13.9) with participants from the fourth year had the most clinical posting experience and participants from the second year had the least of clinical posting experience (44 weeks vs. 9 weeks). Participants from the third year had about 22 weeks (9.0%) or 27 weeks (21.9%) of clinical posting experience. While those in the fourth year, some had 40 weeks and others have 47 weeks of clinical posting experience with 21.9% and 28.7% respectively. The current GPA of most of the participants were 3.0 and above.

Knowledge and compliance of standard precautions

Table 2 shows the mean score and the score percentage of knowledge and compliance of standard precautions among the participants of this study. The results showed the score of knowledge was 90.8% (total mean scores = 16.4/18, SD = 1.5) and the score of compliance was 91.8% (total mean scores = 73.4/80, SD = 10.7). The highest score of knowledge of standard precautions was on hand hygiene (99.5%, mean = 2.0, SD = 0.1) and the lowest score was on the proper spillage management (68.5%, mean = 1.4, SD = 0.8). The highest score of compliance of standard precautions was on the proper use of PPE (96.1%, mean = 19.2, SD = 2.7) and the lowest score was on the proper spillage management (81.5%, mean = 6.5, SD = 1.9).

	Knowledge of Standard Precautions			Compliance of Standard Precautions		
	Mean Score	***SD***	**Score (%)**	**Mean Score**	***SD***	**Score (%)**
Total	16.4	± 1.5	90.9	73.4	±10.7	91.8
Domain						
Hand hygiene	2.0	± 0.1	99.5	11.2	± 1.7	93.3
Proper use of PPE	2.7	± 0.5	88.3	19.2	± 2.7	96.1
Decontamination of equipment and environment	1.9	± 0.3	96.0	7.1	± 1.3	89.3
Proper linen management	1.9	± 0.4	94.0	7.1	± 1.5	89.0
Proper spills management	1.3	± 0.8	68.5	6.5	± 1.9	81.5
Proper waste management	1.9	± 0.4	93.0	7.5	± 1.2	93.8
Proper sharps management	1.9	± 0.2	97.0	7.3	± 1.3	90.8
Proper respiratory hygiene or cough etiquette	2.8	± 0.5	91.7	7.5	± 1.2	93.5

Note. PPE = personal protective equipment, SD = standard deviation.

Table 2: Knowledge and compliance of standard precautions among the undergraduate nursing students (N = 178)

Factor associated with knowledge and compliance of standard precautions

Table 3 shows the association between socio-demographic factors and knowledge and compliance of standard precautions among the participants of the study. There were significant associations between age, year of study, and duration of clinical posting experience and the knowledge with p-values of 0.002, 0.032, and 0.010, respectively. Whilst there was only age that significantly associated with compliance of standard precautions scores among the participants (p = 0.011).

Factor		**N**	**Knowledge of Standard Precautions**		**Compliance of Standard Precautions**	
			Median (*IQ* range)	***p*-value***	**Median (*IQ* range)**	***p*-value***
Age (years)	20 – 21	28	16.0(3)	0.002	72.0(10)	0.011
	22 – 23	98	17.0(2)		76.0(6)	
	24 – 25	52	16.5(1)		76.0(6)	
Sex	Male	28	16.0(2)	0.195**	73.5(10)	0.120**
	Female	150	17.0(2)		76.0(6)	
Hometown	East Coast	78	17.0(2)	0.105	77.0(8)	0.164
	Northern Region	32	16.0(2)		76.0(7)	
	Central Region	35	16.0(1)		74.0(5)	
	Others	33	17.0(2)		76.0(6)	
Year of study	2	33	16.0(2)	0.032	74.0(8)	0.113
	3	55	17.0(2)		76.0(8)	
	4	90	17.0(2)		76.0(6)	
Duration of clinical posting (weeks)	9	33	16.0(2)	0.010	74.0(8)	0.228
	22	16	17.0(1)		78.0(6)	
	27	39	16.0(2)		74.0(9)	
	40	39	17.0(2)		76.0(7)	
	47	51	16.0(1)		76.0(6)	
Current GPA	0.0 – 2.9	14	16.0(2)	0.072**	75.0(9)	0.578**
	3.0 – 4.0	164	17.0(2)		76.0(7)	

Note. GPA = grade point average, N = frequency, SD = standard deviation, IQ = interquartile.
*Kruskal-Wallis, **Mann-Whitney. A p-value <0.05 is significant.

Table 3: The association between socio-demographic factors and knowledge and compliance of standard precautions (N = 178)

The association between knowledge and compliance of standard precautions

Table 4 shows the association between knowledge and compliance of standard precautions. Overall, there was a significant positive association between knowledge and compliance of standard precautions among the participants (rs = 0.187, p = 0.012). Specifically, the association was observed between knowledge and compliance in domains of proper use of PPE (rs = 0.182, p = 0.015), proper spills management (rs = 0.289, p < 0.001), and proper sharps management (rs = 0.334, p < 0.001).

	Spearman correlation coefficient	***p*-value**
Knowledge and compliance of standard precautions	0.187	0.012*
Domain: Knowledge and compliance of		
Hand hygiene	0.040	0.597
Proper use of PPE	0.182	0.015*
Decontamination of equipment and environment	-0.065	0.388
Proper linen management	-0.116	0.123
Proper spills management	0.289	<0.001*
Proper waste management	0.117	0.119
Proper sharps management	0.334	<0.001*
Proper respiratory hygiene or cough etiquette	0.039	0.605

Notes. *A p-value <0.05 is significant.

Table 4: The association between knowledge and compliance of standard precaution among the undergraduate nursing students (N = 178).

DISCUSSION

In this study, the findings showed that the undergraduate nursing students had a very good knowledge represented with the score percentage of 90.9% and a very good compliance of standard precautions with the score percentage of 91.8%. Findings from the previous studies in the West and East Coast region of Peninsular Malaysia as well as most of the studies from the worldwide showed that knowledge and compliance of standard precautions among the nursing students were between good and very good (7,9–12). The scores of this study corresponded to the previous studies that suggested the score of 67% and above indicated that having a good knowledge of standard precautions (5,9,10,13) and the score of 75% and above indicated that having a good compliance of standard precautions (14–17). Of these, our findings of knowledge and compliance of standard precautions were among the highest score, comparable to the study findings from Saudi Arabia which was about 93.0% (5,14). According to Alotaibi et al., these findings can be explained that the students had undergone previous training on IPC and self-learning throughout their clinical posting (14).

The nursing students are expected to have sufficient knowledge and compliance with the nine principles of standard precautions to enable preventing and controlling HAIs. However, most studies revealed that knowledge of hand hygiene had the highest score and knowledge of proper spills management had the lowest score which was similar to our findings (5,14,18). Several studies found that nursing students also had the highest knowledge of standard precautions on the proper use of PPE and proper sharps management (7,17). Goje et al. explained that the reason for these findings was due to lack of experience with a particular procedure at the clinical settings affecting their knowledge of the standard precautions principles associated with the procedure (13).

Previous studies which were conducted in China and Saudi Arabia found that nursing students had moderate level of compliance with standard precautions with the range mean scores of 60.1% to 72.6% (19–21). A lack of formal standard precautions training and inadequate of equipment or materials used for standard precautions in clinical settings were factors that contributed to the low score (19,21). About this study finding, we predicted factors such as the students receive a proper training on standard precautions, the organization monitor the students' care activities, or the organization pays close attention to the compliance of standard precaution during orientation and educations sessions influencing the study finding (22).

Study from a public university from the North East of Peninsular Malaysia found that the highest score of compliance with standard precaution was hand hygiene for both groups of the diploma and undergraduate nursing students (9). Other studies found that the highest score of compliance with standard precaution was proper use of PPE and the lowest score was proper spills management (16,17,20) which was similar to this study findings. Lack of compliance in proper spills management among this study participants was consistent with their knowledge which suggests due to lack of knowledge of the standard

principle.

Age influenced the participants knowledge and compliance of standard precautions. Other factors that influenced knowledge included year of study and duration of clinical posting. For the compliance of standard precautions, several studies also found that year of study and clinical posting experience were also associated with high compliance of standard precautions which was not observed in this study (9,21). A high knowledge among those in older age and higher year of study were hypothesized because of obtaining more clinical experience (13).

Our study findings showed that knowledge of standard precautions was associated with their compliance. A positive association indicated that an increase of knowledge of standard precautions associated with an increase of compliance supported the previous study findings (19,23). However, a weak correlation coefficient of the current finding suggested that the association between knowledge and compliance of standard precautions was minimal with respect to each other without implying any causality. Further study is required to confirm the causal effects of knowledge and compliance of standard precautions considering the teaching methods, availability of the equipment and so forth.

This study had its methodological strengths, including the use of a previously validated questionnaire and having sufficient sample size which increased the statistical power of the sample. Several limitations of this study were identified. The use of a convenience sampling and in particular, recruitment bias had limited the external validity of this study findings. The data of this study was not normally distributed suggesting increasing the sample size is necessary in future study. Given the cross-sectional study design was used to measure the outcome and the exposures at the same time were unable to measure the causal factors. Nonetheless, this study gave some evidence about the provision of knowledge and compliance of standard precautions among the undergraduate nursing students at early COVID-19 outbreak in Malaysia.

CONCLUSION

By exploring the knowledge and compliance of standard precautions among the undergraduate nursing students, this study established that knowledge and compliance of the standard precautions among the undergraduate nursing students were high. While maintaining the standard precautions is highlighted, age was indeed had a significant association with their knowledge and compliance while year of study and clinical posting experience were likely influenced their knowledge only. It is undeniable that knowledge of standard precautions was important for a proper practice of the standard precautions and associated with the compliance. This suggests the need to have a continuous enforcement by the faculty and hospital particularly during the COVID-19 pandemic to create awareness of the importance of knowledge and compliance of standard precautions among the students. Participation in any specific standard precaution training, and the availability of equipment needed in standard precautions lesson or training should be considered. In future study, replicating this study in a larger sample size involving more than one university is recommended.

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CONFLICT OF INTEREST

The authors declare that there was no conflict of interest in this study.

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