

Knowledge and Perception of Health Care Undergraduate and Graduate Students Regarding Infection Control Practices

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A B S T R A C T

Background: Infection control measures are vital. It plays a major role in decreasing both morbidity and mortality. Infection control guidelines developed and continuously updated by CDC and WHO need to be appreciated and strictly followed.

Objectives: Knowledge and perception of healthcare undergraduate and graduate students in Byrdine F. Lewis College of Nursing and Health Profession at Georgia State University regarding infection control practices were explored.

Methods: This is a descriptive study of knowledge and perception of healthcare undergraduate and graduate students in in Byrdine F. Lewis College of Nursing and Health Profession at Georgia State University, Atlanta, Georgia, USA in connection to infection control guidelines. Data was collected using a closed questionnaire which contained 27 questions. Data was analyzed using the statistical program of SPSS version 25.0.

Results: 68 (94.1% females) aged 19-55 years (mean: 30.7) participated. The most common specialty was nursing (44, 64.7%). The majority (>90%) were able to identify the correct answer for the specific knowledge questions. Perceptions of responders for HH and PPE were rated at 50-79.4% and 91.2-92.7% respectively. There was a significant association between the healthcare specialty and perceptions for PPE ($p=0.031$). There was no significant association between the healthcare's gender, age, level of education and participation in a clinical program and perception.

Conclusion: Despite the satisfactory responses obtained in this study reflecting a very good status of infection control policies applied in Georgia State University, the need continues to achieve a better and continuously updated awareness of the current guidelines.

Keywords: Infection control; Knowledge; Perception; Healthcare workers; Hand hygiene; Personal protective equipment

Introduction

Infection transmission is a very significant health issue. It may lead to significant morbidities and mortalities¹. Infection control guidelines have therefore been established by CDC and WHO to

present clear methods of prevention of disease transmission²⁻⁴. These were based on the basic understanding of modes of infection transmission which was also dependent on the nature of the organism and the pathology it causes^{5,6}. This has become obvious and more important during many epidemics faced in

the last few decades, last of which is the covid-19 pandemic⁷. HCWs knowledge and perception of Infection control guidelines is therefore highly required. This study tried to explore the knowledge and perception of undergraduate and graduate students among nursing, nutrition, respiratory therapy (RT), physiotherapy (PT) and occupational therapy (OT) graduate and undergraduate students in Byrdine F. Lewis College of Nursing and Health Profession at Georgia State University, Atlanta, Georgia, USA.

Background

Control of infection transmission within healthcare facilities is a fundamental part of any healthcare system. Application of this should be thorough and includes all related factors. HCWs are perhaps the most important component. It is therefore essential to assure that knowledge and perception of infection control guidelines among HCWs is optimal.

Methods

This study presents a descriptive study done to explore knowledge and perception of healthcare undergraduate and graduate students from Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University, Atlanta, Georgia, USA, in connection to infection control guidelines. Demographic data which also included specialty and level of education, were collected and correlated to knowledge and perception of these students towards hand hygiene (HH) and PPE. Data was collected using a closed questionnaire modified from the literature⁸. The answers could be ticked in preprinted boxes yes, no, and do not know, choosing one option and true, false, and do not know style. The questionnaire contains 27 questions; 5 questions on demographic data, 17 questions on the background, and 5 questions about knowledge and perception. The questionnaire was sent electronically to the targeted population. Anonymous analysis of results was guaranteed. A convenience sample was used in the study, as participants are chosen on the basis of availability. The population was from undergraduate and graduate students who were enrolled in nursing, RT, nutrition, PT, and OT programs in this university (fall semester 2020). The study proposal was approved by Georgia State University Institutional Review Board (IRB). Study participation was voluntary with a consent assumed on return of a completed survey. Data was collected and analyzed using the statistical program of Statistical Package for the Social Sciences (SPSS) version 25.0. Chi-square statistics and analysis of variance were used. Scores of P=0.05 or above were considered as not significant (NS). ANOVA and t-test were also used.

Results

The sample size of this analysis was 68 responders, 64 (94.1%) were females and 4 (5.9%) were males. The age range was from 19 to 55 years (mean: 30.27). Number of graduate students (37, 54.4%) was slightly higher than the undergraduate students (31, 47.6%). Majority of responders' specialty were nursing (44, 64.7%), followed by nutritionists (8, 11.8%), OTs (7, 10.3%), PTs (6, 8.8%), and RTs (3, 4.4%). Thirty-six responders (52.9%) were enrolled in a clinical program (**Table 1**).

(**Figure 1**) illustrates the general background knowledge and perception of responders. Infection control guidelines were reported by 53 (77.9%) of the responders to have been included in the university curriculum. Practical sessions on infection

control guidelines were offered to 36 (52.9%). Instructions about the importance of infection control were provided for 59 (86.8%). More specific instructions about the hospital guidelines on infection control was given to 40 (58.8%). Fifty (73.5%) see their infection control supervisors. Forty-seven (69.1%) were given instruction to report symptoms and signs of an infectious condition promptly to a supervisor or a hospital infection control officer (**Figure 1**).

Table 1. Demographic Data.

Variable	Number (Percentage)
Gender	
Male	4 (5.9%)
Female	64 (94.1%)
Level of education	
Graduated	37 (54.4%)
Undergraduate	31 (45.6%)
Specialty	
Nursing	44 (64.7%)
RT	3 (4.4%)
PT	6 (8.8%)
OT	7 (10.3%)
Nutrition	8 (11.8%)
Enrollment in a clinical program	
Yes	36 (52.9%)
No	32 (47.1%)
Age	19-55 (Mean: 30.27)

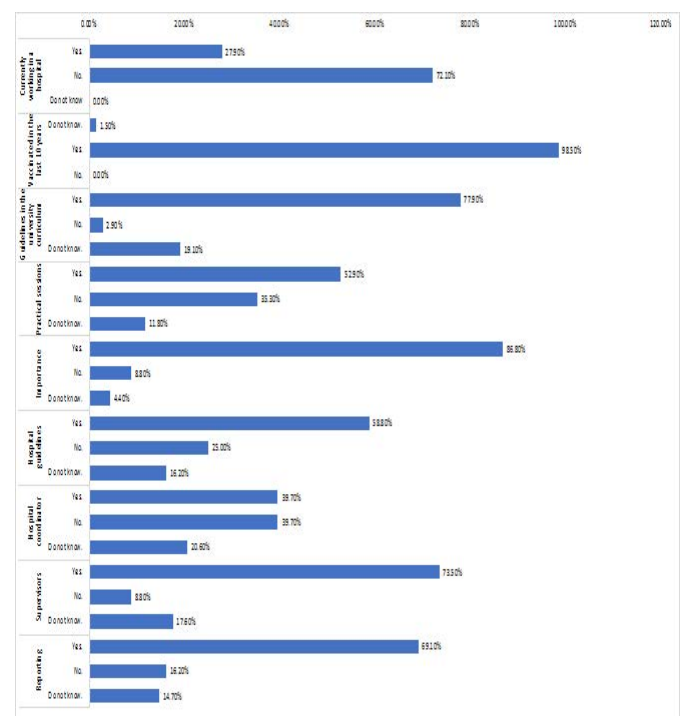


Figure 1. General Background

The specific background of participants was done through 8 multiple choice questions with one correct answer out of the three. The correct answers were: standard precautions are recommended to protect patients and healthcare workers, standard precautions are applied for all patients, HH is recommended before or after a contact with a patient, use of gloves is recommended for each procedure, care of equipment should follow facility protocol in all instances, health workers once contaminated should contact their primary health care provider, respiratory isolation needs gown, mask and gloves, and N95 mask should be used for COVID-19 patients.

As shown in (**Figure 2**), the majority of responders were able to identify the correct answers for the specific questions.

As a matter of fact, the response to the eight items was more than 90% for all except for item 4 where 14 (20.6%) chose the inaccurate choice to make the range between 54 and 68 (79.4% – 100%) (Figure 2).

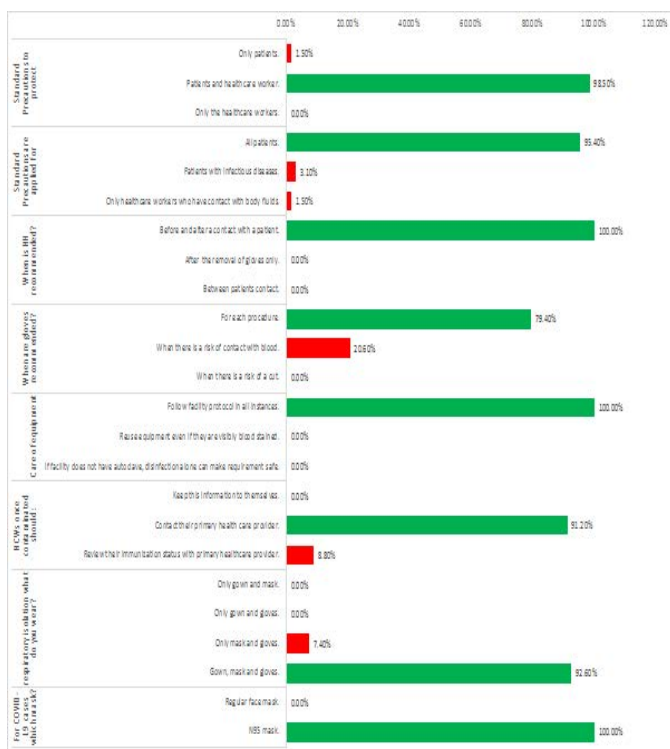


Figure 2. Specific Background

In order to assess knowledge and perception of the two main tools, HH and PPE in infection control among responders, three statements were given for HH. "Spreading of bacteria in hospitals occurs mainly via the hands of personnel" was correctly considered to be true by 54 (79.4%). Ten (14.7%) stated that they do not know and 4 (5.9%) inappropriately labeled it to be false. For "infections are mainly caused by bacteria brought into the hospital-by-hospital workers" only 34 (50%) correctly labeled this to be false while 18 (26.5%) labeled it to be true and the remaining 16 (23.5%) did not know. The statement that "hand jewelry makes a good hand hygiene impossible" was correctly chosen to be true by 49 (72.1%). Fifteen (22.1%) however labeled this statement to be false and 4 (5.9%) did not know. For PPE, two statements were given. The first statement, "there is evidence that aprons, gowns and masks are effective in preventing hospital-acquired infections" was appropriately chosen to be true by 62 (91.2%). None disagreed with this statement, but 6 (8.8%) did not know. The second statement "gloves reduce the contamination of the hands, but do not prevent it completely" was appropriately chosen to be true by 63 (92.7%) responders. Two (2.9%) considered it to be false and 3 (4.4%) did not know (Figure 3).

There was no significant gender relationship with any of the specific background questions ($p > 0.05$). Age was converted into a categorical variable with four groups (15-24, 25-34, 35-44, 45+) to conduct the Chi-Square tests. There was also no significant relationship of age, education level, specialty, participation in clinical program ($p > 0.05$) (Table 2 and Table 3).

Note. Questions: When is hand hygiene recommended? What should healthcare worker do about care of equipment? and for COVID-19 isolate cases which of the following masks

is advisable? were not computed because 100% of respondents chose only one option.

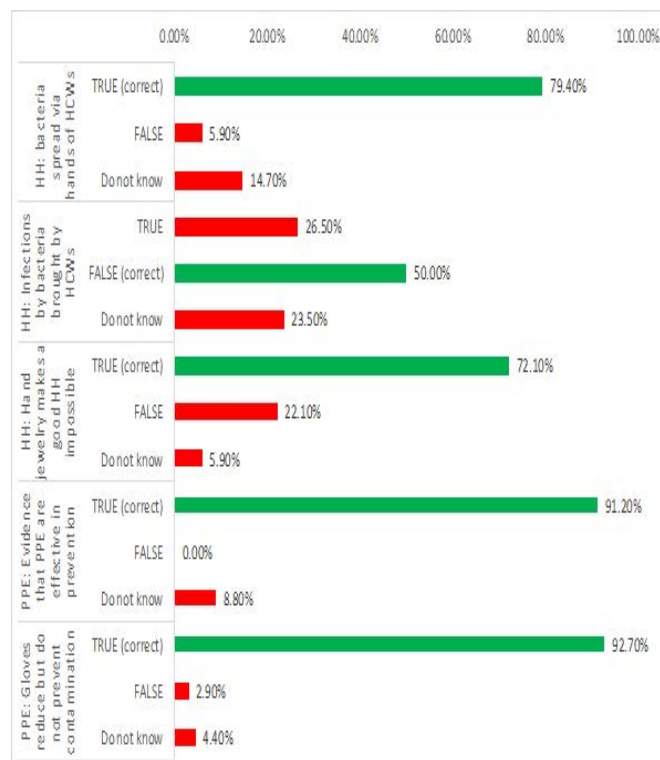


Figure 3. Perception.

Table 2. Comparisons of demographics and background questions.

Demographic variable	Background variable (Correct answer)	Chi-square value	P-value
Gender	Standard Precautions are recommended to protect (Patients and HCWs)	0.063	0.801
	Standard Precautions are applied for (All patients)	0.206	0.902
	When is the use of gloves recommended (For each procedure)	0.051	0.822
	Healthcare worker who believes they have been contaminated with infectious agent, what should they do (Contact their primary health care provider)	1.382	0.240
Age	For a patient on respiratory isolation room what do you wear (Gown, mask and gloves)	1.943	0.163
	Standard Precautions are recommended to protect (Patients and HCWs)	1.861	0.394
	Standard Precautions are applied for (All patients)	4.254	0.373
	When is the use of gloves recommended (For each procedure)	0.707	0.702
Education level	Healthcare worker who believes they have been contaminated with infectious agent, what should they do (Contact their primary health care provider)	1.11	0.574
	For a patient on respiratory isolation room what do you wear (Gown, mask and gloves)	1.154	0.562
	Standard Precautions are recommended to protect (Patients and HCWs)	0.850	0.356
	Standard Precautions are applied for (All patients)	0.801	0.670
	When is the use of gloves recommended (For each procedure)	0.053	0.818
	Healthcare worker who believes they have been contaminated with infectious agent, what should they do (Contact their primary health care provider)	0.052	0.820

Note. Questions: When is hand hygiene recommended? What should healthcare worker do about care of equipment?, and For COVID-19 isolate cases which of the following masks is advisable?, were not computed because 100% of respondents chose only one option.

(Table 4) shows the descriptive statistics of gender, education level, and participation in a clinical program in relationship to knowledge and perception of HH and PPE. It was found that gender and education level had no significant impact

on perception ($p > 0.05$). Participation in a clinical program was present in 21 out of 53 participants (39.6%) for both HH and PPE. Participation variable had no significant impact on perception ($P > 0.05$) (Table 4).

Table 3. Comparisons of demographics and background questions.

Demographic variable	Background variable (Correct answer)	Chi-square value	P-value
Specialty	Standard Precautions are recommended to protect (Patients and HCWs)	0.554	0.968
	Standard Precautions are applied for (All patients)	11.501	0.175
	When is the use of gloves recommended (For each procedure)	10.705	0.030
	Healthcare worker who believes they have been contaminated with infectious agent, what should they do (Contact their primary health care provider)	5.802	0.214
	For a patient on respiratory isolation room what do you wear (Gown, mask and gloves)	2.944	0.567
Participation in Clinical Program	Standard Precautions are recommended to protect (Patients and HCWs)	2.271	0.321
	Standard Precautions are applied for (All patients)	1.922	0.75
	When is the use of gloves recommended (For each procedure)	0.203	0.904
	Healthcare worker who believes they have been contaminated with infectious agent, what should they do (Contact their primary health care provider)	2.949	0.229
	For a patient on respiratory isolation room what do you wear (Gown, mask and gloves)	0.213	0.8

Table 4. Perception for HH and PPE measures by gender, education level, and participation in a clinical program.

Gender			
	Males: Mean (SD)	Females: Mean (SD)	T-Test value, df, p-value
Perception of HH	2.50 (0.58)	1.98 (0.72)	1.39, (66), $p=0.17$
Perception of PPE	2.00 (0.00)	1.83 (0.46)	0.75, (66), $p=0.46$
Level of education			
	Undergraduate: Mean (SD)	Graduate: Mean (SD)	T-Test value, df, p-value
Perception of HH	1.94 (0.78)	2.09 (0.65)	-0.86, (66), $p=0.39$
Perception of PPE	1.76 (0.55)	1.94 (0.25)	-1.78, (66), $p=0.08$
Participation in clinical program			
	Yes: Mean (SD)	No: Mean (SD)	T-Test value, df, p-value
Perception of HH	2.19 (0.68)	1.93 (0.76)	0.83, (66), $p=0.41$
Perception of PPE	1.81 (0.51)	1.81 (0.47)	0.45, (66), $p=0.66$

There was no significant association or impact of age on perception. However, there was a significant correlation between specialty and perception of PPE ($p < 0.05$), but there was no significant effect on perception of HH ($p > 0.05$) (Table 5). A post hoc test was conducted to identify which group differ from the other. According to that, nutrition ($M = 1.38$) group had significantly lower perception of PPE scores compared to nursing ($M = 1.91$), RT ($M = 2.00$), PT ($M = 1.83$) and OT ($M = 1.86$) specialties. This means nutrition group has poorer perception compared to other specialties. (Figure 4).

Table 5. Perception for HH and PPE measures by age and specialty.

Age						
		Sum of Squares	df	Mean Square	F	Sig.
Perception of HH	Between Groups	.294	2	.147	.275	.760
	Within Groups	34.692	65	.534		
	Total	34.985	67			
Perception of PPE	Between Groups	.344	2	.172	.867	.425
	Within Groups	12.877	65	.198		
	Total	13.221	67			
Specialty						
		Sum of Squares	df	Mean Square	F	Sig.
Perception of HH	Between Groups	1.754	4	.438	.831	.510
	Within Groups	33.232	63	.527		
	Total	34.985	67			
Perception of PPE	Between Groups	2.019	4	.505	2.838	.031*
	Within Groups	11.202	63	.178		
	Total	13.221	67			

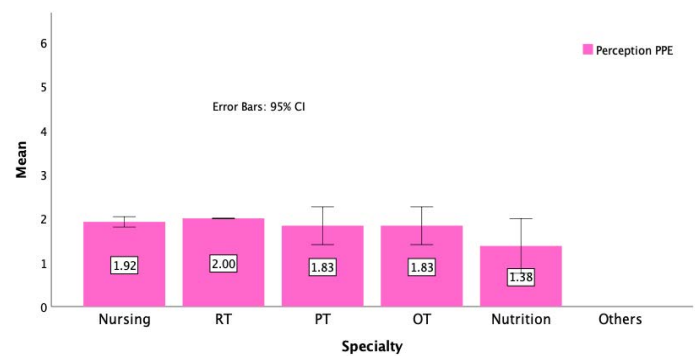


Figure 4. Correlation of specialty and Perception of PPE.

Discussion

The spotlight on infection control research and education initiatives has been focused on and constantly updated by CDC and WHO to be consistent with the current literature^{3,4}. Understanding modes of transmission by the HCWs is an important element in infection control. This strengthens compliance once the rationale of every tool used in infection control is understood. Only 77.9% of responders in the present study stated that these guidelines were included in the university curriculum. About half received practical sessions. Almost 87% received instructions about the guidelines' importance, but only 58.8% received specific hospital guidelines. The specific background of participants tried to look at some selected important related issues needed as a basic knowledge and perception for all HCWs. The response was reassuring as the majority were able to identify the correct answers. This may be taken as a good reflection of how good and well-prepared HCWs are in this university.

The two main tools used for infection control are HH and PPE. In this study, an attempt to obtain an insight on knowledge and perception of the responders towards HH and PPE was made. About 80% of responders considered that infection transmission occurs mainly via the hands of HCWs. Three-quarters of the remaining 20% confessed that they do not know this fact. Contribution of HCWs towards the etiology of infections inside the hospitals i.e., bringing it from outside was not clear in responders' knowledge and perception as more than a quarter felt that this is the main source which of course is not true. It is well known that hand watches, rings and other hand jewelry are not encouraged in any hospital setting as HH

becomes difficult to do. Only 72% agreed with this statement. Knowledge and perception of PPE among the study responders was slightly better as more than 90% agreed that using different PPE in general, like masks, aprons and gowns, is effective in infection control and that gloves have an important role in reducing infection transmission. In this study, there are limited but important and fundamental questions which may be sufficient to show a reflection of responders' knowledge and perception of infection control measures. In a previous cross-sectional study on 243 nurses, only half demonstrated a good level of knowledge and positive perception of HH⁹. Responders in the present study, who were mostly nurses, therefore demonstrated better perception. Perception certainly needs continuous support in both basic education and training. This can be achieved by periodic revision of the university curriculum and regular refreshment of theoretical and practical courses. In a cross-sectional hospital-based study¹⁰, enrolled 293 nurses to fill up a questionnaire about standard precaution transmission of infections. Nurses' knowledge was poor (97.9%). Up to 64.5% of the participating nurses had low knowledge about bloodborne pathogen transmissions. Over 58% used gowns and gloves and 72.7% practiced hand washing. Refresher training was beneficial (34.5%) as the major source of information¹⁰. Emphasis on this is even more needed during epidemics and pandemics. The world nowadays is living COVID-19 pandemic and this has increased the awareness and perception of infection control. Despite this logical assumption, among 74 nurses and 14 RTs in 175 surveyed HCWs, only 50% and 30% identified the donning and the doffing order respectively. It was felt that ongoing training is very important to assure optimal perception¹¹. This pandemic may have reflected on the responders' answers in this study.

Responder's distribution was almost equal in the number of undergraduate versus graduate students. More than half of responders were enrolled in clinical programs. Female gender dominated perhaps due to the nature of the specialties included. The majority of responders (64.7%) were nurses compared to other specialties. This may have an influence on the data analysis and comparisons. The present study is a descriptive study on describing and analyzing the findings as they are. It is felt that all findings are useful regardless of the significance of comparison or correlation made. Since this is perhaps the first study done in this university, it is hoped that the findings will formulate the base of many related studies and research in the future.

Despite the relatively small number of males in the study, there were no significant gender differences in answering the specific questions addressed. The age distribution was fair and for the sake of analysis responders were categorized into four age groups and even with that there was no significant age relationship to the way responders answered the specific questions¹², showed that 64.2% of the 292 participants had formal training in HH for three years and 56.1% had correct knowledge. Correct knowledge in healthcare-related infections were present in 27.4% of the respondents. Females' knowledge and perception were better¹². Another descriptive study was performed on 198 nursing students, where a questionnaire was exploring HH attitudes, knowledge, and practice with some stress on the WHO questionnaire for HCWs and its scales. The knowledge and attitudes were described to be moderate. Ensuring a positive attitude and improving awareness was emphasized¹³.

When comparison addressing age, gender, level of education, specialty, participation in a clinical program effect

on knowledge and perception was made, important findings were found. There were no significant relationship or correlation to gender, age and level of education towards perception. The significant relationships withdrawn from all responders in the present study were that-specialty has significant correlation with knowledge and perception of PPE. Nurses were found to have better knowledge and perception in this and in other studies¹⁴⁻¹⁶. There was however no significant effect or correlation with knowledge and perception of HH in the present study. Innovation to sensitize HCWs towards being able to defend themselves any time has been found useful as it induces self-consciousness of being updated all the time and be prepared for any challenge with a solution based on baseline knowledge and perception¹⁷.

Limitations

This study has several limitations. The small sample size may have given a response bias. Response bias may be influenced by the high proportion of female and nursing respondents in the study. Missing data analyses were not conducted to determine the potential extent of the bias. Future studies should address these limitations in their research.

This study has explored a valuable data in connection to infection control practices in undergraduate and graduate students in nursing and other health professionals in the Byrdine F. Lewis college of nursing and health professions at Georgia State University. This data is needed to be used as a baseline in order to formulate an improvement plan based on modifications and enforcement strategies towards infection control guidelines application which is reflected on knowledge and perception of HCWs. Despite the satisfactory responses obtained in this study reflecting a very good status of infection control policies applied in this university, the need continues to achieve a better and continuously updated awareness of the current guidelines.

It is recommended that continuous research similar to the present study is performed periodically in addition to expansion on studying many of the listed variables. This certainly will add to the distinguished nature of this institution in a very vital health issue i.e., infection control.

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