ORIGINAL ARTICLE

Knowledge and Practices of Nurses on the Prevention and Control of Healthcare-acquired Infections in a Private Tertiary Hospital in Baguio City

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ABSTRACT

Background. Healthcare-acquired infections (HAIs) are adverse events brought about by non-compliance of the healthcare staff to set of infection prevention and control (IPC) standards. Consequently, additional medical costs, increased mortality and morbidity rates, and decreased quality of life among patients can happen. As valuable players in preventing and controlling HAIs, nurses must have good knowledge and strict compliance with infection control; however, recent evidence suggests that nurses may need more knowledge or better integration into practice. Nurses' degree of knowledge and practice in preventing and controlling HAIs and factors influencing them should be determined to provide solutions appropriately.

Objectives. The study specifically sought answers to the following questions: (1) What is the level of knowledge of nurses in the prevention and control of HAIs? (2) What is the degree of practice of nurses in the prevention and control of HAIs? (3) Is there a significant relationship between nurses' knowledge level and degree of practice in the prevention and control of HAIs? (4) What are the facilitating and hindering factors that affect nurses' practice in the prevention and control of HAIs?

Methods. The study utilized a quantitative descriptive correlational design. The study was conducted from May to June 2023 at a private tertiary hospital in Baguio City. The study included 128 nurses who fit the inclusion criteria. The respondents were asked to answer three questionnaires, and the data were statistically treated using mean, Spearman Rank correlation, frequency, percentage, and rank distribution.

Results. The study found that nurses possess good knowledge and a suboptimal degree of practice in preventing and controlling HAIs. The results showed that no significant relationship existed between nurses' knowledge level and degree of practice in preventing and controlling HAIs. Perceived personal benefits and organizational encouragement were seen to primarily facilitate the prevention and control practices of nurses. The primary hindrance identified was workload due to staff shortage, poor dissemination of guidelines, and personal discomfort associated with the use of PPE.

Conclusions. A good level of knowledge is a derivative of learnings obtained through various educational modalities and these strategies are considered effective means of knowledge formulation. However, created knowledge without actual application into practice results in overuse of unhelpful interventions. To avoid the unnecessary effects of ineffective knowledge translation, a multifactorial consideration is necessary to identify other factors that may influence the practices of nurses on HAI prevention and control because knowledge does not solely improve or worsen actual practices. Identified facilitating factors should be supported, and hindering factors should be addressed. Further recommendations based on the study results include strengthening existing programs and policies, and developing accessible materials to improve the present practices of nurses.

Keywords: nurses' knowledge, nurses' practice, infection prevention, infection control, healthcare-acquired infections

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INTRODUCTION

Healthcare-acquired infections (HAIs), known as nosocomial infections, remain a global public health threat amid various health crises. HAIs are conditions not present at admission;[1] they occur in a patient during care in a hospital or other healthcare facility[2]. HAIs are acquired due to healthcare services received or from the hands of nursing and medical staff. HAIs may include device-associated infections and healthcare-acquired pneumonia.[3] HAIs may lead to quality-of-life-related consequences such as pain, discomfort, and psychological trauma. HAIs lead to increased societal medical costs attributed to a more extended hospital stay,[4] and excessive use of antibiotics[5]. In a more significant representation, HAIs substantially increase mortality and morbidity rates.[6] Despite efforts, no country has successfully eliminated the acquisition risk or the probability of getting exposed to or infected by HAIs;[6] thus, it remains a significant issue in every healthcare sector.

In the United States, 1.7M cases of HAIs happen each year, and approximately 99,000 die.[7] The undesirable consequences of HAIs affect high-income countries but are more severe in developing ones. In first-world countries, seven in every 100 patients develop HAIs, and a higher occurrence of 15 in every 100 patients is observed in developing ones.[7] In the Philippines, 28% of patients develop device-associated HAIs,[8] and one in every four to almost half of the patients inside the intensive care unit dies because of sepsis or organ dysfunction[7]. The rate of general compliance with proper hand washing as a preventive measure for HAIs remains very low[9] with an adherence rate of 38.7%[10]. The statistics clearly show that healthcare facilities in low- and middle-income countries, including the Philippines, face a significant challenge in infection control.[11]

The challenges encountered in infection control are highly associated with the lack of participation among healthcare providers, the lack of quality improvement projects, and the poor integration of evidence-based strategies into practice. As part of the healthcare team, nurses play a unique and essential role in preventing HAIs.[12] Nurses must have good knowledge and strict compliance with infection control guidelines;[13] however, works of literature state otherwise. Evidence shows that a gap remains observable despite efforts to improve knowledge and practice among nurses on preventing and controlling HAIs.

Literature suggests nurses possess inadequate knowledge and poor practice in general infection prevention strategies.[14] Several studies show that nurses' knowledge regarding HAIs prevention has been found insufficient.[15-17] The compliance with prevention and control interventions, which include standard precautions, application of care bundles, and transmission-based precautions, was also rated poor.[18] This situation warrants attention to help successfully eliminate the risk of HAIs. Exploration of either inadequacy in knowledge or practice integration should be determined to provide possible solutions appropriately.

Most literature suggests that infection prevention and control failure is associated with poor hand washing habits. Simple hand washing can reduce HAIs' prevalence substantially.[19] International and national organizations support hand washing as the most effective measure in reducing the incidence of HAIs.[20] Despite acknowledging the vital role of hand washing, overall compliance is less than optimal in many healthcare settings worldwide.[21]

In contrast to having a knowledge deficit, results in a study show that all nurses have a high knowledge of the importance of proper hand washing.[12] Still, only 6% perform hand washing before patient contact.[12] In a comparable study, results show that nurses have good knowledge of hand washing and the use of gloves, but there is poor practice and adherence to infection control guidelines.[20] The results of the abovementioned studies suggest that despite being knowledgeable, one may score less than satisfactory in prevention practices.[22] Good knowledge does not automatically equate to good practice, and various factors may have influenced poor compliance with interventions.

Compliance with infection control guidelines remains multifactorial. The facilitating and hindering factors to adherence to infection control guidelines may be intrinsic or extrinsic. Intrinsic factors are innate human characteristics which includes personal qualities, degree of motivation, degree of awareness, and resistance to change.[23] The compliance with infection control practices is greatly affected by extrinsic factors or those that are found within the environment such as the availability of resources, the volume of patients, time pressure, the workload vested in nurses, and organizational support.[24] A significant positive correlation was observed between nurses' degree of knowledge and compliance with infection prevention guidelines and the organizational support provided.[25] A poor translation of knowledge into practice is a gap that requires in-depth exploration and a situation where a solution is warranted. Identifying factors that could have influenced the degree of knowledge and compliance to infection and control strategies against HAIs should be identified to strengthen facilitating factors and address barriers.

Effective infection prevention entails regular assessment, training, and performance feedback. The best way to prevent HAIs is to assess the professional development of nursing staff.[26] Assessment can help develop necessary guiding principles and allow in-service training that has the potential to increase knowledge and subsequently improve the practices of nurses on HAIs prevention and control. In the present setting, there remains a significant number of HAIs, and actual clinical practice supports the presented works of literature on the poor compliance of nurses to prevention strategies; this situation requires investigation to improve actual practices of nurses on infection prevention and control.

The presented literatures clearly state that the level of knowledge, degree of practice, their correlation, and the factors affecting nurses' practice in preventing and controlling HAIs vary across healthcare settings. Despite repeated investigations in different countries, this study was conducted to determine the actual scenario in the chosen locale. Determining the actual scenario will help the education and training plan programs to improve nurses' present knowledge and practices on HAIs prevention and control in the chosen locale. Further, limited implementation of hospital programs, poor compliance with policies, and minimal translation of nursing knowledge and best practices in preventing HAIs were also observed in the chosen institution, prompting the researcher to conduct the study.

OBJECTIVES

This study determined the knowledge and practices of nurses in the prevention and control of HAIs. Specifically, it sought answers to the following questions:

1. What is the level of knowledge of nurses in the prevention and control of HAIs?
2. What is the degree of practice of nurses in the prevention and control of HAIs?
3. Is there a significant relationship between nurses' knowledge level and degree of practice in the prevention and control of HAIs?
4. What are the facilitating and hindering factors that affect nurses' practice in the prevention and control of HAIs?

METHODS

Research Design

The study utilized a quantitative descriptive correlational design.

Locale and Population

The study was conducted from May to June 2023 at a private tertiary hospital in Baguio City. The locale is a Level III private medical center and training hospital in the Cordillera Administrative Region with 120 bed capacity. The hospital is committed to raising the quality of care and the general standards of healthcare practice to produce highly competent, committed, creative, and ethical professionals. The locale was chosen for the study, considering the organizational characteristics. The hospital remains a teaching and research-oriented institution; thus, conducting this study aligned with its organizational objectives of producing more competent healthcare providers who would provide quality patient care. The study has the potential to develop specific nurse-initiated HAIs prevention programs, thus empowering its objective of becoming a self-reliant center for excellence for research and training. At the time of data collection, less than one percent was documented in the Infection Prevention and Control (IPC) section reports from 2020 to 2022. Despite the low documented HAIs rates in the chosen locale, there are inconsistencies with the actual clinical setting. The Infection Prevention and Control Committee (IPCC) considers the possibility of undocumented cases or under-reported incidents of HAIs.

The respondents were the registered nurses working at the chosen institution who met the following inclusion criteria: (a) have a valid/non-expired license, (b) able to understand and write English, (c) render direct care to patients, and (d) willing to participate in the research study.

At the time of data collection, the hospital had 139 nurses employed. A total of 11 nurses were excluded from the study for not meeting the inclusion criteria. The hospital nurses excluded were the chief nurse, the assistant chief nurses, the nurse supervisors, the infection prevention and control nurse, nurses on leave, and the researcher. A total of 128 nurses were left eligible to participate in the study. The study had a 100% response rate. There were no invalidated questionnaires due to missed items, and no respondents refused or withdrew from the study.

Data Gathering Tools

The study utilized three tools. The first tool is a self-made questionnaire consisting of items from a relevant review of literature from similar studies. The questionnaire aimed to determine the degree of knowledge of nurses in the prevention and control of HAIs. The tool has a total of 15 items. The questions included were dichotomous and answerable by true or false. One point was given for every correct response, while incorrect answers were given zero. For the scale of interpretation, the cut-off scores were patterned from the relevant review of literature from similar studies. Scores greater than or equal to 75% were classified good, 50% to 74% were moderate, and less than 50% were poor. The questionnaire was subjected to content validity and reliability tests. Based on the calculations, the S-CVI based on I-CVI Ave (0.96), S-CVI Ave based on proportion relevance (0.96), and S-CVI UA Ave (0.87), the knowledge on HAIs questionnaire has achieved a satisfactory level of content validity. After conducting a test-retest, the reliability score for knowledge on the HAIs questionnaire was 0.76, indicating an acceptable level of reliability.

For the second tool, the study adopted a questionnaire to determine the degree of practice of nurses in preventing and controlling HAIs. The Compliance with Standard Precaution Scale (CSPS) was used. The CSPS was developed in 2010 following the guidelines of the standard precautions of the World Health Organization.[27] The CSPS was first used to measure compliance with the current infection control practice of clinical nurses who are frontline healthcare professionals providing 24-hour direct care in clinical settings.[27] The validity score is 0.90, and the Cronbach alpha score is 0.80. The psychometric properties of the adopted tool still apply to the population used in this study due to the similar characteristics with the first population tested on of

being a nurse in the clinical area who renders 24-hour patient care. Sixteen out of 20 items are positively stated, while four are negatively stated. The response format of CSPS is a 4-point adjectival scale. Only the "always" option in positively worded items and the "never" option in negatively worded items were given a score of one. The total scores ranged from 0 to 20. For the scale of interpretation, scores greater than or equal to 90% were classified as optimal, 80% to 89% were satisfactory, 50% to 79% were suboptimal, and less than 49% were poor.

The third tool used is a self-made questionnaire that identified the facilitating and hindering factors that affect nurses' practice in the prevention and control of HAIs. The items included were from the review of relevant related works of literature, and were dichotomous and answerable by yes or no. The self-made questionnaire was subjected to content validity and reliability tests. Based on the calculations, the tool identifying factors affecting nurses' practice on HAIs also met a satisfactory level of content validity, as evident by S-CVI based on I-CVI Ave (0.94), S-CVI Ave based on proportion relevance (0.94), and S-CVI UA Ave (0.81). After conducting a test-retest, the reliability score for the tool identifying the factors affecting nurses' practice on HAIs was 0.82, showing an acceptable level of reliability.

The following experts were consulted for the validity test:

1. An infectious disease specialist and the chairperson of the chosen institutions' infection prevention and control committee (IPCC).
2. An infection prevention and control nurse (IPCN) from the chosen institution.
3. A faculty with expertise in the field of research and statistics.

The experts were asked to rate each question from one to four: one as not relevant, two as needing revision, three as relevant, and four as very relevant. The comments and suggestions from the experts were carried out to enhance the tool further. The content validity index was computed based on the total number of items rated three and four. Scores of 0.70 and above are valid. The researcher performed a test-retest reliability of the tool on ten respondents from other institutions who met the inclusion criteria. The test-retest was done through an online modality using Google Forms. The self-made questionnaire was floated to the same group of nurses twice, one week apart. Scores obtained from two different times were statistically treated using Pearson's correlation coefficient to measure the strength of the linear relationship. A score of 0.70 and above is considered reliable.

Data Gathering Procedure

An approval to conduct the study in the chosen institution was sought from the Research Ethics Committee (REC), then from the hospital administrator. After approval was sought, a research assistant (RA) was hired to maintain the objectivity of processes.

The RA underwent face-to-face briefing and training from the researcher on ensuring correct steps in data gathering and adequately responding to data gathering issues that may arise. After the briefing and training process, the RA obtained the informed consent of the study respondents through face-to-face visits to their workstations. The RA floated the questionnaires using a paper-and-pen method. When answering the questionnaires, a distance from the study respondents was maintained to give them privacy, and 15 to 20 minutes were provided to answer the research tools. Once the respondents were done answering, questionnaires were retrieved and checked for completeness. The RA immediately returned incomplete questionnaires. The respondents were given a few minutes to complete answering missed item/s while maintaining distance from them. After completing the returned questionnaires, they were immediately collected and rechecked for completeness. After ensuring all items were answered, the respondents were thanked for their time and willingness to participate.

Study respondents were provided with a chance to withdraw from the research at any time voluntarily, provided the researcher was informed.

Statistical Treatment

To address the first and second research questions, the measure of central tendency mean was used. Spearman Rank correlation was used to answer the third research question. Frequency, percentage, and rank distribution were used to determine factors that affect nurses' practice in preventing and controlling HAIs. A 5% level of significance was employed for analysis.

Ethical Considerations

Ethical principles were considered throughout the research process. The researcher sought approval from the Research Ethics Committee and then from the hospital administrator before data collection. Ethical principles of informed consent, anonymity, confidentiality, privacy, safety considerations, fair treatment, and autonomy were observed and maintained for the best interests of the respondents.

RESULTS

Table 1 shows the total number of nurses working in the locale and their characteristics. At the time of data collection, there were 139 nurses employed. One hundred ten (79.14%) were females, and 29 (20.86%) were males. Only three nurses (2.16%) had their master's degrees. Eleven nurses were excluded from the study. A total of 128 nurses were left eligible to participate in the study.

Table 1. Sociodemographic Characteristics of Study Respondents

Nursing Unit	Total number of nurses		Male	Female	With valid license	With Master's degree	Eligible study respondents
	Staff Nurse	Head Nurse					
OB Gyne	8	1	0	9	9	0	9
Palliative – Coronary	8	1	3	6	9	0	9
PR Deluxe	10	1	2	9	11	1	11
Surgery	11	1	1	11	12	0	12
Pediatrics	8	1	0	9	9	0	9
Medical ICU	10	1	4	7	11	0	11
Neuro ICU	4	0	1	3	4	0	4
Nursery	3	1	0	4	4	0	4
Medical	11	1	2	10	12	0	12
Emergency	14	1	3	12	15	0	15
OR Complex	24	1	9	16	25	0	25
OPD	1	0	0	1	1	0	1
Heart Station	2	0	0	2	2	0	2
Endoscopy	4	0	2	2	4	0	3
General Reliever	1	0	0	1	1	0	1
Nurse Supervisors	4		1	3	4	0	0
Assistant Chief Nurse	2		0	2	2	1	0
Chief Nurse	1		1	0	1	1	0
Infection Control Nurse	1		0	1	1	0	0
On leave	2		0	2	2	0	0
Total			29	110	139	3	128

Level of Knowledge of Nurses on the Prevention and Control of HAIs

This study evaluated 128 nurses to determine their level of knowledge on the prevention and control of HAIs. Out of 128 nurses, 85 (66.41%) nurses had good knowledge, 42 (32.81%) nurses had moderate, and one (<1%) had poor knowledge of the prevention and control of HAIs. Overall, nurses in this study have good knowledge in preventing and controlling HAIs. The results presented in Table 2 show that the mean level of knowledge is 12.02 which is equivalent to 80.13%, and the interpretation is "Good". The standard deviation of 1.57 implies that the scores are relatively close to the mean, suggesting a degree of consistency in the knowledge level among the nurses.

The overall knowledge level is good. However, the dimensions of standard precautions need to be considered. Table 2 shows the responses of nurses in every item in the knowledge on healthcare-acquired infections questionnaire. As reflected, 100% of nurses in this study are knowledgeable about preventing cross-infection through handwashing to decrease the transmission of pathogens, as evidenced by the responses in items three and nine. Despite having good knowledge of handwashing, a number of nurses remain outdated in using alcohol rubs instead of soap and water for hand hygiene, as seen in their responses in item five. Only 77 nurses knew that using an alcohol-based antiseptic for hand hygiene is as effective as soap and water if hands are not visibly dirty. Almost 40% of nurses still believe that soap and water remain to be the choice for hand hygiene. According to the Centers for Disease Control and Prevention, unless hands are visibly soiled, an alcohol-based hand rub is preferred over soap and water due to better compliance. Hand rubs are generally less irritating to hands and require fewer resources for an effective method of cleaning hands.[28]

In contrast to the findings of a study stating that most nurses have good knowledge on the use of gloves,[20] nurses in this study showed a low level of knowledge on using personal protective equipment, specifically gloves, as seen in the responses in item one. The World Health Organization emphasizes that gloves do not entirely protect against hand contamination.[10] Pathogens may gain access via minor defects in gloves; hence, proper hand washing remains the basis to guarantee hand decontamination after glove removal. Despite nurses' misconceptions on the extent of protection gloves provided, fortunately, most nurses in this study, accounting for 96.88%, were knowledgeable that gloves should not be reused with multiple patient contacts, as seen in the responses in item number 10. Similarly, the World Health Organization emphasizes that gloves should be single-use and discarded immediately.[10]

As seen in item 13, only 47.66%, less than half of the nurses, were knowledgeable about sharp disposal. Out of 128

Table 2. Level of Knowledge of Nurses on the Prevention and Control of HAIs

Practice Items	CR	% CR	$\bar{X}$	$\bar{X}$ in %	σ	IN
Gloves provide complete protection against acquiring or transmitting infection.	50	39.06	12.02	80.13	1.57	Good
Healthcare-associated pathogens are also found on intact patient skin.	123	96.09				
Washing your hands with soap or an alcohol-based antiseptic decreases the risk of transmission of healthcare-acquired pathogens.	128	100				
If my hands are not visibly dirty, there is no need to wash my hands prior to patient contact.	119	92.97				
Use of an alcohol-based antiseptic for hand hygiene is as effective as soap and water if hands are not visibly dirty.	77	60.16				
Gloves should be worn if blood or body fluid exposure is anticipated.	125	97.66				
When using alcohol-based antiseptics, I should keep rubbing my hands until dry.	98	76.56				
There is no need to wash hands before doing procedures that do not involve bodily fluids.	120	93.75				
Hand hygiene should be performed before and after direct patient contact.	128	100				
I can wear the same pair of gloves for multiple patients as long as it is not visibly contaminated.	124	96.88				
Wearing gloves does not replace the need for hand washing.	99	77.34				
Inappropriate disinfection procedures increase the risk of getting healthcare-acquired infections among healthcare workers.	121	94.53				
It is safe to recap needles before disposing them on the sharp's container.	61	47.66				
Infectious wastes such as body fluids are disposed on a black bag.	104	81.25				
All spills (body fluids or medications) should be disinfected with alcohol.	62	48.44				

CR = Correct responses; % CR = Percentage of correct responses; $\bar{X}$ = mean; $\bar{X}$ in % = mean in percentage; σ = Standard Deviation; IN = Interpretation

nurses, 61 nurses had the correct response, which indicates that the remaining sixty-seven nurses have a misconception that it is safe to recap needles before disposing of them in appropriate containers, which trusted organizations do not advise.[29]

Nurses in this study also needed to gain knowledge on the proper decontamination of spills. Only 62 out of 128 nurses obtained a correct response in item 15, indicating that the remaining 66 (51.56%) nurses have a misconception that all spills, whether medications or body fluids, should be disinfected with alcohol. Sodium hypochlorite is recommended in managing blood spillage and when *Clostridium difficile* is suspected.[2]

The results show good knowledge on the prevention and control of HAIs. However, there are dimensions of standard precautions such as use of personal protective equipment, sharp disposal, and decontamination of spills where nurses need to be more knowledgeable, which requires focused interventions.

Degree of Practice of Nurses on the Prevention and Control of HAIs

This study evaluated 128 nurses to determine their degree of practice in the prevention and control of HAIs. Out of 128 nurses, one (<1%) nurse had optimal practice, 28 (21.88%) nurses had satisfactory, 83 (64.84%) had suboptimal, and 16 (12.5%) had poor practice in preventing and controlling HAIs. Overall, nurses in this study have a suboptimal degree of practice in preventing and controlling HAIs. The results presented in Table 3 show that the mean degree of practice is 12.76 which is equivalent to 63.8%, and the interpretation is "Suboptimal." The standard deviation of 3.17 suggests variability in the scores, indicating differences in the degree of practice among the nurses.

Table 3 also reflects the responses of nurses in the Compliance with Standard Precaution Scale (CSPS). Each item in the CSPS corresponds to a specific dimension of standard precaution. Items 7, 10, 13, 14, 15, and 16 in the CSPS assesses the use of personal protective equipment (PPE), which were mostly reported with the best response with a mean score of 95.

Analyzing the responses in the practice items specifically on hand hygiene, only 94 nurses meticulously wash their hands in between patient contacts. Washing hands between patient contacts is part of the five moments of hand hygiene recommended by the World Health Organization to prevent infection and cross contamination.[10] Also, as seen in the responses in item two, only 43 nurses use other solutions besides water for hand hygiene. Hand rubs such as alcohol and sanitizers are recommended as effective for hand hygiene instead of water only.[28] Additionally, as seen in the responses in item three, only 53 nurses use hand rubs as an alternative when their hands are not visibly soiled—the responses in items two and three show that there remains to be bygone practice on hand hygiene with the use of approved hand rubs.

Further analyzing the dimensions of standard precautions, the lowest degree of practice is reported on sharp and waste disposal with mean scores of 49.7 and 41, respectively, based

on the responses obtained in items 4, 5, 6, and 17. As seen in the responses in practice item four, only 16 nurses never recap used needles after giving an injection. As seen in the responses in item six, only ten nurses knew that sharps boxes should not be waited full before disposal. The remaining 118 nurses have a misconception that sharps boxes should only be disposed of when they are full. According to FDA, sharp containers should be discarded when it is ¾ full and not have it overfilled to prevent accidental injuries and contamination.[29] Aside from safe sharp disposal practices, nurses may also need to be reminded of the proper color coding of waste bags for appropriate disposal. As seen in their responses in item 17, only 41 nurses practice proper disposal of contaminated wastes with secretions of patients. Poor practice on sharp and waste management can lead to chronic blood-borne infections, and food and waterborne diseases, contributing to poor health outcomes. Thus, improvements in sharp and waste management practices should be made.

Correlation Analysis for Level of Knowledge and Degree of Practice of Nurses on the Prevention and Control of HAIs

The results in Table 4 show the correlation coefficient between the level of knowledge and the degree of practice is -0.0904, suggesting a very weak negative correlation. This means that there is almost no linear relationship between the two variables. The negative sign indicates that as the level of knowledge increases, the degree of practice tends to decrease slightly, but the correlation is so weak that it is practically negligible.

The p-value associated with the correlation coefficient is 0.31, greater than the conventional significance level of 0.05. This indicates that the correlation is not statistically significant. In other words, the observed correlation between the level of knowledge and the degree of practice is likely due to chance rather than a trustworthy relationship between the variables.

Table 3. Degree of Practice of Nurses on the Prevention and Control of HAIs

Practice Items	BR	% BR	$\bar{X}$	$\bar{X}$ in %	σ	IN
I wash my hands between patient contacts.	94	73.44	12.76	63.8	3.17	Suboptimal
I only use water for hand washing.	43	35.59				
I use alcoholic hand rubs as an alternative if my hands are not visibly soiled.	53	41.41				
I recap used needles after giving an injection.	16	12.50				
I put used sharp articles into sharps boxes.	123	96.09				
The sharps box is disposed only when it is full.	10	7.81				
I remove Personal Protective Equipment (PPE) in a designated area.	109	85.16				
I take a shower in case of extensive splashing even after I have put on personal protective equipment.	79	61.72				
I cover my wound(s) or lesion(s) with waterproof dressing before patient contacts.	95	74.22				
I wear gloves when I am exposed to body fluids, blood products, and any excretion of patients.	121	94.53				
I change gloves between patient contacts.	102	79.69				
I decontaminate my hands immediately after removal of gloves.	106	82.81				
I wear a surgical mask alone or in combination with goggles, face shield, and apron whenever there is a possibility of a splash or splatter.	64	50				
My mouth and nose are covered when I wear a mask.	121	94.53				
I reuse a surgical mask or disposable personal protective equipment (PPE).	78	60.94				
I wear a gown or apron when exposed to blood, body fluids or any patient excretions.	77	60.16				
Waste contaminated with blood, body fluids, secretion, and excretion are placed in red plastic bags irrespective of the patient's infection status.	41	32.03				
I decontaminate surfaces and equipment after use.	85	66.41				
I wear gloves to decontaminate used equipment with visible soils.	112	87.50				
I clean up spillage of blood or other body fluids immediately with disinfectants.	104	81.25				

BR = Best responses; % BR = Percentage of best responses; $\bar{X}$ = mean; $\bar{X}$ in % = mean in percentage; σ = Standard Deviation; IN = Interpretation

Table 4. Correlation Analysis for Level of Knowledge and Degree of Practice on the Prevention and Control of HAIs

Variable 1	Variable 2	Correlation Coefficient	Qualitative Description	*p*-value	Interpretation
Level of Knowledge	Degree of Practice	-0.0904	Very Weak, Negative Correlation	0.31	Not Significant

Factors Affecting Nurses' Practice in the Prevention and Control of HAIs

The results presented in Table 5 provide information about the facilitating factors that affect nurses' practice in the prevention and control of HAIs. In this study, perceived personal benefits (96.88% to 100%) and organizational encouragement (93.75%) were seen to facilitate prevention and control practices on HAIs primarily.

The results presented in Table 6 provide information about the hindering factors that affect nurses' practice in the prevention and control of HAIs. The leading hindrance nurses reported was the workload due to staff shortage (47.66%). The second hindering factor nurses reported was poor dissemination of guidelines (18.75%). The third leading hindering factor reported by nurses is personal discomfort (17.97%) related to the use of personal protective equipment (PPE).

Table 5. Facilitating Factors Affecting Nurses' Practice in the Prevention and Control of HAIs

Facilitating Factors	f	%
I apply infection control practices because I know their benefits.	128	100
I am doing infection control practices for my own good.	124	96.88
The institution encourages me to promote infection control all the time.	120	93.75
The infection control guidelines in the institution are clearly stated and explained.	111	86.72
I am concerned that overlooking infection control guidelines can greatly impact my evaluation.	103	80.47
I apply standard precautions because it is part of my job.	65	50.78
I am personally motivated to apply infection control.	64	50
Merits are given to nurses who apply proper infection control strategies.	63	49.22

Table 6. Hindering Factors Affecting Nurses' Practice in the Prevention and Control of HAIs

Hindering Factors	f	%
Workload due to the staff shortage makes it difficult for me to take standard precautions.	61	47.66
Infection control guidelines are poorly disseminated.	24	18.75
I don't feel comfortable using personal protective equipment.	23	17.97
Resources such as personal protective equipment and antibacterial soaps are not available.	22	17.19
I do not have enough time to apply standard precautions.	19	14.84
I am lazy to use standard precautions.	13	10.16
There are no infection control policies available in the institution.	7	5.47
I don't know anything about standard precautions.	4	3.13

DISCUSSION

An essential factor for a successful decline in HAIs rates is ensuring that nurses have adequate knowledge and strict compliance with infection prevention and control interventions. The findings of this study are comparable with other studies conducted in different parts of the world showing an acceptable level of knowledge among nurses on infection control. Studies conducted in Nigeria[19] and Ethiopia[30] show that nurses' overall knowledge of HAIs prevention was 90% and 84.5%, respectively, suggesting good knowledge. In the present study, the overall level of knowledge was 80.13%, which is slightly lower. The difference might be due to difference in clinical environment.

The good level of knowledge of nurses in this study could have been influenced by the context of the study, wherein the time of data collection was conducted after the Coronavirus Disease pandemic. The pandemic has taught us to be more meticulous and vigilant when it comes to the application of infection control strategies. If the study had been done at the beginning of the pandemic, the nurses could have scored lower. The start of the pandemic showed the ignorance of most when it comes to applying infection control strategies. It was the time when everybody was uncertain about what precautions to take until it was further enhanced through rigorous research as we moved forward through the pandemic.

Aside from the time of data collection, another factor that could have positively influenced the level of knowledge of nurses is the present setting and its practices in encouraging its people. The institution frequently reminds nurses to participate in Zoom meetings and conferences to improve nurses' knowledge of infection prevention and control. The personal motivations and efforts supplemented by the organizations' support made a successful creation of knowledge among nurses in infection control, particularly with HAIs, as evidenced by the high level of knowledge among nurses.

The knowledge of nurses on the dimensions of standard precautions are greatly affected by the activities, resources, and availability of reminders in the present setting. The solid understanding of nurses on the importance of handwashing could have been positively affected by the availability of reminders posted in appropriate areas, activities involving handwashing such as the creation of video clips per nursing unit, and environmental factors that maximize handwashing among nurses such as the abundance in antimicrobial soaps, alcohol rubs, and free-flowing water supply. The lack of reminders posted inside the hospital premises could have affected the low level of knowledge regarding the extent of protection gloves can provide. Unlike handwashing, the use of gloves is minimally emphasized. When it comes to sharp disposal, anywhere else, recapping sharps using the one-hand method has been long practiced. Today, novice nurses which are growing in population, when they observe senior nurses recap sharps using this technique leave an impression that

it is the correct procedure. Aside from usual practice and direct observation by the novice nurses, there is a need for reminders to be posted in appropriate areas, advising them that sharps should not be recapped. The lack of knowledge on spill management was aggravated because the use of sodium hypochlorite is not well advertised in the institution. Unlike alcohol, sodium hypochlorite is not readily available. The amount of gallons of alcohol everywhere and the emphasis on its effectiveness may have led to the misconception among the nurses that it is also the prescribed agent for managing all spills.

A good level of knowledge becomes useless if not transferred into practice. Knowledge not transferred into practice leads to adverse patient outcomes.[31] In this study, the degree of practice is suboptimal suggesting a need for interventions or initiatives to improve and standardize the implementation of preventive measures to enhance patient safety and reduce the risk of HAIs. The higher variability in the scores further highlights differences in the nurses' degree of practice. The non-congruence of the level of knowledge and degree of practice was seen in previous studies.[15,22,30] Similarly, present situations indicate no actual application of taught information despite available opportunities within the institution.

Despite the overall suboptimal degree of practice in infection control, analyzing the responses on the CSPS scale, some dimensions of infection control showed good practice. Items in the CSPS about using personal protective equipment (PPE) were mostly reported with the best response. The positive practice of using PPE may be due to the wide availability of masks, gloves, gowns, and other protective equipment in the institution.

Studies around the world mentioned that knowledge and practice in infection control are closely associated and demonstrate a positive correlation,[32] which suggests that improvement of practice in HAIs control and prevention becomes successful through empowering nurses' level of knowledge. In contrast, in this study, the correlation coefficient between the level of knowledge and the degree of practice suggests a very weak negative correlation. A weak negative correlation means almost no linear relationship between the two variables. The finding of a weak correlation between good knowledge and suboptimal practice suggests that knowledge does not always translate into good practice, and a multifactorial investigation is required. Similar results were generated in a study pointing out that nurses may have adequate knowledge (90%) and a good attitude but still possess poor practices concerning adherence to infection control and prevention, thus suggesting a targeted approach to improving practice through practical programs and training as part of the employment.[33] The result of the correlational analysis suggests that other confounding predictors, such as personal attitudes and organizational policies, were much more likely to lead to greater compliance with infection control than the knowledge base.[34]

Several confounding predictors may affect the degree of practice of nurses in HAIs prevention and control than knowledge.[34] In this study, perceived personal benefits (96.88% to 100%) and organizational encouragement (93.75%) were seen to facilitate prevention and control practices on HAIs primarily. Similar facilitating factors were seen in other studies.[9,25] Perceived risks and benefits improve the use of personal protective equipment, hand hygiene practices, and other infection control activities. The serious health consequences of cross-infection among patients and the occupational risks of acquiring the disease improve nurses' use of masks, gloves, handwashing practices, and waste management.[35] Organizational support and encouragement are also positively associated with preventive and control practices on HAIs.[25,36] Aside from personal perspectives on the benefits of infection control, organizational support also improves practices against HAIs. An organization should actively support nurses in preventing and controlling HAIs by facilitating mentorship, reinforcing, and supportive supervision.[37]

In the institution, nurses are constantly reminded to apply standard precautions for the patient's well-being and to protect themselves from acquiring diseases heightened by occupational risk. The positive reinforcements received by the nurses in the institution are primarily from the Infection Prevention and Control Nurse (IPCN), who is responsible for the overall coordination and supervision of all the activities in the hospital relevant to infection control. The IPCN regularly monitors staff's adherence to infection prevention and control policies, guidelines, and procedures. When nurses in the institution are caught not complying with prescribed prevention and control strategies, as tasked, the IPCN will professionally and kindly warn the nurses of undesired possibilities due to lack of compliance. The IPCN also serves as a preceptor and mentor in nursing training programs related to infection prevention and control of the hospital; whenever enhancement activities are available or scheduled, the IPCN reminds and encourages the staff's attendance during her clinical care rounds.

Aside from facilitating factors, hindering factors may affect nurses' practice in preventing and controlling HAIs and could even be the reason behind the suboptimal degree of practice at present. The leading hindrance nurses reported was the workload due to staff shortage (47.66%). Workload hinders ideal prevention strategies for HAIs.[19,38] Nurses' workload increases when there is understaffing, which may compromise infection prevention practices.[38] There is a reported break in infection control due to nurses' workload and burnout from long shifts and a less ideal staffing ratio.[39] The fundamental solution is to minimize workload by having more nurses divide the tasks.[39] Similar to global conditions, the institution also experiences shortage of nurses, however, the shortage of nurses is not severely felt. The inadequacy in human resources is only felt briefly and it is associated with a sudden increase in the number of patients or sudden illness of nurses that

caused them to go on leave. The organization continuously hires nurses to address this situation. The shortage of nurses across the globe is far from resolution, hence, to mitigate the ill effects of workload vested on nurses due to staff inadequacy, it is recommended to have stress and time management training to cope and prioritize appropriately against the demands, both of which are not conducted by the Nursing Service Department of the chosen institution.

The second hindering factor nurses reported was poor dissemination of guidelines (18.75%). Poor dissemination of guidelines leads to poor practice. Nurses and other healthcare workers should be aware of and read available guidelines, standards, and standard operating procedures in order to gain better skills in infection prevention and control.[37] The management should immediately disseminate the changes in infection control guidelines to update and improve current practices. The guidelines in the institution are disseminated by the distribution of infection control manuals available in every nursing unit; however, its integration into the hospital information and management system (HIMS) still needs to be practically done. The poor dissemination of guidelines may be perceived because the institution is revising the manual to fit present situations after the COVID-19 pandemic; hence, new manuals still need to be provided to the different units; this, in return, is perceived as poor dissemination strategies.

The third leading hindering factor reported by nurses is personal discomfort (17.97%). Personal protective equipment (PPE) was associated with causing physical discomfort for nurses. Using protective equipment leads to physical discomforts such as dry lips and skin irritation,[40] causing poor compliance and disrupting health and safety practices, thus negatively affecting infection rates.[41] PPE has been proven to mitigate HAIs rates over the years; therefore, it is necessary to inspire nurses to comply with the use of protective equipment while still minimizing its adverse effects. Guidelines on timely change and appropriate use of products such as appropriate size, right fitting, and latex-free should be available, and compliance should always be encouraged to avoid undesired effects such as hypersensitivity, skin irritation, and breakdown. The institution has abundant personal protective equipment (PPE); however, not all PPE is available in different sizes. Gloves are provided in different sizes, but N95 masks and disposable isolation gowns are in one-size-fits-all design. A PPE that does not snuggly fit makes nurses uncomfortable, this in return, does not promote adherence to its use.

The facilitating and hindering factors presented in this study are just a few items identified. Across the literature, more factors are specified to affect nurses' practice in preventing and controlling HAIs. Nevertheless, the elements are categorized into personal and organizational. Both the personal and organizational factors are highly modifiable. For instance, a personal factor identified is a lack of knowledge, which can be dealt with by providing educational materials. Time constraints, categorized as personal and organizational, can be managed by having better time management skills and, from the organization's end, by hiring more nurses to divide the extra tasks. The organizational factor identified involves disseminating available guidelines, a solution for which is better communication strategies. identifying the hindering factors is very important as a possible cause of inadequate practice among nurses. The successful translation of knowledge into practice does not solely depend on the developed knowledge; the barriers and facilitators to its use are also explicitly assessed, fortified, addressed as necessary.

Strengths and Limitations

The study considers utilizing a self-reported questionnaire to examine the nurses' practice towards prevention and control of HAIs as the main limitation of this study. Using a self-report questionnaire might be a main limitation for some threats it posed, like socially desirable responses or the respondents' attempt to make themselves look good. The research assistant managed this problem by informing the respondents that answers were anonymous and confidential, encouraging an honest response. The format of the adopted questionnaire used to determine the practice of nurses on the prevention and control of HAIs is also considered a limitation of the study. The response format was a 4-point adjectival scale. With this type of response format, respondents may also embrace or avoid extreme responses or tend to agree with statements. These threats were reduced by requiring respondents to choose one answer from a list. The length of the CSPS is also another limitation. Respondents may view the twenty-item questionnaire as lengthy and may have omitted from reading the items and just choosing random responses.

A single locale may not closely reflect the actual situation in other hospitals elsewhere in Baguio City; however, a total enumeration sampling technique in a single locale is also the study's strength. The research has a practical application in the chosen locale. After data collection, there was a hundred percent participation with zero attrition; hence, the data obtained is considered an accurate representation of the current level of knowledge and degree of the practice of nurses working in the chosen institution. Understanding an institution's actual HAIs prevention and control practices can guide the planning and implementation of a targeted approach with the possibility of a higher success rate.

CONCLUSIONS

Nurses' knowledge and practices on preventing and controlling HAIs vary significantly across healthcare settings, with some nurses demonstrating strong knowledge and practice. In contrast, other nurses must show more understanding and implement infection control measures. Nurses in this study possess good knowledge in preventing and controlling HAIs, which can be derivatives of learning opportunities available within the setting. Despite good knowledge, nurses in this study have a suboptimal degree of

practice in preventing and controlling HAIs. Being aware and retaining learned information well is not beneficial if it is not applied to practice. A high level of knowledge on preventing and controlling HAIs becomes useful if transferred into practice. As the correlational analysis shows, there is no significant relationship between knowledge and practice, suggesting that other factors may facilitate or hinder nurses' practice in preventing and controlling HAIs. Perceived personal benefits and organizational encouragement should be strengthened since they were reported to facilitate nurses' practice in preventing and controlling HAIs primarily. The identified hindering factors, such as excessive workload, poor dissemination of guidelines, and personal discomfort due to using PPE, should be addressed to improve nurses' present practices in preventing and controlling HAIs.

Recommendations

Based on the results of the study, there are certain domains of infection control, such as the use of gloves, where nurses need to be more knowledgeable. Self-paced courses and study materials can be provided to nurses through Google Classroom to enhance their knowledge. On the other hand, a targeted approach to improving practice through practical programs and training as part of employment is encouraged instead of a pure lecture series. Programs that allow simulation and direct exposure to infection control skills should be integrated. Exposure to interventions significantly increases compliance to infection control strategies such as handwashing compared to healthcare providers unexposed to interventions.[42] Exposure to interventions may increase compliance; however, despite improvement in compliance, infection control practices remain low, suggesting a multifactorial consideration is needed to close the knowledge-practice gap in actual clinical settings.[42] The multifactor consideration suggests that facilitating and hindering factors should be determined. Such factors may be personal or organizational, facilitating or hindering existing practices. Since organizational encouragement positively affected infection control practices, a recognition and awards program should be initiated in organizations where encouragement to nurses remains lacking. Visual reminders should be posted in appropriate areas to enhance infection control practices further. Workload due to inadequate staffing should be addressed by hiring more nurses to divide the tasks. Most of the time, the hindrances that negatively affect nurses' practice are highly modifiable; however, more attention and resource allocation to their solutions is needed; consequently, a delay in improving the practices of nurses remains to be observed.

Further recommendations are for future studies. Future studies may consider performing observational evaluations of the practice of nurses on infection control instead of using self-reported questionnaires to eliminate the risk of response bias. Future studies may consider investigating other variables affecting nurses' practice in preventing and controlling HAIs. The variables may include sociodemographic data like age, gender, area of assignment, years of experience, and educational status. Lastly, future studies may want to cover more than one locale for a more extensive overview of nurses' knowledge and practice on HAIs prevention and control.

Statement of Authorship

Both authors certified fulfillment of ICMJE authorship criteria.

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