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Knowledge and Practice Towards Cleaning Medical Equipment among Nursing Students in a Malaysian Public University

Inas Zuhairah Jamaluddin[1] & Azmir Ahmad[2]*
[1]Thomson Hospital Kota Damansara, Selangor, Malaysia
[2]Department of Basic Medical Science *for* Nursing, Kulliyyah of Nursing, International Islamic University Malaysia, Pahang, Malaysia

ABSTRACT

Background: Healthcare-associated infections are infections acquired by patients during stay or receiving treatment within healthcare facility. High cases of healthcare-associated infections are contributed by poor medical equipment disinfection among healthcare workers, including nurses. It could be due to poor practice and awareness during their training in universities and colleges. This study aimed to assess the knowledge and practices regarding cleaning medical equipment and their association with socio-demographic characteristics among nursing students at International Islamic University Malaysia Kuantan Campus.
Methods: A total of 252 nursing students were recruited using stratified random sampling. Data of socio-demographic characteristics, knowledge, and practices related to medical equipment disinfection were collected using an online questionnaire. Descriptive analysis and chi-square test were used to assess the level of knowledge and practice on medical equipment contamination and disinfection, and their association with socio-demographic characteristics.
Results: Most respondents (84.1%) have a good level of knowledge regarding disinfecting medical equipment. Meanwhile, 50.8% of respondents have a good level of practice regarding disinfecting medical equipment. Further analysis revealed a significant strong association between academic year and level of knowledge (p<0.05).
Conclusion: The study showed that most of the nursing students have good knowledge and practice regarding medical equipment disinfection. The significant strong association between academic year and level of knowledge indicates the knowledge improvement among nursing students as their academic years increasing. Though, a larger study comprising of more universities are needed to gain the better insight on influence of nursing students on healthcare-associated infections in Malaysia.

Keywords: Equipment; Disinfect; Knowledge; Practice; Nursing

***Corresponding author**
Azmir Ahmad
Department of Basic Medical Science *for* Nursing,
Kulliyyah of Nursing,
International Islamic University Malaysia,
Jalan Sultan Ahmad Shah, 25200 Kuantan,
Pahang, Malaysia
E-mail: azmirahmad @iium.edu.my

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INTRODUCTION

Nosocomial infections, or healthcare-associated infections (HAIs), are infections acquired by patients during hospital stay or receiving treatment within a healthcare facility. It can be spread in numerous ways by direct or indirect contact, including touch, droplets, airborne, shared vehicles, and vector-borne (1). Medical equipment is among the healthcare objects that are susceptible to pathogenic microbial colonization due to frequent contact with patients and healthcare workers (2). Therefore, medical equipment could also play an important role in the cycle of HAIs in the healthcare facility.

HAIs are a major problem in healthcare system in Malaysia, where it counted approximately 13% of prevalence rate (4). A study by Ahmed et al. (5) reported that surgical site infection cases in a general hospital in Malaysia was higher compare to other hospitals in Arab states. Meanwhile, in Southeast Asia, Malaysia was the fourth country with high prevalence rate of HAIs after Indonesia, Cambodia and Vietnam (6). Thus, HAIs need to be very well controlled in Malaysia to improve the healthcare system to a safe level.

Nurses play a crucial role in preventing and controlling the spread of microbial infections from medical equipment. So, nursing students need to be trained on cleaning medical equipment effectively and practice it regularly as part of their working routine. However, the studies that reporting level of knowledge and practice on disinfecting medical equipment among nursing students are scare. A study conducted in 2019 among nursing students from six nursing schools in Iloilo City, Philippines reported that less than one-fourth of nursing students frequently disinfected their blood pressure apparatuses after each patient use and after every 8-hour clinical duty. Meanwhile, less than half of nursing students frequently disinfected their stethoscopes after each use and after every 8-hour clinical duty (3).

Even though the cases of HAIs in Malaysia were recently reported to be at a worrying level, no study investigated the level of knowledge and practice in disinfecting medical equipment among undergraduate nursing students (4). This data is important for having an early understanding of the HAIs issue before further investigation is commenced. Thus, this study was conducted to determine the level of knowledge and practice on cleaning medical equipment among nursing students in a public university in Malaysia and their association with socio-demographical characteristics of the students.

METHODS

This study employed a cross-sectional design to evaluate the knowledge and practice regarding the disinfection of medical equipment among nursing students in International Islamic University Malaysia (IIUM), Kuantan Campus. The nursing students in IIUM from year 1 until year 4 who have started with clinical posting and not on leave of absent during the data collection period were recruited using stratified random sampling. The recruitment was performed by obtaining a list of students' names from a batch representative of each year of study. The list was stratified based on the year of study. Then, the students were selected using an online random sampler (https://www.randomizer.org/). Then, a set of questionnaires adopted from Okaekwu et al. (1) was distributed among the selected students using an online survey which was passed through their batch representatives. The questionnaire consisted of three sections, which were socio-demographic data (gender and year of study), knowledge regarding disinfection of medical equipment, and practices regarding disinfection of medical equipment.

Descriptive statistics was used to analyze the sociodemographic characteristics, knowledge, and practices of the respondents. Inferential statistics, namely Chi-square test, was used to assess the association between socio-demographic characteristics and the levels of knowledge and practice regarding the disinfection of medical equipment. All statistical analyses were performed using Statistical Package for Social Sciences version 28 (IBM, New York, United States).

RESULTS

Sociodemographic Data

A total of 252 respondents were successfully recruited based on the aforementioned inclusion and exclusion criteria. Based on

Table 1, the respondents consisted of 81.7% female students and 18.3% male students. Meanwhile, 26.6% were year 1 students, followed by 28.2% year 2 students, 18.3% year 3 students, and 27% year 4 students.

Table 1: Sociodemographic characteristics of respondents (N=252)

Socio-demographical characteristics	Frequency (*f*)	Percentage (%)
Gender		
Male	46	18.3
Female	206	81.7
Academic year		
1	67	26.2
2	71	28.2
3	46	18.3
4	68	27.0

Knowledge Regarding Disinfection Medical Equipment

Based on **Table 2**, most respondents (97.6%) knew that microorganisms were present on medical equipment. Most respondents (94.8 %) also knew that microorganisms on medical equipment were sources of nosocomial infections. Furthermore, about 95.6% knew that patients can be infected by the use of medical equipment. Besides, 96.4% of respondents knew that disinfecting the medical equipment before using it on the patient can reduce or completely killed the microorganisms. Next, 97.6% of the respondents knew that wearing gloves by healthcare workers can reduce the transmission of microbes between patients and healthcare practitioners. Lastly, 96% of respondents knew that placing a thin, sterile physical barrier in between the patient and medical equipment, such as thermometer and sphygmomanometer, can reduce microbial transmission.

The respondents attained a mean score of 0.96 (±0.09) for the knowledge domain. The lowest mean score was 0.50, while the highest was 1.00. Then, the respondents were classified into two groups based on their mean scores, which were poor knowledge (mean<0.96) and good knowledge (mean>0.96). **Table 3** also shows that 212 (84.1%) of respondents have a good level of knowledge regarding disinfecting medical equipment, while 40 (15.9%) of respondents have a poor level of knowledge.

Table 2: Knowledge regarding disinfection medical equipment (N=252)

Questionnaire	Variable	Frequency	Percentage (%)
Microorganisms are present on the medical equipment	Yes	246	97.6
	No	6	2.4
Microorganisms on the medical equipment are sources of nosocomial infections	Yes	239	94.8
	No	13	5.2
Patients can be infected with the use of medical equipment	Yes	241	95.6
	No	11	4.4
Disinfecting the medical equipment before using on the patient can reduce or completely kill the microorganisms	Yes	243	96.4
	No	9	3.6
Wearing gloves by healthcare workers can reduce the transmission of microbes to/from patients and healthcare practitioners	Yes	246	97.6
	No	6	2.4
Placing a thin sterile physical barrier between the patient and medical equipment such as thermometer and sphygmomanometer can reduce transmission	Yes	242	96.0
	No	10	4.0

Table 3: Level of knowledge regarding disinfection medical equipment (N=252)

Characteristics	Variables	Frequency	Percentage (%)
Knowledge	Good knowledge	212	84.1
	Poor knowledge	40	15.9

Practice Regarding Disinfection Medical Equipment

Table 4 shows that 90.5% of the respondents disinfected the medical equipment, such as stethoscope, thermometer, blood pressure cuff and pulse oximeter, after using it on the patients. Furthermore, 63.9% of respondents disinfected the medical equipment after every use on the patients. Meanwhile, the others claimed that they disinfected the medical equipment after the day's activity (25%), weekly (4.8%), and monthly (2.8%). Most respondents (81.7%) use 70% isopropyl alcohol to disinfect the medical equipment. Regarding procedures the respondents performed before handling the medical equipment, 87.3% of respondents washed their hands, 82.5% wore hand gloves, and 58.7% disinfected the medical equipment. The current study revealed that 25% of respondents used the same medical equipment for patients with obvious skin infections and those without skin infections. The majority of the respondents (94.8%) adopted precautionary measures to avert transmission of microorganisms from infected to non-infected patients, where 85.3% of them used hand sanitizer, followed by using disinfecting medical equipment (84.1%) and using disposable covers (80.6%).

The respondents attained a mean score of 0.72 (±0.14) for the practice domain. The lowest mean score was 0.44, while the highest was 1.28. Then, the respondents were classified into two groups based on their mean scores, which were poor practice (mean<0.72) and good practice (mean>0.72). **Table 5** shows that 128 (50.8%) of the respondents have a good level of practice regarding disinfecting medical equipment, while 124 (49.2%) of the respondents have a poor level of practice.

Association Between Sociodemographic Characteristics and Level of Knowledge and Practice on Medical Equipment Contamination and Disinfection

Table 6 shows that a significantly strong association was found between academic year and level of knowledge (p = 0.05, Phi & Cramer's V=0.176).

DISCUSSION

Knowledge Regarding Disinfection of Medical Equipment

The high percentage of good knowledge (84.1%) among nursing students in the current study was consistent with a previous study at Benin City where 94% of respondents had good knowledge about the role of medical equipment in spreading nosocomial infections (1). However, these findings were differed from another study at Iraq which reported that 57% of their study respondents had medium knowledge about infection control (8).

A study by Kooloos et al. (9) found that active education could maintain knowledge retention, regardless of types of learning method, such as multiple-choice test, traditional lecture, e-learning module and group work. This highlights the importance of continuous education to retain high level of knowledge among healthcare personnel, including nursing students.

In the current study also reported that 95.6% of respondents knew that using contaminated medical equipment could expose the patients to infections, and 96.4% knew that disinfecting equipment before use would decrease or prevent microbial transmission. These results were consistent with a previous study which reported that 92.8% of healthcare staff were aware that medical equipment might potentially spread hospital-acquired infections (7). Even though no longitudinal studies reported the knowledge retention among students until their career life, these separated studies could possibly indicate the capability of the students to maintain their level of knowledge. A longitudinal study is necessary to prove this hypothesis.

Table 4: Practice regarding disinfection medical equipment (N=252)

Questionnaire	Variable	Frequency	Percentage (%)
Do you disinfect the medical equipment, such as a stethoscope, thermometer, blood pressure cuff, pulse oximeter, after using it on the patient?	Yes	228	90.5
	No	24	9.5
When did you disinfect it last?			
	Today	84	33.3
	Yesterday	74	29.4
	Last week	39	15.5
	2 weeks ago	14	5.6
	Last month	19	7.5
	Never disinfected before	22	8.7
How often do you disinfect?	After every use on a patient	161	63.9
	After the day's activity	63	25.0
	Weekly	12	4.8
	Monthly	7	2.8
	Never disinfected before	9	3.6
What disinfectant did you use?	70% Isopropyl alcohol	206	81.7
	Hydrogen peroxide	37	14.7
	Izal	1	0.4
	Wash with soap water	43	17.1
	Hand sanitizer	116	46
	None	2	0.8
What do you do before handling the medical equipment?	Wash your hand	220	87.3
	Wear hand glove	208	82.5
	Disinfect the medical equipment	148	58.7
	None	0	0
Do you use the same medical equipment (blood pressure, stethoscope, thermometer) between patients with an obvious skin infection and patients without skin infections?	Yes	63	25
	No	189	75
Do you adopt any precautionary measures to avert transmission from infected to non-infected patients?	Yes	239	94.8
	No	13	5.2
What precautionary measure do you take to avert this transmission?	Use disposable cover	203	80.6
	Disinfect medical equipment	212	84.1
	Use hand sanitizer	215	85.3
	None	4	1.6

Table 5: Level of practice regarding disinfection medical equipment (N=252)

Characteristics	Variables	Frequency	Percentage (%)
Practice	Good practice	128	50.8
	Poor practice	124	49.2

Table 6: Association analysis between demographic characteristics with level of knowledge and practice

Sociodemographic data	Level of knowledge		Level of practice	
	χ^2	*p*-value	χ^2	*p*-value
Gender	0.097	0.755	1.205	0.272
Academic year	7.805	0.050	0.495	0.920

Practice Regarding Disinfection of Medical Equipment

The current study showed that 90.5% of respondents cleaned their medical devices, like thermometers, blood pressure monitors, pulse oximeters, and stethoscopes, after used on the patients. Comparatively, a study conducted among nursing students in the Philippines found that only 9.4% of the students routinely cleaned their blood pressure monitors, and 17.3% cleaned their stethoscopes after each use and every eight hours of clinical duty (3). The current study also revealed various frequency of disinfection practices, where 25% disinfected after the day's activities, 4.8% weekly, and 2.8% monthly. These findings are consistent with a previous study where only 19.8% of healthcare workers regularly disinfected sphygmomanometers, despite 94% being aware of the risks (1). The inconsistency between the knowledge and practice in this issue highlights the need for regular training, awareness campaigns, and enforcement of disinfection practices.

Association Between Sociodemographic Characteristics and Level of Knowledge and Practice on Medical Equipment Contamination and Disinfection

There was a significant strong association between the academic years and level of knowledge (p = 0.050, Phi & Cramer's V = 0.176). This result suggests that the level of knowledge among students might be influenced by their years of study. The highest percentage of good knowledge was observed among third-year students (95.7%), followed by second year (84.5%), fourth-year (83.8%), and first-year students (76.1%). This trend indicates that as the students are progressively going through their educational program, their knowledge regarding medical equipment contamination and disinfection tends to improve. The decreased in good knowledge that was observed in fourth-year students compared to third- year students may warrant further investigation to identify a potential reason for this decline.

ETHICAL MATTERS

The protocol of study was reviewed and approved by IIUM Research Ethic Committee (IREC(UG) 2024-024). Informed consent was obtained from the respondents prior to embarkment into the study. Their information was kept confidential, and their identities were kept anonymously.

CONCLUSION

The study objectives were successfully achieved. The study found that the majority of the nursing students have good knowledge regarding disinfection of medical equipment, while more than half of the nursing students have a good level of practice regarding disinfection of medical equipment. Moreover, a significant association was found between academic years and level of knowledge regarding disinfection of medical equipment. Continuous education and closed monitoring from clinical instructors who accompany the nursing students are important in ensuring the knowledgeability of the students and consistent practice among them in cleaning the medical equipment every time after use.

LIMITATIONS AND RECOMMENDATIONS

The study has several limitations that should be acknowledged. The study's cross-sectional approach only provides a point in time, making it impossible to draw conclusions

about causality or how knowledge and practices develop over time. Social desire bias in self-reported practice is another limitation in the current study. The tendency to underreport the practice in disinfecting medical instrument would affecting the real practice among the nursing students and mislead the result interpretation. Improvement of these issues in the future studies are recommended to gain a better insight on preparedness of nursing students for their career life in hospitals in terms of knowledge and practice of disinfecting medical instrument.

CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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AUTHOR CONTRIBUTIONS

IZJ: writing the manuscript, data collection and data analysis.
AA: reviewing the manuscript and finalizing and editing the manuscript.

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