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Perceptions, Attitudes, and Compliance of Health Care Undergraduate and Graduate Students Regarding Infection Control Practices

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ACCEPTANCE

This thesis, PERCEPTIONS, ATTITUDES, AND COMPLIANCE OF HEALTH CARE UNDERGRADUATE AND GRADUATE STUDENTS REGARDING INFECTION CONTROL PRACTICES, by Raghad Alherbish was prepared under the direction of the Master's Thesis Advisory Committee of the Respiratory Therapy department at Georgia State University. It is accepted by the committee in partial fulfillment of requirements for the Master of Science degree in Respiratory Therapy at Byrdine F. Lewis College of Nursing and Health Professions, Georgia State University. The Master's Thesis Advisory Committee, as representatives of the faculty, certifies that this thesis has met all standards of excellence and scholarship as determined by the faculty.

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By

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(Under the Direction of Dr. Rachel E. Culbreth)

ABSTRACT

Introduction : Infection control is a very important part of healthcare in any facility. This has been the focus of attention of researchers and many international institutions. Understanding infection control basis and its guidelines is fundamental for all healthcare workers. This has therefore been added to university curricula. Continuous enforcement mechanisms have been established in order to assure optimal application to avoid infection transmission. This thesis presents a study on perceptions, attitudes, compliance and obstacles faced by undergraduate and graduate students in Byrdine F. Lewis School of Nursing and Health Professions, Georgia State University, Atlanta, Georgia. **Methods:** A questionnaire was sent to undergraduate and graduate students in the fields of nursing, nutrition, occupational therapy, physiotherapy, and respiratory therapy exploring perceptions, attitudes, compliance and obstacles faced in connection to infection control guidelines and used tools, hand hygiene (HH) and personal protective equipment (PPE). Data was analyzed using the statistical program of Statistical Package for the Social Sciences (SPSS). Chi-square and ANOVA were used to analyze variance and associations. **Results:** There was a total of 102 responders to the survey. However, 34 were excluded as they failed to answer all components. The total sample size of this analysis was therefore 68 responders. The majority were female nurses. Perceptions of responders for HH and PPE were rated at 50-79.4% and 91.2-92.7% respectively. Their attitudes for HH and PPE were rated at 92.7-100% and 92.7-98.5% respectively. Compliance was rated at 89.7-98.5% for HH and 13.2-91.2% for PPE. Age was associated with PPE; such that younger responders had better attitudes towards using PPE. There was also a significant association between the healthcare specialty and perceptions for PPE ($p=0.031$). Facing obstacles was also significantly associated with for both HH and PPE with specialty ($p<0.001$). **Conclusion:** Attitudes towards infection control of undergraduate and graduate students at school of nursing and health professions in George State University was overall excellent. Younger responders had better PPE utilization compared to older responders. This is followed by compliance and then perceptions. Healthcare specialty had a major influence on perceptions for PPE and compliance for HH overall. Further studies are needed to explore these findings periodically in order to improve infection control guidelines in addition to expansion on studying all individual variables and build up their significant association.

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Chapter I

Introduction

Infections can be transmitted directly or indirectly from one individual to the other. This may occur through different modes of transmission. It may happen in both the community and in hospitals and healthcare centers. Hospitals are the place where many diseases are found and the contagious ones form a significant source of transmission of infection. A significant cause of mortality and morbidity in admitted patients is healthcare-acquired infections (HCAIs). Data suggests that more than 1.4 million patients worldwide are affected at any given time (Gold & Avva, 2020). Control of this transmission is vital in controlling the spread of infections. It is, therefore, important to have clear methods of prevention of disease transmission. This process is called infection control (Halboub et al., 2015).

As early as the beginning of the eighteenth century, studies on cross infections in hospitals, mostly originated from Scotland, began. In 1858 Florence Nightingale, developed hospital reform (LynnMcDonald, 2013). This, however, materialized well at the discovery of the bacteria by Pasteur, Koch, and Lister (Toledo-Pereyra & Toledo, 1976). Hospital cross infections were thought to be happening only in the obstetric and surgical patients where control was noticed to be successful. It was then realized that this process is not limited to these patients only but to other medical diseases caused by different organisms where various modes of transmission were discovered (Nair et al., 2014). The 19th, 20th, and 21st centuries have witnessed great development in the medical and surgical technologies. This led to patients' better survival but increased the chance of complications like infections. This era has also witnessed establishment of sophisticated methods of infection control. Most of these have been concentrating on patient care within hospitals (Friedman et al., 2008).

Infection control guidelines developed and continuously updated by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) emphasized the importance of having all health personnel immune status periodically updated. This is in addition to observing isolation procedures and infection control guidelines (Centers for Disease Control and Prevention [CDC], 2017; World Health Organization [WHO], 2009). Hand hygiene (HH), wearing appropriate masks and gowns, eyes and skin protection, and wearing gloves wherever appropriate are important examples of tools used to ensure infection transmission control (Tenna et al., 2013). Understanding the modes of infection transmission is critical for developing prevention methods against disease transmission. Infections can be transmitted by many ways such as droplet (>5 um), e.g., through cough and sneezing, airborne (<5 um) e.g., via aerosols, direct contact like diarrhea or indirect where the organism may get deposited onto a solid object to survive long to infect another individual (Stetzenbach et al., 2004; Wong & Leung, 2004).

Infection control applies principles which have been scientifically and statistically proven to contribute towards preventing disease transmission. Some authors prefer to use the term "infection prevention and hospital epidemiology" instead of infection control as it is a more descriptive term in connection to the discipline needed. It has been well demonstrated in the literature that serious implementation of infection control programs is both cost-effective and also has a significant role in reducing transmission of infections (Dick et al., 2015). Health workers including doctors, nurses, respiratory therapists (RTs), nutritionists, technicians, cleaners and others, particularly those in close contact with patients need to follow infection control guidelines during their training and work. Infection control guidelines have, therefore, become a significant part of university curricula. Perceptions and attitudes of healthcare personnel formulate a fundamental requirement for this. Compliance with these guidelines is mandatory for all healthcare personnel. Education of healthcare workers (HCWs) is important to

establish perceptions, attitudes, and compliance towards applying these guidelines to control hospital infection transmission.

There are many examples of infections which have occurred during the last few years illustrating the importance of the health system's ability of controlling the spread of these infections in hospitals and community. First, the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 in Asia, where more than 8000 cases were diagnosed. Person to person transmission was evident. It was however very much controlled and the epidemic disappeared in the world in less than a year with the exception of 4 cases, 3 of them were accidental lab incidents (Herzig et al., 2016). Second, the Middle East Respiratory Syndrome (MERS), which was initially reported in Saudi Arabia in 2012 and later on in Korea in 2015 with a high case fatality risk ranging between 30% and 45%. Despite that the initial and main source remains unknown, human to human transmission, mainly in hospitals, was very much recognized. Appropriate infection control measures played a major role in controlling its transmission leading to its limited spread. Persistence of the disease for years to follow may indicate some features related to the virus itself, lack of specific therapy, or still possible suboptimal isolation measures (Penttinen et al., 2013; Yang & Cho, 2017). Third, Ebola which affected some areas in Africa where the importance of controlling the disease in one area and finally eradicating it was successful (CDC, 2015). Fourth, the recently discovered virus namely COVID-19 which started in China but spread all over the world in a very fast way to be labelled by the WHO as a pandemic. Transmission from one patient to the other is evident. Its spread was more pronounced in the community compared to hospitals (Zhou et al., 2020).

The present study aimed to evaluate and assess nursing, RT, physical therapy (PT), occupational therapy (OT), and nutrition undergraduate and graduate students' perceptions,

attitudes, compliance, and obstacles faced towards infection control practices in Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University.

Statement of Problem

Infection control measures are very important to be applied and strictly monitored in every healthcare facility. Perceptions, attitudes, and compliance of HCWs is very important. There are many published data from all over the world exploring this important issue. To my knowledge, this is the first study to examine perceptions, attitudes, and compliance of infection control measures among undergraduate and graduate students in the Byrdine F. Lewis college of nursing and health professions at Georgia State University.

Purpose of the Study

The purpose of the study was to evaluate perceptions, attitudes, compliance, and obstacles of health care undergraduate and graduate students in the Byrdine F. Lewis college of nursing and health professions at Georgia State University regarding infection control guidelines. The purpose of this study was to also determine correlations of the findings in relation to the healthcare specialty and other demographic factors.

Research Questions

1. What are the perceptions, attitudes, compliance, and obstacles of health care undergraduate and graduate students in the Byrdine F. Lewis college of nursing and health professions at Georgia State University regarding infection control guidelines?
2. Which student profession in the Byrdine F. Lewis college of nursing and health professions is most compliant to infection control guidelines?

3. What are the correlates of demographic factors and compliance to infection control practices?

Significance of the Study

This study is significant as it is the first of its kind to be conducted in Byrdine F. Lewis college of nursing and health professions at Georgia State University. Similar studies have been conducted in other centers showed very useful information in the field. The achieved results were used as an important baseline information for the infection control guidelines.

Definition of Terms

WHO: World Health Organization is an agency of the United Nations that is concerned with international public health.

CDC: Centers for Disease Control and Prevention is one of the major operating components of the Department of Health and Human Services found to promote and protect the public health of USA by preventing and controlling health threads.

HCWs: Healthcare worker is the one who delivers care and services to the patients directly (doctors and nurses) or indirectly (paramedics).

HH: Hand hygiene is a way of cleaning one's hands that substantially reduces potential pathogens on the hands. It is considered a primary measure for reducing the risk of transmitting infection among patients and HCWs.

PPE: Personal protective equipment is an equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses.

Limitations

The study may have the following limitations:

1. Undergraduate and graduate students used in the study are from different specialties and experience.
2. The questionnaire was completed by electronic communication.
3. Potential nonresponse was expected.

Delimitations

Results of this study were analyzed in view of the many similar studies done all over the world. The outcome is going to be beneficial for Byrdine F. Lewis College of Nursing and health Professions towards updating infection control guidelines and emphasizing the importance of compliance. Comparison to other similar studies in different centers all over the world are useful.

Chapter II

Review of the Literature

Infection diseases may get transmitted from one person to the other through different modes of transmissions. These can be through direct or indirect ways. Direct transmission implicates simple transfer of the causative organism from the sick individual to the healthy one. Infections can also be transmitted indirectly through a third individual who does not have the disease or even through an object or an animal. Control of this transmission is the core purpose of preventing spread of the disease both in hospital and the community. This process, which can be achieved by various ways, is called infection control. It is essential to make sure that knowledge of the mechanisms of infection transmission from one person to the other is mastered by all HCWs in order to avoid being a factor in transmitting this infection from one individual to the other. More importantly, is the perceptions, attitudes, and compliance of HCWs towards implementing the general guidelines (Refeai et al., 2020). There are many ways to prevent infection transmission from one patient to the other. These methods are:

Hand hygiene (HH)

The WHO and CDC guidelines emphasized HH for visible dirt or blood/body fluid and also after using the washrooms. It has been noticed that washing hands with water and soap for 20 seconds has a major role in eliminating any bacteria contaminating the hands. Alcohol-based hand rubs, as defined by the WHO of alcohol-containing materials to apply to hands to inactivate or suppress micro-organisms growth, have been considered as a tool to reduce cost and the prevalence of contact dermatitis associated with higher rates of hand washing with soap and water noticed in some individuals (Halm & Sandau, 2018; Gold & Avva, 2020). It is actually a reliable way for prevention of infection transmission (Boyce et al., 2009; Pittet et al., 2009;

Pittet, 2017). In a study with 19 HCWs participants, it was found that hand rubbing with sprayed alcohol-based hand rubs was not inferior to poured alcohol-based hand rubs in reducing bacteria present on hands (Tan et al., 2020). The recommended preparations for significant microbial control are ethanol, isopropanol, and n-propanol (60 to 85%). The most commonly used is ethanol which is more effective for virus control compared to propanol which is more effective towards bacteria (Gold & Avva, 2020).

Several studies looked at the value of doing surveillance and observation on HCWs in observing the general guidelines for infection controls in hospitals. This has taken into consideration the fact that HCWs particularly in the intensive care units (ICUs) knowingly skip hand washing due to stress, personal beliefs, or ignorance. In a study looking at 25 participants (19 graduates, 4 interns, and 2 high school graduates), nurses were found to have better compliance with HH. Compliance to HH was found to be only 40% and even lower in intensive care settings. One-to-one education and training methods concentrating on modification programs of behavior succeed in establishment of collaborative safety culture (Ay et al., 2019).

Motivation towards compliance was performed using direct observation of HCWs in 3 hospitals in Japan. Adherence to HH improved significantly when multimodal intervention questionnaire recommended by WHO was used, 18% Vs. 32.7% in 2012 and 2013 respectively. This questionnaire was conducted by a trained observer in medical, surgical, intensive care, and emergency units where the secondary outcome was that HCWs responses to this WHO questionnaire on HH practices which consisted of five moments of HH leading to an observed sustainability over the following five years (Sakihama et al., 2020). In another study by Onyedibi et al., from Nigeria, 46 units at a tertiary care center showed that 72% of these units had no written policy or poster in connection to HH, alcohol-based hand rubs were not available in 87% of the units, a minimum of one hand wash sink was available in 98% of the units, all day tap

water was available in 28% while cups and buckets were utilized in 72%, and hand drying facilities were not available in 58%. Four hundred and six HH were documented in 175 HCWs. This defined compliance to be only 31%, ranging from 18% to 82% in ward attendants and medical students respectively. The average HH compliance using the WHO five moments was 21%, 23%, 63%, 41%, 40%, before patient contact, before aseptic procedure, after body fluid exposure risk, after patient contact, and after contact with patients' surroundings respectively. High HH compliance was observed to be the best among medical students. HH and compliance with its guidelines were very poor confirming that HCWs seemed to be more exposed to the risk of exposure to microbes than to infection cross-transmission (Onyedibe et al., 2020).

The Personal Protective Equipment (PPE)

PPE is defined as an equipment or specialized clothing used by an employee to protect against infectious material and minimizing transmission of infection from one patient to the other. PPE improves personal safety when appropriately used. PPE include gloves to protect the hands, gowns or aprons to protect the skin, masks and respirators to protect the mouth and nose, goggles to protect the eyes, and face shields to protect other parts of the face. Hospitals and health centers must provide their employees all appropriate PPE and ensure that they are either disposable or properly cleaned if reusable. Safe environment in hospitals and healthcare centers require training in all aspects related to infection control, including guidelines with a strong compliance system, providing patients with airborne diseases a special room (e.g., negative pressure), clear policy for needles disposals, and PPE. PPE is a very important tool in preventing infection transmission inside hospitals and healthcare centers (Casanova et al., 2008). Indications depend on many factors, like the nature and seriousness of the disease, the nature of transmission, and the durability and the appropriate size of the PPE (Siegel et al., 2007).

Gloves

Gloves are perhaps the most common type of PPE used (Chughtai & Khan, 2020). The most important indication is surgical or respiratory procedures or diseases. There are many types depending on the material used to manufacture them. There are also special gloves made to avoid skin allergy. Gloves should be of appropriate size to the user. Sterile surgical gloves are used during surgery to prevent contamination of the wound leading to infection and delayed healing. It is important to assure that the one who wears gloves should touch the clean body sites before the dirty ones. Of course, the user should avoid the so-called touch contamination meaning touching part of the face while wearing gloves. Gloves need to be changed whenever they are soiled, dirty, or contaminated.

Gowns/Aprons

Gowns are considered to be the second most used type of PPE following gloves. CDC guidelines considered isolation gowns to be essential to protect HCW's arms and exposed body areas during procedures when anticipating contacts with blood, body products, or secretions. The choice of a gown or an apron as a PPE depends on the purpose of its use. There are also different kinds of gowns which are either penetrated or resistant to fluid which has to be used appropriately according to the nature of the possible contaminant. Clean gowns are needed for isolation if contamination to the arm or other parts of the body is anticipated where they should cover all the body, including arms. Invasive procedures require the use of sterile gowns (Kilinc, 2015).

Masks/Respirators/Goggles/Shields

Face protection plays a major part in infection control as this is evident in the old history as well (Weaver, 1919). Masks are used to protect the mouth, nose and parts of the face. Goggles provide barriers to the eyes. Face shields are used to protect the forehead and is extended around

face sides. Respiratory protection may also dictate the use of respirators. These are similar to masks, but have a sub-micron filter capable of excluding particles that are less than 5 microns in diameter to pass. They come in different kinds like N95, N99, and N100. Respirators are approved by the CDC national institute for occupational safety and health (Chughtai et al., 2013; Lepelletier et al., 2019; MacIntyre et al., 2017).

PPE are used before entering the patient's room to minimize contact. If more than PPE is to be used, then the order should be done in a logical way to assure protection; for example, gown should be worn first. The HCWs should know exactly how to wear a PPE correctly to get the most benefit in preventing infection transmission and avoiding possible injury. PPE has to be dispatched in a very careful way in order to prevent infection transmission. This should follow the sequence for removing PPE to avoid contamination before they are put in the specific container. After removal of PPE, subsequent HH is very important (Chughtai et al., 2013; MacIntyre & Chughtai, 2015).

When one discusses issues related to infection control, the literature covers many related matters. These include the place setting (facility) i.e., hospitals, offices, or nursing homes. Availability of needed materials and set-up is vital to assure proper infection control systems. There are then published articles on the perceptions, attitudes, and compliance of HCWs towards infection control guidelines.

The Healthcare Facility

Nursing homes, especially lately with COVID-19 pandemic, have been the attention of some researchers as transmission of infection is not uncommon (Cohen et al., 2015). Carolyn Herzig and her group performed a survey on 990 nursing homes in the US in 2014, where the infection prevention and control person in charge at each nursing home participated. Most responders stated that they have at least two more responsibilities in addition to their position as

an infection control leader. This may compromise the main role they have. Only 61% had no specific training in infection control. At least 36% of responding facilities received an infection control citation and those had less experienced and less trained professionals who are less likely to provide financial support to perform continuous education in infection control. There was, therefore, a wide and an important area for improvement in order to minimize disease transmission in these facilities (Herzig et al., 2016).

The role of nurses at home health care agencies has also been a subject of a study done by Russell et al., where they analyzed 359 responses from 2 large agencies. Compliance, knowledge, and attitudes were high, 0.89,0.85, and 0.81 respectively. Attitudes but not knowledge correlated better with compliance. Interestingly compliance was better among older and non-Hispanic blacks compared to younger and white non–Hispanic nurses. A call was made to focus on altering perceptions strategies related to the risk of infection transmission and HCWs attitudes (Russell et al., 2018).

In an exploratory cross-sectional designed study done by Niyonzima in Uganda, inadequate HH resources were observed in most of the wards. In the five wards studied, 287 HH were observed. The compliance before or after contacting the patient was 25.4% and 33.8% respectively. Higher rates were observed in ICU compared to surgical wards. More emphasis on the improvement of compliance was recommended (Niyonzima et al., 2018).

In a detailed position statement written by Moore from the Canadian pediatric society in 2018, administration policies, office design, triage management, waiting room policies, and actions related to toys in the pediatric office were illustrated. They also explained very well the process of HH and PPE in addition to methods of disinfection, sterilization, and simple cleaning (Moore, 2018).

The Patients

Studies have also looked at patient's knowledge, attitudes, and practice. Ibrahim et al., looked at 225 patients attending a dental clinic. The satisfactory level was obtained in only 21.8% while 39.5% and 38.7% obtained a poor or fair level in knowledge respectively. Despite presence of positive attitudes mostly obtained from their level of education and social media, only 9.3%,13.3%, and 16.4% asked their dentists about instrument sterilization, wearing face masks, and gloves respectively. This is an interesting data to compare to results obtained from dental students and practicing dentists and their assistants (Ibrahim et al., 2017).

A strong correlation was found between both the environmental and organizational factors and self-reported compliance in a study conducted by Yassi et al., where he studied 16 healthcare facilities and concluded this important conclusion. It is therefore important to realize that compliance with infection control procedures are very much tied to the environment factors and organization characteristics which means that efforts to improve the availability of equipment and promote safety culture are the key issue to achieve that goal. This, of course, should be complemented with continuous training directed towards HCWs, specifically those who are working with high-risk patients (Yassi et al., 2007).

Tools

A systematic review done by Chughtai et al., this year looked at 13 studies which were observational, cross-sectional in nature. All studies examined PPE (7 hospitals, 4 dental clinics, and 2 laboratories). The policies and practices were inconsistent; gloves and face masks were the most common. Many facilities did not have enough PPE. Furthermore, compliance was low. The authors concluded that large multimethod studies are needed to explore this problem (Chughtai & Khan, 2020).

Tertiary hospital-based interviews with 20 HCWs in Sydney, Australia, showed that HCWs had a small role in the use and selection of face masks and respirators. Fourteen out of twenty participants demonstrated that the use of respirators was easy and fifteen felt comfortable to wear them. They all believed that respirators gave more comfort, protection, and reusability in N95 masks (Chughtai et al., 2020).

Registered Nurses

There are five essential skills clusters which are included in all pre-registration nursing programs in the United Kingdom. One important essential skill cluster is the infection prevention and control. It provides an overview and discussion of the key skills and behaviors that must be demonstrated by any nursing student to meet the standards set by the nursing and midwifery council in 2010. This very well covers the essential parts of knowledge given to nurses even before their graduation. This covers the importance of infection control; the national policies and guidelines in this connection, the risk assessment, the standard precautions suggested in connection to infection control, HH, PPE related issues, management of blood and body fluid products, disposal of wastes including sharps, safe handling of linen and management of patient care equipment in addition to environmental control and appropriate patient placement which assures infection control and aseptic techniques whenever that is needed (Pegram & Bloomfield, 2015).

Many studies looked at knowledge, attitudes, and perceptions of infection control guidelines and their applications in hospitals. In a study done by Kim et al., from Korea, 197 nurses working in a university hospital contributed to a self-administered questionnaire. Correct answers for questions related to knowledge was 67.4%. Favorable attitudes were 6.5 of 8, and good perceptions for safe environment was 7.75 of 9. The compliance score was 87.1 of 100. This compliance was felt to be very much related to attitudes, environment, and clinical

experience. ICUs showed the highest compliance (Kim & Hwang, 2020). Only 9% of nursing and medical students had acceptable knowledge in connection to HH. Nursing students were better than medical students (Nair et al., 2014). HCWs working in an emergency room have better attitudes and knowledge, but less compliance. Nurses were better than doctors. The concentration was on hepatitis C and HIV infections where 307 responses were analyzed in an Italian study (Parmeggiani et al., 2010). In a cross-sectional hospital-based study, Acharya et al., from India 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 information (Acharya et al., 2013). 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 emphasized (Cruz & Bashtawi, 2016). It was interesting to find some papers written on the behavior of nurses in rationalizing their own behavior. Nurses, in general, were very eager to give a good impression on their infection prevention behavior and present themselves as knowledgeable practitioners (Gould, 2015).

Sixty-six percent of 342 nursing students responded to a questionnaire looking at the attitudes and compliance of nursing students towards infection control measures. Attitudes was generally positive as compliance after contact with body fluid was high (99.5%) and before aseptic procedures (98. 5%). This was thought to be suboptimal prior and after patient contact (85% & 87% respectively), and after contact with patient surroundings (61%). Interestingly the

first-year nursing students were more compliant than their senior fourth-year students (Kingston et al., 2017).

Bakarman et al., 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 Attitudes were better (Bakarman et al., 2019). Ojulong et al., in Namibia reported a better score by medical students compared to radiology and nursing students, 73%,66%, and 61% respectively regardless of their sex and location of school (Ojulong et al., 2014).

In a commentary written by Arash Arianpoor in 2020, they used innovation for pre-graduate students as an education strategy which sensitized them to the challenge of infection transmission. This was felt to drive them to be innovative and be able in presenting a defense and therefore deepening their insight. This certainly improved their knowledge and prepared them very well to be self-conscience about it (Arianpoor et al., 2020).

Dentists

In a study performed on dental students, 86.43% washed their hands before touching the patient, but only 31.26% did so after touching the surroundings of the patient. These results need to alert teachers of dental profession to create awareness among their students regarding practical application of infection control measures (Hambire et al., 2020). Khanghahi et al., in a literature review, found that between 1985 and 2012, only 15 completely related articles were found to have looked at knowledge attitudes and practice among dental students (Khanghahi et al., 2013). Singh et al., from central India found that the mean knowledge, attitudes, and practice scores were 3.75 out of 6, 3.40 out of 4, and 3.35 out of 5 respectively. Level of knowledge and practice was poor among dental students. The attitudes was positive, but compliance was sub-optimal (Singh, 2011). In Pakistan, Ali et al., conducted a study which showed that dental students'

knowledge was favorable. There was, however, a clear need to transfer this knowledge into practice. They also concluded that these measures should be compulsory (Ali et al., 2014). In Yemen, Halboub et al., published a study where they did a survey on 145 final year dental students to report that only 53.8% were using face masks and 14% using eyewear. The majority of these students (62%) reported non-sterile occupational injuries (Halboub et al., 2015).

AlMaweri et al., in a study published in 2015, reported that despite the good attitudes and knowledge, the compliance was low among dental students (Al-Maweri et al., 2015). Two hundred and seventeen undergraduate, graduate, and postgraduate dental students participated in a study conducted by Abdul Hakam et al., in Pakistan which showed that protective devices like gloves and masks were used by most of the participants. Up to 82.5% of the students were highly aware of standard infection control. However, they never washed their hands before putting on gloves (33.6%) and dental impressions (72.8%), casts (80.6%), prostheses (56.2%), shade tabs (71.9%) and prosthetic instruments (58.1 %). It was also found in this study that individuals were not immunized against infectious diseases like Hepatitis-B (Hakam et al., 2018). Ghimire and Chandra conducted a cross-sectional study with a self-administered questionnaire to 144 dental students and interns from different levels of undergraduate training. When they were asked about the implementation of infection control policy in the clinical practice, only one scored very good, but 74 (51.4%) were fair, and 44 (30.6%) were good and 25 (17.4%) were poor in implementing infection control policy and their practice. This study was conducted in Nepal and the conclusion was that the knowledge and practice among dental students were poor and the attitudes towards infection control measures needs to be improved (Ghimire & Chandra, 2018). Ravichandran et al., in 2019 looked at attitudes, knowledge, and practices among postgraduates and compulsory rotatory residential internship (CRRIs) in connection to HH in India, among 275 participants (148 Postgraduates and 127 CRRIs), the majority had moderate knowledge (90.9%),

postgraduates were better. The attitudes was moderate at 40.7% and practices at 44%. Postgraduates also had better practices and attitudes compared to the CRRIs. 73.5% suggested better available facilities in HH training and interventional behavioral program (Ravichandran et al., 2019).

It is sometimes important to address some reports of real infections encountered by contacts with patients for HCWs or even undergraduate students. An example of this is the report of 12 individuals who were diagnosed to have tuberculosis when they became in contact with patients with tuberculosis. Most of these students convict that the tuberculosis infection-control practices at the hospitals they were trained were suboptimal and it was considered to be a major risk factor for them to acquire the disease (Westhuizen & Dramowski, 2017). Humran, in a cross-sectional study, enrolled 270 students from medical school, nursing school, and respiratory therapy college and found that the overall average of knowledge score was 81.13 points out of 100. The knowledge score of HH was higher among nursing students, followed by medical school and then the respiratory therapy program. The results also showed that students who took courses covering HH were higher in knowledge as compared to students who did not take such courses (83 Vs. 75). There were no significant differences in compliance between students in all categories in connection to HH. In terms of their satisfaction towards education and training, the results showed that nursing students had higher satisfaction scores than their counterparts in medical school and respiratory therapy programs (Humran & Alahmary, 2018).

Other Specialties

One hundred twenty-nine students participated in a study conducted by Khubrani et al., on students from college of medicine, dentistry, applied medical sciences, nursing, and pharmacy. Up to 73.6% of the students demonstrated sufficient knowledge. They concluded that these students' knowledge of standard precautions and infection control was satisfactory, with no

significant differences between gender or college. They also stated that this was purely due to satisfactory formal curricular teaching which was thought to be effective to assure students' knowledge in this field (Khubrani et al., 2018).

Chapter III

Methodology

This cross-sectional study explored perceptions, attitudes, obstacles, and compliance of health care undergraduate and graduate students from Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. Related demographic factors were examined, including healthcare specialty, level of education, gender, and age. This chapter contains a description of methods and procedures that were used in this study.

Research Questions

1. What are the perceptions, attitudes, and compliance of health care undergraduate and graduate students in the Byrdine F. Lewis college of nursing and health professions at Georgia State University regarding infection control guidelines?
2. Which student profession in the Byrdine F. Lewis college of nursing and health professions is most compliant to infection control guidelines?
3. What are the correlates of demographic factors and compliance to infection control practices?

Instrumentation

Demographic data on population characteristics including department, profession, age, and gender was examined for association with perceptions, attitudes, and compliance with respect to HH and use of PPE. This information was collected using a closed questionnaire (Appendix A) (Duerink et al., 2013). The attitudes of health care undergraduate and graduate students towards infection control was obtained from questions about their opinion about infection control (attitudes) and by asking if they faced problems in complying with infection

control guidelines (obstacles). The answers could be ticked in preprinted boxes yes, no, and do not know, choosing one option and true, false, and do not know. The questionnaire contains 59 questions; 5 questions on demographic data, 17 questions on the background, 5 questions about perceptions, 14 questions about attitudes, 12 questions about obstacles, and 6 questions about compliance with HH and PPE.

Research Design

Information about perceptions, attitudes, and compliance of health care undergraduate and graduate students was collected through the questionnaire. The questionnaire was sent electronically to the targeted population, which consisted of undergraduate and graduate students in the Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. The survey had a 30-day deadline period and two reminder emails were sent. A cover page, which included introduction, definitions, assurance of confidentiality, methods of answering, and the method of returning the questionnaire to the researcher was prepared. Data analysis was de-identified, such that each respondent was assigned a unique participant identifier.

Sample

A convenience sample was used in this study, as participants are chosen on the basis of availability (n=68). The population was from undergraduate and graduate students who were enrolled in nursing, RT, nutrition, PT, and OT programs in the Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University.

Protection of Human Subjects

The study proposal was submitted to Georgia State University Institutional Review Board (IRB) and approval was obtained (Appendix B). Study participation was voluntary

with consent (Appendix C) assumed on return of a completed survey. Confidentiality was implemented as no names or personal identifying information was used for data collection.

Procedure

Upon receiving IRB approval, distribution of the survey was done through electronic communication. The folder consisted of a cover letter, the questionnaire, and the consent form. The survey had a 30-day deadline period and two reminder emails were sent two and three weeks later. To ensure the anonymity of the participant, there was no identifying information on the survey folder. When the convenient sample size was achieved, statistical analysis was performed to revel the achieved results.

Data Collection and Analysis

Data was collected and analyzed by using the statistical program of Statistical Package for the Social Sciences (SPSS) version 25.0.

Chi-square analyses, analyses of variance, and independent samples t-tests were used. P-values of <0.05 were considered statistically significant.

Correlations between scores for perceptions, attitudes, obstacles, and compliance were computed. Descriptive statistics were used to measure frequency and percentage, which were used to identify differences in the demographic data of the sample. Moreover, descriptive statistics were used to measure mean scores and standard deviation for the subscales of the survey.

Chapter IV

Results

This chapter consists of 1) describing the sample obtained on demographic data, general and specific background, perceptions, attitudes, obstacles faced, and compliance of responders and 2) associations of perceptions, attitudes, obstacles, and compliance with the demographic data and towards HH and PPE.

The Sample and Findings Description

There was a total of 102 responders to the survey. However, 34 were excluded as they failed to answer all components. The total sample size of this analysis was therefore 68 responders.

Demographic Data

Out of the 68 responders, 64 (94.1%) were females and 4 (5.9%) were males. The age ranged from 19 to 55 years (mean: 30.27). The number of graduate students (37, 54.4%) was slightly higher than the undergraduate students (31, 47.6%). The majority of responders' specialty was 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).

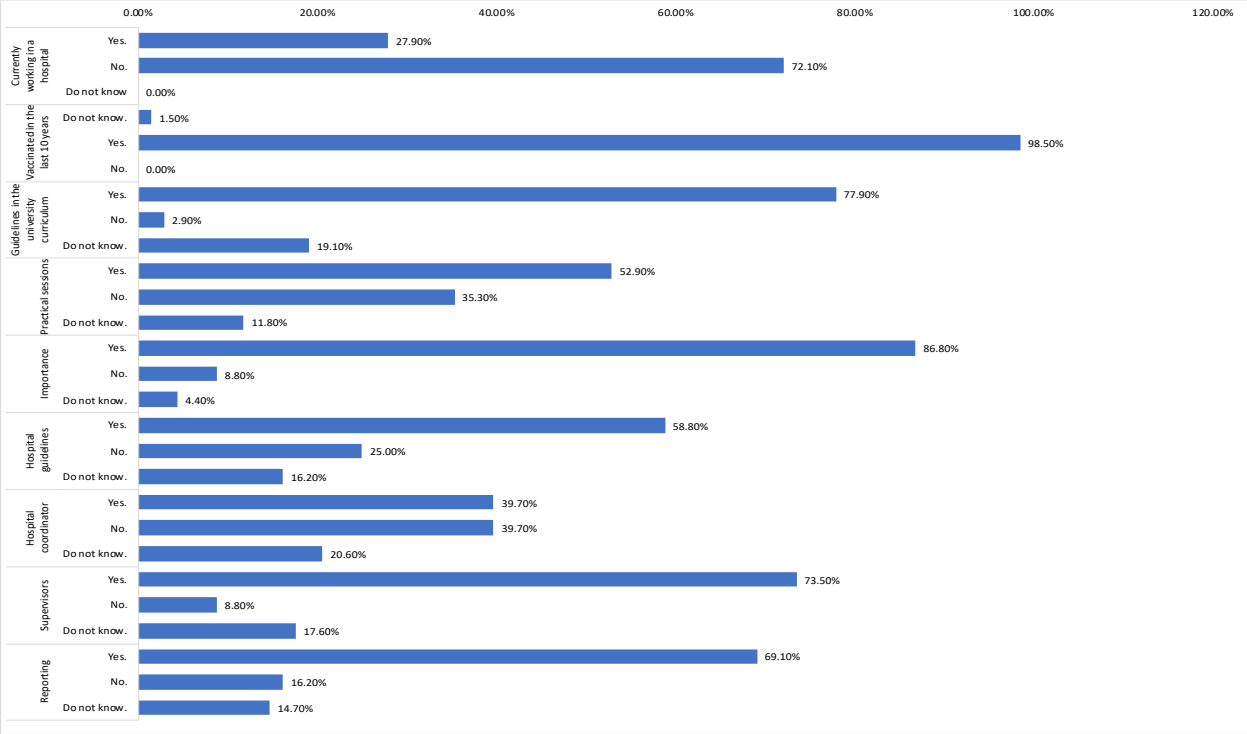
Table 1. Demographic Data

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)

General and Specific Background

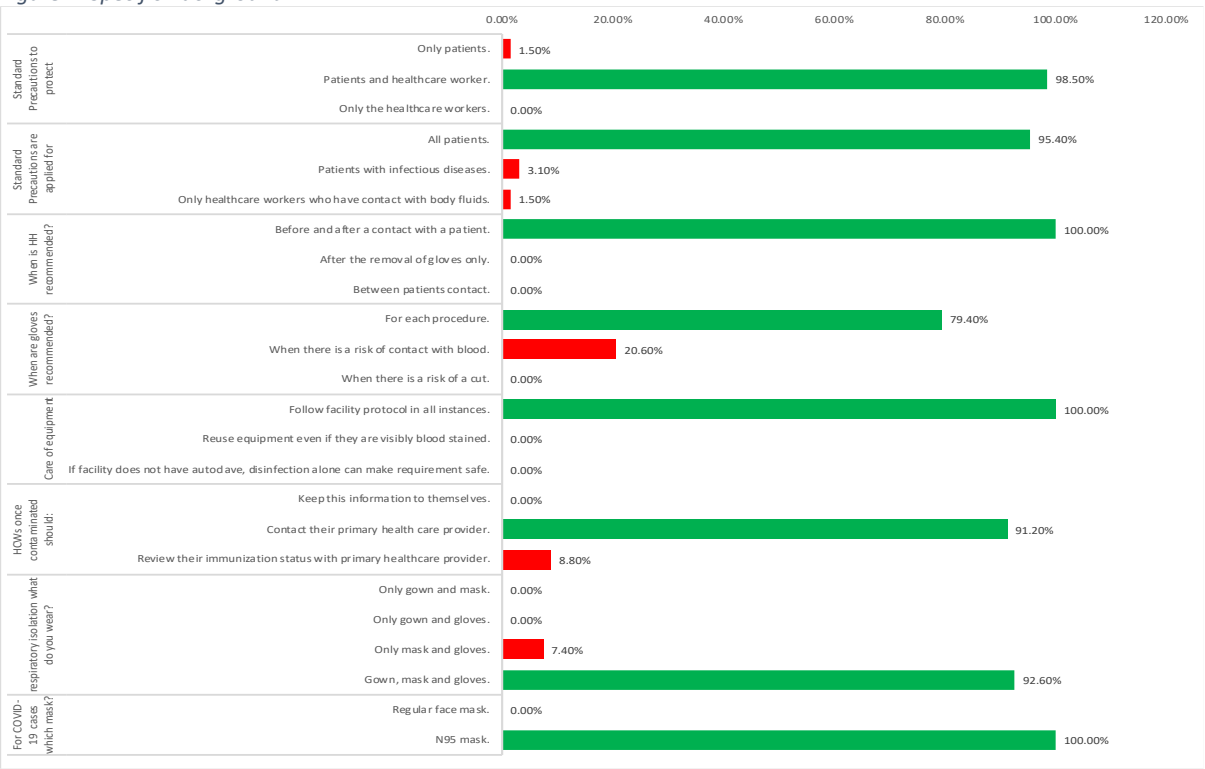
General Background. The majority of responders, 49 (72.1%) stated that they are not currently working in a hospital. Most responders received a vaccine in the last 10 years, 67 (98.5%). Infection control guidelines were reported by 53 (77.9%) of the responders to have been included in the university 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%). Forty-one (60.3%) of the responders do not know or have never been told about the professionals in the hospital who coordinate the infection control. 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).

Figure 1. General Background



Specific 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 HCWs, 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, HCWs 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 8 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



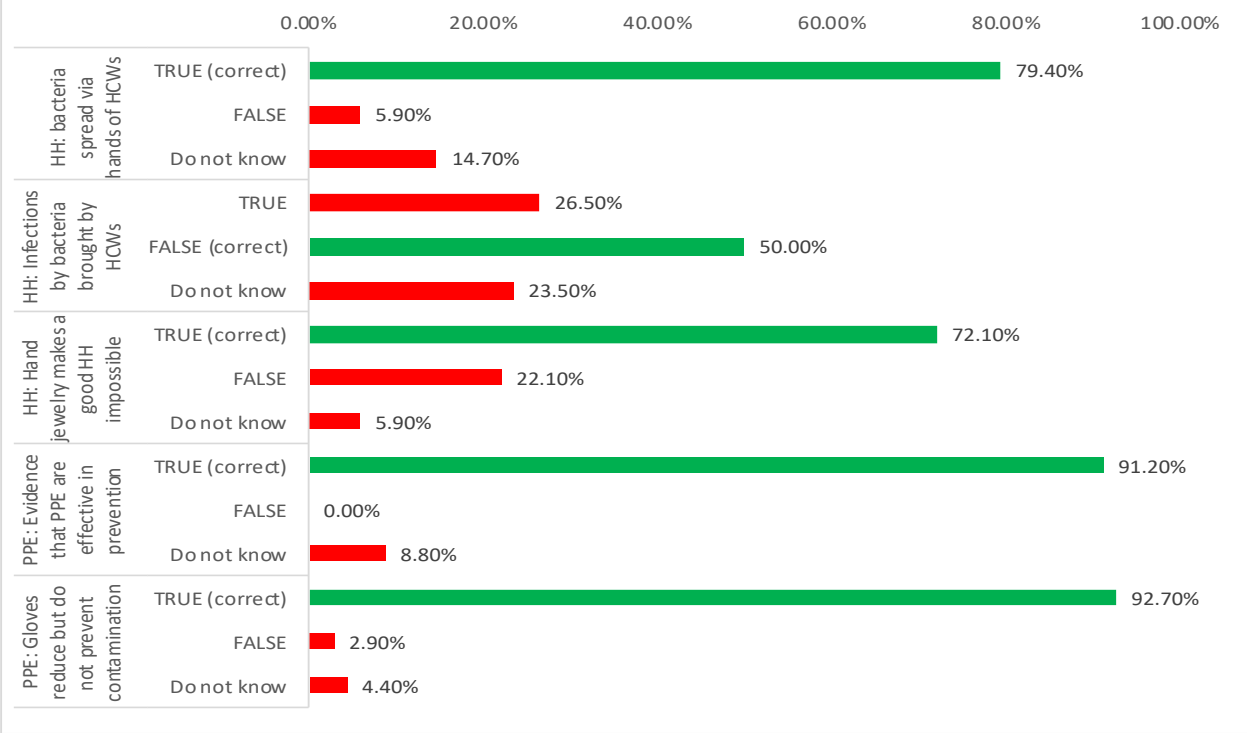
Perceptions, Attitudes, Obstacles and Compliance

In order to assess perceptions, attitudes, obstacles and compliance of the two main tools (HH and PPE) in infection control among responders, 2 to 7 statements were addressed for the responders to state that the statement is true, false or they do not know.

Perceptions. Three statements were given for HH. “Spreading of bacteria in hospitals occurs mainly via the hands of HCWs” 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 HCWs” 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 HH 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).

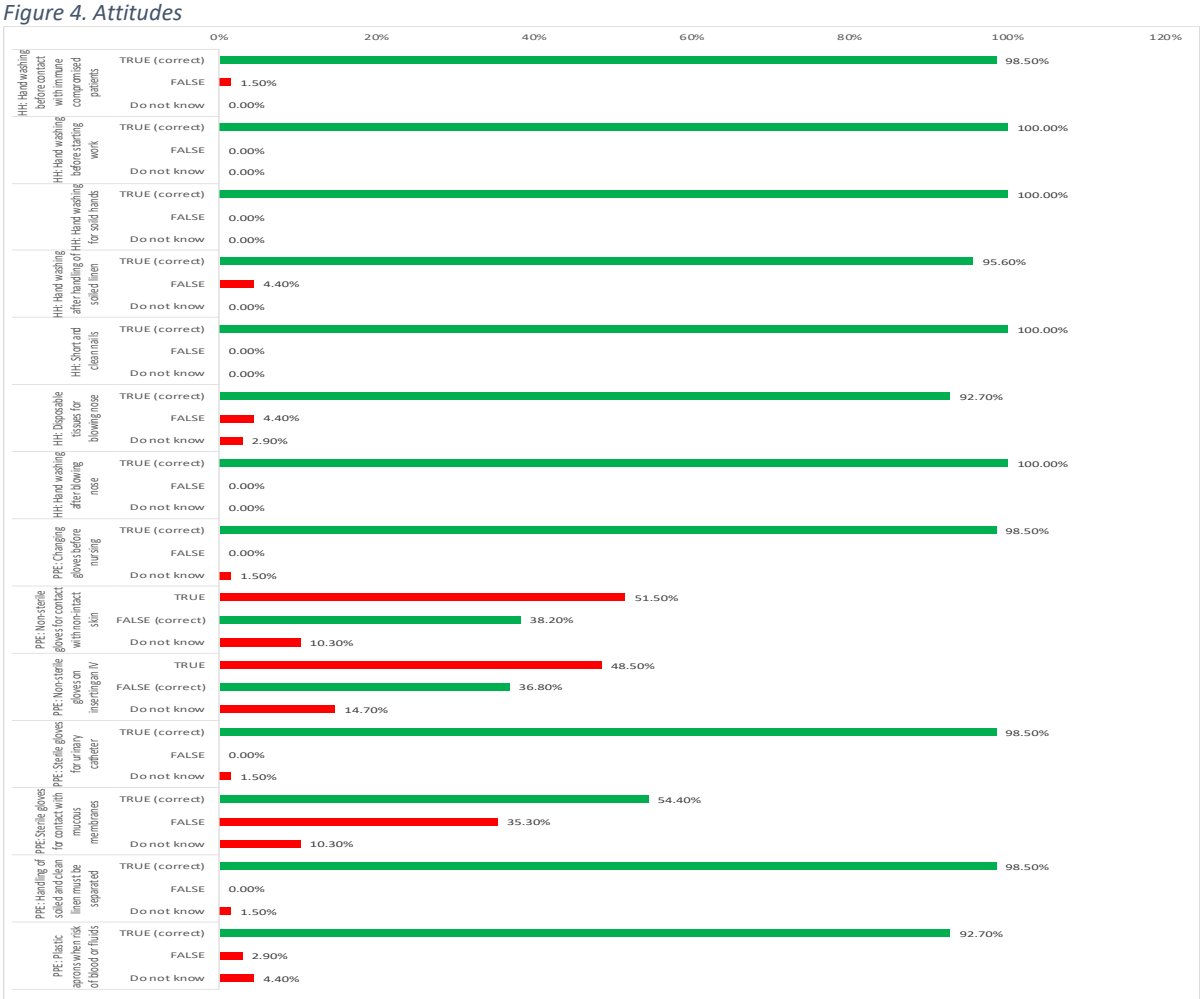
Figure 3. Perceptions



Attitudes. Seven statements were given for each of HH and PPE. For HH, all responders appropriately chose the correct choice (true) that "hands should be washed before starting work on the ward, visibly soiled hands must be washed with water and soap, nails should be cut short, clean and well-cared for, and employees should wash their hands after blowing their nose". The remaining three statements were chosen by the majority (92.7-98.5%) appropriately. They chose the correct choice (true) in "before contact with immune compromised patients, hands must always be washed with soap and water or rubbed with alcohol, after handling of soiled linen, hands must be washed or rubbed with alcohol, and employees should use disposable tissues for blowing their nose". For PPE, the majority (92.7-98.5%) appropriately chose the correct answer

(true) for “for every patient who has to be nursed with gloves, the employee has to change the gloves, sterile gloves must be worn during insertion of urinary catheter, handling of soiled and clean linen must be separated, and disposable (plastic) aprons should be worn when there is a risk that clothing or uniform may become exposed to blood, body fluids, secretions or excretions, with the exception of sweat”. The response for the other three choices was however interesting. Only 26 (38.2%) appropriately labeled that “non-sterile gloves must be worn in case of contact with non-intact skin” to be false. Similarly, only 25 (36.8%) appropriately labeled that “non-sterile gloves must be worn when inserting an intravenous catheter” to be false. Thirty-seven (54.4%) appropriately labeled that “sterile gloves must be worn in case of contact with mucous membranes” was however interestingly to be true (Figure 4).

Figure 4. Attitudes

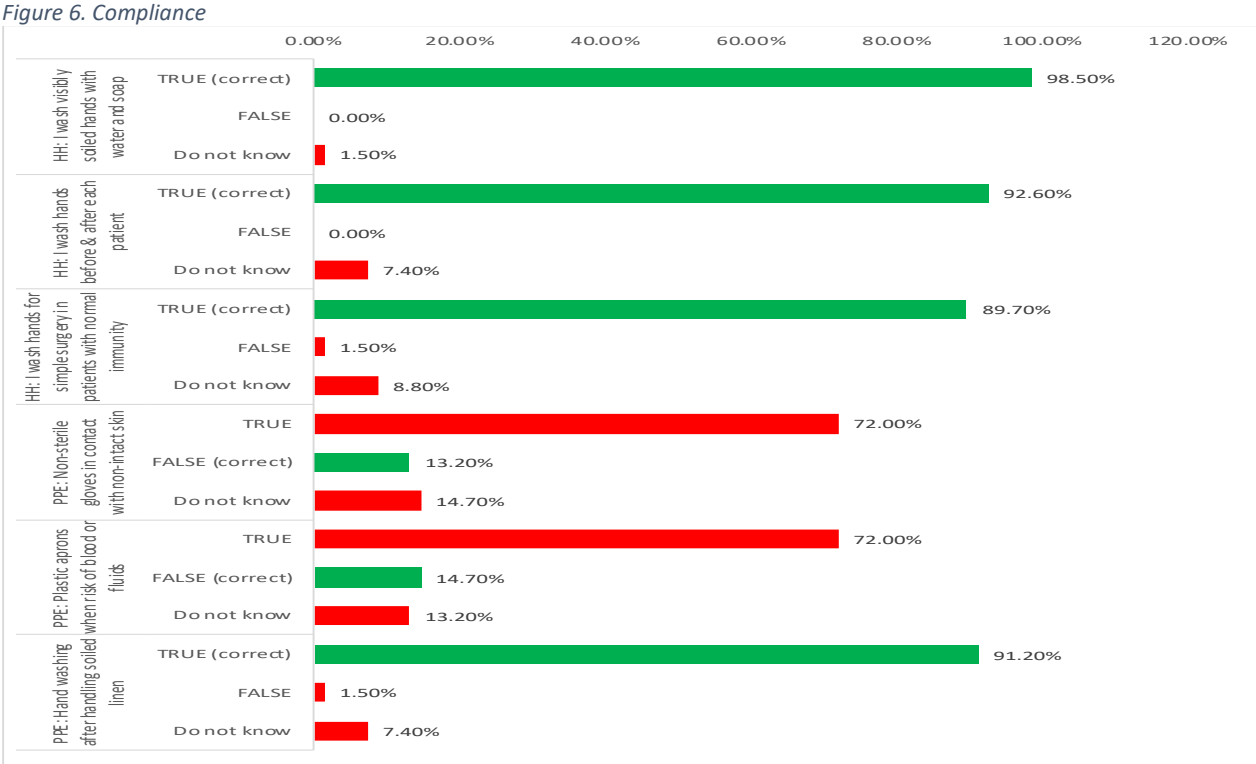


Obstacles. Six statements were addressed for each HH and PPE. For HH, the majority (95.6-97.1%) appropriately chose the correct answer (false) for "there is no proof of the importance, they make my work harder, and it takes too much time". For the statement "there are not enough hand washing facilities on the ward", 42 (61.8%) chose the appropriate answer (false). Ten (14.7%) and 16 (23.5%) inappropriately chose the true and do not know option respectively for this statement. "The skin of my hands becomes irritated" was inappropriately considered to be a correct choice by the majority of the responders 44 (64.7%). Only 16 (23.5%) chose the correct answer (false) and 8 (11.8%) did not know. Similarly, a good percentage (36.8%) of responders for "others do not follow the guidelines on HH" was inappropriately chosen to be true. Sixteen (23.5%) chose the correct answer (false) and 27 (39.7%) did not know. For PPE, more than 79% (79.4-95.6%) chose the appropriate answer (false) for "there is no proof of the importance, the guidelines are vague, they make my work much harder, it takes too much time, and nobody cares about it". Thirty-seven (54.4%) felt that there were enough gloves in the ward, while 10 (14.7%) thought otherwise and 21 (30.9%) did not know (Figure 5).

Figure 5. Obstacles

Compliance. Three statements were given for each HH and PPE. For HH, the majority (89.7- 98.5%) appropriately selected the correct choice (true) for "I wash visibly soiled hands with water and soap, I wash or disinfect hands before and after each patient contact, and I wash hands or rub with alcohol before performing simple surgery and caring for wounds, in patients with normal immune systems". For PPE, the majority of responders (91.2%) appropriately chose the correct answer (true) for "after handling soiled linen, I wash my hands or rub them with alcohol". However, the response for the other two statements namely "I wear non-sterile gloves in case of contact with non-intact skin and I only wear (plastic) aprons when there is a risk that my clothing or uniform may become exposed to blood, body fluids, secretions or excretions, with the exception of sweat" was interesting as only 9 (13.2%) and 10 (14.7%) chose the appropriate answer (false) respectively, while the majority 49 (72%) have actually chosen the inaccurate answer (true) for the two statements. Ten (14.7%) and 9 (13.2%) stated that they do not know respectively (Figure 6).

Figure 6. Compliance



Comparisons

The Background

Chi-square tests were conduct to identify the relationship between demographic factors and the 7 specific background questions:

Gender. There was no significant gender relationship with any of the specific background questions ($p > 0.05$). Hence, males and females are similar when it comes to the opinions about specific background questions (Table 2). Since all the respondents have chosen a single answer from the specific question, the necessary condition for at least two groups have been violated. Hence, chi-square tests cannot be conducted using those variables.

Age. Age was converted into a categorical variable with 4 groups (15-24, 25-34, 35-44, 45+), and chi-square tests were conducted. Similarly, there was no significant relationship of age with any of the specific background questions ($p > 0.05$) (Table 2).

Education level. Education level also showed no significant relationship with the specific background questions ($p > 0.05$). So, graduate and undergraduate students were similar in their opinion about the specific background questions (Table 2).

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 believe they have been contaminated with infectious agent, what should they do (Contact their primary health care provider)	1.382	0.240
	For a patient on respiratory isolation room what do you wear (Gown, mask and gloves)	1.943	0.163
Age	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
	Healthcare worker who believe 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
Education level	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 believe they have been contaminated with infectious agent, what should they do (Contact their primary health care provider)	0.052	0.820
	For a patient on respiratory isolation room what do you wear (Gown, mask and gloves)	1.425	0.233

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.

Specialty. Specialty had no significant relationship with any of the specific background questions ($p > 0.05$). So, opinions of responders about the specific background questions were not different based on specialty (Table 3).

Participation in a clinical program. Participation in a clinical program had no significant relationship with any of the specific background questions ($p > 0.05$) (Table 3).

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 believe 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 believe 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

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.

Perceptions, Attitudes, Obstacles, and Compliance

Gender. Table 4 shows the descriptive statistics of the gender in relationship to perceptions, attitudes, obstacles, and compliance with HH and PPE. Eight independent sample t-test were conducted to identify the gender difference. It was found that gender had no significant impact on all variables ($p > 0.05$) (Table 4).

Table 4. Perceptions, attitudes, obstacles, and compliance for HH and PPE measures by gender

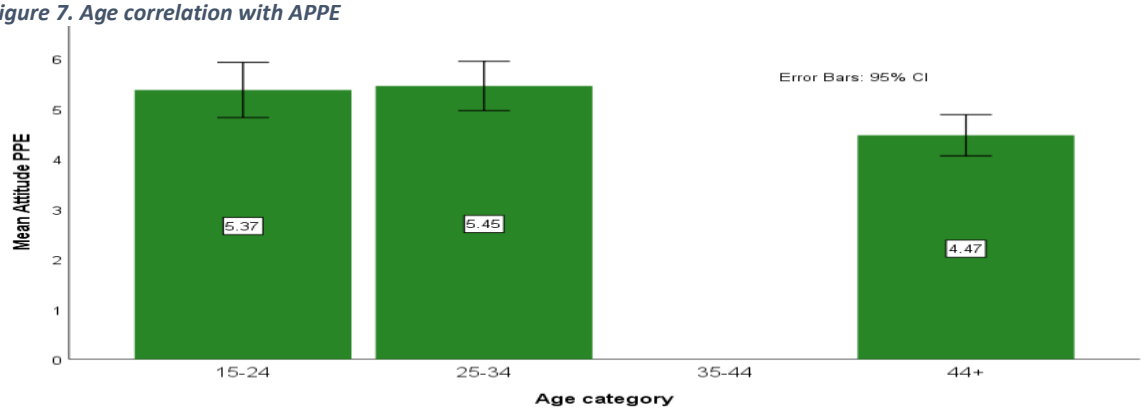
	Gender- Males, Mean (SD)	Gender- Females, Mean (SD)	T-Test value, *df*, *p*-value
Perceptions of HH	2.50 (0.58)	1.98 (0.72)	1.39, (*66*), p=0.17
Perceptions of PPE	2.00 (0.00)	1.83 (0.46)	0.75, (*66*), p=0.46
Attitudes of HH	6.75 (0.50)	6.86 (0.39)	-0.52, (*59*), p=0.60
Attitudes of PPE	5.50 (0.58)	5.16 (1.24)	0.55, (*60*), p=0.58
Obstacles of HH	4.00 (0.82)	3.96 (1.28)	0.05, (*58*), p=0.96
Obstacles of PPE	5.00 (1.15)	4.86 (1.46)	0.19, (*59*), p=0.85
Compliance of HH	2.67 (0.58)	2.80 (0.60)	-0.38, (*52*), p=0.70
Compliance of PPE	1.33 (0.58)	1.18 (0.66)	0.39, (*51*), p=0.69

Age. ANOVA test was used for this segment. There was no significant association or impact of age on 7 out of 8 variables. They were perceptions (HH, PPE), attitudes (HH), obstacles (HH, PPE), and compliance (HH, PPE). The age however had a significant effect on attitudes of PPE ($p < 0.05$) where 15-24 and 25-34 age groups had significantly higher scores compared to older than 44 age group. It clearly indicates that attitudes about PPE is significantly better in responders younger than 35 compared to older than 44 years (Table 5 & Figure 7).

Table 5. Perceptions, attitudes, obstacles, and compliance for HH and PPE measures by age

		Sum of Squares	df	Mean Square	F	Sig.
Perceptions of HH	Between Groups	.294	2	.147	.275	.760
	Within Groups	34.692	65	.534		
	Total	34.985	67			
Perceptions of PPE	Between Groups	.344	2	.172	.867	.425
	Within Groups	12.877	65	.198		
	Total	13.221	67			
Attitudes of HH	Between Groups	.284	2	.142	.876	.422
	Within Groups	9.388	58	.162		
	Total	9.672	60			
Attitudes of PPE	Between Groups	10.069	2	5.034	3.761	.029*
	Within Groups	78.980	59	1.339		
	Total	89.048	61			
Obstacles of HH	Between Groups	.209	2	.104	.065	.937
	Within Groups	91.725	57	1.609		
	Total	91.933	59			
Obstacles of PPE	Between Groups	6.167	2	3.084	1.532	.225
	Within Groups	116.783	58	2.014		
	Total	122.951	60			
Compliance of HH	Between Groups	.849	2	.424	1.208	.307
	Within Groups	17.911	51	.351		
	Total	18.759	53			
Compliance of PPE	Between Groups	2.362	2	1.181	2.990	.059
	Within Groups	19.751	50	.395		
	Total	22.113	52			

Figure 7. Age correlation with APPE



Level of education. Table 6 shows the descriptive statistics of education in relationship to perceptions, attitudes, obstacles, and compliance with HH and PPE. Eight independent sample t-test were conducted to identify effect of education level. Education level was found to have no significant impact on all variables ($p > 0.05$) (Table 6).

Table 6. Perceptions, attitudes, obstacles, and compliance for HH and PPE measures by level of education

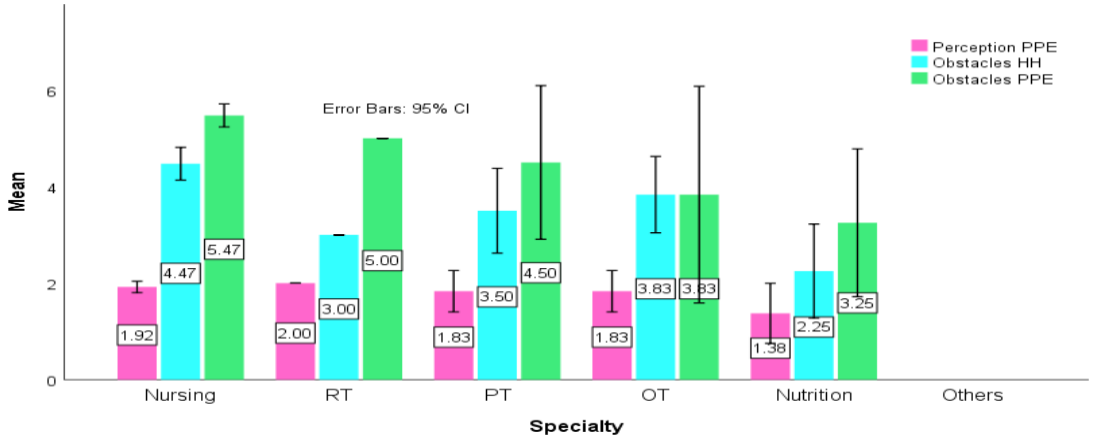
	Level of education-Undergraduate, Mean (SD)	Level of education-Graduate, Mean (SD)	T-Test value, *df*, *p*-value
Perceptions of HH	1.94 (0.78)	2.09 (0.65)	-0.86, (*66*), *p*=0.39
Perceptions of PPE	1.76 (0.55)	1.94 (0.25)	-1.78, (*66*), *p*=0.08
Attitudes of HH	6.86 (0.43)	6.85 (0.37)	1.11, (*59*), *p*=0.92
Attitudes of PPE	5.33 (1.22)	4.96 (1.18)	1.20, (*60*), *p*=0.23
Obstacles of HH	3.94 (1.43)	4.00 (0.98)	-1.18, (*58*), *p*=0.86
Obstacles of PPE	4.89 (1.43)	4.85 (1.46)	0.11, (*59*), *p*=0.92
Compliance of HH	2.81 (0.64)	2.77 (0.53)	0.24, (*52*), *p*=0.81
Compliance of PPE	1.25 (0.72)	1.10 (0.54)	0.84, (*51*), *p*=0.40

Specialty. There was a significant correlation between specialty and perceptions of PPE, obstacles of HH and PPE ($p < 0.05$), but there was no significant effect on the remaining variables; perceptions (HH), attitudes (HH, PPE), and compliance (HH, PPE) ($p > 0.05$) (Table 7). A post hoc test was conducted to identify which group differ from the other. According to that, nutrition (M = 1.38, SD = .744) group had significantly lower perceptions of PPE scores compared to nursing (M = 1.91, SD = .362), RT (M = 2.00, SD = .00), PT (M = 1.83, SD = .408) and OT (M = 1.86, SD = .378) specialties. This means nutrition group has poorer perceptions compared to other specialties. Considering the obstacles of HH and PPE, nutrition group had significantly lower scores compared to other specialties. This is a clear indication in that nutrition group has substantial obstacles compared to other specialties (Figure 8).

Table 7. Perceptions, attitudes, obstacles, and compliance for HH and PPE measures by specialty

		Sum of Squares	df	Mean Square	F	Sig.
Perceptions of HH	Between Groups	1.754	4	.438	.831	.510
	Within Groups	33.232	63	.527		
	Total	34.985	67			
Perceptions of PPE	Between Groups	2.019	4	.505	2.838	.031*
	Within Groups	11.202	63	.178		
	Total	13.221	67			
Attitudes of HH	Between Groups	.220	4	.055	.326	.859
	Within Groups	9.452	56	.169		
	Total	9.672	60			
Attitudes of PPE	Between Groups	4.763	4	1.191	.805	.527
	Within Groups	84.285	57	1.479		
	Total	89.048	61			
Obstacles of HH	Between Groups	36.626	4	9.157	9.106	.000*
	Within Groups	55.307	55	1.006		
	Total	91.933	59			
Obstacles of PPE	Between Groups	39.682	4	9.920	6.672	.000*
	Within Groups	83.269	56	1.487		
	Total	122.951	60			
Compliance of HH	Between Groups	3.286	4	.822	2.602	.050
	Within Groups	15.473	49	.316		
	Total	18.759	53			
Compliance of PPE	Between Groups	3.841	4	.960	2.523	.053
	Within Groups	18.272	48	.381		
	Total	22.113	52			

Figure 8. Correlation of specialty and PPPE, OHH, OPPE



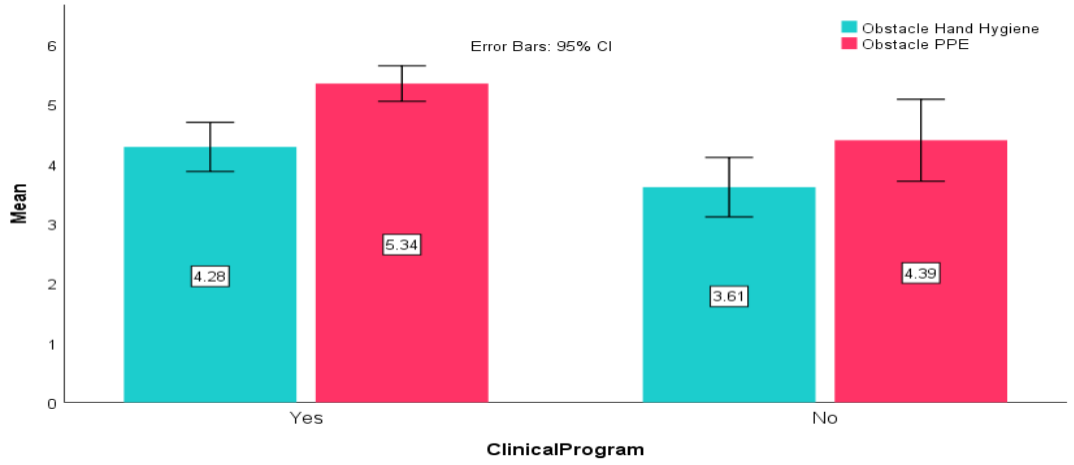
Participation in a clinical program. Table 8 shows the descriptive statistics of participation in clinical program in relationship to perceptions, attitudes, obstacles, and compliance with HH and PPE. Eight independent sample t-test were conducted to identify the difference between participating and non-participating responders. Participation variable had 0no

significant impact on perceptions (HH, PPE), attitudes (HH, PPE), and compliance (HH, PPE) (P > 0.05). However, it had a significant impact on obstacles of HH and PPE ($p < 0.05$). Responders who did not attend the clinical program had significantly lower obstacles of HH (M = 3.61, SD = .985) and obstacles of PPE scores (M = 4.39, SD = 1.771). For responders who attended the clinical program, on the other hand showed obstacles of HH (M = 4.71, SD = .985) and obstacles of PPE scores (M = 5.33, SD = .970). This clearly indicates that there are less obstacles among clinical program non-participants compared to participants (Table 8 & Figure 9).

Table 8. Perceptions, attitudes, obstacles, and compliance for HH and PPE measures participation in clinical program

	Participation in clinical program- Yes, Mean (SD)	Participation in clinical program- No, Mean (SD)	T-Test value, *df*, *p*-value
Perceptions of HH	2.19 (0.68)	1.93 (0.76)	0.83, (*66*), *p*=0.41
Perceptions of PPE	1.81 (0.51)	1.81 (0.47)	0.45, (*66*), *p*=0.66
Attitudes of HH	6.82 (0.39)	6.83 (0.47)	0.46, (*59*), *p*=0.65
Attitudes of PPE	4.89 (1.13)	5.28 (1.39)	-0.59, (*60*), *p*=0.55
Obstacles of HH	4.71 (0.98)	3.61 (1.29)	2.15, (*58*), *p*=0.03*
Obstacles of PPE	5.33 (0.97)	4.39 (1.77)	2.38, (*59*), *p*=0.02*
Compliance of HH	3.00 (0.00)	2.68 (0.75)	1.29, (*52*), *p*=0.20
Compliance of PPE	1.13 (0.35)	1.16 (0.75)	0.30, (*51*), *p*=0.76

Figure 9. Correlation of being enrolled in a clinical program with OHH and OPPE



Chapter V

Discussion

This chapter aims to address the study findings in comparison to other centers' experience found in the published literature. It will also formulate the conclusion and related recommendations.

As stated in chapter III, the purpose of this research is to explore perceptions, attitudes and compliance of health care undergraduate and graduate students in the Byrdine F. Lewis college of nursing and health professions at Georgia State University in addition to the obstacles faced in connection to infection control guidelines. Correlation of demographic factors of the responders towards these variables was made.

The spotlight on infection control has been the focus of research and education initiatives by CDC and WHO recently. In addition to the establishment of appropriate related guidelines, they are constantly updating the guidelines consistent with the current literature (Centers for Disease Control and Prevention [CDC], 2017; World Health Organization [WHO], 2009). Health personnel immunization status should be continuously updated and proper vaccines are administered if clinically needed. In this study, 98.5% responders received some vaccine in the last 10 years. Understanding modes of transmission by the HCWs is also an important element. This will strengthen their compliance when they understand the rational of every tool used in infection control. Importance of compliance is also a solid component of these guidelines. These guidelines actually formulate a significant part of any university curriculum. Only 77.9% of responders in the present study stated that these guidelines were included in the university curriculum. About half received practical sessions but almost 87% received instructions about the guidelines' importance, but only 58.8% received specific hospital guidelines. There was an

alarming fact that almost two thirds (60%) were not aware of who is handling infection control issues in the hospital.

The specific background of participants tried to look at some selected important related issues needed as a basic knowledge and perceptions for all HCWs. Fortunately, 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 the HH and PPE. In this research, an attempt to obtain an insight on perceptions, attitudes, compliance in addition to the obstacles faced by the responders towards HH and PPE was made. About 80% of responders considered that infection transmission occurs mainly via the hands of HCWs. Almost three quarters of the remaining 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' perceptions 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 or perhaps impossible to do. Only 72% agreed with this statement, however, perceptions 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 but not totally preventing infection transmission. This may have actually reflected responders' optimal background and perceptions towards infection control. In this study, there are limited but important and fundamental questions which may be sufficient to show a reflection of responders' perceptions of infection control measures. In a previous cross-sectional study on 243 nurses, only half demonstrated a good level of knowledge and positive perceptions of HH (Al-Mohaithef et al., 2020). Responders in the present study, who were mostly nurses, therefore demonstrated better

perceptions. Perceptions certainly needs continuous support in both basic education and training. This can be achieved by periodic revision of the university curriculum and regular refreshment theoretical and practical courses. 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 perceptions 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 perceptions (Piché-Renaud et al., 2020). This pandemic may have reflected on the responders' answers in this study.

Perceptions is not actually sufficient if not accompanied by optimal attitudes. Attitudes was assessed in this study by 14 questions, 7 for HH and 7 for PPE. As a matter of fact, most responders to these attitudes' questions chose the correct choices, as for HH 4 out of 7 statements were chosen by all and the remaining 3 by more than 90% of responders. The case was similar for PPE as correct answers were chosen by more than 90% for 4 statements. It is well known that attitudes in life is affected by many factors like the genetics of the person, the way the person is brought up by parents and teachers, education which includes knowledge and perceptions, peers and after all the personality itself. All of these areas may be the subject of proper development throughout all stages of life. Auditing at any stage of all these stages is very important as if accompanied by reinforcement will result in an optimal outcome and continuous improvement. An Australian hospital-based study, although it was performed on cleaning staff HH, concluded that they were 3 important themes, the culture, reminders and the personal values (Sendall et al., 2019). This can certainly be extended to any other job. COVID-19 pandemic has actually improved attitudes among HCWs. In a study performed on a large Turkish pandemic center with

553 HCWs, it was clear that not only the compliance as will be explained below but also the attitudes of HCWs particularly in the use of PPE improved (Çiriş Yildiz et al., 2020)

Obstacle which may face HCWs regardless of their specialty or level of profession are many. Examples addressed in the present study were: importance, increasing difficulties in performing duties, consuming too much time, lack of hand washing facilities, the possible relationship to skin irritation due to too frequent hand washing and blaming others for not doing it. More than 79% of responders chose the proper choice for 8 out of the 12 statements provided. Lack of certain facilities differ from one country to the other. It has been evident that it is an existing problem in studies done in some countries like Egypt, Nigeria and Uganda (Refeai et al., 2020; Onyedibe et al., 2020; Niyonzima et al., 2018).

Compliance with infection control guidelines is also an important cornerstone to assure proper and continuous application of these guidelines. In the present study, compliance with HH and PPE was very good as 89.7-98.5% of responders chose the correct answers related to compliance with HH. A similar conclusion was achieved in Denmark where the compliance rate with HH guidelines was at least 80% in more than 200 HCWs responses (Vikke et al., 2019). This was found to be lower at 40% in ICUs (Ay et al., 2019). This however was not the case in Ethiopia where the overall level of HH compliance among HCWs was poor at only 14.9% (Engdaw et al., 2019) and in Nigeria at 21-63% (Onyedibe et al., 2020). This big difference may be related to the quality of training and follow up provided in the developed compared to developing countries. Compliance is also affected by the environmental and organizational factors which include availability of the needed sinks and tools for HH and PPE (Yassi et al., 2007; Chughtai & Khan, 2020). A proof that refreshment and positive enforcement activities provided by the health care facility to HCWs was well shown by Chavali et al., in the study published in the Indian journal of critical care medicine in 2014 where a one-year aggressive

multimodal intervention program in improving HH compliance resulted in a 78% overall compliance rate. This shows that ongoing training ensures that sustained performance and compliance to HH is achieved (Chavali et al., 2014; Ay et al., 2019). H-J. Seo et al., looked at 973 studies and retrieved 57 with potential relevance to include 24 studies which met the criteria of the study about intervention to improve HH compliance in emergency departments. All these studies applied multimodal or dual interventions to improve HH compliance. Through this, they applied many strategies like education, monitoring, providing feedback and campaigns. This improved HH compliance in the majority of the studies reviewed (Seo et al., 2019). Five-year sustainability was achieved in a Japanese study which used multimodal intervention questionnaire recommended by WHO (Sakihama et al., 2020). There is however a clear need for future randomized controlled trials to emphasize these findings and also to determine which intervention modalities are most effective and sustainable.

In the present study, responder's distribution was almost equal in the number of undergraduate versus graduate students. A little 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 of course may have an influence on the data analysis when comparisons were considered. 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 4 age groups and even with that there was no significant age relationship to the way responders answered the specific questions.

Comparing undergraduate and graduate responders and participation in clinical programs failed to show any significant differences in education level as they both demonstrated similar opinions in connection to the specific questions. There were also no significant differences of the specialties.

When comparison addressing age, gender, level of education, specialty, participation in a clinical program effect on perceptions, attitudes, faced obstacles and compliance was made, important findings were found. There were no significant relationship or correlation to gender, some age categories and level of education towards perceptions, attitudes, obstacles and compliance. This is similar to the findings in the literature (Khubrani et al., 2018). The significant relationships withdrawn from all responders in the present study were that younger participants (less than 34) had better attitudes in connection to PPE and that specialty has significant correlation with perceptions of PPE and also with the obstacles faced for both HH and PPE. Nurses were found to have better perceptions in this and in other studies (Ay et al., 2019; Nair et al., 2014). Compliance was better in older compared to younger nurses in s study done in nursing homes in USA (Russell et al., 2018). There were however no significant effect or correlation with perceptions, attitudes and compliance of HH or with compliance of PPE 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 perceptions (Arianpoor et al., 2020).

Limitations

This study has several limitations, including small sample size and potential response bias. Response bias may be influenced by the high proportion of female and nursing respondents in the study. Non-response bias may also be present, and there were many excluded surveys that were not completed. Missing data analyses were not conducted to determine the potential extent of the bias. Future studies should address these limitations in their research.

Conclusion and Recommendations

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 perceptions, attitudes, compliance and the capability of HCWs to overcome all obstacles faced.

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 individually and their correlations. This certainly will add to the distinguished nature of this institution in a very vital health issue i.e., infection control. The suggested innovations in order to sensitize HCWs is certainly a very attractive approach to assure self-consciousness of continuously updated knowledge and attitudes to face any challenge. More awareness of the importance of research related to infection control issues is needed.

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Appendix A: Questionnaire to Assess the Perceptions, Attitudes, and compliance of Health Care Undergraduate and Graduate Students Regarding Infection Control Practices.

Part I: Demographic data:

1. Sex: ☐Female ☐Male
2. Age: _____
3. Level of Education: ☐Undergraduate ☐ Graduate
4. Specialty: ☐Nursing ☐RT ☐PT ☐OT ☐Nutrition ☐Others
5. Are you currently enrolled and participating in a clinical program?
   ☐ Yes ☐No If yes Specify: _____

Part II:

II.I: General:

1. Are you currently working in a hospital?
   ☐ Yes ☐No ☐Do not know
2. Were you vaccinated in the last 10 years?
   ☐ Yes ☐No ☐Do not know If yes Specify: _____
3. Have infection control guidelines been included in the university curriculum?
   ☐Yes ☐No ☐Do not know
4. Have you been given practical session (hand on) on infection control guidelines?
   ☐ Yes ☐No ☐Do not know
5. Have you been instructed about the importance of infection control?
   ☐ Yes ☐No ☐Do not know
6. Have you been instructed about the hospital guidelines on infection control?
   ☐ Yes ☐No ☐Do not know
7. Were you told which professionals in the hospital coordinate the infection control?
   ☐ Yes ☐No ☐Do not know
8. Do you see your supervisors apply infection control guidelines?
   ☐ Yes ☐No ☐Do not know
9. Have you had instructions to report signs and symptoms of an infectious condition promptly to a supervisor or a hospital infection control practitioner?
   ☐ Yes ☐No ☐Do not know

II.II: Specific: (Choose one option)

1. Standard Precautions are recommended to protect:
   a) Only the patients. ☐
   b) The patients and the healthcare worker. ☐
   c) Only the healthcare workers. ☐

2. Standard Precautions are applied for:
   a) All the patients. ☐
   b) Patients with infectious diseases. ☐
   c) Only healthcare workers who have contact with body fluid. ☐

3. When is hand hygiene recommended?
   a) Before or after a contact with a patient. ☐
   b) After the removal of gloves only. ☐
   c) Between patients contact. ☐

4. When is the use of gloves recommended?
   a) For each procedure. ☐
   b) When there is a risk of contact with blood. ☐
   c) When there is a risk of a cut. ☐

5. What should healthcare worker do about care of equipment?
   a) Should follow facility protocol in all instance ☐
   b) Reuse equipment even if they are visibly blood stained. ☐
   c) If facility does not have autoclave, disinfection alone can make requirement safe. ☐

6. Healthcare worker who believe they have been contaminated with infectious agent, what should they do?
   a) Keep this information to themselves. ☐
   b) Contact their primary health care provider. ☐
   c) Review their immunization status with primary healthcare provider. ☐

7. For a patient on respiratory isolation room what do you wear?
   a) Only gown and mask. ☐
   b) Only gown and gloves. ☐
   c) Only mask and gloves. ☐
   d) Gown, mask and gloves. ☐

8. For COVID-19 isolate cases which of the following masks is advisable?
   a) Regular face mask. ☐
   b) N95 mask. ☐

Part III:

	True	False	Do not Know
III.I: Perceptions:			
Hand hygiene:			
1. Spreading of bacteria in hospitals occurs mainly via the hands of personnel.			
2. Infections are mainly caused by bacteria brought into the hospital by hospital workers.			
3. Hand jewelry make a good hand hygiene impossible.			
Personal Protective Equipment (PPE):			
1. There is evidence that aprons, gowns and masks are effective in preventing hospital- acquired infections.			
2. Gloves reduce the contamination of the hands, but do not prevent it completely.			
III.II: Attitudes:			
Hand hygiene:			
1. Before contact with immune compromised patients, hands must always be washed with soap and water or rubbed with alcohol			
2. Hands should be washed before starting work on the ward.			
3. Visibly soiled hands must be washed with water and soap.			
4. After handling of soiled linen, hands must be washed or rubbed with alcohol.			

5. Nails should be cut short, clean and well-cared for.			
6. On wards employees should use disposable tissues for blowing their nose.			
7. On wards employees should wash their hands after blowing their nose.			
Personal Protective Equipment (PPE):			
1. For every patient who has to be nursed with gloves, the employee has to change the gloves			
2. Non-sterile gloves must be worn in case of contact with non-intact skin.			
3. Non-sterile gloves must be worn when inserting an intravenous catheter.			
4. Sterile gloves must be worn during insertion of urinary catheter.			
5. Sterile gloves must be worn in case of contact with mucous membranes.			
6. Handling of soiled and clean linen must be separated.			
7. Disposable (plastic) aprons should be worn when there is a risk that clothing or uniform may become exposed to blood, body fluids, secretions or excretions, with the exception of sweat.			
III.III: Obstacles:			
Hand hygiene:			
1. There is no proof of the importance.			
2. They make my work harder.			
3. It takes too much time.			
4. There are not enough hand washing facilities on the ward			
5. The skin of my hands becomes irritated			
6. Others do not follow the guidelines on hand hygiene.			
Personal Protective Equipment (PPE):			
1. There is no proof of the importance.			
2. The guidelines are vague			
3. They make my work much harder			
4. It takes too much time			
5. Nobody cares about it			
6. We do not have enough gloves on the ward			
III.IV: Compliance:			
Hand hygiene:			
1. I wash visibly soiled hands with water and soap.			
2. I wash or disinfect hands before and after each patient contact.			
3. I wash hands or rub with alcohol before performing simple surgery and caring for wounds, in patients with normal immune systems.			
Personal Protective Equipment (PPE):			
1. I wear non-sterile gloves in case of contact with non-intact skin.			
2. I only wear (plastic) aprons when there is a risk that my clothing or uniform may become exposed to blood, body fluids, secretions or excretions, with the exception of sweat.			
3. After handling soiled linen, I wash my hands or rub them with alcohol.			

Appendix B: IRB Approval

INSTITUTIONAL REVIEW BOARD

Mail: P.O. Box 3999 In Person: 3rd Floor
Atlanta, Georgia 30302-3999 58 Edgewood
Phone: 404/413-3500 FWA: 00000129

July 13, 2020

Principal Investigator: Douglas Gardenhire

Key Personnel: Alherbish, Raghad A; Gardenhire, Douglas

Study Department: Respiratory Therapy

Study Title: PERCEPTION, ATTITUDE, AND COMPLIANCE OF HEALTH CARE UNDERGRADUATE AND GRADUATE STUDENTS REGARDING INFECTION CONTROL PRACTICES

Submission Type: Exempt Protocol Category 2

IRB Number: H21022

Reference Number: 361343

Determination Date: 07/09/2020

Status Check Due By: 07/08/2023

The above-referenced study has been determined by the Institutional Review Board (IRB) to be exempt from federal regulations as defined in 45 CFR 46 and has evaluated for the following:

1. Determination that it falls within one or more of the eight exempt categories allowed by the institution; and
2. Determination that the research meets the organization's ethical standards

If there is a change to your study, you should notify the IRB through an Amendment Application before the change is implemented. The IRB will determine whether your research continues to qualify for exemption or if a new submission of an expedited or full board application is required.

A Status Check must be submitted three years from the determination date indicated above. When the study is complete, a Study Closure Form must be submitted to the IRB.

This determination applies only to research activities engaged in by the personnel listed on this document.

It is the Principal Investigator's responsibility to ensure that the IRB's requirements as detailed in the Institutional Review Board Policies and Procedures For Faculty, Staff, and Student Researchers (available at gsu.edu/irb) are observed, and to ensure that relevant laws and regulations of any jurisdiction where the research takes place are observed in its conduct.

Any unanticipated problems resulting from this study must be reported immediately to the University Institutional Review Board. For more information, please visit our website at www.gsu.edu/irb.

Sincerely,

Jamie Zaikov, IRB Member

Appendix C: Cover Letter and Consent

Georgia State University

Department of Respiratory Therapy

Informed Consent

Title: Perceptions, Attitudes, and Compliance of Health Care Undergraduate and Graduate Students Regarding Infection Control Practices.
Investigator: Raghad Alherbish, BSRT
Supervisor: Rachel E. Culbreth, PhD, MPH, RRT

I. Purpose

Dear colleague,

You are invited to participate in a study entitled "Perceptions, Attitudes, and Compliance of Health Care Undergraduate and Graduate Students, Byrdine F. Lewis College of Nursing and Health Professions, Georgia State University Regarding Infection Control Practices." The aim of this study is to explore student's perceptions, attitudes, and compliance towards infection control. The research is being conducted by Raghad Alherbish, a master's degree student from the Department of Respiratory Therapy at Georgia State University, under the advisement of Dr. Rachel Culbreth, Assistant Professor in the Department of Respiratory Therapy as part of the requirements of the master's degree. You are invited to participate because you are an undergraduate or graduate health care student. A convenient number of participants will be recruited for this study. Participation will require approximately 15 minutes of your time to complete the questionnaire.

II. Procedures

You are asked to kindly complete the following questionnaire in connection to perceptions, attitudes, and compliance of infection control guidelines. The questionnaire should take approximately 15 minutes to complete. Please note that your participation in this study is strictly voluntary. You can submit the questionnaire at any time (not later than August, 30). The questionnaire will need to be completed one time only.

III. Contact Persons

If you have any questions or concerns about this study, please contact Dr. Rachel Culbreth at rculbreth@gsu.edu or 404-413-1224, or contact Raghad Alherbish at ralherbish1@student.gsu.edu or 470-439-9360. You can talk about questions, concerns, offer input, obtain information, or suggestions about the study.

IV. Copy of Consent Form to Participant

You may print or save a copy of this consent for your records. Please note: Completion and submission of this questionnaire implies that you have read this information and consent to participate in this study. If you agree to participate in this research, please continue with the questionnaire.

Sincerely,
Rachel E. Culbreth, PhD, MPH, RRT
Raghad Alherbish, BSRT