EXPLORING INFECTION PREVENTION AND CONTROL EDUCATION IN ATLANTIC CANADIAN UNDERGRADUATE NURSING EDUCATION PROGRAMS

by

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ABSTRACT

Purpose: To identify whether or not undergraduate nursing education curricula contain the material and delivery necessary to prepare nursing students to meet published core competencies for infection prevention and control (IP&C).

Methods: Directors completed a curriculum review questionnaire to identify when and how IP&C material was covered in their programs. Online questionnaires were used to assess nurse educator and student knowledge and confidence.

Results: Most programs provided at least some coverage of all topics identified in the published core competencies for IP&C, but the extent of coverage varied by topic. Educator and student total knowledge scores ranged from 61.5% - 86.5%, and 55.8% - 92.3% respectively, with variation found within topic areas. Educator and student total percent confidence scores ranged between 68.5% - 100.0% and 59.3% - 100.0% respectively, with variation also found within topic areas.

Conclusion: Gaps in curricula were identified related to IP&C, as were gaps in educator and student knowledge and confidence. Strategies were identified to address these gaps.

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"You have brains in your head. You have feet in your shoes. You can steer yourself in any direction you choose".

-Dr. Seuss

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Chapter 1: Introduction

This chapter provides the background for a research study that assessed curricular content, nurse educator knowledge and confidence, and student knowledge and confidence related to infection prevention and control (IP&C). It outlines the model developed for the research study, the rationale for the study, and the associated research questions. A brief overview of the methods is also included.

1.1. Background

Healthcare-associated infections (HAIs) are a significant issue in the healthcare environment, resulting in substantial morbidity, mortality, and financial burden on the healthcare system. Of concern, there is data to suggest that incidence rates of HAIs are increasing in Canada. The Canadian Nosocomial Infection Surveillance Program (2013) reported that rates of HAI CDAD rose from 4.72 per 1,000 patient admissions in 2010, to 5.35 per 1,000 patient admissions in 2011. They also reported an increase in Cerebrospinal Fluid Shunt-specific Blood Stream Infection (BSI) rates from 3.43 infections per 100 procedures in 2010, to 5.62 infections per 100 procedures in 2011. However, regardless of whether the incidence rates for any HAI increase, decrease, or remain static, the rates continue to be of concern not just in Canada, but also abroad. For example, the Centers for Disease Control (2014) reported that very little progress was made in 2012 in the prevention of infections of Methicillin-resistant *Staphylococcus aureus* (MRSA).

Etchells et al. (2012) determined that in general hospital populations, the cost per case of hospital-acquired infection ranged from US$2,027 to US$12,197. Marchetti and

Rossiter (2013) estimated the overall burden of HAIs, including lost income and other direct and indirect healthcare costs, and found that HAIs in US acute-care hospitals result in an overall financial burden of $96 - $147 billion annually. Undeniably, as the literature suggests, HAIs are associated with significant personal and financial costs to patients, families, and governments.

HAIs in the healthcare environment can originate from a variety of sources, and commonly result from specific procedures or use of devices. Examples of such procedure or device associated infections are surgical site infections, ventilator-associated infections, catheter-associated urinary tract infections, or central-line catheter bloodstream infections (Yokoe & Classen, 2008). Healthcare workers (HCWs) transmit microorganisms from patient to patient in the healthcare environment, for example through contaminated hands, equipment, or clothing. In addition to risks associated with HCWs transmitting infections to their patients, HCWs themselves may be at risk of transmission of infectious agents in a healthcare setting. During the Severe Acute Respiratory Syndrome (SARS) outbreak in 2002/03, 44% of probable cases in Canada were in HCWs (Ofner-Agostini et al., 2006). As such, HCWs must be adequately prepared to protect themselves against infection transmission when caring for their patients. In order to reduce the number of HAIs, it is imperative that HCWs be knowledgeable and skilled in the area of IP&C, and that this knowledge and these skills be incorporated into their practice. They must understand the role they play in reducing and preventing infection transmission.

1.1.1. Breaking the chain of infection.

The chain of infection refers to the process in which an infection occurs when an infectious agent, e.g., a bacterium or a virus, is transmitted to a susceptible host, so there is potential for infection to occur. In order to protect both HCWs and patients from infectious agents, Canadian HCWs should adhere to the guidelines provided under Routine Practices and Additional Precautions, also known as RPAP (Public Health Agency of Canada Centre for Communicable Diseases and Infection Control, 2012a). Routine Practices (RP) refer to the recommendations for activities to be used in the care of all patients, regardless of setting or health status. These fundamental practices include basic-level strategies for preventing infection transmission, such as hand hygiene and the use of personal protective equipment (PPE). PPE is a term used to describe equipment, e.g., gloves, masks, gowns, and goggles, which are worn by healthcare workers to protect themselves, and their patients, from infectious agents.

Additional Precautions (AP) include guidelines and recommendations for transmission-based precautions, e.g., the use of additional transmission-based strategies in the confirmed or suspected presence of a microorganism, deemed to be paramount in further protecting both HCWs and patients from transmission of that infectious agent.

While RPAP and their American equivalent, Standard Precautions and Transmission-Based Precautions (TBP), have been well developed as sets of guidelines and recommendations, variances exist in the extent to which, and accuracy with which, individual HCWs integrate them into their practice. In response to an identified practice gap, Infection Prevention and Control Canada (IPAC), until recently known as the Community and Hospital Infection Control Association of Canada (CHICA-Canada),

recognized the need for adequate knowledge and skills of HCWs in the area of IP&C, and developed core competencies for knowledge and skills in IP&C. For the purposes of this study, the core competencies will be referred to as the CHICA-Canada core competencies, because this is the title of the published document. This document was published in 2006, and while currently under review, is the only existing document. It is based on RPAP and consistent with current RPAP recommendations. The core competencies address the following content areas: Microbiology, Hand Hygiene, RPAP, Personal Protective Equipment, Personal Safety, Sterilization and Disinfection, and Critical Assessment Skills (Henderson, 2006). These competencies, with 21 different topics, were originally written as guidelines for health education programs. A summary of the competencies can be found in Appendix A. The competencies have been disseminated largely within the IP&C community, however, the extent to which they have been disseminated to other groups such as educators has not been examined.

1.1.2. The sub-optimal application of RPAP in practice.

Multiple studies worldwide have found that HCWs have suboptimal compliance rates for recommended IP&C precautions. For example, an American study by Geller, Bakken, Currie, Schnall, and Larson (2010), had post-baccalaureate nursing students track infection control hazards and near misses observed during their clinical practice in an electronic data base. Of the 3,492 entries generated over 3 years, 25.4% were related to infection control practices. Of these observations, 27.6% were related to non-adherence to isolation precautions. In an American study by Beam, Gibbs, Boulter, Beckerdite, and Smith (2011), all of the 10 participants in an observational study

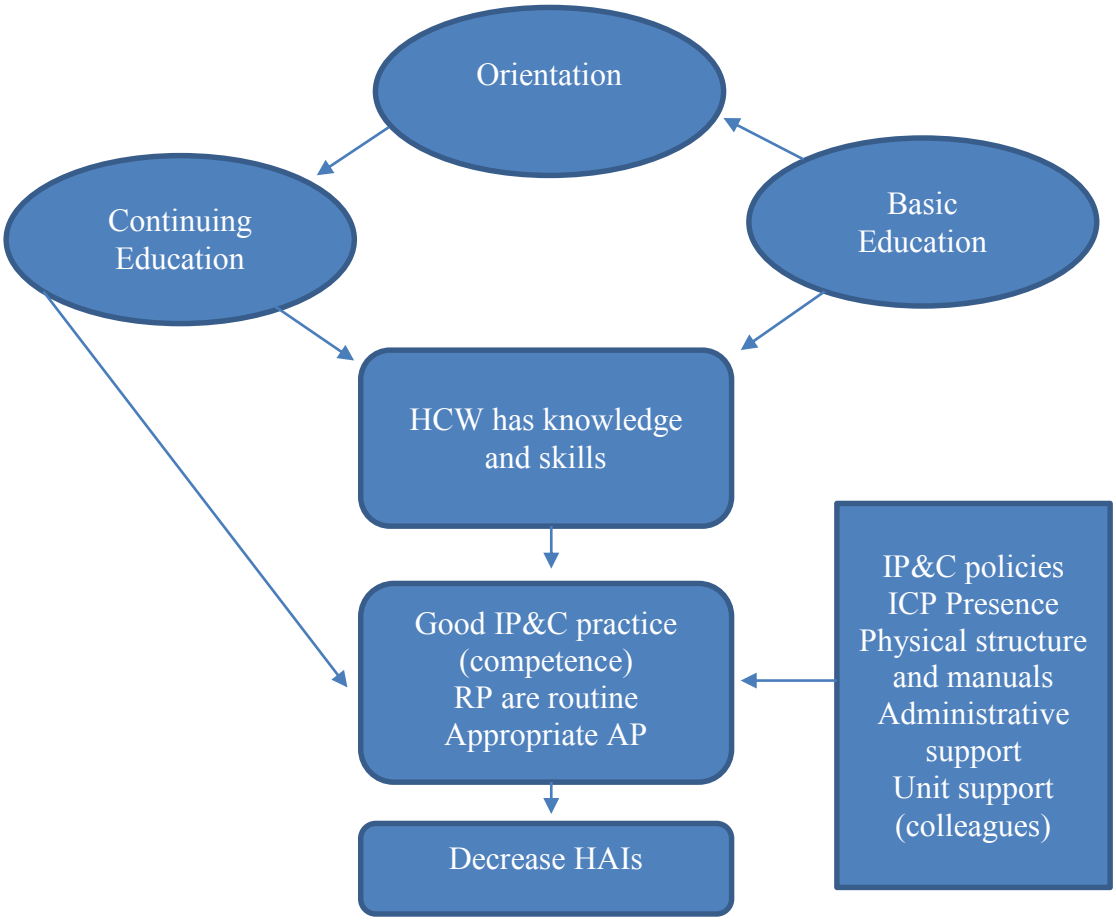
committed at least one breach of airborne and contact isolation precautions. Ofner-Agostini et al. (2008) stated, in a report, that during the 2003 SARS outbreak in Toronto, several HCWs contracted SARS in part as a result of facility-specific reductions of enhanced IP&C procedures in their hospital during the outbreak. The literature supports the fact that HCW practice in IP&C is sub-optimal, so it is important to explore this issue further and to attempt to identify any factors that contribute to this problem.

In order to address the issue of sub-optimal IP&C practice among HCWs, we must first understand what factors may lead to the development of this problem. These may include IP&C policies, peer influences (e.g., observing colleagues not wearing gloves when required), and access to materials which can impact performance (e.g., availability of Personal Protective Equipment within a unit). These factors need to be addressed by administration and practicing nurses at the institutional level. However, HCWs need to have the knowledge and skills before they can be expected to implement strategies for addressing these factors.

Figure 1 summarizes key factors in the development and application of IP&C knowledge and skills. Knowledge and skills can be learned at the undergraduate level, through continuing education, and/or through orientation. As evidenced by the fact that IP&C material is noted in the entry-to-practice documents for many licensing bodies in Canada (e.g., CRNNS), new graduates are expected to be proficient in at least basic material related to IP&C. Orientation sessions and continuing education sessions are designed to enhance previous learning through reinforcing and refining previously learned material. However, in an assessment of an IP&C orientation program for practicing nurses, Coates (2008) determined that it did not contain the information

needed to help staff meet the CHICA-Canada Core Competencies for IP&C. If, as Coates suggests, orientation is not sufficient, it is clear that a strong foundation of IP&C knowledge and skill must be obtained at the undergraduate/basic education level.

Figure 1: Improving IP&C Practice



1.1.3. Current state of knowledge and skills of nursing students.

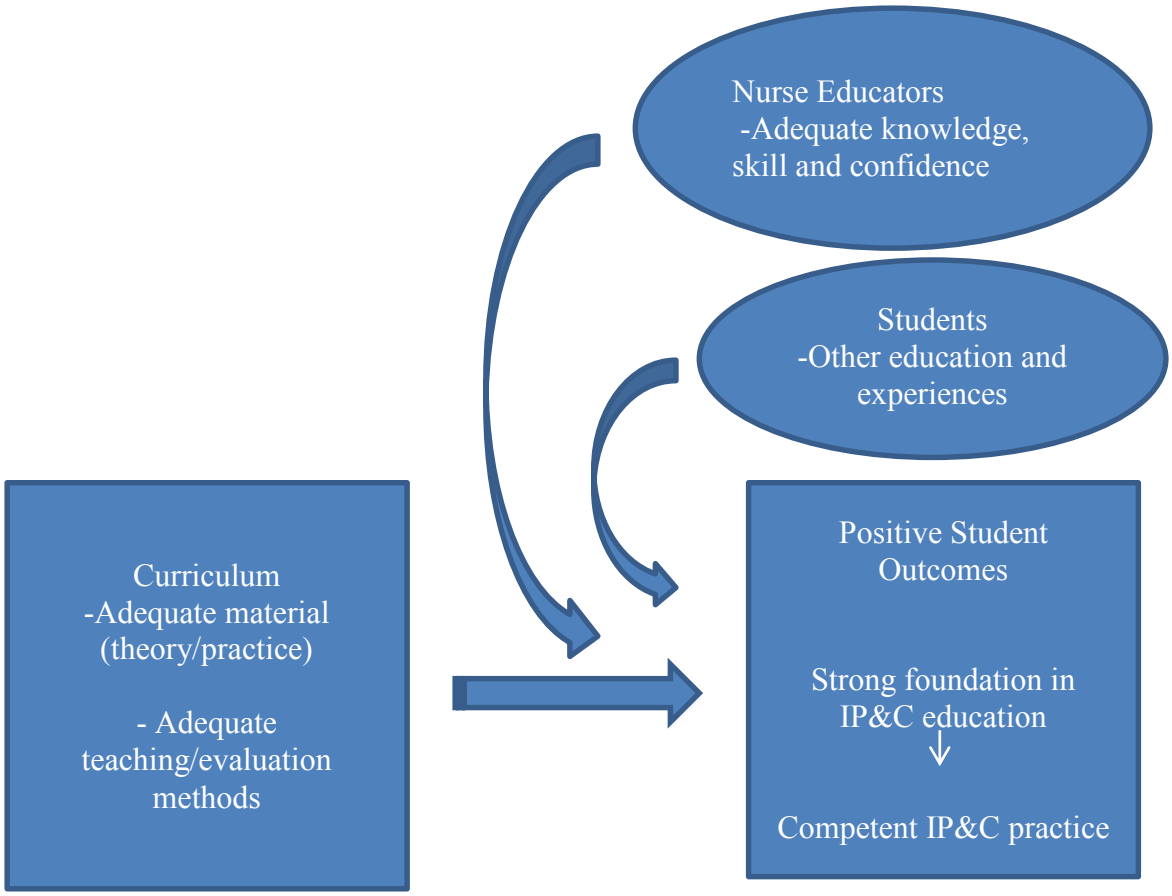
In order to be adequately prepared for their role as graduate nurses, nursing students need to develop adequate knowledge and skill in IP&C in their undergraduate nursing programs. There is a limited amount of literature that specifically addresses this issue as it relates to nursing students. However, some studies exist that suggest that, like practicing HCWs, students also struggle with applying RPAP in practice. As part of a Canadian study by Yonge, Rosychuk, Biley, Lake, and Marrie (2007), 456 undergraduate nursing students at the University of Alberta were surveyed about their general knowledge and risk perception of pandemic influenza. Results suggested that nursing students did not have adequate knowledge about the management of pandemic influenza, including the role of antiviral drugs, or even how the illness is transmitted. In an Italian study of nursing and medical students, van de Mortel, Kermode, Progano, and Sansoni (2011) assessed for hand hygiene knowledge, beliefs, and practices. In the hand hygiene knowledge portion of their study, only 22.4% of nursing students scored above 50.0% on the questions overall, with the student scores ranging from zero to nine out of twelve (mean 5.25). As hand hygiene is a very basic level topic in IP&C, it would be expected that student knowledge should be higher in this area. These studies suggest that knowledge gaps in IP&C may exist among nursing students, and that these gaps are not necessarily exclusive to more advanced concepts/material.

1.1.4. Developing adequate undergraduate education in IP&C.

Before being able to address gaps in undergraduate education, it is important to understand how students obtain their knowledge and develop their skills. As outlined in

the study model found in Figure 2, the main areas that influence student outcomes are curriculum and nurse educators. Students may have other factors that influence their learning, such as previous education and experiences, however, curriculum and the role of nurse educators are the main influences on student outcomes, and the influences of interest in this study.

Figure 2: IP&C Knowledge and Skill Development Among Nursing Students



In order to be effective, curricula must contain adequate coverage of relevant topics, both theory and practice, as outlined in the CHICA-Canada core competencies related to IP&C. Material must be taught using topic-appropriate methods, and learning must also be evaluated using topic-appropriate methods (e.g., using demonstration and practice for psychomotor skills). One older study was found that addresses the IP&C curricular content of health care related programs, in particular nursing education programs in Canada. Duregon (2003) conducted a content review of 96 Canadian schools of nursing (graduate and undergraduate) and medical schools for program content specific to outbreak management. In this Master's thesis study, it was found that the majority of undergraduate nursing programs included elements such as hand washing, infection transmission, disease prevention, and immunization in their curricula. However, curricular content related to this material varied from program to program. Topics such as basic principles of epidemiology were covered as part of standard nursing education, while topics such as outbreaks or epidemics were often covered only if the student chose to participate in extra learning opportunities. There has been minimal literature in this area since Duregon (2003), with no other studies found in the literature, so new evaluation research is necessary to identify if gaps still exist.

Nurse educators responsible for teaching IP&C material must also have adequate knowledge, skill, and confidence in order to provide appropriate instruction and feedback to students, and to be able to be role models in the area of IP&C. They must also remain current with any changes in recommendations in IP&C practices. A search of the literature did not identify any reports of studies done to address the issue of nurse educator needs or skills in the area of IP&C knowledge and skill. We assume that

educators have adequate knowledge and confidence in the area of IP&C as they are licensed registered nurses. However, this assumption may not be valid as the evidence suggests that nurses do not always have adequate knowledge related to IP&C, and if they do have the knowledge, do not always apply this in practice. If gaps in knowledge and skill are identified in future, recommendations may be made for continuing education sessions for nurse educators.

1.2. Study Rationale

A review of the literature has indicated that HAIs are a serious issue in the healthcare environment. One contributing factor is that there are serious deficiencies in knowledge, behaviors, and skill in the area of IP&C practice, contributing to the development of HAIs. Orientation and Continuing Education are sources of information for practicing nurses. However, even if well designed, which Coates (2008) suggested is not the case, material cannot be reinforced in these sessions if nurses begin the sessions with knowledge gaps in these areas. As such, it is critical that students obtain a strong IP&C foundation at the undergraduate level. While several studies have addressed the issue of knowledge and skill within the context of practicing nurses, there is minimal literature that addresses the knowledge, skills, and behaviors of undergraduate nursing students. There are no recent studies that address the IP&C-specific curricular content of undergraduate nursing programs, and the needs of nurse educators in this area are not well understood.

1.3. Study Purpose and Research Questions

The purpose of this research project was to identify whether or not undergraduate nursing education curricula contain the material and delivery necessary to prepare nursing students to meet the CHICA-Canada core competencies for IP&C. The research questions for this project were as follows:

1. Do nursing curricula contain the content necessary to help nursing students meet the CHICA-Canada core competencies for IP&C?
2. Do clinical nurse educators have the knowledge required to teach material needed to help nursing students meet the CHICA-Canada core competencies for IP&C?
3. Do clinical nurse educators feel adequately prepared and confident in teaching material specific to the CHICA-Canada core competencies for IP&C?
4. Do nursing students have the knowledge required to meet the CHICA-Canada core competencies for IP&C?
5. Do nursing students feel adequately prepared and confident in meeting the CHICA-Canada core competencies for IP&C?

1.4. Methods

There were two separate research methods used: one to assess curriculum, and one to assess nurse educator and student knowledge and confidence. The details and methods for this study can be found in Chapter 3. They both used a cross-sectional descriptive survey design. The content of the survey instruments was based on the CHICA-Canada core competencies for IP&C which were previously described. Directors of nursing programs were asked to provide information about the IP&C content

of curricula using a self-administered questionnaire. In addition to responding to yes/no questions, they were also asked to respond to questions on the quantity, type, timing, evaluation, and method of delivery of material taught to students in specific IP&C-related content areas. When applicable, directors sought assistance from other nurse educators in their program for completion of curriculum review.

This study also identified nurse educators' and nursing students' knowledge of, and confidence in, IP&C practice. Data were obtained from individual nurse educators and nursing students via online questionnaires. The nurse educator and nursing student questionnaires were divided into four sections: demographics, knowledge, confidence, and general information.

1.5. Summary

While HAIs are a significant problem in the healthcare environment, little is known about the IP&C – related knowledge and confidence of nurse educators and nursing students in undergraduate nursing education programs. In addition, there exists a deficit of knowledge related to the quantity and type of IP&C-specific content found in undergraduate nursing curricula. However, the importance of developing a strong IP&C foundation at the undergraduate level has been established. As such, this research study assessed the curricular content of several undergraduate nursing programs for coverage of material related to IP&C, assessed nurse educator knowledge and confidence related to IP&C since they are key in the delivery of material, and assessed student knowledge and confidence related to IP&C. In doing so, the researcher attempted to address some of the gaps in the literature related to this very important issue.

Chapter 2: Literature Review

This chapter summarizes the literature related to healthcare-associated infections, and the role that nurses and nursing students have on the transmission of infectious agents that cause healthcare-associated infections. It also includes literature that addresses contributing factors in competent infection prevention and control practice, as well as relevant literature pertaining to curriculum review and curriculum content. The chapter identifies current knowledge and trends, as well as highlights any gaps in the literature.

2.1. Literature Search Methods

Using the services available through the MUN Health Services Library, relevant literature was obtained through a thorough search of the PubMed and CINAHL databases. Results were limited to English articles published between 2008 and January 2015. In situations where no current relevant results were found, earlier literature, from 2003 to 2008, was also searched. Search terms used included, but were not limited to: healthcare-associated infections, infection prevention and control, routine practices and additional precautions, standard precautions, hand hygiene, personal protective equipment, student knowledge, nurse knowledge, student confidence, nurse confidence, curriculum review, teaching methods, evaluation methods, and contributing factors. Abstracts for articles were reviewed to determine relevance of the article. Once a decision was made to include an article, the articles were obtained either electronically or through a document request from the Health Services Library.

When appropriate, the search engine Google was used to locate documents not found through searches of peer-reviewed literature, for example, government and hospital

reports. Search terms used were the same terms used for locating peer-reviewed articles, and the results were limited to documents published between 2008 and January 2015.

2.2. Healthcare-Associated Infections

A review of the literature revealed an abundance of evidence to support that healthcare-associated infections (HAIs) are a significant issue in the healthcare environment. For example, the Public Health Agency of Canada (2013) reported that 200,000 patients become infected each year while receiving health care in Canada, and that more than 8,000 of these patients will die as a result of these infections. In addition, the World Health Organization (2011) stated that 7 out of 100 hospitalized patients in developed countries will acquire at least one healthcare-associated infection, and 30% of patients in intensive care units are affected by at least one healthcare-associated infection. While these recent reports clearly document the existence of HAIs, they are based on data that may be up to a decade old since few organizations have the resources to conduct total surveillance and report rates for all HAIs. No one organization completes total surveillance programs for all HAIs on a global level as was once commonly done. As such, in order to develop a better understanding of the gravity of the problem, it is also necessary to consider HAI rates obtained through focused surveillance studies and research studies.

The most commonly cited sources of Canadian surveillance data identified in the literature review for this research study were from the Canadian Nosocomial Infection Surveillance Program (CNISP), the Provincial Infection Control Network of British Columbia (PICnet), the Public Health Agency of Canada, and the provincial Departments

of Health. In addition, the HAIs in Canada that have been most frequently reported are infections caused by Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile*-associated diarrhea (CDAD). For example, CNISP (2013) reported that healthcare-associated MRSA rates rose slightly from 1.22 per 1,000 patient admissions in 2010, to 1.39 per 1,000 patient admissions in 2011. In addition, CNISP reported that rates of HAI CDAD rose from 4.72 per 1,000 patient admissions in 2010, to 5.35 per 1,000 patient admissions in 2011.

These MRSA and CDAD incidence rates show that these microorganisms continue to be an issue in the healthcare environment. While they are two of the most common microorganisms causing infection, they are far from being the only ones. Surveillance on HAIs is not only conducted on specific microorganisms, but also on specific procedures including Central Line Blood Stream Infections (BSI) and Surgical Site Infections (SSI). The Public Health Agency of Canada (2014), for example, reported an increase in Cerebrospinal Fluid Shunt-specific BSI rates from 3.43 infections per 100 procedures in 2010, to 5.62 infections per 100 procedures in 2011. Rates are not always increasing however. For example, one study reported that cesarean section SSI rates in a Toronto hospital went from 7.6% of procedures in 2008, to 3.7% in 2011 following implementation of an education program to reduce prehospital hair removal (Ng, Alexander, Kerr, Ho, Amato, & Katz, 2012). It is important to note that regardless of whether the incidence rates for any HAI increase, decrease, or remain static, the incidence rates of HAIs continue to be of concern in Canada.

Global data provide evidence that HAIs continue to be an issue in other developed countries as well. In the Centers for Disease Control (CDC) *National and State*

Healthcare Associated Infection Progress Report (2014), the CDC reported that the CDAD standardized infection ratio (SIR) as 0.98 in 2012, and that for MRSA as 0.96. The SIR is a statistic used by the CDC to track HAI prevention progress over time, with a lower SIR indicating better progress, and an SIR of 1 meaning no change. These data indicate that very little progress was made in 2012 in the United States in infection prevention for these organisms. European data from the European Centre for Disease Prevention and Control (2012) also supports the presence of HAIs in those countries. They suggested that in 2011/2012, the overall prevalence of HAIs was 5.7%, 12.3% of which were related to MRSA.

While the existence of HAIs is well documented, data sources related to HAIs are not always optimal. Data sources are often limited to medium to large sized acute care facilities, and local surveillance is usually focused and specific. As a result of the lack of comprehensive surveillance being done on a global level, it is difficult to make comparisons between microorganisms/procedures, sectors, or regions. As such, in order to develop a better understanding of the gravity of the problem, it is also necessary to include data obtained through research studies when assessing for rates and burden related to HAIs. In spite of issues in obtaining comprehensive HAI rates, HAIs are still a global concern.

2.2.1. HAI- related burden.

The presence of HAIs causes significant burden, both to the healthcare environment, and outside of the healthcare environment. In addition to any morbidity and mortality consequences of HAIs, there is also an economic burden associated with

these infections. Unfortunately, these issues are not well studied, and literature specific to HAI burden is sometimes old and outdated. However, some examples of more current assessments exist. Etchells et al. (2012) completed a comprehensive review of the global literature related to the economics of HAIs. Even their review contained several older studies, some dated in the early 2000s. They concluded that in general hospital populations, the cost per case of hospital-acquired infection ranged from US$2,027 (CAN$2,265) to US$12,197 (CAN$22,400). Nosocomial bloodstream infection was associated with costs ranging from €1,814 (CAN$3,268) to €16,706 (CAN$29,950). They also estimated the economic burden of microorganism specific HAIs in Canada, with CDAD being $46,131,449, MRSA $36,283,237, and BSI $24,404,335.

While the literature provides economic estimates associated with the burden of HAIs, very few of these studies assessed for the burden of HAIs beyond any direct healthcare costs. One exception to this was a study by Marchetti and Rossiter (2013). In this study, they attempted to include estimates for costs such as lost productivity and income, post-discharge diagnosis, readmission, malpractice and wrongful death, and direct healthcare costs. In considering a more holistic approach of burden calculations, they estimated that direct and indirect costs associated with HAIs in US acute-care hospitals total $96-$147 billion annually. Undeniably, as the literature suggests, HAIs are associated with significant personal and financial costs to patients, families, and governments. As such, it is imperative that we develop a better understanding of the role that healthcare workers (HCWs) play in the transmission of HAIs, so we can decrease incidence and burden.

2.3. Healthcare Workers and Infections

HAIs in the healthcare environment can originate from a variety of sources. Commonly, HAIs result from specific procedures or use of devices, such as surgical site infections, ventilator-associated infections, catheter-associated urinary tract infections, or central-line catheter bloodstream infections (Yokoe & Classen, 2008). While there is more indirect than direct evidence to support it, it is accepted that HCWs also contribute to rates of HAIs. This is because HCWs transmit infectious agents from patient to patient in the healthcare environment. For example, in a study by Helms, Dorval, St. Laurent, and Winter (2010), they noted a decrease in post-intervention infection rates in their institution when hand hygiene compliance increased following implementation of a hand hygiene team. This indirect evidence of HCWs transmitting infectious agents that lead to rates of HAIs supports the need for improved infection prevention and control (IP&C) practice among HCWs in the healthcare setting.

In addition to risks associated with HCWs transmitting infectious agents to their patients, HCWs themselves may be at risk of transmission of infectious agents in a healthcare setting. This issue became clear during the Severe Acute Respiratory Syndrome (SARS) outbreak in 2002. During this outbreak, 44% of probable cases in Canada were among HCWs (Ofner-Agostini et al., 2006). In addition, Ofner-Agostini et al. (2008) stated that during the second wave (Phase 2) of SARS in Toronto, 42.5% of cases occurred among hospital employees, and 71.4% of nurses who had cared for a certain SARS patient during this timeframe developed SARS. The issue of transmission of infectious agents to HCWs occurs with other infectious agents as well. In 2009, the United States Centers for Disease Control and Prevention (CDC) collaborated with state

and local officials to identify pandemic (H1N1) influenza rates among healthcare workers. They determined that of 70 healthcare workers identified from 22 states, 35 (50%) were infected in the healthcare setting, and of those, 23 were infected by ill patients (Wise et al., 2011). This evidence supports the fact that HCWs continue to become infected with microorganisms while caring for patients, and it is clear that they require additional knowledge and skills to prevent transmission of infectious agents during patient care. In order to do this, HCWs must understand the transmission process, also known as the chain of infection, and how to break the chain.

2.4. Breaking the Chain of Infection

The chain of infection refers to the process whereby an infectious agent, e.g., a bacterium or a virus, is transmitted to a susceptible host, leading to the development of an infection. Factors such as age, heredity, hygiene, nutrition, hydration status, stress, immunizations, glycemic control, and circulation increase susceptibility to infection. There are multiple routes of transmission for a susceptible host. In the healthcare setting, the most common routes are direct, such as a nurse touching a patient, or indirect, such as through contact with contaminated surfaces or equipment. For example, if a HCW is caring for a patient with *Clostridium difficile*-associated diarrhea and does not properly clean his/her hands or equipment before caring for another patient, he/she can transmit *C. difficile* to the other patient. Infectious agents can also be transmitted through droplet and airborne routes. It is important for HCWs to understand the mode of transmission, as the mode of transmission determines the type of activity required to break the chain of infection.

In response to the need for clear transmission-based guidelines for infection prevention, the Public Health Agency of Canada developed guidelines known as Routine Practices and Additional Precautions (RPAP). These guidelines were originally released in 1999, and have recently been updated (Public Health Agency of Canada Centre for Communicable Diseases and Infection Control, 2012a). While Canada uses RPAP, the rest of the world follows a very similar transmission-based system known as Standard Precautions (SP).

The assumption for Routine Practices (RP) is that all patients are carrying microorganisms. As such, these recommendations are for activities to be used in the care of all clients, regardless of setting or health status. These fundamental practices include basic-level strategies for preventing transmission of infectious agents, such as hand hygiene and the use of personal protective equipment (PPE) when appropriate. PPE is a term used to describe equipment, e.g., gloves, masks, gowns, and goggles that are worn by healthcare workers to protect themselves, and their patients, from infectious agents. A table outlining what is included in RP can be found in Appendix B. Additional Precautions, or AP, include guidelines and recommendations for transmission-based precautions, e.g., the use of additional transmission-based strategies in the confirmed or suspected presence of a microorganism, deemed to be paramount in further protecting both HCWs and patients from transmission of that infectious agent. If followed properly, the recommendations found in the RPAP guidelines will prevent transmission of infectious agents. However, variances exist in the extent to which individual HCWs accurately integrate the guidelines into their practice.

2.5. Sub-Optimal Application of RPAP

The sub-optimal application of RPAP in practice is a serious issue that has been identified among both practicing nurses and nursing students. This problem gained significant attention during the SARS outbreak in 2003. The outbreak highlighted issues with RPAP application among nurses, which in turn led to greater awareness of IP&C issues, resulting in greater surveillance, research, and initiatives in this area. With additional research being conducted in the decade since this outbreak, it has become clear that the issue of sub-optimal application of RPAP is a problem that persists even at present.

2.5.1. RPAP application among practicing nurses.

There are numerous examples in the literature of breaches in RPAP application among practicing nurses, such as self-contamination, issues in choosing the correct PPE for a client interaction, breaches in hand hygiene, sharps/needlestick injuries, and problems with the application of AP. Details of some key studies are found in the literature summary tables located in Appendix C.

In a Canadian observational study by Mitchell et al. (2013) conducted in 11 hospitals in Canada in 2011, the researchers used a standardized data collection tool to record 442 observations of HCWs selecting and removing PPE and performing hand hygiene on entry into the rooms of patients experiencing febrile respiratory illness. Details of this study can be found in the literature summary tables found in Appendix C. Overestimation of IP&C practices may have occurred in this study due to participants being aware that they were being observed. As such, results from this study are even

more concerning than suggested, as participants were supposedly at their best IP&C performance. Of the HCWs observed, only half (54%) removed their PPE in the correct sequence. Only 26% performed hand hygiene after removing their gloves, 46% after removing their gown, and 57% after removing their mask. Only 37% of were observed to have put on eye protection. Finally, only 34% of HCWs put on all required PPE (gloves, gown, mask, and eye protection). This study highlighted issues with hand hygiene and choice/application of PPE, which are very basic skills in infection prevention and control. In an American study by Beam, Gibbs, Boulter, Beckerdite, and Smith (2011), all of the 10 participants in a simulated observational study committed at least one breach of airborne and contact isolation precautions, most commonly self-contamination through improper application or removal of PPE.

The issue of inadequate hand hygiene was also noted in the PICNet report titled *"Hand Cleaning Compliance in BC Acute Care Facilities"* (2013). In this report, it was noted that overall hand cleaning compliance increased slightly from 70% in 2011/2012, to 73% in 2012/2013. However, this fell short of the target performance rate of 80% compliance. While 80% of HCWs performed hand cleaning after patient contact, only 64% performed hand cleaning before patient contact.

Studies reported in the literature did not only examine hand hygiene and PPE. Sharps injuries, related to the RP element of sharps safety, were also noted in the literature. The Massachusetts Sharps Injury Surveillance System tracked sharps injuries among hospital workers for 2010. In this report, it was noted that 2,497 sharps injuries were recorded among hospital-based HCWs, one third (36%) of which were among nurses (Massachusetts Department of Public Health, 2010). These breaches are all of

concern, as they place both nurses and patients at risk for transmission of infectious agents.

There have also been studies where nursing students observed issues with application of RPAP among practicing nurses in their clinical settings. An American study by Geller, Bakken, Currie, Schnall, & Larson (2010) required nursing students in BC to record their observations related to hazards and near-misses. Of the 3492 comments noted over 3 years, one quarter (25.4%) of near misses and hazards were related to IP&C. The most common areas of concern were nonadherence with isolation precautions (27.6%), contamination of the environment or equipment (18.5%), breaks in aseptic technique (17.2%), hand hygiene (15.9%), and gloving failures (11.5%). In a study by Gould and Drey (2013), 488 student nurses in the UK completed questionnaires identifying breaches in compliance with IP&C protocols they observed during their clinical placements. While over or under estimation of breaches may have occurred due to recall bias, this study still gives a sense that issues in IP&C practice are present in clinical practice settings. Over 75% of respondents reported witnessing failure to perform hand hygiene between patient contacts, and 59.3% reported observing failure to apply isolation precautions (e.g., not wearing PPE). Over half reported observing HCWs not changing PPE between patients, as well as observing poor sharps management. Almost half reported observing HCWs reusing items without cleaning between patients. Interestingly, they also felt that many HCWs had a negative attitude toward IP&C guidelines. Details of both of these studies can be found in the literature summary tables found in Appendix C.

These studies describing nursing students observing RPAP breaches among practicing nurses while in their clinical settings are of concern, as it suggests that role modeling among practicing nurses is not ideal, and students may be learning poor RPAP practices from those in the clinical settings. Regardless of the origin of the issues, there is also literature that describes situations where the students themselves have committed breaches in the application of RPAP in their clinical settings.

2.5.2. RPAP application among nursing students.

There is very limited literature that addresses the issue of whether or not nursing students have adequate skill in the application of RPAP. Very few studies relate to actual practices or behaviors, and of those, many focus on self-reported behaviors. However, some anecdotal evidence exists to support the suggestion that nursing students are not adequately prepared in the area of RPAP, or IP&C practice in general. As part of a study by Liu, Curtis, and Crookes (2013), of the 65 Taiwanese and Australian experts who provided feedback, 75.4% had the opinion that the infection control competency levels of newly graduated nurses were inadequate.

Much of the limited research related to inadequacies in RPAP practice among students focuses on needlestick or sharps injuries. However, there are no recent studies in North American or Western Europe in related to sharps injuries due to advances in practice (e.g., needleless systems). While this issue is still of concern in other countries such as China, they have limited generalizability to North America. However, it highlights the fact that different settings may have different challenges or issues in IP&C practice. In a study by Cheung, Ching, Chang, and Ho (2012), the researchers surveyed

878 nursing students in Hong Kong regarding prevalence and risk factors for needlestick and sharps injuries. Their findings revealed that 8.8% of students reported having received a needlestick or sharps injury, with approximately 85% of those having reported same receiving only one injury. Yao et al. (2010) also conducted a study regarding needlestick injuries among nursing students in 7 different training hospitals in China. They found that 26.05% of nursing students had experienced at least one needlestick injury during their training in hospital. Of note, of those who reported having experienced a needlestick injury, 96.4% of students responded that they did not report these incidents. Only 0.96% of students had completed post-exposure blood testing following a needlestick injury. The breaches identified by the researchers are significant and of concern. They suggest that current IP&C practices among nursing students are inadequate related to sharps safety. This could place both the patient and the student at risk of transmission of infectious agents while they are completing their nursing training, and without improvements, when they are practicing as graduate nurses. As such, it is important factors that could be contributing to these RPAP breaches.

2.5.3. IP&C knowledge and confidence gaps.

There are several contributing factors that may lead to breaches in application of RPAP among nurses and nursing students, including lack of equipment/placement of equipment, role modeling/peer influences, and attitudes towards IP&C. However, the most prominent and pervasive topic that is linked to issues in IP&C is an overall lack of adequate IP&C knowledge among both practicing nurses and nursing students.

A French study of 4,439 HCWs by Atif et al. (2013) assessed for awareness/knowledge of standard precautions. Details of this study can be found in the literature summary tables found in Appendix C. This cross-sectional survey was conducted in 34 institutions in France, and used an anonymous, self-administered questionnaire. The respondents included nurses (44.1% of sample), nurses' aides (26.7%), and physicians (3.5%), and a variety of other non-professional HCWs such as paramedics or technical personnel. The percentage of correct answers ranged from 37.1% to 91% for each question. While 72.6% 0f participants correctly answered Hand Hygiene questions, only 7.3% correctly answered the questions on use of appropriate barriers and disposal of needles. Only 39.3% of all respondents, and 42.1% of nurses, correctly answered 8 or more of the 10 Standard Precautions questions. This study highlights that IP&C knowledge gaps exist among nurses, which in turn may be translating into sub-optimal application of RPAP in practice, placing both nurses and patients at risk of transmission of infectious agents.

While very few studies were found that focused on RPAP practice gaps of nursing students, the literature was more plentiful related to the IP&C knowledge gaps among nursing students. Some studies focused on general IP&C knowledge. For example, Wu, Gardner, and Chang (2008) completed a cross-sectional survey of nursing students in southern Taiwan. Details of this study can be found in the literature summary tables found in Appendix C. They assessed for the level of knowledge, application, and confidence with standard and additional precautions in infection control. They found that respondents had a mean knowledge score of 8.69 (SD 1.55, range 3-12), out of a possible score of 15. Over 71% of the respondents had a score between 8 and 10. Most

respondents correctly answered questions related to disposal of sharps (98.3%), use of masks and goggles (98.3%) and use of standard precautions when in contact with vaginal discharge (95.4%). Very few students correctly answered questions related to additional precautions.

As another example, Hinkin and Cutter (2013) surveyed 354 nursing students form a university in the UK regarding their IP&C knowledge and variables that influence their IP&C practice. The proportion of respondents having correct knowledge was high for some topics, such as pathogen transmission (83.1%), hand hygiene (91.5%), immediate action post-needlestick injury (79.4%), and risk reduction related to sharps and waste management (77.4% - 83.6%). However, smaller proportions had correct knowledge for topics such as glove use (59.6%), chain of infection (32.8%), use of ABHR and *Clostridium difficile* (44.4%), and the definition of inoculation injury (31.4%). Once again, this is of concern as it suggests that students are lacking adequate knowledge in very basic IP&C topics.

Tavolacci, Ladner, Billy, Merle, Pitrou, and Czernichow (2008) surveyed 78 first year nursing students, and 272 medical, physiotherapy, and assistant radiology students. Participants were surveyed for their knowledge of IP&C, as well as their sources of information. The questionnaire included multiple-choice questions in the areas of standard precautions, hand hygiene, and nosocomial infection. An overall perfect score of 30 points was possible. The mean overall score for nursing students was 23.2 (± 2.35, $p<.001$), and this was the highest mean overall score of all of the disciplines. However, the results of this study may not be comparable to the results of the other studies as

students were enrolled in optional public health courses which may have contained enhanced IP&C content.

Some studies focused only on one aspect of RP, such as hand hygiene. For example, in an Italian study of nursing and medical students, van de Mortel, Kermode, Progano, and Sansoni (2011) assessed for hand hygiene knowledge, beliefs, and practices. In the hand hygiene knowledge portion of their study, only 22.4% of nursing students scored above 50.0% on the questions overall, with the student scores ranging from zero to nine out of twelve (mean 5.25). As hand hygiene is a very basic level topic in IP&C, it would be expected that student knowledge should be higher in this area. These studies suggest that knowledge gaps in IP&C may exist among nursing students, and that these gaps are not necessarily exclusive to more advanced concepts/material.

Other studies of IP&C knowledge of nursing students focused more on specific infectious agents. For example, in a Canadian study by Yonge, Rosychuk, Biley, Lake, and Marrie (2007) staff and students at the University of Alberta were surveyed for their general knowledge and risk perception of pandemic influenza. Participants in the survey included 456 undergraduate nursing students. Results suggested that nursing students did not have adequate knowledge about the management of pandemic influenza, the role of antiviral drugs in influenza management, or even something as basic as how the illness is transmitted. Without this basic, fundamental IP&C knowledge, students will be severely limited in their ability to correctly apply the principles of RPAP.

Another example of a study focusing on a specific agent is Jennings-Sanders and Jury (2010), the details of which are summarized in the literature summary tables found in Appendix C. They conducted an American study that assessed 113 nursing students

for their knowledge of methicillin-resistant *Staphylococcus aureus*. They found that the mean knowledge scores for students ranged from 6.256 to 6.500 across levels within the program, out of a possible score of 8. More importantly, 54% of respondents felt they did not have enough understanding of MRSA. Because it is one of the most common microorganisms in the current healthcare environment, even if there is limited generalizability, this suggests that individual schools need to assess for knowledge gaps among students in their program.

There was a very limited amount of research that addressed confidence among nursing students. Most often, self-reported confidence scores were noted as a sub-section of a study exploring student knowledge, such as was the case with Wu et al. (2008). In their cross-sectional survey of 175 Taiwanese nursing students, they found that the mean confidence score for students was 5.71 (SD 2.36) out of 8, with a range of scores from 0-8. Their results did not suggest that there was a significant relationship between knowledge and confidence (r = -0.03). However, they found that those having previous clinical experiences in caring for patients with infectious diseases had higher confidence than those who did not (mean confidence scores 6.54 vs. 5.40).

Some literature identified knowledge by confidence mismatches among nursing students. Cole (2009) reported on the findings of a study in the UK in which it was concluded that nursing students overestimated their knowledge and skills in the area of hand washing, found it difficult to give an objective account of their performance, and reported an improbable level of compliance with hand washing. This has research implications, as studies that rely on self-reported knowledge or skill in the area of IP&C may result in findings that overestimate actual knowledge and skill in this area. While

this has research implications, the fact that students, and nurses, may be overconfident in relation to their actual knowledge and/or skill may have practice implications as well.

In summary, the issue of sub-optimal RPAP application has been noted among both nurses and students. Additionally, there is literature that suggests that IP&C knowledge gaps exist among both groups, and this may result in inadequate compliance with RPAP. As such, it is important to understand how IP&C knowledge is obtained.

2.6. Current Curricular Content

The model described in Figure 1 in Chapter 1 suggests that practicing nurses obtain their knowledge through basic education, orientation, and continuing education. However, in an assessment of one IP&C orientation program for practicing nurses, Coates (2008) determined that it did not contain the information needed to help staff meet the core competencies for IP&C, nor did it cover all of the categories in the CHICA-Canada Core Competencies for IP&C document. If, as Coates suggested, orientation is not sufficient, it is clear that a strong foundation of IP&C knowledge and skill must be obtained at the undergraduate/basic education level. This is supported by Tavolacci et al. (2008), who reported that students felt that curriculum was their primary source of information. As suggested by the study model for this project discussed in Chapter 1, the need for adequate IP&C content in the curriculum of undergraduate nursing programs is essential. Adequacy was not defined a priori, but will be discussed in detail in Chapter 5. If knowledge gaps are present among both nurses and nursing students, and curriculum is noted as a primary source of information, it is therefore necessary to explore what material is covered in curriculum.

In addition to the material previously presented in the literature, the need for adequate coverage of IP&C material in undergraduate nursing curricula is supported by the simple fact that several regulatory bodies, such as the College of Registered Nurses of Nova Scotia (2013), or the College of Nurses of Ontario (2014), include some material specific to IP&C in their entry-level competencies for Registered Nurses documents, albeit in a limited amount. In addition, the Public Health Agency of Canada (2012b) recommends that healthcare educational and training bodies train students about hand hygiene recommendations, but no guidelines related to content and coverage are provided.

Despite the importance of adequate IP&C coverage in curriculum, only one study has been identified that addresses the IP&C curricular content of healthcare related programs, in particular nursing education programs, in Canada. Duregon (2003) conducted a content review of Canadian schools of nursing (graduate and undergraduate) and medicine programs for content specific to outbreak management. In this Master's thesis study, the only comprehensive review that was identified in the literature, it was found that the majority of undergraduate nursing programs included elements such as hand washing, infection transmission, disease prevention, and immunization in their curricula. However, in topics covered in each program, curricular content related to this material varied from program to program. Topics such as basic principles of epidemiology were covered as part of standard nursing training, as well as in programs considered to be specialized due to enhanced content, and topics such as outbreaks or epidemics were covered as a specialization and not considered part of basic education.

It was difficult to locate any current literature related to IP&C content in curricula due to the challenges that exist in obtaining this data. For example, Watt-Watson et al. (2009) experienced similar challenges in assessing for pain content in the curricula of Canadian prelicensure health science programs. They found that respondents had difficulty quantifying the amount of pain-specific teaching that was offered, as well as in quantifying the number of theory vs. practice teaching hours that were provided. This suggests that the curriculum review process in general is difficult, and challenges in finding literature related to curriculum content may not be topic-specific.

2.6.1. Addressing gaps in curricula.

In response to an identified practice gap, the Community and Hospital Infection Control Association of Canada (CHICA-Canada) recognized the need for adequate knowledge and skills of HCWs in the area of IP&C, and developed core competencies for knowledge and skills in IP&C. These core competencies address the following content areas: basic microbiology, hand hygiene, RPAP, personal protective equipment, personal safety, sterilization and disinfection, and critical assessment skills (Henderson, 2006).

As a result of the difficulties that exist with the curriculum review process, it is not surprising that there were also no studies that were identified that provided specific guidelines for what material should be included in IP&C curricula, specifically quantity, when it should be introduced, or how it should be delivered. The CHICA-Canada core competencies document provides some guidance for content, but the competency statements are broad, and additional work would need to be done before they could be used to specifically guide curricula. This is true for other competency documents as well.

For example, the Canadian Association of Schools of Nursing (2014) recently released a document designed for undergraduate nursing programs that provides specific entry-level competencies for Public Health Nurses. The primary purpose of these competencies is to provide programs with guidelines for related content that should be incorporated into their curricula. However, as with the CHICA-Canada IP&C competency document, other than providing suggestions for recommended topics, the document does not provide any guidelines for how much teaching should be provided, when it should be offered, or how it should be taught or evaluated.

These competencies, originally written as guidelines for health education programs, have been disseminated largely within the IP&C community. However, the extent to which they have been disseminated to other groups such as educators has not been examined. This document is possibly used in a limited way, but the extent to which is it used is not known. It has potential uses in identifying topics for inclusion in curricula, but it cannot be used if it its existence is not known. Additionally, the competency document has not been modified to provide specific competencies for undergraduate nursing programs, and its role in the development of IP&C curricula for nursing students is not clear. This requires further investigation.

There is some literature that suggests that the use of specific, targeted interventions may be beneficial in strengthening curricula. While it was difficult to identify studies that addressed gaps in IP&C curricula as a whole, there were some studies that identified targeted strategies that improved student outcomes in undergraduate nursing programs. For example, Al-Hussami and Darawad (2013) used an experimental design to examine the effects of a targeted infection prevention education

program on students' IP&C knowledge. They determined that mean knowledge scores increased from 50.5% to 91.6% among students who had participated in the experimental group, that which received specific enhanced IP&C education, vs. the control group who followed the normal/existing curriculum. There was no significant change in the pre- and post-test scores of the control group (48.8% vs. 48.5%), suggesting that the provision of targeted IP&C education was effective in increasing student knowledge scores.

As another example, Wu, Gardner, and Chang (2009) conducted a Taiwanese study in which nursing students in a control group received the standard education currently provided by their nursing program, and an experimental group received an Standard and Additional Precautions-focused education program in addition to their regular curriculum. While the knowledge and confidence scores of the students in the control group did not vary significantly over time (8.87/15 vs. 8.70/15 for knowledge, and 5.87/8 vs. 5.54/8 for confidence), the knowledge and confidence scores of those in the experimental group increased significantly over time (8.87/15 vs. 11.0/15 for knowledge, and 5.38/8 vs. 6.06/8 for confidence). These studies suggest that the provision of targeted education modules may result in positive student outcomes, and their role in improving IP&C curriculum should be considered (Al-Hussami & Darawad, 2013; Wu, Gardener, & Chang, 2009). The details of these studies can be found in the literature summary tables found in Appendix C.

2.6.2. Teaching and evaluation methods.

In addition to identifying the material that should be included in these teaching strategies, it is also important to identify teaching and evaluation methods that are most

effective for IP&C material. Several international studies have examined various methods that have been used to teach infection control, including case studies, lectures, demonstrations, computer-mediated programs, and scenario-based simulation with an instructor (Mikkelsen, Reime & Harris, 2008; Wang, Fennie, He, Burgess, & Williams, 2003). Case studies are useful teaching and evaluation tools as they promote the development of critical thinking skills, problem solving skills, and facilitate learning through real life scenarios (Mills et al., 2014).These studies have suggested that some teaching methods are more effective than others in teaching IP&C content, including case scenarios and computer-assisted learning. For example, Young, Rose, & Willson (2013) found that students whose programs incorporated Elseiver's online case studies in their curricula had better NCLEX-RN exam scores than those who did not. The proportion of students who passed the NCLEX-RN exam was significantly higher than those who did not use the online case studies. Reime, Harris, Aksnes, & Mikkelsen (2008) assessed the effectiveness of an e-learning program related to infection control in a school of nursing in Norway, and found it to be equally as effective as lecture for teaching this material. They also found that students benefitted from having learning goals, as well as from the integrated tests for assessing learning found within the e-learning modules. In addition to identification of program content and teaching strategies used, opportunities for practice, delivery methods, and evaluation of knowledge and skills should also be identified to direct recommendations for action.

2.6.3. The role of nurse educators in curriculum delivery.

As discussed, strategies have been identified that may strengthen IP&C curriculum content in undergraduate nursing programs. However, even if specific guidelines are provided for the content (what to teach, when to teach it, how it should be taught and evaluated), the role of nurse educators in curriculum delivery cannot be ignored. There is no literature that addresses the IP&C knowledge and practice gaps of educators in a university setting. However, like their colleagues practicing in other healthcare settings, nurse educators must also be licensed Registered Nurses. As such, it is appropriate to assume that they must also have a basic, foundational level of knowledge and skill in the area of IP&C. If this is lacking among practicing nurses, it is reasonable to question if similar gaps in knowledge and skill may also be present among nurse educators. The impact of nurse educator preparedness on student learning and outcomes is not known, and as such, research to explore this issue is urgently needed.

2.7. Conclusion

The problem of HAIs has been well documented, and the role of nurses in transmission of infectious agents has been identified. While sub-optimal application of RPAP is present among practicing nurses, educators, and nursing students, lack of IP&C knowledge has been identified as a contributing factor. Curriculum has been noted to be the primary source of information for nursing students, but very little is known about the IP&C content of undergraduate nursing curricula. While several studies have addressed the issue of knowledge and skill within the context of practicing nurses, there is minimal literature that addresses the knowledge, skills, and behaviors of undergraduate nursing

students. There are no recent studies that address the IP&C-specific curricular content of undergraduate nursing programs, and the needs of nurse educators in this area are not well understood. Before we can begin to remedy any gaps in curriculum, educator and student knowledge, or practice, we must first identify what the gaps are and where they occur.

Chapter 3: Methods

This study used a cross-sectional descriptive survey design to identify when and how infection prevention and control (IP&C) content was covered in nursing curricula in Atlantic Canadian undergraduate nursing education. Directors of undergraduate nursing programs were asked to provide information about the curricula using a self-administered questionnaire. This study also identified, via online questionnaires, nursing educators' and students' knowledge of, and confidence in, IP&C practice. This chapter provides a detailed description of the research study methods.

3.1. Participants

Participants for this study were recruited from the six anglophone Atlantic Canadian Schools of Nursing with undergraduate nursing education programs that are members of the Canadian Association of Schools of Nursing – Atlantic Region (ARCASN): Memorial University of Newfoundland (three sites), University of Prince Edward Island, University of New Brunswick (four sites, excluding Humber College), Dalhousie University (two sites), St. Francis Xavier University, and Cape Breton University. When applicable, data were collected from all sites of schools who offer their program on more than one campus/site, i.e., Memorial University of Newfoundland, University of New Brunswick, and Dalhousie University. In circumstances where a school having multiple sites had some sites for whom the ethical approval process differed and/or the program content varied from that of the main program, those sites were treated as independent schools/programs for analysis purposes. Sites that did not offer all four years of their program were not included. There were three categories of

participants from the participating programs: directors of undergraduate nursing programs, nurse educators from undergraduate nursing programs, and nursing students in the final year of their respective regular stream undergraduate nursing programs. For the purposes of this study, the term "director" was used to describe the head of an undergraduate nursing program.

3.2. School/Program Approval for Participation

Contact information for the directors of nursing programs was obtained from the ARCASN member listing, and from the websites of the individual undergraduate nursing programs. The nursing program directors of each school were contacted by email and by phone to discuss possible participation in the study, and to gain information on the steps required for the process of obtaining approval for the research study, e.g., to gain approval from the Executive Committee. Schools were given the opportunity to approve participation in any or all of the components the survey: curriculum review questionnaire, nurse educator questionnaire, and student questionnaire. The letter requesting approval for school participation can be found in Appendix D. A formal application for approval was then sought from each school, as necessary, following their process and requirements. Once approved, data were collected for agreed-upon portions of the study.

3.3. Curriculum Review

The purpose of the curriculum review was to assess the amount of IP&C teaching being provided in undergraduate nursing programs, including quantity, sequencing, initial teaching vs. reinforcement of material, and teaching and evaluation methods. Directors

of undergraduate nursing programs were asked to complete the curriculum review questionnaire.

3.3.1. Recruitment and data collection: curriculum review questionnaire.

In addition to receiving a request for school participation in the study, each director received an introductory email from the researcher inviting participation in the curriculum review questionnaire portion of the research study. The email can be found in Appendix E. The invitation also provided an outline of the study, the date on which the researcher would email the curriculum review questionnaire to the directors of nursing programs, and the contact information of the researcher. Agreement to participate in the curriculum review questionnaire was then obtained from the directors of nursing programs, through email or by telephone. Completion of the questionnaire implied consent.

On the date designated in the introductory email, the researcher emailed the questionnaire to each director. The director was then asked to complete the self-administered questionnaire, or to have it completed by the person who was most familiar with/responsible for the curriculum of their program. Three weeks following distribution of the questionnaire, the researcher contacted persons who had not yet returned their completed curriculum review questionnaires to determine if additional time was required, or if the director had decided that he or she no longer wished to participate. Upon finalization of the thesis, the directors of nursing programs will be provided with an executive summary of the research study.

3.3.2. Data collection instrument: curriculum review questionnaire.

The purpose of the curriculum review questionnaire was to audit the program curriculum for IP&C content. The content of the curriculum review questionnaire, found in Appendix F, was based on the CHICA-Canada core competencies for IP&C. It included several yes/no questions related to content of the school's curriculum. The directors of nursing programs were also asked to respond to questions on the quantity, type, timing, evaluation, and method of delivery of material taught to students in specific IP&C-related content areas. The content areas were Microbiology, Hand Hygiene, RPAP, Personal Protective Equipment, Personal Safety, Sterilization and Disinfection, and Critical Assessment Skills. The criteria for the content areas are found in Appendix A. The questionnaire was emailed to the directors of nursing programs in the format of a word document, and based on their preference, the directors of nursing programs were asked to type in, or print and handwrite, their responses. As necessary, this was done with assistance from other nurse educators in their programs. They then emailed or mailed the responses to the researcher.

The curriculum review questionnaire had content validity as it was developed in consultation with experts in the fields of IP&C and undergraduate nursing education. Reliability has not been established, and this is a limitation of this study. There was limited pilot testing of the questionnaire. This pilot test consisted of the curriculum review questionnaire being assessed by a former director of an Atlantic Canadian undergraduate nursing education program. Feedback was sought regarding the clarity of the questionnaire, as well as if, and how, the information required to complete the questionnaire could be obtained in a reasonable timeframe. The reviewer was not

expected to comprehensively complete the curriculum review questionnaire as part of the pilot, and the data collected were not included in the study results. There were no changes recommended from the reviewer's feedback, and time for completion was deemed reasonable. The reviewer was not eligible to complete the curriculum review questionnaire, but could choose to participate in the nurse educator survey if she so desired.

3.3.3. Data management and analysis: curriculum review questionnaire.

For the curriculum questionnaires, discrete variables such as type of teaching methods were summarized using frequency counts and percentages. Also, schools were divided into categories according to intensity of their program, e.g., "least extensive", "moderately extensive", and "most extensive" programs. Program intensity was based on hours of teaching and content areas covered related to infection prevention and control. In situations where the curriculum was shared by more than one program, they were treated as one program for the purposes of analysis. When more than one questionnaire was returned for a particular program, the data from the individual questionnaires were merged into one final questionnaire for that program.

3.4. Knowledge Assessment of Nurse Educators and Students

In order to determine if any gaps existed in nurse educator and student knowledge, a knowledge assessment was completed. For the purposes of this study, the term "nurse educator" was used to describe persons who were directly involved in the delivery of nursing theory, practice, or clinical experiences in undergraduate nursing programs, and not just those having tenure-track positions. For this study, only those

involved in clinical teaching were eligible. Participants involved in clinical teaching are referred to as "clinical educators" in the analysis and discussion chapters. Student participants consisted of students in the final year of their basic undergraduate nursing education program. Students in other streams, e.g., advanced option, post-degree, or post-RN streams, were not included in this study. These other streams were excluded because the backgrounds and needs of those students may have differed from those of students in the four year undergraduate program. The researcher and members of the research team were affiliated with schools that were asked to participate in the research study, and as such, excluded themselves from participating in the research study.

3.4.1. Recruitment and data collection: nurse educators and students.

Nursing program directors were asked to identify an individual who would act as the third party contact person, and provide contact information for this individual. The designated third party contact person was someone with the authority to, and means to, contact nurse educator and student participants via email on behalf of the researcher. An email invitation for nurse educator and student participants was sent to the designated contact person, who then forwarded the information to nurse educators and students using the school's email distribution system. These email invitations, found in Appendix G, consisted of an outline of the research study, an invitation to participate in the study, and the contact information of the researcher. They also contained the instructions for completion of the nurse educator and student questionnaires, and the link for the online questionnaire. Participants then accessed the questionnaire using the link provided, and completed the questionnaire.

Two weeks following initial distribution of the invitation and link for the questionnaire, a reminder email was sent to the designated contact person for distribution to participants. Two weeks following distribution of the reminder email, access to the online questionnaire was closed. Following closure of the online questionnaires, an email was distributed to participants via the third-party contact person. The email contained the correct responses to knowledge questions found within the self-administered questionnaire.

3.4.2. Data collection instruments: nurse educator and student questionnaire.

The nurse educator and student questionnaires can be found in Appendix H. The content of the questionnaires were the same, except where indicated. These questionnaires were divided into four sections: demographics, knowledge, confidence, and general information. The nurse educator and student questionnaires took approximately twenty minutes to complete. Demographic questions were asked related to educational background, practice background, and the school with which they were affiliated. In addition, to confirm eligibility, nurse educators were also asked whether or not they had taught in the undergraduate program in the past three years, and if they had taught in the clinical area in the past three years.

Knowledge questions were related to specific IP&C topics. There were 19 knowledge questions, using a mix of five short answer, five multiple choice, and nine true/false questions. Confidence of participants in several IP&C-related procedures was assessed using a 3-point Likert-response scale (“not confident”, “somewhat confident”, and “very confident”). Knowledge and confidence questions were also asked regarding

the pandemic influenza and seasonal influenza strains, and participants were asked to identify their sources of IP&C information. Only the nurse educator questionnaire included questions on confidence in teaching IP&C to nursing students. The nurse educator questionnaire included questions pertaining to faculty development needs in the area of IP&C. Only the student questionnaire included questions specific to recommendations for improvements in IP&C education.

The questionnaires had content validity as they were developed in consultation with experts in the fields of IP&C and undergraduate nursing education. Reliability has not be established, and this is a limitation of this study. There was a limited pilot test of the questionnaires to assess clarity and time for completion. The nurse educator questionnaire was assessed by a colleague teaching in an undergraduate nursing program located outside of Atlantic Canada. The student questionnaire was assessed by a fourth year nursing student who was employed as a Research Assistant in the Nursing Research Unit. Data collected as part of the pilot testing of the instrument were not included in the results of the study. However, the student had the opportunity to choose to participate in the study, along with her classmates, when actual data collection began.

Additional feedback on the student and nurse educator questionnaires was obtained from the Research Coordinator at the Nursing Research Unit. In this role, the reviewer has had experience in creating a number of questionnaires, both paper and pencil and using Survey Monkey. While the platform used for this study was AskItOnline, the Research Coordinator was experienced with completion and development of online questionnaires. As a nurse, the reviewer also had an understanding of the questionnaire-related content specific to IP&C.

Minor editorial revisions were suggested for the educator and student questionnaires, and these were incorporated into the final versions of the questionnaires. Feedback from pilot testing suggested that time for completion of the questionnaires was appropriate.

3.4.3. Data management and analysis: nurse educator and student questionnaires.

Data files were transferred from Word documents and questionnaire data files to a STATA data set. Data were analyzed using the STATA/IC 11 (2009) software program.

For both nurse educator and student questionnaires, only those completing the majority of the questionnaire were included in the analysis. This was to allow for calculation of overall total knowledge and confidence scores, as well as sub scores by the topic areas of PPE, Sterilization, RPAP, Hand Hygiene, Personal Safety, Microbiology (knowledge score only), and Critical Assessment Skills (confidence score only). For nurse educator and student questionnaires, short answer knowledge questions were scored as 2 if the answer was correct, 1 if the answer was partially correct, and 0 if the answer was incorrect. Confidence scores were scored as 2 for "very confident", 1 for "somewhat confident", and 0 for "not confident".

Total knowledge scores were calculated using the sum of all scores for all knowledge questions. **Total confidence scores** were also calculated using the sum of all scores for all confidence questions. In addition, **sub scores** were calculated for each topic area. For example, hand hygiene knowledge scores were calculated using the sum of the scores for all questions related to hand hygiene. The same approach was used for

confidence scores by topic area. **Raw knowledge and confidence scores** (total and by topic area) were converted to percent knowledge and percent confidence scores, and then categorized into three ranked categories. This was done by taking the raw score, dividing it by the highest possible score, and converting it to a percentage by multiplying it by 100. Scores of 80% or greater were ranked as **high knowledge or confidence scores**, scores between 65% - 79% were categorized as **moderate knowledge or confidence scores**, and the scores below 65% were categorized as **low knowledge or confidence scores**.

Descriptive statistics were used to describe the results. The proportion of respondents who correctly answered specific knowledge-based questions were also reported. Median and ranked percent knowledge and confidence scores were compared between topic areas, as well as within topic areas. Topic area specific knowledge by confidence scores were also calculated in several topic areas. Finally, results were compared between nurse educator and student questionnaires.

Because the focus of the study was description, and sample size was small, statistical testing was limited to testing differences in proportions between the educator and student groups. Statistical testing was only done between groups when differences were greater than ten percentage points. Differences were tested using chi-squared, with an alpha set at .05. No statistically significant differences were found, therefore significance testing is not reported in the results chapter.

General information short answer questions, such as questions related to pandemic influenza education, were analyzed using content analysis, and themes were identified. When applicable, frequencies were reported. When possible, such as with

questions specific to formal education received related to pandemic influenza, results were compared to total ranked percent knowledge scores for a particular topic area.

3.5. Ethical Considerations

The research proposal, along will all necessary documentation, was submitted to the Memorial University of Newfoundland Human Investigation Committee (HIC) for review, and full ethics approval for the research study was granted by the HIC on December 14, 2009. Individual approval from each school was sought for participation. Ethical approval for the study was obtained from the research ethics boards of participating universities and colleges as required. The study was not initiated without all required ethical and school approvals.

3.5.1. Consent.

Individual consent by directors, nurse educators, and students was obtained. Participation in the study was entirely voluntary. A detailed information letter regarding the study was provided to potential participants via email. Written constent was not obtained; completion of the curriculum review questionnaire, nurse educator questionnaires, and student questionnaires implied consent.

3.5.2. Confidentiality.

Several strategies were used to ensure that the confidentiality of the participants was maintained at all times. The curriculum review questionnaires from directors of nursing programs were only accessible to the researcher and research team. The student and nurse educator online questionnaires were anonymous and participants were not able

to be identified. The schools were coded for data analysis and reporting purposes. Due to the low participation rates, specific results for each school were not reported in order to protect the anonymity of the participating schools. Data were reported at the aggregate, rather than individual, level.

3.5.3. Data Management.

Askitonline, a Canadian-based database, was used in compliance with section 30.1 of the *Freedom of Information and Protection of Privacy Act*, as data were stored in Canada. It was a SSL-encrypted site. Upon completion of the survey, all data files were deleted from the servers of www.askitonline.com. There was no link to the participants' identifying information. Integrity of the dataset was assured by limiting access to data files through passwords and account control, and data access was controlled as per the research ethics boards' requirements. Access was limited to the research team.

3.6. Risks and Benefits

There was some risk for harm in participating in the curriculum review questionnaire in that findings of the study may have resulted in some concern or embarrassment from participants. However, confidentiality was maintained for all programs and participants, and results were reported at the aggregate level. There was limited risk for harm to individuals, as again, results were reported at the aggregate level. Due to the power balance that existed between faculty and student or school and faculty member, a third party contact person was used for contact with nurse educators and students to reduce any perceived or actual undue influence on the decision to participate.

The benefit of participation in the study is that directors will receive an executive summary of the entire study, which may be used to help identify gaps they wish to examine more closely within their own curricula. Additionally, while knowledge gaps may have been identified in the educator and student questionnaires, answers for knowledge questions were provided when data collection was complete.

3.7. Conclusion

The results of this research study are reported separately in the next chapter by results of the curriculum review, and results of the knowledge and confidence questionnaires of clinical educators and students.

Chapter 4: Results

This chapter focuses on the questionnaire results for the three groups. Director participants provided data on the amount of IP&C teaching provided in their programs, as well as data related to the types of teaching and evaluation methods used for this content. Knowledge and confidence score results pertaining to several IP&C-specific topics are also presented for clinical educator and student respondents, as is a summary of results relating to general questions and H1N1 influenza questions.

4.1. Curriculum Review Questionnaire for Directors of Nursing Programs

Curriculum review questionnaires, exploring curriculum content related to IP&C education, were submitted by seven directors of nursing programs, or their site designates, with undergraduate nursing programs in Atlantic Canada. Three sites within the same School of Nursing shared the same curriculum, and as such, were treated as one program for the purposes of analysis and discussion. Analysis was thus completed using the results from five programs. The questionnaires were either completed by the director of the school, or by person(s) designated by each director as having sufficient knowledge of the curriculum content of their program to complete the questionnaire. When multiple questionnaires were returned for one program, data from the individual questionnaires were merged into one final questionnaire for that program. Some directors did not complete the actual questionnaire, and instead submitted supporting documentation such as course syllabi. In instances such as these, relevant data were taken from these documents.

In general, the respondents had difficulty quantifying the amount and type of teaching provided in their curricula, including distinguishing between theory-specific teaching hours and practice-related teaching hours. They also had difficulty in providing data on the amount of teaching provided in the form of initial learning experiences versus additional learning experiences. In some content areas, some programs were not able to provide any information at all specific to that content area, both in amount of teaching provided, as well as types of teaching and evaluations methods used. All five programs reported having a separate microbiology course as part of their curricula. None of the programs provided information related to the content of their microbiology courses, and all data provided were based solely on material found within the nursing courses. One school only provided data in the topic area of Microbiology and Infectious Diseases, providing "unknown" as the response for all other content areas, and as such, was only included in the analysis for this content area. In general, some content areas were covered more than others, and the programs who reported the greatest amount of teaching time in any content area were often the same. The data are limited, but summarized by total number of initial theory and practice teaching hours (combined).

4.1.1. Teaching time for IP&C topics.

Table 1 summarizes the amount of initial teaching time (theory and practice combined) by content area for the four programs with reasonably complete data. The criteria for the content areas are found in Appendix A. Table 1 shows that overall, all topics were covered, but not every program covered every topic. All five programs reported coverage of the three topics related to Microbiology, often through a separate

microbiology course. However, only four programs provided responses for the six other content areas; two reported coverage for all 18 topics within the six content areas, and two reported covering 13-15 of the remaining topics. One of these programs was categorized as having the "most extensive" coverage, spending more than three hours teaching each of 11 out of 21 topics, and covering each of the remaining 10 topics in between one to three hours. In contrast, the program categorized as having the "least extensive" coverage spent three hours or less teaching on any single topic. This program covered five topics in less than an hour each and did not report on five topics. The 11 remaining topics that were reported on were each covered in between one and three hours of teaching. The remaining two programs were categorized as having "moderately extensive" coverage. In one of these programs, clinical educators spent more than three hours teaching each of two topics, 1-3 hours teaching 11 topics, and less than one hour on the remaining eight topics. In the other program clinical educators spent more than three hours teaching each of three topics, 1-3 hours teaching nine topics, and less than one hour teaching each of the remaining six topics. This program was unable to provide data for three topics.

The amount of teaching time, or coverage, by individual program is not reported here, to preserve the confidentiality of the schools and programs. The results described here show that there was variability by program in the amount of time spent on IP&C topics, but also illustrate the difficulty programs had in estimating coverage time.

Table 1: ***Summary of Total Hours of Initial Teaching (Theory and Practice Combined) by Content Area***

Content Area	# Hours of Teaching (Theory and Practice Combined)			
		<1	1-3	>3
	n[1]	n[2]	n[2]	n[2]
Microbiology and Infectious Diseases				
Chain of Infection	5	-	3	2
Common Infections	5	-	3	2
Cough Etiquette	5	2	3	-
Hand Hygiene				
Indications for Hand Hygiene	4	3	1	-
Technique for Alcohol-Based Hand Rub	4	2	2	-
Technique for Hand Washing	4	1	3	-
Routine Practices and Additional Precautions				
Point of Care Risk Assessment	4	2	2	-
Routine Practices	4	-	4	-
Additional Precautions	4	1	3	-
Personal Protective Equipment				
Selection of Personal Protective Equipment	4	1	3	-
Application of Personal Protective Equipment	4	1	3	-
Removal of Personal Protective Equipment	4	1	3	-
Personal Safety				
Sharps	4	-	3	1
Post-Exposure Protocols	2	-	1	1
Vaccinations	4	1	1	1
Self-Care	4	1	1	2
Sterilization and Disinfection				
Indications for Cleaning	2	-	1	1
Waste Management	2	-	1	1
Critical Assessment Skills				
Critical Thinking	3		1	2
Role in Outbreaks	4	2	1	1
Use of Infection Prevention &Control Resources	3	1	1	1

n[1] = total number of programs who provided quantitative data in each content area
n[2] = number of programs within each category

Table 1 shows that there was also variability in the amount of time spent on individual topics. The program providing the "most extensive" coverage of IP&C material covered each of the topics of chain of infection and common infections in more than three hours, and the topic of cough etiquette in one to three hours. Conversely, the program with the " least extensive" coverage of IP&C material covered chain of infection and common infections in one to three hours each, and cough etiquette in less than one hour.

None of the content areas of Hand Hygiene, Routine Practices and Additional Precautions, or Personal Protective Equipment had topics that were covered in more than three hours of teaching time. The program providing the "most extensive" coverage of IP&C material consistently covered all topics in these areas in one to three hours of teaching per topic, whereas coverage was variable by topic for the other programs. Of note, the two programs providing "moderately extensive" coverage of IP&C material actually provided less coverage of these topics than did the program with the least extensive coverage of IP&C material. In general, the content area of Hand Hygiene received the least amount of teaching time, having more topics covered in less than one hour, than the content areas of Routine Practices and Additional Precautions and Personal Protective Equipment. With respect to PPE, all four programs reported fit-testing their students for an NIOSH equivalent high filtration mask (e.g., N95 respirator).

There was considerable variability in the coverage of the content areas of Personal Safety, Sterilization and Disinfection, and Critical Assessment Skills, with these topics typically receiving the least amount of coverage compared to Hand Hygiene and Routine Practices and Additional Precautions. The program with the "most extensive" coverage

of IP&C material covered all topics in these content areas in more than three hours, while the program with the "least extensive" coverage spent less than one hour on two topics (self-care and role in outbreaks), 1-3 hours on two other topics (vaccination and sharps safety), and did not report on the other five topics. One of the programs with "moderately extensive" coverage spent more than three hours on vaccinations and self-care, and 1-3 hours on the remaining seven topics, while the other program with "moderately extensive" coverage spent more than three hours on one topic (Critical Thinking), 1-3 hours on two topics, less than one hour on three topics, and did not report on three topics. Only two programs reported providing teaching related to post-exposure protocols, as well as for the two topics related to Sterilization and Disinfection (indications for cleaning and waste management).

4.1.2. Teaching methods and evaluation.

Respondents were asked to provide information regarding the type of teaching method used for each topic, as well as the methods used for evaluating students' learning for each topic. The amount of data provided regarding teaching and evaluation methods varied both between and within each content area. While all programs used case studies as a teaching and evaluation method, only one program used it as a teaching and evaluation method for 18 out of 21 topics. The other three programs reported use of case studies for between 1 and 7 out of 21 topics, including one program who only reported its use as a teaching method for chain of infection.

Demonstration was a method of teaching and evaluation that was commonly used for topics requiring psychomotor skill, with 75.0% - 100.0% of programs reporting same.

In contrast, 50.0% - 100.0% of programs used lectures and readings as a teaching method for over half of theory-based topics, with 25.0% - 75.0% of programs using short answer and multiple choice questions as evaluation methods for over half of theory-based topics.

4.1.3. Summary of curriculum review by directors of nursing programs.

In general, topics were covered by most programs. There was considerable variability by topic and program, but one program reported more coverage of the topics than did the others. Demonstration was the primary method of teaching and evaluation for topics related to psychomotor skills, while multiple choice questions and short answer questions were the most common evaluation method for theory-based topics. Case studies were consistently used as a teaching and evaluation method by one program, and less frequently by others. Most directors had difficulty quantifying the amount of teaching time provided (theory and practice) for any given topic, and also had difficulty identifying the level of the program in which this teaching was provided. Finally, they also had difficulty identifying the teaching and evaluation methods used for various topics

4.2. Survey Results from Clinical Educators and Nursing Students

Clinical educators and nursing students were surveyed and asked a series of questions to assess knowledge of IP&C topics, as well as their confidence in the area of IP&C. Knowledge and confidence score results pertaining to IP&C-specific questions are reported for clinical educator and student respondents.

4.2.1. Description of the clinical educator and student samples.

There were 26 clinical educator respondents from nine schools. Table 2 summarizes the demographic characteristics of these respondents. Almost half of clinical educator respondents (46.2%) worked in medical-surgical clinical areas and 57.7% had a Master of Nursing preparation. Eighty percent (80.8%) said they also teach a theory component in their program.

Table 2: ***Clinical Educator Demographic Characteristics***

Characteristic	Categories	Total	
		n[1]	%[1]
Specialty	Medical-Surgical	12	**46.1**
	Community	6	**23.1**
	Pediatrics	5	**19.2**
	Psychiatry	2	**7.7**
	Long Term Care	1	**3.9**
Educational Preparation	MN	15	**57.7**
	BN/BScN	7	**26.9**
	Other graduate studies	3	**11.5**
	PhD	1	**3.9**
Teach Theory	Yes	21	**80.8**
	No	5	**19.2**

[1] n and %: number of respondents and % of 26 respondents who gave the identified response

There were 25 student respondents from nine schools who completed the majority of the questions in the questionnaire. The nursing students were in the final year of a four year undergraduate nursing program. Table 3 summarizes the demographic characteristics of these respondents. Slightly less than one eighth (12.0%) of respondents reported having some secondary educational preparation prior to beginning their nursing program. Slightly less than half (44.0%) of nursing students reported having participated in nursing clinical experiences outside of their nursing program, while one fifth (20.0%)

had non-nursing clinical experiences such as working as a ward clerk or a pharmacy technician.

Table 3: ***Student Demographic Characteristics***

Characteristic	Categories	Total	
		n[1]	%[1]
Educational Preparation	Bachelor/Diploma	3	**12.0**
	None	22	**88.0**
Other Clinical Experiences	Nursing	11	**44.0**
	Non-Nursing	5	**20.0**
	None	9	**36.0**

[1] n and %: number of respondents and % of 25 respondents who gave the identified response

4.2.2. Clinical educator and student knowledge scores.

Table 4 summarizes the median raw knowledge scores for the clinical educator and student respondents for each of the six topic areas of the questionnaire: Microbiology (Micro), Hand Hygiene (HH), Personal Protective Equipment (PPE), Routine Practices and Additional Precautions (RPAP), Safety, and Sterilization. Maximum scores represent the sum of the scores for correct answers for all related questions in each topic area, if each question had been answered correctly. There was a fairly wide range in the raw knowledge scores for the six topic areas, and scores were fairly similar in all categories between clinical educator and student respondents. The data were not all normally distributed, so a median score was calculated rather than a mean score. The median total scores of 41 and 39, for the clinical educators and nursing students respectively, were out of a possible 52.

Table 4: ***Median Raw Knowledge Scores by Topic Area***

Topic Area	Maximum Possible Score	Clinical Educators		Students	
		Median	Range	Median	Range
Microbiology	18	**13**	7 – 16	**14**	4 – 16
PPE[1]	14	**12**	10 – 14	**12**	6 – 14
Sterilization	6	**6**	0 – 6	**4**	0 – 6
RPAP[1]	6	**4**	2 – 6	**4**	2 – 6
Hand Hygiene	4	**4**	2 – 4	**3**	2 – 4
Personal Safety	4	**3**	1 – 4	**3**	0 – 4
Total Score	**52**	**41**	**32 – 45**	**39**	**29 - 45**

[1]PPE, RPAP – Personal Protective Equipment, Routine Practice and Additional Precautions

To facilitate comparison of scores, rather than using raw scores, percent knowledge scores were calculated for each topic area. The raw score for a topic area was divided by the maximum possible score for that topic area, and converted to a percentage by multiplying by 100. The percent knowledge scores were calculated for each respondent's scores, one percent knowledge score for each topic area. As the data were not all normally distributed, the median percent knowledge score for each topic area was then calculated. Because of the wide ranges, the percent knowledge scores within each of the six topic areas were categorized into three ranked categories. Scores of 80% or greater (≥80%) were ranked as high knowledge scores, scores between 65% – 79% were categorized as moderate knowledge scores, and scores below 65% were categorized as low knowledge scores. Tables 5 and 6 summarize these results.

Table 5: ***Median Percent Knowledge Scores by Topic Area***

Topic Area	Clinical Educators		Students	
	Median %[2]	**Range %**	**Median %[2]**	**Range %**
Hand Hygiene	**100.0**	50.0 – 100.0	**75.0**	0.0 – 100.0
Sterilization	**100.0**	0.0 – 100.0	**66.7**	33.3 – 100.0
PPE[1]	**85.7**	71.4 – 100.0	**85.7**	42.9 – 100.0
Personal Safety	**75.0**	25.0 – 100.0	**75.0**	0.0 – 100.0
Microbiology	**72.2**	38.9 – 88.9	**77.8**	22.2 – 94.4
RPAP[1]	**66.7**	33.3 – 100.0	**66.7**	33.3 – 100.0
Total Score	**78.8**	**61.5 – 86.5**	**75.0**	**55.8 – 92.3**

[1]PPE, RPAP – Personal Protective Equipment, Routine Practices and Additional Precautions
[2]Median % score = median of (raw score/total score) *100

Table 5 summarizes the median percent knowledge scores for the clinical educator and nursing student respondents for each of the six topic areas of the questionnaire. Median scores were very similar for both groups, with the exception of Hand Hygiene and Sterilization. In the area of Hand Hygiene and Sterilization, over half had scores of 100.0%, so the median scores were reported as 100.0%. Student respondents had a median score of 75.0% in the area of Hand Hygiene, with only 44.0% of student respondents having a score of 100% in this area. In the area of Sterilization, nursing students had a median score of 66.7%, with only 36.0% of respondents having a score of 100.0% in this area.

In all content areas other than Sterilization and RPAP, there was wider variation in the range of percent knowledge scores for student respondents than there were for clinical educator respondents. In the area of Sterilization, the range of scores was narrower (33.3% - 100.0%) for nursing students than for clinical educators (0.0% - 100.0%). In the content area of RPAP, the range of scores was the same for both groups (33.3% - 100.0%).

Table 6 shows the total ranked percent knowledge scores, with 42.3% of the total ranked percent knowledge scores being high for clinical educators, and 28.0% for nursing students. Similar proportions of clinical educators (50.0%) and nursing students (48.0%) had moderate ranked percent knowledge scores. Only 7.7% of clinical educator respondents had low total ranked percent knowledge scores, while one quarter (24.0%) of nursing students had low total ranked percent knowledge scores.

Table 6: ***Ranked Percent Knowledge Scores by Topic Area***

Topic Area	High Scores (≥80%)		Moderate Scores (65-79%)		Low Scores (<65%)	
	Educators[2]	Students[3]	Educators[2]	Students[3]	Educators[2]	Students[3]
PPE[1]	92.3	60.0	7.7	24.0	--	16.0
Hand Hygiene	53.9	44.0	34.6	52.0	11.5	3.8
Sterilization	53.9	36.0	34.6	36.0	11.5	28.0
RPAP[1]	46.2	32.0	30.8	28.0	23.1	40.0
Safety	26.9	24.0	26.9	44.0	46.2	32.0
Microbiology	15.4	40.0	61.5	32.0	28.1	28.0
Total Score[4]	**42.3**	**28.0**	**50.0**	**48.0**	**7.7**	**24.0**

[1] PPE, RPAP – Personal Protective Equipment, Routine Practices and Additional Precautions
[2]% of 26 clinical educator respondents
[3]% of 25 student respondents
[4]Total Percent Knowledge Score = sum of all six knowledge scores for each respondent

Table 6 also summarizes the high, moderate, and low ranked percent knowledge scores for the clinical educator and student respondents by the six topic areas of the questionnaire. In the topic area of PPE, most (92.3%) clinical educators had high ranked percent knowledge scores, and 7.7% had moderate ranked percent knowledge scores, but no respondents had low ranked percent knowledge scores. In contrast, only 60.0% of nursing students had high ranked percent knowledge scores, while 16.0% had low ranked percent knowledge scores.

In the topic areas of Hand Hygiene, Sterilization, and RPAP, 46.2% - 53.9% of clinical educators had high scores compared to 32.0% - 44.0% of nursing students. For the topic of Hand Hygiene, clinical educators had more low scores than did nursing students (11.5% vs. 3.8%), but nursing students had more low scores than did clinical educators for the topics Sterilization and RPAP. And of note, even though the median score for Hand Hygiene for clinical educators was 100%, 11.5% still had low ranked percent knowledge scores in this area.

Similar proportions of clinical educator and student respondents had high ranked percent knowledge scores in the topic area of Personal Safety, however more clinical educators than nursing students had low ranked percent knowledge scores. In the area of Microbiology, more nursing students than clinical educators had high ranked percent knowledge scores, but similar proportions of respondents had low ranked percent knowledge scores.

Total ranked percent knowledge scores were also analyzed by educator educational background, and by area of specialty. The differences in total ranked percent knowledge scores were not notable by educational preparation, but area of specialty had some variation. While 50.0% those with medical-surgical or community backgrounds had high total ranked percent knowledge scores, only 20.0% of those with a pediatric background had high total ranked percent knowledge scores.

Student total ranked percent knowledge scores were analyzed by whether or not they had clinical experiences other than those provided in their program, however, the results were similar for those having nursing vs. non-nursing experiences.

4.2.3. Clinical educator and student responses to knowledge questions in each topic area.

Tables 7, 8, 9, and 10 provide summaries of clinical educator and student responses to each of the Hand Hygiene, Routine Practice and Additional Precautions, Personal Protective Equipment, Personal Safety, Sterilization, and Microbiology knowledge questions. Responses were marked as being correct or incorrect. However, in cases where respondents were asked to select or list more than one item within a single question, a mark of partially correct was given if the respondent correctly listed or chose at least some of the possible correct responses.

As outlined in Table 7, for the Hand Hygiene question related to technique for alcohol-based hand rub, roughly three quarters (76.0% - 76.9%) of both clinical educator and student respondents had correct responses. However, slightly less than one quarter (24.0%) of student respondents had partially correct responses and none had incorrect responses, while only 15.4% of clinical educators had partially correct responses, and 7.7% had incorrect responses. Knowledge related to indicators for hand hygiene had more variability, with 73.1% of clinical educators providing a correct response, and only 64.0% of nursing students providing the correct response. Neither group had an incorrect response for this question.

Table 7: ***Clinical Educator and Student Responses for Hand Hygiene and RPAP Knowledge Questions***

Questions	% Correct		% Partially Correct		% Incorrect	
	Educators[2]	Students[3]	Educators[2]	Students[3]	Educators[2]	Students[3]
Hand Hygiene						
Important aspects of ABHR[1]	76.9	76.0	15.4	24.0	7.7	--
List indicators for HH[1]	73.1	64.0	26.9	36.0	--	--
Routine Practices and Additional Precautions						
Respiratory hygiene/cough etiquette	65.4	48.0	34.6	52.0	--	--
Routine Practices	46.2	40.0	42.3	32.0	11.5	28.0
Select PPE for client interaction	30.8	16.0	65.4	84.0	3.8	--

[1] ABHR – Alcohol-based hand rub, HH – Hand Hygiene, PPE – Personal Protective Equipment
[2] % of 26 clinical educator respondents
[3]% of 25 student respondents

In the area of Routine Practice and Additional Precautions (RPAP), in general, clinical educator knowledge appeared to be stronger than student knowledge. When identifying the main components of cough etiquette, 65.4% of clinical educator respondents provided a correct response, vs. 48.0% of student respondents. Neither group had any incorrect responses for this question. When asked to list two examples of Routine Practices (other than Hand Hygiene or Personal Protective Equipment), 46.2% of clinical educators provided a correct response, while 40.0% of nursing students provided the same. However, 28.0% of nursing students provided an incorrect response, while only 11.5% of clinical educators provided an incorrect response. When identifying what PPE a nurse should wear when checking vitals or helping a patient to sit up in bed if the

patient is on droplet precautions, 30.8% of clinical educators provided a correct response, vs. 16.0% of nursing students. While there were no incorrect student responses to this question and one incorrect clinical educator response, 65.4% of clinical educators provided a partially correct response to the question, vs. 84.0% of student respondents.

Table 8 provides summaries of clinical educator and student responses to the Personal Protective Equipment (PPE) knowledge questions. All clinical educator and student respondents provided correct responses to the PPE question related to whether or not gloves should be worn for handling contaminated items, as well as the question addressing whether or not hand hygiene should be performed after removing one's gloves. Almost all of the respondents, 92.6% of clinical educators and 96.0% of nursing students, knew that a gown can be worn for multiple patients if it has not been in contact with blood or bodily fluids.

More variability exists between the clinical educator and student respondents' responses to the questions related to whether or not gloves should be worn during all patient care activities, whether eye glasses are adequate protection from splashes/sprays of body fluids, and whether or not gloves should be worn when touching intact skin. While clinical educator knowledge was relatively high for these questions, with 92.3% - 96.2% providing correct responses, student respondent knowledge was not as high, with between 60.0% - 76.0% of respondents having correct responses.

Table 8: ***Clinical Educator and Student Responses for PPE[1] Knowledge Questions***

PPE Questions	% Correct		% Incorrect	
	Educators[2]	Students[3]	Educators[2]	Students[3]
Gloves should be worn for handling contaminated items	100.0	100.0	--	--
Not necessary to perform hand hygiene after removing your gloves	100.0	100.0	--	--
A gown can be worn for multiple patients if not in contact w/body fluids	96.2	96.0	3.8	4.0
Gloves should be worn during all patient care activities	96.2	60.0	3.8	40.0
Eye glasses are adequate protection from splashes/sprays of body fluids	92.3	76.0	7.7	24.0
Gloves should be worn when touching intact skin	92.3	76.0	7.7	24.0
Eye protection is needed when a mask is worn for protection	53.8	60.0	46.2	40.0

[1] PPE – Personal Protective Equipment
[2]% of 26 clinical educator respondents
[3]% of 25 student respondents

There was only one question where the clinical educators did not have a higher correct response rates than the nursing students. Only 53.8% of clinical educators correctly answered the question related to whether or not eye protection was needed when a mask is worn for protection, compared to 60.0% of nursing students.

Table 9 summarizes clinical educator and student responses to the Personal Safety and Sterilization knowledge questions. Once again, there was variability between the clinical educator and student responses to questions. More student respondents (68.0%) than clinical educator respondents (53.8%) correctly answered the question related to whether or not nurses who are non-immune for chickenpox should care for patients with shingles (zoster). In contrast, when asked why a nurse should contact Occupational

Health and Safety after a blood or body fluid exposure is experienced, 50% of clinical educators provided the correct response, vs. 40.0% of nursing students.

Both groups had similar response rates for the question related to the level of cleaning required if a stethoscope is used for multiple patients, with 88.5% of clinical educators and 84.0% of nursing students providing the correct response. Lower proportions of nursing students compared to clinical educators correctly answered the question regarding the level of cleaning required if using a commode for multiple patients (64.0% vs. 80.8%), and the question regarding using a blood pressure cuff for multiple patients (56.0% vs. 69.2%).

Table 9: ***Clinical Educator and Student Responses for Personal Safety and Sterilization Knowledge Questions***

Questions	% Correct		% Incorrect	
	Educators[2]	Students[3]	Educators[2]	Students[3]
Personal Safety				
Nurses non-immune for chickenpox should not care for patients with shingles	53.8	68.0	46.2	32.0
Why to contact OH&S[1] if a blood/body fluid exposure is experienced	50.0	40.0	50.0	60.0[4]
Sterilization				
Level of cleaning if used for multiple patients: Stethoscope	88.5	84.0	11.5	16.0
Level of cleaning if used for multiple patients: Commode	80.8	64.0	19.2	36.0
Level of cleaning if used for multiple patients: Blood Pressure Cuff	69.2	56.0	30.8	44.0

[1] OH&S – Occupational Health and Safety
[2] % 26 of clinical educator respondents
[3]% of 25 student respondents
[4]1 response was incorrect, 14 responses were partially correct

Table 10 provides summaries of clinical educator and student responses to the Microbiology knowledge questions. For three out of four airborne vs. droplet transmission questions (droplet nuclei or dust, particles enter the lower respiratory tract, and particles land on the mucous membranes of the nose and mouth), student respondents had higher knowledge scores, with between 80.0% - 100.0% of nursing students providing a correct response for these questions, and only 65.4% - 92.3% of clinical educators providing correct responses for these questions. However, for the Microbiology question related to secretions being greater than 5 microns, 92.3% of clinical educators provided the correct response, vs. 84.0% of nursing students. Similar proportions of respondents were also able to list one microorganism transmitted by airborne transmission (65.4% correct vs. 64.0% correct).

There was less variability between the clinical educator and student responses to the Microbiology questions focusing on route of transmission and one factor that increases host susceptibility for both influenza and *Clostridium difficile,* with responses either being very similar between the two groups, or a slightly greater percentage of nursing students providing the correct or partially correct response. Regarding one factor that increased host susceptibility to influenza, 80.8% of clinical educators provided a correct response, compared to 88.0% of nursing students. When asked to list the route of transmission for influenza, 76.9% of clinical educators provided a partially correct response, vs. 72.0% of nursing students. Only 65.4% of clinical educators and 64.0% of nursing students were able to correctly identify one factor that increases host susceptibility to *Clostridium difficile,* and only 15.4% of clinical educators and 28.0% of nursing students were able to correctly identify the route of transmission of *Clostridium*

difficile. However, 80.8% of clinical educators provided a partially correct response to this question, as did 60.0% of student respondents.

Table 10: ***Clinical Educator and Student Responses for Microbiology Knowledge Questions***

Microbiology Questions	% Correct		% Partially Correct		% Incorrect	
	Educators[2]	Students[3]	Educators[2]	Students[3]	Educators[2]	Students[3]
Airborne vs. Droplet Transmission						
Secretions >5	92.3	84.0	--	--	7.7	16.0
Droplet nuclei or dust	65.4	80.0	--	--	34.6	20.0
Particles enter LRT	92.3	100.0	--	--	7.7	--
Particles land on nose/mouth	65.4	80.0	--	--	34.6	20.0
Airborne microorganism	65.4	64.0	--	--	34.6	36.0
Other						
Increase host susceptibility: Influenza	80.8	88.0	7.7	--	11.5	12.0
Route of transmission: Influenza	7.7	4.0	76.9	72.0	15.4	24.0
Increase host susceptibility: *C. difficile*	65.4	64.0	3.8	--	30.8	36.0
Route of transmission: *C. difficile*	15.4	28.0	80.8	60.0	3.8	12.0

[1] LRT – Lower Respiratory Tract, *C. difficile. – Clostridium difficile*
[2]% of 26 clinical educator respondents
[3]% of 25 student respondents

4.2.4. Clinical educator and student confidence scores.

Table 11 summarizes the median raw confidence scores for the clinical educator and student respondents for each of the six topic areas of the questionnaire: Routine Practices and Additional Precautions, Hand Hygiene, Personal Protective Equipment, Safety, Critical Assessment Skills, and Sterilization. Responses were assigned a score based on their self-reported level of confidence. The response "very confident" received 3 points, "somewhat confident" received 2 points, and "not confident" received 1 point. A response of "not applicable" was assigned a score of zero. Maximum scores represent the sum of the scores for all related questions in each topic area, if each question had been answered as "very confident". There was a fairly wide range in the raw confidence scores for the six topic areas. The data were not all normally distributed, so the median scores were calculated rather than mean scores. The median total scores of 47.5 and 45.0, for the clinical educators and nursing students respectively, were out of a possible 54.

Table 11: ***Median Raw Confidence Scores by Topic Area***

Topic Area	Maximum Possible Score	Clinical Educators		Students	
		Median	Range	Median	Range
RPAP[1]	12	**9.5**	4 – 12	**10**	4 – 12
Hand Hygiene	9	**9**	7 – 9	**9**	7 – 9
PPE[1]	9	**9**	6 – 9	**9**	5 – 9
Safety	9	**8**	6 – 9	**7**	4 – 9
CAS[1]	9	**7**	5 – 9	**6**	3 – 9
Sterilization	6	**5**	3 – 6	**5**	3 – 6
Total Score	**54**	**47.5**	**37 - 54**	**45.0**	**32 – 54**

[1]PPE - Personal Protective Equipment, RPAP - Routine Practice and Additional Precautions, CAS – Critical Assessment Skills

To facilitate comparison of scores, percent confidence scores were calculated for each topic area. The raw score for a topic area was divided by the maximum possible score for that topic area, and converted to a percentage by multiplying by 100. The percent confidence scores were calculated for each respondent's scores, one percent confidence score for each topic area. As the data were not all normally distributed, the median percent confidence score for each topic area was then calculated. Because of the wide ranges, the percent confidence scores within each of the six topic areas were categorized into three ranked categories. Scores of 80% or greater (≥80%) were ranked as high confidence scores, scores between 65% – 79% were categorized as moderate confidence scores, and scores below 65% were categorized as low confidence scores. Tables 12 and 13 summarize these results.

Table 12: ***Median Percent Confidence Scores by Topic Area***

Topic Area	Clinical Educators		Students	
	Median %[2]	**Range %**	**Median %[2]**	**Range %**
Hand Hygiene	**100.0**	77.8 – 100.0	**100.0**	77.8 – 100.0
PPE[1]	**100.0**	66.7 – 100.0	**100.0**	55.6 – 100.0
Safety	**88.9**	66.7 – 100.0	**77.8**	44.4 – 100.0
Sterilization	**83.3**	50.0 – 100.0	**83.3**	50.0 – 100.0
RPAP[1]	**79.2**	33.3 – 100.0	**83.3**	33.3 – 100.0
CAS[1]	**77.8**	55.6 – 100.0	**66.7**	33.3 – 100.0
Total Score	**87.9**	**68.5 – 100.0**	**83.3**	**59.3 – 100.0**

[1]PPE, RPAP – Personal Protective Equipment, Routine Practices and Additional Precautions
[2]Median % score = median of (raw score/total score) *100

Table 12 summarizes the median percent confidence scores for the clinical educator and student respondents for each of the six topic areas of the questionnaire. For both educators and students, over half of respondents had scores of 100.0% in the areas of Hand Hygiene and PPE. As such, median scores are reported as 100.0% for both

groups in these topic areas. Median percent confidence scores were very similar for both groups in most questions, both between topic areas, and in the overall total percent confidence scores (87.9% for clinical educators, 83.3% for nursing students). However, there was some variability in the areas of Safety and Critical Assessment Skills. In the content area of Safety, the clinical educators had a median percent score of 88.9%, while the nursing students had a median percent score of 77.8%. Similarly, in the area of Critical Assessment Skills, clinical educators had a median percent sore of 77.8%, while nursing students had a median percent score of 66.7%. There were also wider ranges of scores for these two questions in both groups, with clinical educators having a range of 66.7% - 100.0% for Safety and 55.6% - 100.0% for Critical Assessment Skills. Student scores ranged between 44.4% - 100.0% and 33.3% - 100.0% respectively for these questions.

Table 13: ***Ranked Percent Confidence Scores by Topic Area***

Topic Area	High Scores (≥80%)		Moderate Scores (65-79%)		Low Scores (<65%)	
	Educators[2]	Students[3]	Educators[2]	Students[3]	Educators[2]	Students[3]
Hand Hygiene	96.2	96.0	3.9	4.0	--	--
PPE[1]	80.8	60.0	19.2	40.0	--	4.0
Safety	73.1	32.0	26.9	52.0	--	16.0
Sterilization	61.5	52.0	30.8	36.0	7.7	12.0
RPAP[1]	50.0	60.0	42.3	32.0	7.7	8.0
CAS[1]	34.6	28.0	53.8	40.0	11.5	32.0
Total Score[4]	**69.2**	**56.0**	**30.8**	**32.0**	**--**	**12.0**

[1] PPE– Personal Protective Equipment, RPAP - Routine Practices and Additional Precautions, CAS – Critical Assessment Skills
[2] % of 26 clinical educator respondents
[3]% of 25 student respondents
[4]Total Percent Confidence Score = sum of all six knowledge scores for each respondent

Table 13 shows the total ranked percent confidence scores, with 69.2% of the total ranked percent confidence scores being categorized as high for clinical educators, and 56.0% for nursing students. Clinical educators and nursing students had similar percentages of moderate ranked percent confidence scores, being 30.8% for clinical educators, and 32.0% for nursing students. None of the clinical educators had low total ranked percent confidence scores, while 12.0% of nursing students had low total ranked percent confidence scores.

Table 13 also summarizes the high, moderate, and low ranked percent confidence scores for the clinical educator and student respondents by the six topic areas of the questionnaire. Similar proportions of clinical educator and student respondents had high ranked percent confidence scores (96.2% vs. 96.0%). Higher proportions of clinical educators had high ranked percent confidence scores compared to nursing students in the areas of Safety (73.1% vs. 32.0%) and Critical Assessment Skills (34.6% vs. 28.0%). More nursing students (32.0%) than clinical educators (11.5%) had low ranked percent confidence scores related to Critical Assessment Skills, and 16.0% of nursing students had low ranked percent confidence scores related to Safety (vs. no clinical educators).

Of note, while 80.8% of clinical educators had a high ranked percent confidence score in the area of PPE, only 60.0% of nursing students had high ranked percent confidence scores in this area. Additionally, while 61.5% of clinical educators had high ranked percent confidence scores in the area of Sterilization, only 52.0% of nursing students had high ranked percent confidence scores in this area. While in most instances the clinical educators had higher ranked percent confidence scores than nursing students, there was one exception to this. In the area of RPAP, 60.0% of nursing students had high

ranked percent confidence scores, while only half (50.0%) of clinical educators had high ranked percent confidence scores in this area. The two groups had similar proportions with low ranked percent scores (7.7% - 8.0%).

Total ranked percent knowledge scores were also analyzed by educator and student demographic characteristics. All respondents having a BN/BScN educational background had high ranked percent confidence scores, compared to 75% of those with other degrees (in other fields, or a PhD), and 66.7% of those with an MN. Of those with a Pediatrics specialty, 100.0% had high ranked percent confidence scores. Only 75.0% of those with a Medical-Surgical background had high ranked percent confidence scores, as did 66.7% of those with a Community background. Only one third (33.3%) of those having other specialty backgrounds had high ranked percent confidence scores.

Of note for student respondents, of those who had nursing clinical experiences outside of those provided by their program, only 45.5% of nursing students had high ranked percent confidence scores, compared to 80.0% of those with non-nursing clinical experiences, and 55.6% of those without any additional clinical experiences.

4.2.5. Clinical educator and student responses to confidence questions in each topic area.

Tables 14 and 15 provide summaries of clinical educator and student responses to each confidence level question, divided into the content areas of the Hand Hygiene, Personal Protective Equipment, Routine Practices and Additional Precautions, Personal Safety, Sterilization, and Critical Assessment Skills. As outlined in Table 14, overall confidence in the area of Hand Hygiene was high. All clinical educator and student

respondents reported feeling very confident in performing hand hygiene when indicated, and similar numbers (96.0% - 96.2%) of respondents reported feeling very confident in using the correct technique for hand washing. While slightly fewer (84.5%) clinical educators were very confident in using the correct technique for alcohol-based hand rub, 96.0% of student respondents were very confident in this area.

Confidence levels related to Personal Protective Equipment varied between topics. Confidence scores in wearing gloves was high for both clinical educators (96.2%) and nursing students (100.0%). While 80.0% of clinical educators were very confident in removing a mask without self-contaminating, only 57.7% were very confident in removing PPE without self-contaminating. Nursing students had less confidence in these areas, with only 56.0% being very confident in removing a mask without self-contaminating, and only 52.0% being very confident in removing PPE without self-contaminating.

Confidence scores in the content area of Routine Practices and Additional Precautions were also low. Only 50.0% of clinical educator respondents and 36.0% of student respondents reported feeling very confident in applying airborne precautions. Overall confidence was also lower in applying contact or droplet precautions; however student confidence was slightly higher than clinical educator confidence in these areas. Regarding contact precautions, 72.0% of nursing students reported feeling very confident, compared to half (50.0%) of clinical educators. Confidence in applying droplet precautions was very high for 52.0% of student respondents, and 46.2% of clinical educator respondents. Less than half of respondents, 46.2% of clinical educators and 44.0% of nursing students, reported feeling very confident in choosing the

right PPE for the patient interaction. In addition, 12.0% of nursing students reported feeling not confident in this area.

Table 14: ***Clinical Educator and Student Responses for Hand Hygiene, PPE[1], and RPAP[1] Confidence Questions***

Questions	Very Confident		Somewhat Confident		Not Confident	
	Educators[2]	Students[3]	Educators[2]	Students[3]	Educators[2]	Students[3]
Hand Hygiene						
Performing HH[1] when indicated	100.0	100.0	--	--	--	--
Correct technique HW[1]	96.2	96.0	3.8	4.0	--	--
Correct Technique ABHR[1]	84.6	96.0	15.4	4.0	--	--
Personal Protective Equipment						
Wearing gloves	96.2	100.0	3.8	--	--	--
Removing mask	80.8	56.0	19.2	40.0	--	4.0
Removing PPE	57.7	52.0	38.5	44.0	3.8	4.0
Routine Practices and Additional Precautions						
Applying airborne precautions	50.0	36.0	46.2	56.0	3.8	8.0
Applying contact precautions	50.0	72.0	42.3	20.0	7.7	8.0
Applying droplet precautions	46.2	52.0	46.2	40.0	7.7	8.0
Choosing right PPE[1]	46.2	44.0	50.0	44.0	3.8	12.0

[1] PPE – Personal Protective Equipment, RPAP – Routine Practices and Additional Precautions, HH – Hand Hygiene, HW – Hand Washing, ABHR – Alcohol-based Hand Rub

[2]% of 26 clinical educator respondents

[3]% of 25 student respondents

Table 15 summarizes the results from the Personal Safety, Sterilization and Critical Assessment confidence questions. There were wide variations in the confidence scores within and between all content areas. In the area of Personal Safety, respondents generally seemed very confident in preventing needle-stick injuries, with 88.5% and 80.0% of clinical educator and student respondents providing this response respectively. However, only 61.5% of clinical educators reported feeling very confident in initiating first aid for punctures, and only 28.0% of nursing students were confident in this area. In addition, 20.0% of nursing students reported not feeling confident in this area. Also, only 38.5% of clinical educators and 16.0% of nursing students reported feeling very confident in initiating first aid fluid exposure to the eyes, nose, or mouth, with an additional 28.0% of nursing students reporting feeling not confident in this area.

Confidence scores in the content area of Sterilization also varied. Equal numbers of student respondents (44.0%) reported feeling very confident in disposing of contaminated waste and cleaning contaminated equipment. However, 12.0% of nursing students reported feeling not confident in disposing of contaminated waste, and 4.0% reported feeling not confident in cleaning contaminated equipment. In contrast, 53.8% of clinical educators were very confident in disposing of contaminated waste, while only 34.6% reported feeling very confident in cleaning contaminated equipment.

Table 15: ***Clinical Educator and Student Responses for Personal Safety, Sterilization, and Critical Assessment Skill Confidence Questions***

Questions	Very Confident		Somewhat Confident		Not Confident	
	Educators[2]	Students[3]	Educators[2]	Students[3]	Educators[2]	Students[3]
Personal Safety						
Preventing needle-stick injuries	88.5	80.0	7.7	20.0	3.8	--
Initiating first aid for punctures	61.5	28.0	30.8	48.0	--[4]	20.0[5]
First aid for fluid exposure	38.5	16.0	53.8	56.0	--[4]	28.0
Sterilization						
Disposing of contaminated waste	53.8	44.0	46.2	44.0	--	12.0
Cleaning contaminated equipment	34.6	44.0	57.7	52.0	7.7	4.0
Critical Assessment Skills						
Sources of IP&C[1] info	65.4	52.0	34.6	28.0	--	20.0
Problem solving r/t IP&C[1]	26.9	20.0	73.1	56.0	--	24.0
Performing PCRA[1]	23.1	20.0	61.5	52.0	15.4	28.0

[1] IP&C – Infection Prevention and Control, PCRA – Point of Care Risk Assessment
[2]% of 26 clinical educator respondents
[3]% of 25 student respondents
[4] In addition, 7.7% of respondents answered "N/A"
[5] In addition, 4.0% of respondents answered "N/A"

In general, confidence in the area of Critical Assessment Skills was the lowest of all six content areas. While 52.0% of nursing students reported feeling very confident in identifying sources of information related to IP&C material, 20.0% reported feeling not confident in this area; 65.4% of clinical educators reported feeling very confident in

identifying these resources. Remarkably, only 26.9% of clinical educators and 20.0% of nursing students reported feeling very confident in problem solving related to IP&C, with 24.0% of nursing students reporting that they did not feel confident in this area. Similarly, only 23.1% of clinical educators and 20.0% of nursing students reported feeling very confident in performing point of care risk assessments, and over one quarter (28.0%) of nursing students and 15.4% of clinical educators reported feeling not confident in this area.

4.2.6. Clinical educator and nursing student knowledge scores associated with high confidence scores.

A comparison was made to see if clinical educator respondents' high knowledge scores were associated with high confidence scores. Table 16 summarizes these comparisons for each of the five topic areas where similar knowledge and confidence questions were asked. There were notable differences in the knowledge and confidence scores across the topic areas. Knowledge and confidence scores seemed more congruent for Hand Hygiene and Personal Protective Equipment than for other topic areas. Slightly more than half (53.8%) of clinical educator respondents who had high ranked percent knowledge scores also had high ranked percent confidence scores in the area of Hand Hygiene. Slightly less than three quarters (73.1%) of clinical educator respondents who had high ranked percent knowledge scores in the area of PPE also had high ranked percent confidence scores in this area. However, not all scores were congruent. For example, for the topic of Hand Hygiene, one third (34.6%) of clinical educators with only moderate ranked percent knowledge had high ranked percent confidence scores, and even

those with low ranked percent knowledge scores had moderate or high ranked percent confidence scores (3.9% - 7.7%). In the area of PPE, 19.2% of clinical educator respondents with high ranked percent knowledge scores only had moderate ranked percent confidence scores.

Table 16: ***Clinical Educator General Knowledge by Confidence***

Topic Area	Knowledge scores[1,2]	Confidence scores[1,2]		
		High	Moderate	Low
Hand Hygiene	High	53.8%	--	--
	Moderate	34.6%	--	--
	Low	7.7%	3.9%	--
PPE	High	73.1%	19.2%	--
	Moderate	7.7%	--	--
	Low	--	--	--
RPAP	High	19.2%	23.1%	15.4%
	Moderate	15.4%	15.4%	--
	Low	7.7%	3.9%	3.9%
Personal Safety	High	11.5%	15.4%	--
	Moderate	23.1%	3.9%	--
	Low	38.5%	7.7%	--
Sterilization	High	34.6%	15.4%	3.9%
	Moderate	23.1%	7.7%	3.9%
	Low	3.9%	7.7%	--

[1] % of 26 respondents who gave the identified response within each knowledge vs confidence topic area
[2] High Score = ≥80%, Moderate Score = 65-79%, Low Score = <65%

In the other three content areas, there was a great deal of variation in the scores, and no real pattern identifiable in the data. In the area of RPAP, of those with high ranked percent knowledge scores, 19.2% had high ranked percent confidence scores, one quarter (23.1%) had moderate ranked percent confidence scores, and 15.4% had low ranked percent confidence scores. Regarding Personal Safety, of those with high ranked percent knowledge scores 11.5% had high ranked percent confidence scores. In contrast, one quarter (23.1%) with moderate ranked percent knowledge scores had high ranked

percent confidence scores, and slightly more than one third (38.5%) with low ranked percent knowledge scores had high ranked percent confidence scores. Finally, in the area of Sterilization, one third (34.6%) of clinical educator respondents who had high ranked percent knowledge scores also had high ranked percent confidence scores, while one quarter (23.1%) of those with moderate ranked percent knowledge scores had high ranked percent confidence scores.

A comparison was also made to see if student respondents' high knowledge scores were associated with high confidence scores. Table 17 summarizes these comparisons for each of the five topic areas where similar knowledge and confidence questions were asked. As with the clinical educators, there were notable differences in the nursing students' knowledge and confidence scores across the topic areas, and knowledge and confidence seemed more congruent for Hand Hygiene and Personal Protective Equipment than for other topic areas. For both Hand Hygiene and Personal Protective equipment, 40.0% of student respondents who had high ranked percent knowledge scores also had high ranked percent confidence scores in these areas. However, student respondents seemed to be more confident related to Hand Hygiene than Personal Protective Equipment. For example, in the area of Hand Hygiene, half (52.0%) with only moderate ranked percent knowledge scores had high ranked percent confidence scores, and even those with low ranked percent knowledge scores had high ranked percent confidence (4.0%). In the area of PPE, 16.0% of those with high ranked percent knowledge scores had moderate ranked percent confidence scores, and 16.0% of those with moderate ranked percent knowledge scores had moderate ranked percent confidence scores.

As with the clinical educators, there was a great deal of variation in the nursing students' scores in the other three content areas, and no real pattern identifiable in the data. In the area of RPAP, of those with high ranked percent knowledge scores, 28.0% had low ranked percent confidence scores. Regarding Personal Safety, of those with high ranked percent knowledge scores, 4.0% had high ranked percent confidence scores. In contrast, 16.0% with moderate ranked percent knowledge scores had high ranked percent confidence scores, and 12.0% with low ranked percent knowledge scores had high ranked percent confidence scores. Finally, in the area of Sterilization, 16.0% of student respondents who had high ranked percent knowledge scores also had high ranked percent confidence scores, while 24.0% of those with low ranked percent knowledge scores had high ranked percent confidence scores.

Table 17: ***Student General Knowledge by Confidence***

Topic Area	Knowledge scores[1,2]	Confidence scores[1,2]		
		High	Moderate	Low
Hand Hygiene	High	40.0%	4.0%	--
	Moderate	52.0%	--	--
	Low	4.0%	--	--
PPE	High	40.0%	16.0%	4.0%
	Moderate	8.0%	16.0%	--
	Low	8.0%	8.0%	--
RPAP	High	12.0%	12.0%	8.0%
	Moderate	20.0%	8.0%	--
	Low	28.0%	12.0%	--
Personal Safety	High	4.0%	16.0%	4.0%
	Moderate	16.0%	24.0%	4.0%
	Low	12.0%	12.0%	8.0%
Sterilization	High	16.0%	12.0%	8.0%
	Moderate	12.0%	20.0%	4.0%
	Low	24.0%	4.0%	--

[1] % of 25 respondents who gave the identified response within each knowledge vs confidence topic area

[2] High Score = 80%≥, Moderate Score = 65-79%, Low Score = <65%

In summary, there was wide variation in educator and student knowledge and confidence scores, both within and between topic areas. Additionally, knowledge and confidence scores were not always congruent.

4.3. Clinical Educator and Student Respondents' Influenza-related and General Information Results

Respondents answered questions related to their knowledge, confidence, and education related to influenza, infection control, and general questions. In addition, clinical educator respondent results are provided for questions focused on their view of their role in teaching IP&C material to their nursing students.

4.3.1. Influenza-related education received.

Participants were asked a series of questions that addressed whether or not they received H1N1-specific influenza education. Of those who responded, 69.2% of clinical educator respondents said that they had, compared to 80.0% of nursing students. Clinical educators had a mean of 2.59 hours of teaching, vs. 2.9 hours for nursing students. One third of clinical educators and just over one quarter (28.6%) of nursing students received their education from their School of Nursing, with similar proportions of respondents (44.4% vs. 42.9%) receiving their education from other outside agencies. The primary method of delivery for the education was inservices and presentations for both groups. Of note, while 60.0% of nursing students said that their learning had been evaluated, only 17.6% of clinical educators reported the same. Only two thirds of clinical educators, compared to 84.2% of nursing students, felt that their learning needs had been met.

If they had received Influenza-specific education, participants were asked whether or not this education covered several key topics: RPAP, Transmission, Prevention, and Management. Student responses suggest that they received more coverage of these topics than did clinical educators. While 95.5% of nursing students received education about Routine Practices, and 84.2% received education focusing on Additional Precautions, only 66.7% of clinical educators received education regarding the topics of Routine Practices and Additional Precautions. All nursing students (100.0%) reported they received education specific to Transmission and Prevention, while only two thirds of clinical educators reported they received education related to Transmission, and 77.8% received education related to Prevention. Most nursing students (95.5%) received education related to management, but only 61.1% of clinical educators reported having this topic covered in their education sessions.

4.3.2. H1N1 influenza-specific education and knowledge and confidence scores.

Of those who received formal education related to H1N1 influenza, half (50.0%) of clinical educator respondents had high ranked percent knowledge scores, compared to 16.7% of those who did not receive formal education in this area. In contrast, of those nursing students who received formal education related to H1N1 influenza, only one third (35.0%) had high ranked percent knowledge scores, and those who did not receive the education did not have high ranked percent knowledge scores. Of those clinical educators who felt that their learning needs had been met, only 66.7% had high ranked

total percent knowledge scores. A similar proportion (60.0%) of nursing students who felt that their learning needs were met had high total ranked percent knowledge scores.

Of note, of the 12 clinical educator respondents who received formal education related to Routine Practices and Additional Precautions, one quarter (25.0%) had high scores in these areas, while 83.3% of those who did not receive formal education in these areas also had high scores. Of the student respondents who received formal education related to Routine Practices and Additional Precautions, one third (31.3%-33.3%) had high scores in these areas. One third (33.3%) of clinical educator respondents having education in the area of Routine Practices had low scores, compared to 33.3% of nursing students. While one quarter (25.0%) of educator respondents who received education in the area of Additional Precautions had low scores, one third (31.3%) of nursing students also had low scores.

Of the clinical educator and student respondents who reported receiving education in the area of transmission, 83.3% of respondents were only partially correct when asked to identify the route of transmission for influenza, while only 8.3% correctly answered this question.

Respondents were asked if the H1N1 influenza pandemic had any impact on their general IP&C, and influenza-specific, knowledge and confidence. Many (69.2% – 73.1%) clinical educator respondents indicated that pandemic influenza had increased both their general IP&C and influenza-related knowledge, and similar proportions (70.8% - 75.5%) of student respondents reported the same. In contrast, only one half (50.0%) of clinical educator respondents, and 45.8% - 50.0% of student respondents, indicated that it had increased both their general IP&C, and influenza-related confidence.

4.3.3. Influenza education and actions.

Interestingly, of those who reported receiving formal education focusing on influenza, 55.6% of clinical educator respondents (vs. 40.0% of nursing students) reported that awareness of pandemic influenza had increased their general IP&C compliance, while 50.0% of clinical educators who did not receive formal education reported the same (vs. 25.0% of nursing students). Two thirds of clinical educator respondents who received influenza education (vs. 47.4% of nursing students) indicated that pandemic influenza had increased their influenza compliance. In contrast, 62.5% of clinical educators who did not receive influenza education reported having increased influenza compliance, vs. 25.0% of nursing students. Slightly less than one third (32.0%) of clinical educator respondents reported that they had increased the IP&C content of their teaching in response to pandemic influenza.

When asked questions regarding their influenza vaccination habits, 84.6% of clinical educators responded that they had been immunized with the H1N1 vaccine (vs. 92.0% of nursing students), while 80.0% of clinical educators (vs. 70.8% of nursing students) said that they had, or would be, immunized with the seasonal influenza vaccine. Interestingly, 94.4% of clinical educators who received influenza-specific education reported receiving the H1N1 vaccine, while 83.3% had, or would be, immunized with the seasonal influenza vaccine. In contrast, 62.5% of those who did not receive education were not immunized with the H1N1 vaccine, and 71.4% did not, or would not, be receiving the seasonal influenza vaccine. Student respondents who had received education related to influenza had more variation in their immunization rates, with 95.5% being immunized with the H1N1 vaccine, and 68.4% having been, or would be,

immunized with the seasonal influenza vaccine. Of those nursing students not receiving formal education related to influenza, 80.0% were immunized with the H1N1 influenza vaccine, and had been, or would be, immunized with the seasonal influenza vaccine.

4.3.4. Educator preparedness.

Most student respondents (96.0%) felt that their clinical educators were knowledgeable in the area of IP&C, and all felt that they had the opportunity to apply their IP&C knowledge and skills in the clinical area. Many (80.0%) clinical educator respondents reported seeing themselves as a role model for nursing students in the area of IP&C. Of those who reported seeing themselves in this role, 40.0% had high ranked total percent knowledge scores, while 75.0% had high ranked total self-reported confidence scores. When asked whether or not they felt adequately prepared for their role in teaching IP&C material, 60.9% of clinical educator respondents replied that they felt adequately prepared for this role. Of those who felt adequately prepared, only 42.9% had high ranked total percent knowledge scores, while 100.0% had high ranked total self-reported confidence scores.

Many clinical educator respondents (84.0%) indicated that they would be interested in receiving more education related to IP&C. However, only half (48.0%) of clinical educator respondents collaborated with their local IP&C Professionals, and only one quarter (28.0%) of clinical educator respondents were familiar with the CHICA-Canada core competencies for IP&C. Only one quarter (25.0%) of student respondents were familiar with the CHICA-Canada core competencies for IP&C. In general, when asked whether or not they would like to see some changes in their curriculum related to

IP&C content, student respondents indicated that they wanted to have more education and opportunity to practice what was learned, and they recommended having the material covered across all levels of the program.

4.4. Summary

While it is assumed that clinical educators would have more knowledge and confidence than nursing students related to IP&C material, the study findings suggest that that nursing students received more formal education specific to influenza than did clinical educators during the H1N1 influenza pandemic. In addition, nursing students were more likely to have their learning needs met and their learning evaluated. Nursing students were also more likely to have received teaching related to several key IP&C-related topics such as Routine Practices and Additional Precautions. Having received formal education related to influenza appears to be related to higher knowledge for both nursing students and clinical educators for some topics, but not all. However, RPAP education did not. In general, participants who received influenza education were more likely to have been vaccinated with the H1N1 influenza and seasonal influenza vaccines, with the exception of student participants being immunized with the seasonal influenza vaccine.

Nursing students reported feeling that their clinical educators were knowledgeable in the area of IP&C, and many clinical educators reported seeing themselves as role models in this area. However, clinical educator confidence in the area of IP&C appears to exceed their knowledge in this area.

4.5. Conclusion

The results of this study have identified gaps in curriculum, as well as knowledge and confidence gaps among clinical educators and nursing students. The results and implications of these findings will be discussed in the next chapter.

Chapter 5: Discussion

The purpose of this research project was to identify whether or not undergraduate nursing education curricula contain the material and delivery necessary to prepare nursing students to meet the CHICA-Canada core competencies for IP&C. The research questions for this project focused on assessing curricular content, as well as the knowledge and confidence of clinical educators, because they are instrumental in curriculum delivery, and nursing students. The issue of whether or not undergraduate nursing students are adequately prepared in meeting the CHICA-Canada core competencies for IP&C is a multi-faceted one. This chapter discusses the findings related to the study's research questions within the context of the study model, while incorporating any relevant literature. This chapter will also discuss the strengths and limitations of the study, and the implications of the results. The recommendations developed from this research study will be discussed further in Chapter 6.

5.1. Do Nursing Curricula Contain The Content Necessary To Help Nursing Students Meet The CHICA-Canada Core Competencies For IP&C?

As outlined in the study model found in Chapter 1, nurses obtain information through undergraduate education, orientation, and continuing education. The literature suggests that education received through orientation or continuing education is not always sufficient, highlighting the need for adequate education at the undergraduate level. The need for IP&C content in nursing curricula is further supported by the inclusion of IP&C content in both the CNA RN and NCLEX exams, as well as in the

Entry-Level competencies required by various provincial and state regulatory bodies. Before understanding what enhancements may be needed in IP&C education at the undergraduate level, we must first understand what education is currently being provided, and its effectiveness.

The approach taken for addressing the question related to curriculum content was to look at both what was covered, and whether or not the material was sufficiently covered. This was achieved through completion of a curriculum review. It was guided by the 21 topics found in the seven CHICA-Canada categories of core competencies for infection prevention and control for healthcare workers. There were several key findings from the curriculum review: for the most part all topics were covered, there was variation within and between topics and programs, there were similarities in the types of teaching and evaluations methods used, directors had difficulty quantifying the amount of teaching that was provided, and it was not possible to assess for sufficiency of coverage. In this section, these findings will be discussed in greater detail, and illustrated with relevant examples from the data. This section will also include a discussion of any lessons learned and implications. The findings will be addressed in three subsections: what was covered, how it was covered, and whether coverage was adequate.

5.1.1. Findings related to coverage of IP&C material: what was covered?

The first finding was that for the most part, all 21 topics and all seven content areas found in the CHICA-Canada core competencies document were covered by the participating programs. All five programs reported coverage of the three topics related to Microbiology, often through a separate microbiology course. However, only four

programs provided responses for the six other content areas; two reported coverage for all 18 topics within the six content areas, and two reported covering 13-15 of the remaining topics. It cannot be assumed that failure to report data regarding a topic implied it was not covered. As such, no assumptions were made regarding missing data, and analysis was only completed on what was actually reported.

Although the majority of topics were covered, as shown in Table 1 in Chapter 4, variation existed in the extent to which each of the topics was covered. Some topics had similar patterns in coverage, while others had greater variability in the number of hours of teaching reported. For example, in the areas of Hand Hygiene, PPE, and RPAP, none of the programs reported providing more than three hours of coverage, and most reported between one to three hours of coverage. In contrast, more variability existed in the hours of teaching in the areas of Personal Safety, Sterilization and Disinfection, and Critical Assessment, with at least one program reporting less than one hour, and some reporting more than three hours.

It is also important to note that in addition to topic-specific variation, variation existed between programs regarding the total amount of coverage of IP&C related content that was provided. Some programs consistently reported having more teaching time for topics. The program categorized as "most extensive" reported providing more than three hours of teaching for half of the topics. In contrast, the program categorized as "least extensive" did not spend more than three hours on any given topic. This program did not provide data for five topics. However, it is unlikely that the conclusion regarding categorization of "least extensive" coverage would change even if data had been provided for the missing topics. The other programs reported lower hours of teaching for these

missing topics, and as this program had lower hours for everything else, it seems reasonable to assume they would have had lower hours for these topics as well.

Because of the variations in the amount of coverage provided, it was difficult to generalize. There was no consistency between programs, therefore different schools may have different curriculum gaps. The implications of this will be discussed later in this chapter.

5.1.2. Findings related to coverage of IP&C material: how was it covered?

While the amount of teaching provided for various topics varied considerably, this curriculum review found that the teaching and evaluation methods used for IP&C material were somewhat consistent between programs, and were appropriate for each topic. For example, topics involving psychomotor skill, such as hand washing technique or application and removal of PPE, were taught and evaluated using demonstration. Lectures and readings were the most common teaching methods used for theory-based questions, while multiple choice questions, short answer questions, and less frequently, case studies, were the most common method of evaluation for these topics. Over half of the programs used multiple choice questions as an evaluation method for half of the topics. However, short answer questions were used less often, with only one quarter of programs using these methods for evaluation for half of the topics. Only one program reported consistently using case studies as both a teaching and evaluation method. Increasing the use of case studies would be worth exploring further, as they promote the development of critical thinking skills, problem solving skills, and facilitate learning through real life scenarios (Mills et al., 2014). Adequate skill in these areas is key for

competent practice, as they assist the nurse in being able to make sound practice-based judgements and decisions, in particular in situations when specific guidelines and recommendations may not be available to them.

Measurable data exists to support that the use of case studies results in increased knowledge among nursing students. In a study of 72 American schools of nursing, Young, Rose, and Willson (2013) found that NCLEX-RN testing scores of nursing students whose programs included online case studies were higher than those from schools who did not. While the literature clearly supports the use of case studies in nursing education, the use of this teaching and evaluation method varied by topic area in the programs reviewed in this study. Three quarters of these programs reported using case studies as the method of evaluation for the topics related to the CHICA category of Critical Assessment Skills, including critical thinking, role in outbreaks, and use of IP&C resources. However, no programs used case studies as an evaluation method for the topics of self-care, vaccinations, or sharps, and only one school used it as an evaluation method for post-exposure protocols. These all relate to the content area of Personal Safety.

However, more case studies could be used to teach and evaluate topics other than critical assessment skills, such as RPAP and PPE. Nurses require the ability to use critical thinking to assess for, and respond to, problematic issues encountered in the real world. Using case studies would be important as they facilitate discussion of the rationale behind various decisions, including pros and cons, practicality of recommendations (e.g., implementing protocols related to RPAP), defending the decision making process (e.g., choosing a gown vs. a mask), and sorting through the

appropriateness of various options (e.g., choosing droplet vs. contact precautions). In fact, the PHAC RPAP toolkit (2012), a set of educational tools developed to assist IP&C professionals and those responsible for providing IP&C education for HCWs, use cases studies as a means of strengthening the decision making process relevant to RPAP.

5.1.3. Difficulties assessing coverage.

While variation in the coverage of IP&C topics was identified, it was difficult to accurately assess the amount and nature of coverage that was actually provided to the nursing students. Respondents seemed to have difficulty reporting the data from their programs, as evidenced by many of the fields in the curriculum review questionnaire being left blank or filled in with an "unknown" response. They had difficulty sorting out the number of teaching hours related to theory and practice in their curricula, as well as information related to hours of theory vs. practice, and initial teaching vs. reinforcement of material. Finally, they also had difficulty identifying the teaching and evaluation methods used for various topics. This is not surprising, as the curriculum review process is a very difficult one, wrought with numerous challenges and issues. In a study by Watt-Watson et al. (2009), the researchers noted similar challenges in assessing for pain content in the curricula of prelicensure health science programs. Similar to this research project, they found that respondents had difficulty quantifying the amount of pain-specific teaching that was offered, as well as quantifying the number of theory vs. practice teaching hours. However, despite the challenges with the curriculum review process, the data that were provided suggests that gaps could be present in existing curricula, and different programs have different gaps in curricula.

5.1.4. Was IP&C coverage adequate?

The results of the curriculum review questionnaire identified gaps in curricula, as well as considerable variation in the IP&C-related material found in curricula. As such, the results were difficult to interpret. The optimal measure of adequacy would be to look at student outcomes. However, research is needed to determine what defines a student outcome as "adequate". This would involve several considerations. First, the level of knowledge required for competent practice needs to be determined, and the proportion of students one would wish to have achieving this result must be assessed. For example, is it reasonable to expect that all students in a particular program have knowledge sores of 90% or more, or would it be satisfactory if 75% of students had scores of 80% or more?

The CHICA-Canada IP&C core competencies for healthcare workers document provided an outline of the IP&C material that would be necessary for competent practice in the area of IP&C. What this document did not provide, however, were clear guidelines regarding how much coverage should be provided, how it should be taught and evaluated, and guidance for when the material should be introduced and reinforced. No clear measure of adequacy, in terms of recommendations for amount or type of coverage required, exist. For example, the Public Health Agency of Canada (2012b) recommends that healthcare educational and training bodies train students about hand hygiene recommendations, but no guidelines related to content and coverage are provided. As two examples, the Entry-Level Competencies for nurses for NS and Ontario identified competencies for IP&C practice, but they were broad and did not include any specific recommendations for content.

While this study did evaluate knowledge related to IP&C material, it did not evaluate knowledge in relation to actual behaviour or skills. Due to the small number of respondents and the need to preserve confidentiality, it was also not possible to report findings by program. However, student knowledge and confidence scores will be discussed later in this chapter in relation to the other research questions. Although this research study did not assess student outcomes in the context of specific curricula, the existing literature and study results related to student knowledge suggest that current curricular content may not be adequate.

One interesting finding that emerged from this curriculum review was that topics that could be expected to have more coverage and/or high knowledge scores sometimes did not. A review of the websites of many IP&C-focused organizations, such as PICNET, PIDAC, and PHAC, revealed that in the practice setting, there are numerous continuing education programs centered on hand hygiene and PPE. It could be assumed that hospitals would provide feedback to undergraduate nursing programs regarding the need for these campaigns, and that these nursing programs may then increase their content as a result. However, the need for implementation of such education campaigns in the practice setting, combined with ample research studies that highlight practice gaps in this area, suggests that this material may not be adequately covered in basic education.

5.1.5. Potential strategies for addressing gaps.

Although curriculum review methods did not allow for complete assessment of adequacy, what this study did highlight is that there were gaps and inconsistencies in the curricula, and the gaps differed by program. As such, guidelines may be helpful

regarding the amount of teaching time required for each topic, suggestions for sequencing of the material to optimize initial learning and reinforcement opportunities, and recommendations for teaching and evaluation strategies. While no clear guidelines exist that provide these recommendations, competency statements found within the CHICA-Canada document could be used to identify recommended topics for review. This would be the first key step for developing guidelines for curriculum and delivery. However, since only one quarter of educator and student respondents were familiar with the CHICA-Canada competency document, additional work is needed to promote awareness of this resource.

Once guidelines for content and delivery are developed, the next step could be to develop standardized teaching modules. Schools could then adapt or adopt these modules to meet their needs. The use of standardized modules in improving IP&C competency has been described in several studies (Al-Hussami & Darawad, 2013; Wu, Gardner, & Chang, 2009). The use of standardized modules and delivery/evaluation methods would be beneficial in ensuring that an appropriate amount of coverage is provided for each identified topic.

An additional benefit of a standardized module is that it might decrease the risk of curriculum drift. While curricula should evolve as new material and findings emerge, and clinical educators should refer to their own expertise and experiences to enhance their teaching, too much variation is problematic when it deviates from well-planned curriculum objectives. This is known as curriculum drift. Curriculum drift occurs when the curriculum content is controlled by the person teaching the material vs. a curriculum committee. As a result, what is actually taught can vary from person to person, causing

curriculum content to change over time. This could result in the teaching that is being offered missing emphasis on key material. For example, if an educator focuses primarily on Ebola rather than the required content, nursing students may be lacking key information in their basic education.

With clear guidelines and recommendations for IP&C curriculum content and delivery, programs may be able to minimize their risk for curriculum drift, as highlighted by van de Mortel and Bird (2010). The researchers developed a formative continuous curriculum review process aimed at preventing curriculum drift and improving the quality of the bachelor of nursing curriculum of study. As a result, several positive outcomes were identified within their nursing program, for nursing students, staff, and the university.

While programs and curriculum committees can have control over curriculum content, in order to prevent drift, program directors should ensure that nurses tasked with providing this teaching, both the theory and clinical aspects, be provided with the tools, practice, education, and support required to deliver the identified program material. It should also be noted that standardized modules would not interfere with academic freedom. Clinical educators would still be at liberty to personalize the teaching as they saw fit, without compromising the amount and type of coverage that was provided to the nursing students.

A part of the development of standardized material, guidelines are also needed for delivery of the material. For example, while the literature supports the use of case studies in improving IP&C knowledge, this strategy is often underutilized. Clinical educators could be provided with guidelines outlining the material that needed to be introduced and

reinforced, when it could be introduced and reinforced, and how it could be introduced and reinforced. Classroom teaching of theory-based material may be easier to standardize than would be clinical learning experiences, as clinical educators often have no control over the types of learning experiences that may arise for nursing students in the clinical setting. This is supported by Watt-Watson et al. (2009), who found that some nursing students had more experience with pain management than did others depending on their clinical experiences. However, strategies can be developed that support clinical educators in attempting to provide some standardization of the clinical experiences. This could include support and resources that promote reinforcement of material previously taught in the classroom or lab setting. IP&C material is relevant to all areas of nursing, and as such, material taught in the classroom or lab could be adapted to be reinforced in any clinical setting. For example, clinical educators could incorporate group discussions related to patient care that focused on IP&C –centered material. An example would be to ask nursing students about their patients, and then ask them what Routine Practices were relevant in the provision in care, for example sharps safety and selection of PPE.

While this study has identified curriculum and student learning needs, it is important to note that clinical educators themselves may also require additional education in the area of IP&C. They have a key role in the delivery of IP&C material found in the curricula, and as such, must be competent in the area of IP&C. In fact, 84.0% of respondents indicated that they would be interested in receiving more educations related to IP&C. However, they may experience challenges in ensuring that they are current and knowledgeable in this area. Those providing clinical supervision may not be employed in their clinical facilities, and as such, may not benefit from any IP&C education sessions

that are offered to staff nurses in partner agencies. Those who teach in the classroom or lab setting may have been out of the clinical area for some time, and may also be lacking opportunities for continuing education that may be provided in this area. Ensuring that all clinical educators have a current knowledge base in the area of IP&C is crucial in ensuring that nursing students' learning needs are met.

5.1.6. Conclusion.

All topics found in the CHICA-Canada document were covered, however, there was a great deal of variation in what was covered, and different programs had different gaps. Similar teaching and evaluation methods were used, but more emphasis needs to be placed on the use of case studies. A more clear and comprehensive curriculum review process is needed so directors can identify their curriculum needs and gaps, and evaluate their progress. While we do have competency statements related to IP&C, guidelines are needed for content and delivery of IP&C material. Standardized modules that could be adapted and adopted by programs to meet their needs may be beneficial in addressing curricular gaps. These modules would need to be made available, and additional work is needed in disseminating these and the core competency statement to a broader audience.

5.2. Do clinical educators and nursing students have the knowledge required to meet the CHICA-Canada core competencies for IP&C?

The purpose of this research project was to identify whether or not undergraduate nursing education curricula adequately prepare nursing students to meet the CHICA-Canada core competencies for IP&C. According to the model outlined in Chapter 1,

education received through orientation or continuing education is not always sufficient. Undergraduate education consists of the actual material (theory and practice), as well as adequate teaching and evaluation methods. This research study looked at what was contained in the curricula; the results and the difficulty in determining adequacy were also discussed in the previous section. It also assessed student knowledge as one measure of the effectiveness of the curricula. While it was not possible to relate knowledge scores of nursing students from particular programs to the IP&C coverage in their programs, assessing student knowledge in general may still facilitate identification of knowledge gaps. Any knowledge gaps might have been a result of insufficiencies in the nursing curricula.

As the basis for interpreting this study's results, it was assumed that nursing students in the final semester of their undergraduate nursing program should have a minimum, basic amount of knowledge related to IP&C. As a result, it was expected that all nursing students would have moderate (65% - 79%) or high (> 80%) knowledge scores in all content areas. The minimum score of 65% was chosen as it is the equivalent of a pass mark at the MUN School of Nursing. It was also assumed that there would be no low scores, being those less than 65%. If all nursing students had high scores, it would suggest that the program was highly successful. If all nursing students had moderate or high scores, it could be argued that the content of the program was satisfactory, but that there would still be room for improvement as nursing students having moderate knowledge scores could still have knowledge scores closer to the lower end of the scores defining the category, that is closer to 65% than to 79%. It was also assumed that in order to facilitate learning in the area of IP&C, clinical educators need to

be at least as knowledgeable as nursing students in this area, preferably more so. This would imply that all clinical educators would have knowledge scores in the moderate or high knowledge categories, with more of the clinical educators having scores in the high category. With the content of the questionnaire being very basic IP&C information that would apply in all areas of practice or specialty, these are reasonable expectations. Ultimately, it could be assumed that the higher the knowledge scores and the greater the knowledge base of both clinical educators and nursing students, the better.

The results of the knowledge questionnaire revealed three key findings: 1) knowledge scores were lower than would be expected for both clinical educators and nursing students; 2) there was variation in the level of knowledge between and within the 6 content areas, as well as the 21 topics within these content areas, and some of the variation with low scores suggests that knowledge gaps may be present; and 3) clinical educators had more knowledge than did nursing students in 18 out of 21 topics of the 6 content areas. In this section, these findings will be reviewed, summarized, and discussed related to any relevant literature. Any implications of these findings will be discussed at the end of the knowledge section.

5.2.1. Lower than expected knowledge scores.

The first key finding was that knowledge scores were lower than expected. As assumed would be the case, educator knowledge was higher than that of nursing students. As shown in Table 5, the median score for clinical educators was 78.8%, but the highest total score was 86.5%, and the lowest total score was 61.5%. The median total score was similar to that of nursing students (75.0%), and the participant with the highest score

(92.3%) was a student. Many more clinical educators than nursing students had actual total scores that fell in the high score (> 80%) range vs. between 75% - 79%, with 42.3% of clinical educators having high scores. Additionally, while half of scores were below the median of 78.8%, only 7.7% of clinical educators had low scores (< 65%). However, it was expected that there would be no low scores for this group.

The median score for nursing students was 75.0%, which means that half of the nursing students had scores higher than 75.0%, and half had scores lower than 75.0%. The highest total score received was 92.3%, but only 28.0% of nursing students had high scores (>80%). The lowest score was 55.8%, and one quarter of nursing students had low scores (<65%). While the median score was 75.0%, a large proportion of the scores that fell above 75.0% were actually in the 75% -79% range, which is still considered moderate knowledge. In fact, overall, half (48.0%) of nursing students had moderate total knowledge scores. These findings are supported by Wu, Gardner, and Chang (2008) who found that students had a mean knowledge score of 8.69 (SD 1.55, range 3-12), out of a possible score of 15, and over 71% of the respondents had a score between 8 and 10. Nursing students with knowledge in this category may have enough knowledge, but it would be advantageous if they knew more. As expected, the majority of nursing students met the criterion of achieving a pass mark (score > 65%). However, it was expected that no nursing students would have low scores, and this was not the case. Therefore, it can be stated that while some nursing students had at moderate or high knowledge scores, many did not, and knowledge gaps were evident. In order to address these knowledge gaps, changes to education, both through improvements to curriculum and educator knowledge, are needed. This is also supported by the findings of Tavolacci, Ladner,

Billy, Merle, Pitrou, and Czernichow (2008), who surveyed healthcare students for their IP&C knowledge, and found that the mean overall score for nursing students was 23.2/30 (± 2.35, $p<.001$), and this was the highest mean overall score of all of the disciplines.

It should be noted that there is some difficulty with interpreting the findings related to moderate knowledge vs. high knowledge among clinical educators, as it is not known how much knowledge is required in order to be an effective teacher. For example, it is not known whether a teacher with a high knowledge score can more effectively cover and reinforce the material than a teacher with a moderate knowledge score. All that can be done is to assume that the higher the knowledge score, the better. Due to the limited number of participants, it was not possible to assess specific student knowledge scores in relation to the scores of clinical educators from the same program. However, the possibility exists that lower total knowledge scores among nursing students may have been related to moderate or low knowledge scores among clinical educators. If those providing the education to the nursing students have knowledge gaps themselves, it may be difficult to successfully teach that material to the nursing students.

The implications of this are that additional education needs to be provided to clinical educators so that they can strengthen their knowledge base related to IP&C. As previously stated, in their role in delivering IP&C material found in the curricula, they must be knowledgeable and competent themselves in this area. They must also develop strategies for incorporating this material into theory courses and for reinforcing it in clinical so that they could be more effective in their teaching. This could be supported by linking with IP&C professionals in their area, however only half of clinical educators reported collaborating with local IP&C professionals. This suggests that additional work

should be done in creating those partnerships and linkages. Additionally, more research needs to be done that examines the relationship between educator knowledge levels and student knowledge levels.

It should also be noted that as a result of the heightened awareness of IP&C issues related to the H1N1 pandemic influenza outbreak that was occurring during the data collection process, educator and student knowledge should have been at their highest. Participation in H1N1 education sessions appears to have resulted in improved knowledge scores. For example, of the 18 clinical educators who reported receiving formal education related to H1N1 influenza, half of clinical educators had high ranked percent knowledge scores. In contrast, 16.7% of those who did not receive this education had high ranked percent knowledge scores. Of the 20 nursing students who received formal education related to H1N1 influenza, one third (35.0%) had high ranked percent knowledge scores, vs. none of the nursing students who did not receive this education. Even at a time when respondents were receiving enhanced IP&C education, there were still gaps in knowledge levels of educators and students. This suggests that knowledge scores may even be lower than were found in this research study during time periods where awareness of IP&C issues is decreased. This even more urgently highlights the need for improvements in the IP&C knowledge base of clinical educators and nursing students.

5.2.2. Variation in knowledge.

While only 7.7% of clinical educators had low overall ranked knowledge scores, vs. 24.0% of nursing students, many more had low scores in specific content areas. In

reviewing the data in Table 6, it is evident that both educator and student knowledge varied between content areas and topics, and the variations and low scores suggest that very clear knowledge gaps exist, in particular in the areas of RPAP, Personal Safety, and Microbiology. These are the three content areas where at least one quarter (range 23.1% - 46.2%) of both educator and student respondents had low knowledge scores. Additionally, 28.0% of nursing students had low scores in the area of Sterilization, vs. 11.5% of clinical educators. In contrast, only 3.8% of nursing students and 11.5% of clinical educators had low scores in the area of Hand Hygiene. The scores in the area of PPE differed more, with 16.0% of nursing students, and no clinical educators, having low scores in this area.

As noted, educator knowledge related to RPAP was lower than expected. Interestingly, of the 12 clinical educator respondents who received formal education related to RPAP, one quarter had high ranked percent knowledge scores in this area. In contrast, 83.3% of those who did not receive formal RPAP education also had high ranked percent knowledge scores. This suggests that provision of additional education related to RPAP did not have an effect on knowledge scores even though influenza education did. However, further exploration is needed to determine if there are ways to make the teaching more effective, and more relevant.

While marked variation in educator and student knowledge between content areas was present, variation also occurred within the questions for each topic area. Within the same content area, respondents did well in some topics and related questions, and not well in others. For example, as shown in Table 9, within the content area of Sterilization, while 84.0% of nursing students and 88.5% of clinical educators correctly

identified the level of cleaning required if a stethoscope was used for multiple patients, only 56.0% of nursing students and 69.2% of clinical educators correctly identified the level of cleaning required for a blood pressure cuff in the same situation. Over half (53.9%) of clinical educators and one third (36.0%) of nursing students had high Sterilization scores. In contrast, 11.5% of clinical educators and 28.0% of nursing students had low scores. This variation within the content area supports the conclusion that even in content areas where a great number of respondents appeared to generally be knowledgeable, knowledge gaps were still identified when specific topics were assessed. The implications of these findings of variation both between and within content areas, are that the data can be used to identify areas where greater emphasis should be placed on teaching some topics vs. others.

5.2.3. Clinical educator knowledge greater than nursing student knowledge.

The third key finding was that clinical educator knowledge was typically greater than nursing student knowledge, as has been illustrated by many of the previous examples related to knowledge gaps and variability. In fact, as shown in Table 6, in four out of six content areas, more clinical educators had higher ranked knowledge than did nursing students. However, while knowledge scores were lower than expected for both groups, and clinical educators generally had higher knowledge scores than did nursing students, caution must be used in interpreting the total scores from these findings because of the marked variation in total scores both between and within content areas. For example, while the proportions of clinical educators and nursing students having high knowledge scores related to Personal Safety were roughly equivalent (24.0% for students

vs. 26.9% for educators), only 32.0% of nursing students had low scores in this area vs. 46.2% of clinical educators. In the area of Microbiology, both groups had roughly one quarter of participants with low scores, but 40.0% of nursing students had high scores vs. only 15.4% of clinical educators.

The information assessed in this study was basic information that would apply across specialties and practice areas. It would not be unreasonable to expect that licensed RNs be knowledgeable in these areas. However, the results indicated that educators with medical-surgical or community backgrounds were more knowledgeable than educators with a pediatric background. What these results highlight is the need for additional continuing education opportunities for clinical educators in areas they may not actively be involved in.

It was expected that educators would have greater knowledge than students, as practicing nurses would have more experience and education than students. In addition, clinical educators failing to be current and knowledgeable related to IP&C material may result in knowledge gaps among nursing students. Of note, there were actually three topics in three different content areas where student knowledge exceeded educator knowledge in this study: 1) ABHR (content area of Hand Hygiene), immunity (content area of Personal Safety), and 3) Chain of Infection (Microbiology). It is concerning that clinical educators scored lower than nursing students in some areas, but it is important to note that topics related to microbiology and immunology are often taught by faculty members outside of the schools of nursing, for example in the biology department. As such, it may have been quite some time since clinical educators received any education or refresher sessions in this area.

Clinical educators may be deficient in areas where they rarely use the material being taught (e.g., microbiology), they may never have learned it, or they may not have kept up to date with any practice changes. For example, as shown in Table 8, between 92.3% - 100.0% of clinical educators correctly answered six out of seven PPE questions. In contrast, only 53.8% correctly answered whether or not eye protection is needed when a mask is worn for protection. This variation may be a result of changes in recommendations related to eye protection that were made during the pandemic influenza season (2009).

5.2.4. Strategies for addressing knowledge gaps.

As previously discussed, strategies to address gaps in curricula could strengthen educator and student knowledge as well. In addition, specific strategies for students could include initiatives where students play an active role in ensuring that the education they receive adequately prepares them for nursing practice. In order to ensure that all necessary skills and practice are complete prior to graduation, students could be given a tool to track their IP&C education. They could be provided with a "passport" of sorts that outlines all IP&C-related skills that must be complete, and the number of times that it should be done. For example, it could be made clear that a student must receive education related to the selection, application, and removal of PPE in years 1 and 2, and that reinforcement and 2 additional practice opportunities must be completed in years 3 and 4 before that particular item could be considered "complete" in the passport. In order to graduate, all students must have completed all required practice/experience with topics in said document, they must be tested/evaluated, and they must successfully complete

these items. With this type of tool, programs would have measurable data to support that student education has been effective.

Educator knowledge gaps must also be addressed. Of note, 84.0% of clinical educators indicated that they would be interested in receiving more education related to IP&C. Additionally, while 80.0% of clinical educators felt they were role models for nursing students in the area of IP&C, only 60.9% reported feeling adequately prepared for that role. This highlights the need for professional development and continuing education related to IP&C. For example, data from educators suggested that those who received formal education related to H1N1 influenza had higher knowledge scores than those who did not. In addition, this data showed that only 2-3 hours of teaching can be beneficial. Professional development or continuing education can be provided by the programs themselves, or by collaborating with partner institutions. Resources should be provided to educators, in particular related to reinforcing IP&C material in the clinical setting. Also, any interventions aimed at addressing educator knowledge gaps should include an assessment of whether or not learning needs are met. As reported in Chapter 4, only two thirds of educators found that their learning needs were met. If learning needs are not met, this may affect outcome.

5.2.5. Conclusion.

Due to the small number of respondents and the need to preserve confidentiality, it was not possible to compare curriculum content, educator scores, and student scores by program. However, even in the absence of this comparison, the data clearly suggest that curriculum content related to IP&C could be strengthened, and knowledge gaps exist

among clinical educators and nursing students. While educator knowledge was usually greater than student knowledge, knowledge gaps were present among both groups. In addition, knowledge gaps varied both within and between topic areas. Strategies have been identified to address these knowledge gaps, including the need for professional development. Educators require tools for strengthening their teaching, as well as tools for self-assessment to identify their own learning needs. In addition, they require access to continuing education or professional development opportunities to address these learning needs.

5.3. Do clinical educators and nursing students have the confidence required to meet the CHICA-Canada core competencies for IP&C?

While adequate knowledge is an integral part of competent IP&C practice, we also expect nurses be confident in their knowledge and skills related to IP&C. However, there is no literature that identifies what would be expected regarding practicing nurse confidence related to IP&C, nor is there literature that outlines the same expectations for nursing students or clinical educators. It can be assumed and expected that practicing nurses, clinical educators, and nursing students would be confident in something as basic and practical as IP&C. This study assessed educator and student confidence in six of the seven content areas identified in the CHICA-Canada IP&C competencies document; microbiology was excluded. There were three main findings from this portion of the research study: in general clinical educators were more confident than nursing students,

confidence varied both between and within content areas, and confidence scores were not always congruent with knowledge scores.

5.3.1. Clinical educators more confident than nursing students.

The first key finding was that, in general, clinical educators were more confident than nursing students. It was assumed that clinical educators would be more confident than nursing students in the area of IP&C due to having more education, experience, and practice opportunities. The median student total confidence score was 83.3%, as shown in Table 12, with the highest score being 100.0%, and the lowest score being 59.3%. In contrast, the median educator total confidence score was slightly higher (87.9%), with the highest score also being 100.0%, and the lowest score being 68.5%. More than two thirds (69.2%) of clinical educators actually had high confidence scores, those being >80%, vs. 56.0% of nursing students. Roughly one third (32.0%) of nursing students, and one third of clinical educators (30.8%) had moderate confidence scores (between 65% - 79%). However no clinical educators, and 12.0% of nursing students, had low scores (<65%). These results are higher than the results of Wu, Gardner, & Chang (2008), who found that the mean confidence score for students was 5.71 (SD 2.36) out of 8, with a range of scores from 0-8.

While the overall presence of higher confidence scores among clinical educators vs. nursing students is expected, and it is encouraging that most nursing students and all clinical educators were generally at least moderately confident in the area of IP&C, caution must be used when considering this information. This is because variation exists

both within and between categories, and in some cases, nursing students were more confident than clinical educators.

5.3.2. Variations in confidence.

As previously mentioned, the second study finding was that variation existed both within and between categories. The proportion of clinical educator respondents having high scores, as shown in Table 13, varied from 96.2% for Hand Hygiene, to 34.6% for Critical Assessment Skills. All other categories had between 50.0% - 80.8% of respondents with high scores. Nursing students also had variation in their scores. The proportion of nursing students with high scores varied from a high of 96.0% for Hand Hygiene, to a low of 28.0% for Critical Assessment Skills. With the exception of the category of Personal Safety, where only 32.0% of nursing students had high scores, all other categories had between 52.0% - 60.0% of respondents with high scores. This suggests that, while most clinical educators and nursing students are at least moderately confident in some areas, in particular highly confident in Hand Hygiene, many have a notable lack of confidence in other areas, including Critical Assessment Skills. As a result, it is important to look at more than just overall total confidence scores when attempting to determine the level of confidence present among nursing students and clinical educators.

There was also variation within each content area. For example, as shown in Table 14 in Chapter 4, in the area of PPE, 80.8% of clinical educators and 60.0% of nursing students had high overall confidence scores (>80%). However, while 100% of nursing students reported feeling very confident in wearing gloves, only 56.0% were very

confident in removing a mask, and only 52.0% were very confident in removing PPE. Additionally, 4.0% of nursing students actually reported feeling not confident in these two areas. Similarly, while 96.2% of clinical educators reported feeling very confident in wearing gloves, only 80.8% were very confident in removing a mask, and only 57.7% reported feeling very confident in removing PPE. As with nursing students, 3.8% of clinical educators reported feeling not confident in removing PPE. A similar pattern of variation within content areas emerged in the area of Personal Safety. One third (32.0%) of nursing students had high confidence overall scores related to Personal Safety. While 80.0% of nursing students reported feeling very confident in preventing needlestick injuries, only 28.0% felt very confident in initiating first aid for punctures, and 16.0% were very confident in first aid for fluid exposures. As with nursing students, while 73.1% of clinical educators had high overall Personal Safety scores, and 88.5% of clinical educators reported feeling very confident in preventing needle-stick injuries, only 61.5% were very confident in initiating first aid for punctures, and only 38.5% reported feeling very confident in first aid for fluid exposures.

While the previous section outlined clear examples of variation both between and within content areas, notably the areas of Critical Assessment Skills and PPE, the study results also highlighted examples of variation in the trend of clinical educators having more confidence than nursing students. The most obvious exception to the trend of clinical educators having higher confidence than nursing students was in the area of RPAP. In this area, 60.0% of nursing students had high overall confidence scores, vs. half (50.0%) of clinical educators. Additionally, within the content area of RPAP, three quarters of nursing students reported feeling very confident in applying contact

precautions, vs. only half of clinical educators. While it was expected that confidence scores would be higher for clinical educators, the fact that they had lower scores than nursing students related to RPAP is not surprising as there were content areas within RPAP where clinical educators also had low knowledge scores. These findings suggest that in some cases, nursing students may be more confident than those who are providing them with teaching related to these topics. This may be problematic if this causes the clinical educators to be less effective in their delivery of any necessary material.

These findings related to educator confidence vs. student confidence, and variation found between and within content areas, highlight the need for by-topic assessment of confidence levels vs. overall analysis of general confidence scores. In interpreting the general, overview data only, one would miss the subtle cues that emerge from the more detailed analysis. These cues suggest specific areas of concern regarding student and educator lack of confidence, for example in the overall area of Critical Assessment Skills, or in categories within content areas such as initiating first aid for fluid exposure in the area of Personal Safety. As well, when specific areas of concern exist regarding educator lack of confidence, such as in Critical Assessment Skills or topics within Personal Safety, this should be further examined for any potential impact this may have on the clinical educators' ability to effectively teach this material. While it is clear this should be done for content areas where many or most respondents reported a lack of confidence, it should also be done for areas where only some respondents experienced the same lack of confidence. Strategies for increasing confidence could include an assessment tool so that educators could gain a more realistic appreciation for their true IP&C knowledge. They also need access to continuing education that includes

assessment of learning needs. Finally, they would also benefit from the provision of more IP&C resources to support their teaching, and to link with IP&C professionals in their area.

5.3.3. Knowledge and confidence mismatches.

The third finding related to the confidence questionnaire was that confidence scores were not always congruent with knowledge scores. There were few examples where confidence scores were congruent with knowledge scores, for example, in the area of PPE where 73.1% of clinical educators had both high confidence and high knowledge. More commonly, there were huge mismatches in knowledge vs. confidence scores. Results generally fell into one of two categories: unsupported low confidence, where those having low confidence scores had high knowledge scores, and unsupported high confidence, where those having high confidence scores only had low or moderate knowledge scores.

While the issue of the knowledge by confidence mismatch was clearly present in the findings, it is important to use some caution when interpreting the knowledge by confidence results. This is due to the fact that the topics assessed in the knowledge and confidence sections of the questionnaire did not always mirror each other. For example, in the area of Personal Safety, there were both knowledge and confidence questions that addressed the topic of exposure to blood and bodily fluids. However, the knowledge piece also assessed for knowledge of immunity related to varicella, while the confidence piece addressed prevention of needlestick injuries and first aid for punctures. As such, levels of knowledge and confidence that were assessed by the questionnaire may not

reflect knowledge and confidence for the same topics. It is possible that respondent knowledge or confidence scores might have been higher or lower than those obtained had the topics for the questionnaire questions mirrored each other in the knowledge and confidence sections. Some respondents may have been more confident or knowledgeable in some topics vs. others, and that may not be accurately reflected in these results.

The issue of unsupported low confidence, where confidence scores were low but knowledge scores were high, was present to a limited extent among both clinical educators and nursing students. More than one eighth (15.4%) of clinical educators had low confidence but high knowledge related to RPAP, and only 3.9% of those with low confidence related to Sterilization had high knowledge scores. In contrast, only 4.0% - 8.0% of nursing students experienced this, and it was in the areas of PPE, Personal Safety, Sterilization, and RPAP. Having low confidence yet high knowledge is a concern since the individuals with low confidence but high knowledge may not feel as comfortable in the area of IP&C practice as they should. The implication of this may be that they may delay actions if awaiting verification of correctness of decisions from others, which may increase risk of transmission infectious agents to both the nurse and the patient.

In contrast, the issue of unsupported high confidence scores was a very common issue among both educator and student respondents. All content areas had student respondents with high confidence but low or moderate knowledge. Notably, one quarter (24.0% - 28.0%) of nursing students with high confidence related to Sterilization and RPAP actually had low knowledge in these areas, and one eighth (12.0%) of those having high confidence related to Personal Safety had low knowledge in this area.

Similar trends emerged among clinical educators, with one third (38.5%) of those with high confidence scores related to Personal Safety having low knowledge scores. There were also example of educator and student respondents who had high confidence but only moderate knowledge, which is also a concern as those having moderate knowledge may have had scores as low as 65%.

Any indication that an unsupported confidence mismatch among both nursing students and clinical educators may be present is of concern, as it suggests that some respondents feel much more confident than they should for the level of knowledge that they have. As a result, those respondents may not seek out or make use of additional education opportunities if they are overconfident in their knowledge. If they feel they do not have any knowledge gaps in a certain area, they may feel less motivated to attempt to fill these knowledge gaps. Cole (2009) reported on the findings of a study in the UK in which it was concluded that nursing students overestimated their knowledge and skills in the area of hand washing, found it difficult to give an objective account of their performance, and reported an improbable level of compliance with hand washing. This has research implications, as studies that rely on self-reported knowledge or skill in the area of IP&C may result in findings that overestimate actual knowledge and skill in this area. While this has research implications, the fact that students, and nurses, may be overconfident in relation to their actual knowledge and/or skill may have practice implications as well. It is therefore imperative that individuals develop an understanding of their learning needs related to IP&C. If both nursing students and clinical educators see that their knowledge may not be as strong as they had thought it was, they may be more likely to seek out, and participate in, continuing education opportunities. As such,

testing should be part of IP&C education, and teachers need tools for assisting students with their learning in this area. Furthermore, self-awareness related to knowledge gaps is especially important for nurses engaged in teaching, as they could be confidently teaching incorrect material.

Clinical educators need to have adequate knowledge related to IP&C, and many felt that they did despite low knowledge scores. This is evidenced by the fact that 60.9% of clinical educators felt adequately prepared for their role in teaching IP&C material. However, of those who felt adequately prepared for this role, only 42.9% had high ranked total percent knowledge scores, while 100.0% had high ranked total percent self-reported confidence scores. Remarkably, of the 20 educator respondents who felt they were role models for nursing students in the area of IP&C, only 40% had high total percent knowledge scores, while 75.0% had high ranked self-reported confidence scores. These results are of concern, as it suggests that clinical educators may not be self-aware of their knowledge gaps. The concern is that they may also be confidently teaching incorrect material. They may also refrain from seeking additional education opportunities to enhance their knowledge and confidence related to IP&C. The suggestion that clinical educators could confidently be teaching incorrect material is also supported by the fact that almost all nursing students (96.0%) reported feeling that their clinical educators were knowledgeable in the area of IP&C, despite the fact that only 42.3% of clinical educators actually had high overall knowledge scores. This suggests that inconsistencies exist between educator knowledge vs. confidence, and in order to minimize any negative impact this may have on student outcomes, it is important to ensure that clinical educators develop self-awareness of their perceived vs. actual learning needs. This could

be achieved through the provision of self-assessment tools. Learning opportunities that are provided must then address any gaps in educator knowledge that they have identified through self-assessment, and learning should be evaluated.

5.3.4. Conclusion.

In addition to identifying gaps in curriculum and in student and educator knowledge, this study has also identified gaps related to confidence. While the issue of low confidence relative to knowledge scores has been identified, of more concern is the presence of knowledge and confidence mismatches where confidence is too high relative to respective knowledge scores. This scenario leads to the risk that clinical educators and nursing students may not be self-aware of their knowledge gaps, and may not seek out any additional education if they falsely perceive themselves to have sufficient knowledge in any given area. Strategies such as self-assessment, continuing education, or teaching tools, are needed to ensure that clinical educators and nursing students develop a more realistic perspective related to their learning needs.

5.4. Strengths and Limitations

The primary strength of this research study is that it addressed important research questions related to IP&C education, some that were previously understudied such as curriculum content related to IP&C and educator and student knowledge and confidence related to IP&C. A review of the literature identified significant gaps related to these questions, with some topics having little or no related literature. While there were limitations with the study findings, which will be discussed next, data obtained through

this research study can be used to suggest future areas of study, as well as recommendations for curriculum and educator professional development.

Another strength of this study is that it included data collection during a pandemic influenza outbreak, a time when it could be assumed that due to heightened awareness of IP&C issues, knowledge and confidence could have been expected to have been at their highest. This would have been the ideal time to complete data collection as respondent knowledge and confidence scores should have been at their highest. Some respondents even reported receiving formal education specific to H1N1 influenza, including topics such as transmission and RPAP. Data collection during this period of time could have increased the chances that educator and student knowledge would be as high as possible, and if gaps emerged even in this environment of enhanced awareness, it was clear that notable gaps were present.

This study had a few limitations, one of which was sample size. As a result of the low sample size, comparisons could not be made between the results from individual respondents and their corresponding programs. This data cannot be considered to be representative of all programs, educators, or students. This prevented the researcher from being able to explore whether or not those with high or low knowledge or confidence scores were affiliated with programs of "more extensive" or "least extensive" coverage of IP&C material. While this comparison would have been useful, the overall trend of low knowledge scores among clinical educators and nursing students in itself is still of note as it suggests that overall knowledge and confidence gaps are present at least in the study participants, and these must be addressed regardless of program of study, recognizing different programs have different gaps to address.

An additional limitation of the study was the fact that there were limited data that could be obtained related to curriculum. There were numerous difficulties in collecting curriculum data, and it was difficult to obtain a comprehensive understanding of the curriculum content of each program. In some circumstances, multiple questionnaires were returned for one program, or in lieu of completion of the questionnaire, supporting documents were instead forwarded to the researcher. Despite these difficulties in data collection, this limitation highlighted the need for a clear, standardized curriculum review process that could facilitate data collection for research and self-assessment related to IP&C curricula in nursing programs.

The response rate for this study was poor, resulting in limited generalizability of the study findings. Some programs did not provide denominator information, and as such, response rates could not be calculated for each category of participants. Self-selection bias may have been present in the study, as well as social desirability related to confidence. We cannot assess for this, but some participants may have reported feeling more confident than they actually were. Finally, reliability has not been established for this study.

5.5 Conclusion

This study identified the need for guidelines related to sufficiency, as well as gaps in curriculum, and in educator and student knowledge and confidence. However, identification of these gaps also led to discussion of opportunities for future steps. While this study had some limitations, overall, the researcher was able to identify the challenges that exist in providing IP&C education, including in the curriculum review process. As a

result of this data, several recommendations were made related to curriculum, educator knowledge and confidence, and student knowledge and confidence. Through the development of recommendations related to curricula, clinical educators, and nursing students, strategies may be developed to address any deficits or gaps identified in this study. These recommendations are summarized in Chapter 6.

Chapter 6: Recommendations and Conclusion

This chapter summarizes the recommendations related to IP&C specific undergraduate nursing education that have emerged from this study and that were previously discussed in Chapter 5. The results suggest that improvements and research are needed in the areas of undergraduate nursing curricula, education of nursing educators, and education of nursing students. The research questions for this project focused on assessing curricular content, as well as the knowledge and confidence of clinical educators and nursing students. Recommendations therefore focus on guidelines and strategies for strengthening IP&C curriculum content and teaching.

6.1. Main Study Findings

One of the findings of this research study is that, for the most part, all topics found in the CHICA-Canada core competencies document received at least some coverage by the participating programs. However, there was a great deal of variation in the extent to which these topics were covered, both between and within topic areas. In addition, the coverage provided varied between programs. Another finding is that educator and student knowledge and confidence scores were lower than expected, with variation also existing within and between scores for the seven different topic areas. The final finding of this research study is that the curriculum and educator needs (specifically learning needs and teaching support) are quite different for each program or educator. While overall gaps emerged throughout the data, and it cannot be assumed that the results for the nurse educators and nursing students are representative of all nurse educators and nursing students, the wide variations in content, scores, and other indicators suggest that

any interventions aimed at addressing identified gaps must be specific to the program or person of interest.

6.2. Recommendations

To address some of the identified gaps in curricula or educator and student knowledge and confidence, six key recommendations have emerged. The recommendations are interconnected, and therefore may address more than one gap simultaneously.

The first recommendation is that the study be replicated using methods that address the identified limitations, for example using a larger sample size and better review tool, resulting in more accurate and generalizable findings. This would allow for collection of more robust data, and more comprehensive analyses such as sub-analyses by higher or lower program intensity could then be performed. As a result, a better understanding of the problem areas could be gained. It would also ensure that specific recommendations could be made for addressing any identified gaps.

The second recommendation is that guidelines be developed to guide curriculum development in the area of IP&C. These guidelines must address curriculum content as well as delivery of recommended material. While competency documents, such as the CHICA-Canada core competency statements, can be used to determine the recommended content for IP&C curricula, further guidance is needed. For example, guidelines are needed on the number of hours of teaching that is required (theory and clinical), when it should be introduced vs. reinforced, what opportunities should be provided for additional clinical learning experiences, and how it should be taught and evaluated. These

guidelines would be useful for curriculum committees tasked with developing and evaluating effective curricula in the area of IP&C. Infection prevention and control professionals who have content expertise could take the lead in developing guidelines. However they would need to work in collaboration with curriculum experts and nursing faculty who have expertise in teaching nursing students. Additionally, research is needed to determine what characterizes optimal IP&C teaching so that guidelines would be evidence-based.

The third recommendation is that resources be developed to facilitate student learning. One type of resource might be the development of standardized teaching modules, which would not only include content, but teaching and evaluation strategies as well. Use of standardized modules will ensure that all students receive a minimum amount of teaching in a particular area. Another strategy may be the development and integration of additional IP&C case studies into existing teaching/curricula. Students may also benefit from a tool such as an IP&C learning "passport", where practice opportunities are tracked and evaluation/successful completion of a skill is recorded. Finally, it would be beneficial for nurse educators to have teaching tools to assist them in clinical settings, for example, case studies, exercises that could be used in clinical settings, and guidelines for assessing student performance in IP&C. The development of resources is an excellent opportunity for collaboration between infection prevention and control experts and teaching experts.

The fourth recommendation is that tools be developed to facilitate needs assessments and self-evaluation in the area of IP&C. Directors had difficulty quantifying the teaching that was provided in their programs. As such, a comprehensive curriculum

review tool would be beneficial for assessment of curriculum content specific to IP&C. Such a tool could be used by programs for self-assessment of current IP&C content, and for evaluation of their level of success when steps are taken to strengthen IP&C teaching in their programs. Once programs are modified following new curriculum guidelines, additional testing and evaluation should be done to assess the success of these changes.

Self–assessment tools would be useful not only at the curriculum level, but also at the individual level. Both the educators and students in this study had lower than expected knowledge scores, so they would benefit from a self-assessment tool that they could use to identify their own learning needs. Content of these tools may differ for each group. Student and educator self-assessment could be incorporated into any standardized teaching module, with students identifying their learning needs, and educators identifying areas for instruction. In addition, educators can identify areas where their own knowledge and skills may need strengthening.

The fifth recommendation is that professional development on IP&C be provided for nurses engaged clinical teaching at the undergraduate level. Educators in this study had varying needs, which they could further explore through a process of self-assessment. Continuing education sessions could then address those learning needs. Through needs-based continuing education, educator knowledge may increase, and higher confidence may be warranted.

The final recommendation is that educators and infection control professionals (ICPs) build stronger professional linkages, and collaborate more often in providing education to nursing students. As stated by Infection Prevention and Control Canada, formerly CHICA-Canada, ICPs are responsible for keeping abreast of all current

infection control standards and practices, and ensuring that standards are maintained and implemented in their institutions. They achieve this through orientation and continuing education of healthcare workers, consultation, surveillance and coordination of results. They identify problems (e.g., through surveillance), are involved in the promotion of RPAP, and facilitate IP&C orientation and continuing education for HCWs. While many linkages currently exist between ICPs and educators, it is often in a limited capacity (e.g., guest lectures). In strengthening these linkages, ICPs may develop an expanded role in undergraduate nursing education. For example, they may assist in curriculum development by identifying gaps and problem areas in practice that need to be addressed. ICPs can also provide access to resources and support for educators, and they can play a role in the ongoing professional development of the educators themselves in the area of IP&C. As a result of nurse educators becoming more aware of IP&C resources, dissemination of these resources may occur to a broader audience. In addition, the increased dissemination may result in more frequent integration of these resources into undergraduate nursing education. This may in turn strengthen the IP&C teaching that is provided.

6.3. Conclusion

Findings from this research study suggest that program-specific gaps exist in current undergraduate curricula related to IP&C, and that IP&C knowledge and confidence gaps exist among both clinical educators and nursing students. This study identified six key recommendations that could guide curricula and strengthen the IP&C teaching that is provided to nursing students. One of the recommendations focuses on

research, specifically to replicate the study using a larger sample size and revised survey tools. The remaining five recommendations focus on education. These recommendations address curricular needs of programs, the professional development needs of educators, and the learning needs of students. As outlined in the study model found in Chapter 1, by strengthening curriculum content and effectiveness of educators, nursing students may develop the knowledge, confidence, and skills required to become competent practicing nurses in the area of IP&C. While there are no direct practice implications that have been identified in this study, the recommendations have implications for the future nursing practice of undergraduate nursing students.

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Appendix A: IP&C Core Competencies for Health Care Workers

Core Competencies for Health Care Workers

Henderson, E. & CHICA (2006). Infection prevention and control core competencies for health care workers: a consensus document. *The Canadian Journal of Infection Control,* Spring 21(1): 62-67.

Areas of Competency	Core Competency Category	Detailed Core Competency
Basic Microbiology	Understands basic microbiology and how infections can be transmitted	HCWs are to know the routes of transmission; the three components required for infection transmission; recognize susceptible persons; describe respiratory etiquette; identify reportable and notifiable diseases and define antibiotic resistance including protocols
Hand Hygiene	Understands the importance of hand hygiene and hand washing	HCW is the able to recognize when to perform, identify the proper steps and demonstrate appropriate technique of hand washing and hand hygiene and recognizing that hand washing is the best method in preventing the transmission of microorganisms.
Routine Practices and Transmission-based Precautions	Understands the activities of Routine Practices/ Standard Precautions and Transmission-based Precautions	HCWs understands that: • Routine precautions are the standard for preventing transmission of microorganisms; are considered minimal practice activities and able to assess the need for these precautions based on what patient care activity is to be performed. • Transmission-based precautions may be necessary in addition to routine precautions depending on the mode of transmission of the microorganism and knows how to operate a negative pressure room

Areas of Competency	Core Competency Category	Detailed Core Competency
Personal Protective Equipment-PPE	Knows and selects the appropriate PPE for their jobs and demonstrates the appropriate use of PPE	The HCW is able to identify the appropriate PPE required for each specific activity, disease, or clinical symptoms. Able to demonstration the correct manner in which to apply PPE and remove contaminated PPE. Demonstrates the use of a NIOSH – high filtration mask
Personal Safety	Knows how to appropriately manage: sharps and blood and body fluids. Recognizes the appropriate first aid activities for exposure to blood and body fluids. Understands the role of vaccinations in infectious disease prevention, including annual influenza vaccination for HCW. Knows the infectious diseases that require their absence from work or work restrictions	The HCW can describe how to: safely manage sharps; blood and body fluids; administer first aid for punctures and fluid exposure to the eyes, nose or mouth. Recognizes that prompt assessment is required for any work related blood or body fluid exposure. Appreciates that vaccination can prevent infection in susceptible persons and can explain why annual vaccination is recommended and important. Knows where to access information on infectious diseases which may require work restrictions or an absence from work. Recognizes that a co-worker with an infectious condition poses a threat to others.
Sterilization and Disinfection	Recognizes that reusable patient equipment must be cleaned after each patient use. Appreciates the difference between clean, disinfected (low, medium and high-level) and sterile items. Knows the difference between regular and biohazard wastes.	The HCW can distinguish what patient care equipment: • needs cleaning with soap and water or hospital grade equipment (equipment does not touch the patient or touches only intact skin). • comes into contact with the mucous membranes- this equipment requires thorough cleaning followed by disinfectant.

Areas of Competency	Core Competency Category	Detailed Core Competency
		• Is introduced directly to the blood stream or other sterile body parts- this equipment must be cleaned and then sterilized before re-use. Recognizes that not all cleaning products or disinfectants are the same. Can identify biohazard and regular wastes; what containers are used for each and where these items are disposed (landfill or incinerated)
Critical Assessment Skills	Critical assessment skills related to exposure to infectious agents, awareness to local outbreaks and the use of infectious disease specific protocols	The HCW is able to demonstrate problem solving and critical thinking ability when presented an infectious disease, able to implement disease protocol ; able to access infection control resources; identify high risk patients and how to mange them; able to identify clusters of illnesses; provide leadership and act as a role model for others including HCWs, visitors and patients and demonstrate workplace practices that reduce the risk of infections.

Appendix B: Routine Practices

Routine practices include

■ Point-of-care risk assessment

■ Hand hygiene program (including point-of-care ABHR)

■ Source control (triage, early diagnosis and treatment, respiratory hygiene, spatial separation)

■ Patient placement, accommodation, and flow

■ Aseptic technique

■ Use of PPE

■ Sharps safety and prevention of bloodborne pathogen transmission

■ Management of the patient care environment

– Cleaning of the patient care environment

– Cleaning and disinfection of non-critical patient care equipment

– Handling of waste and linen

■ Education of patients, families and visitors

■ Visitor management

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Appendix C: Literature Review Tables

Studies	Objectives/Sample/Methodology	Key Results	Comments
Atif et al., 2013 *"Awareness of standard precautions for 4439 healthcare professionals in 34 institutions in France"*	• France, 2010 • Multicenter cross-sectional survey conducted in 34 volunteer institutions • Study did not exceed one week per unit • Anonymous, self-administered questionnaire – 15 questions, 10 related to knowledge, and 5 to management. • Participating hospitals could choose which units to use, and which groups of HCWs if they so desired (it was open to all HCWs) • 44,439 questionnaires analyzed	• Percentage of correct answers per question ranged between 37.1% - 91%. • 44.1% of respondents were nurses • Highest percentage of correct answers was related to HH questions (72.6% of correct answers) • Lowest percentage of correct answers related to barrier measures when giving care (7.3% of correct answers) • 39.3% of respondents correctly answered at least 8/10 knowledge questions. • 42.1% of nurses correctly answered at least 8/10 knowledge questions	• Over-estimation possible if only the HCWs with more IP&C experience, or units with the lowest infection rates, were chosen

Studies	Objectives/Sample/Methodology	Key Results	Comments
Al-Hussami & Darawad, 2013 *"Compliance of nursing students with infection prevention precautions: Effectiveness of a teaching program"*	• Experimental design using control and intervention groups • Pre- and post-testing of both groups • Nursing infection prevention educational program given to intervention group before graduation • 97 students in the final year of their program at a public university in Jordan • Assessment test – demographic info, 9 T/F questions, 21 multiple choice questions • Attitudes assessment – 11 items using a 5-point Likert scale • Compliance assessment – 15 items on a 4-point Likert scale	• Difference in knowledge scores between groups was statistically significant • Mean pre-test knowledge scores of control 12.20/25 (SD 3.64) vs intervention 12.62/25 (SD 2.90). Mean post-test knowledge scores of control 12.12/25 (SD 3.60) vs. intervention 22.89/25 (SD 1.41), p = 0.000	• Education program used lectures only – other methods have been shown to be more effective in the literature • Limited generalizability due to different education, culture, and healthcare system • Post-testing was done after 1 week of the education program – not known if knowledge retained long-term
Geller et al., 2010 *"Infection control hazards and near misses reported by nursing students"*	• Columbia University, New York • 500 Post-baccalaureate nursing students (1st year of BS/MS degree) • Throughout their clinical placements, students were asked to record their comments re: any hazards or near misses they observed in their shifts	• 886 responses (25.4%) were related to IP&C near misses/hazards, of these: ○ 27.6% nonadherance to isolation precautions	• One school of nursing • Students may have over or under estimated events – results limited by their knowledge of IP&C

Studies	Objectives/Sample/Methodology	Key Results	Comments
	• Comments were recorded in an electronic reporting system • 3492 comments were recorded over 3 year period (2006-2009) • Comments were then coded into 7 categories of IP&C problems by a team of researchers	○ 18.5% contamination of the environment or equipment ○ 17.2% breaks in aseptic technique ○ 15.9% HH failure ○ 11.5% gloving failure ○ 8.2% occupational risks	practices. Some students may have said that an event, e.g. gloving, should have occurred when in fact it was not necessary, or they may have failed to notice a hazard or near miss
Gould & Drey, 2013 *"Student nurses' experiences of infection prevention and control during clinical placements"*	• 488 student nurses from the UK • Descriptive study with online questionnaires – 19 Likert-style questions and 1 open ended question (all related to IP&C) • Students were presented with a range of various breaches of IP&C protocols and asked to indicate if they had never been witnessed, witnessed occasionally (once or twice), witnessed often (every week), witnessed very often (every day) • Study was piloted with 62 student nurses	Of the poor IP&C practices that students said they observed: ○ 76.4% reported that HCWs did not cleanse hands between patient contacts ○ 59.5% reported failure to apply isolation precautions (e.g., not wearing PPE)	• Depended on student knowledge of IP&C protocols – may have over or under estimated compliance if their own knowledge of what should be done was not correct • Issues with recall bias may be present, resulting on over or under estimation

Studies	Objectives/Sample/Methodology	Key Results	Comments
		○ 56.4% reported poor cleaning of equipment ○ 53.6% reported not changing PPE between patients ○ 52.3% reported poor sharps management practices ○ 44.5% reported items being used between patients without being cleaned ○ 35.9% reported dealing with body fluids without wearing gloves ○ 32.4% reported cleansing hands with water only	
Jennings-Sanders & Jury, 2010	• Cleveland, Ohio 2008 • Sophomore, junior, and senior year students	• 54% of students felt they did not	• Small sample (one school of

Studies	Objectives/Sample/Methodology	Key Results	Comments
"Assessing methicillin-resistant Staphylococcus aureus knowledge among nursing	• 119 participants • Piloted with 10 nursing students • Descriptive study using an MRSA survey developed by the researcher.	have enough understanding of MRSA • 52% were not satisfied that all IP&C measures were being taken in their current healthcare setting • Mean score (out of 8) was 6.25 for sophomores, 6.58 for juniors, and 6.50 for seniors • Only 58.9% of sophomores, 58.3% of juniors, and 68.1% of seniors (p value 0.585) correctly answered that they should wear gloves/wash hands with soap to reduce their risk of getting MRSA	nursing) – may not be generalizable • 53% of students reported having taken an IP&C course or inservice – may be bias as the study did not assess for influence of the course
Mitchell et al., 2013 *"Are health care workers protected?*	• 11 tertiary acute care hospitals in 6 Canadian provinces • Jan 7 – March 30, 2011	• PPE selection o 34% of HCWs put on all	• All hospital personnel included and called HCWs – results may not

Studies	Objectives/Sample/Methodology	Key Results	Comments
An observational study of selection and removal of personal protective equipment in Canadian acute care hospitals"	• Observational study to assess selection and removal of PPE. • Used trained observers • 442 observations recorded and a pilot-tested audit tool. • Observations recorded for patients with febrile respiratory illness • All inpatient or Emergency Department units included	required PPE ○ Only 37% put on eye protection ○ HCWs on peds units significantly less likely to put on all PPE compared to HCWs on other units (e.g. mask selection – 79% on peds units, 91% on ICU – OR 2.92, p = .026, 89% on medical unit – OR 2.32, p = .008, 96% in ED – OR 7.12, p = .060) • PPE removal ○ 54% removed their PPE in the correct sequence ○ Nurses significantly more	be generalizable to nurses • Generalizability only to other CNISP hospitals or other similar settings • Staff may have been aware that observation was taking place – may cause overestimation of PPE use • No comment re: whether or not this took place during the same shifts (e.g. day shift) – would it still be the same on a different shift? • Strengths: standardized data collection tool

Studies	Objectives/Sample/Methodology	Key Results	Comments
		likely to remove PPE in correct sequence vs. physicians (Physicians 36%, Nurses 56% - OR 2.20, p = .020) ○ HCWs on peds unit significantly less likely to remove PPE in the correct sequence vs. HCWs on other units (peds unit 28%, ICU 83% - OR 12.53, p = <.001, medical unit 51% - OR 2.75, p = <.001, ED 70% - OR 6.18,	

Studies	Objectives/Sample/Methodology	Key Results	Comments
		p = <.001) • Hand hygiene ○ 26% performed HH after removing gloves, 46% after removing gown, and 57% after removing mask. 9% did not perform HH	
Wu, Gardner, et al., 2009 *"Nursing students' knowledge and practice of infection control precautions: an educational intervention"*	• Two junior nursing colleges in southern Taiwan, 2005-2006 • 175 fourth year nursing students • Quasi-experimental study design using a non-equivalent, pre-/posttest control group • 3 evaluations: before intervention, immediately after, 3 months post-intervention • Intervention group received 16 hours of additional teaching related to standard and additional	• Statistically significant improvement in knowledge scores in intervention group. Mean pre-test 8.87 (SD 1.41), post-test 9.85 (SD 1.87), follow-up 11.00 (SD 1.76), p = 0.001. Control group pre-test mean 8.87 (SD	• May not be generalizable due to different education, culture, and healthcare systems • Low response rate to follow-up survey (58%) • Intervention group came from one

Studies	Objectives/Sample/Methodology	Key Results	Comments
	precautions over 18 weeks. Control group had existing teaching.	1.86), post-test 8.67 (SD 1.16), follow-up 8.70 (SD 1.49) • Statistically significant improvement in confidence scores in intervention group. Mean pre-test 5.38 (SD 2.50), post-test 5.58 (SD 2.52), follow-up 6.06 (SD 2.30), p = 0.041. Control group pre-test mean 5.87 (SD 2.38), post-test 6.38 (SD 2.29), follow-up 5.54 (SD 2.01)	college, control came from another – assumption made that same standard teaching was delivered, but this may not have been the case
Wu, Gardner, et al., 2008 *"Taiwanese nursing students' knowledge, application and confidence with standard and additional precautions in infection control"*	• Two junior nursing colleges in southern Taiwan, 2005 • 175 fourth year nursing students • Cross-sectional survey – self-administered questionnaire containing demographic questions and three scales with 36 items: o Knowledge questions – 11 T/F statements and 4 multiple choice questions. Max possible score 15	• Mean knowledge score 8.69 (SD 1.55) out of 15. Over 71% scored b/w 8-10 • Knowledge results acceptable for standard precautions (e.g., use of gloves and goggles), poor	• Application section was not assessed through actual behavior, but through self-administration of scale items (and no internal consistency test for this scale) • Additional education and experience

Studies	Objectives/Sample/Methodology	Key Results	Comments
	○ Application scale included 3 case studies with 13 yes/no statements ○ Confidence scale included 8 statements with "having confidence" or "no confidence" as responses – max possible score was 8.	for additional precautions • Mean application score 9.28 (SD1.57) out of 13. Over 72% scored b/w 8-10. Results better for standard precautions than for additional precautions. • Significant relationship between knowledge and application skills (r = 0.16, p= 0.04) • Mean confidence score 5.71(SD 2.36) out of 8, min score 0, max score 8 • Previous experience caring for clients with ID significantly correlated with confidence in this area (p = 0.004). Mean confidence scores for those with previous	needed in these areas.

Studies	Objectives/Sample/Methodology	Key Results	Comments
		experiences vs. those who did not were 6.54 vs., 5.40 • No significant relationship between knowledge and confidence (r = -.03)	

Appendix D: Letter Requesting School Participation

School of Nursing
Memorial University of Newfoundland

Dear Director and/or Members of the Executive Committee:

My name is Moira Chiasson. I am a Master of Nursing student at the Memorial University of Newfoundland. In partial fulfillment of my Master of Nursing degree, I am conducting a thesis research study in the area of infection prevention and control education in undergraduate nursing education programs. Recruitment and data collection for the study is scheduled to begin in January and/or February 2010.

I am contacting you today to invite your school to participate in this research study, and to request information about the additional procedures, if any, required to obtain approval. A full proposal can be sent as part of whatever process is required for approval from your school. For your reference, attached please find an information sheet outlining the key details of the research study. Full ethics approval for this research study has been granted by the Memorial University of Newfoundland Human Investigation Committee. For your review, attached please find a copy of the letter confirming that full ethics approval has been granted.

Please note that the primary supervisor for the study, Dr. Donna Moralejo, may be contacted at moralejo@mun.ca.

If you have any questions or require any additional information, please contact me at your earliest convenience. Should additional steps be required in order to proceed with the request for approval from your school, please advise accordingly. If no additional information is required and you would like for your school participate in this study, please contact me to confirm your
willingness to participate.

I thank you advance for your assistance and consideration of my request.

Sincerely,
Moira Chiasson
Master of Nursing Student
Memorial University of Newfoundland
mchiasson@mun.ca
(902) 224-1053

Why is this study an important research study?

As background to the study, healthcare associated infections (HAIs) are a serious concern. Annually they account for significant personal and economic costs in areas such as quality of life, morbidity and mortality, and increased burden on the healthcare system. The need for adequate knowledge, skills, and behaviors in areas of infection prevention and control (IP&C) among healthcare workers (HCWs), specifically nurses, is well documented. However, equally well documented is the fact that serious deficiencies in this area exist in the nursing profession. While numerous studies have addressed this issue within the context of practicing nurses, there is a minimal amount of literature, from both Canada and elsewhere, that addresses the knowledge, skills, behaviors, and confidence of undergraduate nursing students and faculty, or that addresses the curricular content of undergraduate nursing programs in relation to education specific to IP&C. In order to develop an understanding of the issue, research is needed in this area. The purpose of this research project is to identify whether or not undergraduate nursing education curricula adequately prepare nursing students to meet the CHICA-Canada core competencies for IP&C.

How will data be collected?

This research study involves data collection from multiple stakeholders in Atlantic Canadian undergraduate nursing education programs: directors, nurse educators, and students in the final year of their program. Directors will be asked to complete a curriculum questionnaire, which will be emailed to them as a word file, with assistance from others as needed This questionnaire will serve as an audit tool for curriculum content specific to IP&C. This curriculum questionnaire may be time-consuming to complete. In appreciation for the time dedicated to completing the questionnaire, upon completion of the study, the researcher will provide each director with a school-specific summary of results for their respective program.

Through email communication via a pre-identified third party contact person, nurse educators and students will be asked to complete an online questionnaire that will assess their knowledge and confidence in several key IP&C-related content areas. These questionnaires, comprised of short answer, multiple choice, and true/false questions, will take approximately 20 minutes to complete. Upon completion of the data collection phase of the study, the researcher will forward an email containing the correct answers to the knowledge questions to the third party contact person, for distribution to nurse educators and students. Data collection for all questionnaires, from the beginning of the data collection phase, to the end of the data collection phase, is expected to take approximately 6 weeks.

Must approval be given for all 3 parts of the study in order for our school to participate?
No. Each participant group, and related part of the study, is viewed independently. Schools can choose to participate in any combination of the 3 parts of the study (curriculum questionnaire, nurse educator questionnaire, and/or student questionnaire).

What about privacy concerns related to online data collection?
In compliance with section 30.1 of the *Freedom of Information and Protection of Privacy Act*, data will be stored in Canada. The survey platform, www.askitonline.com, is a Canadian online survey provider. There will be no link to the participant's identifying information. The questionnaires will be developed using a SSL-encrypted site. Integrity of the dataset will be assured by limiting access to data files through passwords and account control. Upon completion of the survey, all data files will be deleted from the servers of www.askitonline.com.

What about any negative consequences to participating in the study if the findings for our school are not favorable?
Please be assured that all data collected throughout this research study will be handled with sensitivity and discretion. The confidentiality of participants will be ensured at all times. Data files will only be accessible to the research team, and access will be controlled as per the research ethics boards' requirements. Data will only be reported at the aggregate level. Findings of the study may result in some concern from participants, but recommendations will be made that address identified limitations. At no time will any individual results be made available to the general public. The direct benefit of participating in this study is that the summary of findings from your school, which will be provided to your director, may be used to strengthen your existing curriculum in the area of IP&C.

Has this study been approved by an ethics committee?
Yes. This study has been approved by the Memorial University of Newfoundland Human Investigation Committee.

Who should I contact for more information?
Should you require any additional information, please contact:
Moira Chiasson
Master of Nursing student
Memorial University of Newfoundland
mchiasson@mun.ca
(902) 224-1053

Appendix E: Recruitment Letter – Curriculum Review

School of Nursing
Memorial University of Newfoundland

Dear Director:
My name is Moira Chiasson. I am a Master of Nursing student at the Memorial University of Newfoundland. In partial fulfillment of my Master of Nursing degree, I am conducting a thesis research study in the area of infection prevention and control (IP&C) education in undergraduate nursing education programs. The purpose of this research project is to identify whether or not undergraduate nursing education curricula adequately prepare nursing students to meet the CHICA-Canada core competencies for IP&C.

I am contacting you today to invite you to take part in my research study. Approval for this research study has been granted by your school. Your participation in the study is voluntary. Before you decide, you need to understand what the study is for, what risks you might take and what benefits you might receive. For your reference, attached please find an information sheet outlining key information regarding this study.

Should you wish to participate in this study, please contact me via email or by phone at your earliest convenience.

I thank you in advance for your time in considering my request.

Sincerely,
Moira Chiasson, B.Sc.N., RN
Graduate Student
Master of Nursing
Memorial University of Newfoundland
(902) 224-1053
Email: mchiasson@mun.ca

This study has been reviewed by, and received ethics clearance through, the Human Investigation Committee, Memorial University of Newfoundland.

Why is this study an important research study?

As background to the study, healthcare associated infections (HAIs) are a serious concern. Annually they account for significant personal and economic costs in areas such as quality of life, morbidity and mortality, and increased burden on the healthcare system. The need for adequate knowledge, skills, and behaviors in areas of infection prevention and control (IP&C) among healthcare workers (HCWs), specifically nurses, is well documented. However, equally well documented is the fact that serious deficiencies in this area exist in the nursing profession. While numerous studies have addressed this issue within the context of practicing nurses, there is a minimal amount of literature, from both Canada and elsewhere, that addresses the knowledge, skills, behaviors, and confidence of undergraduate nursing students and faculty, or that addresses the curricular content of undergraduate nursing programs in relation to education specific to IP&C. In order to develop an understanding of the issue, research is needed in this area. The purpose of this research project is to identify whether or not undergraduate nursing education curricula adequately prepare nursing students to meet the CHICA-Canada core competencies for IP&C.

How will data be collected?

This research study involves data collection from multiple stakeholders in Atlantic Canadian undergraduate nursing education programs: directors, nurse educators, and students in the final year of their program. Directors will be asked to complete a curriculum questionnaire, which will be emailed to them as a Word file, with assistance from others as needed This questionnaire will serve as an audit tool for curriculum content specific to IP&C. This curriculum questionnaire may be time-consuming to complete. In appreciation for the time dedicated to completing the questionnaire, upon completion of the study, the researcher will provide each director with a school-specific summary of results for their respective program.

Through email communication via a pre-identified third party contact person, nurse educators and students will be asked to complete an online questionnaire that will assess their knowledge and confidence in several key IP&C-related content areas. These questionnaires, comprised of short answer, multiple choice, and true/false questions, will take approximately 20 minutes to complete. Upon completion of the data collection phase of the study, the researcher will forward an email containing the correct answers to the knowledge questions to the third party contact person, for distribution to nurse educators and students.

If I choose to participate, what will I need to do?

As the director, you will then be asked to complete a word file-based curriculum questionnaire for your program. The questionnaire will be emailed to you on *this date* (to be added when known). Within three weeks, you will be asked to fill in the questionnaire and email it to the researcher, or to print it, complete it by hand, and mail it to the

researcher. This curriculum questionnaire will serve as an audit tool, which will be used to collect data on the content of the curriculum of your program as it relates to IP&C. This audit tool, which has been developed as a series of tables and short answer questions, may be labor-intensive to complete. In appreciation for your time, a school-specific summary of data from your school will be provided to you upon completion of the research study. If needed, you are encouraged to consult with others in your department for assistance in completing the tool.

After three weeks, if the completed questionnaire has not been returned to the researcher, you will be contacted to determine whether or not additional time is required, or if you have chosen to withdraw your agreement to participate in the study.

What about any negative consequences to participating in the study if the findings for our school are not favorable?
Please be assured that all data collected throughout this research study will be handled with sensitivity and discretion. The confidentiality of participants will be ensured at all times. Data files will only be accessible to the research team, and access will be controlled as per the research ethics boards' requirements. Data will only be reported at the aggregate level. Findings of the study may result in some concern from participants, but recommendations will be made that address identified limitations. At no time will any individual results be made available to the general public. The direct benefit of participating in this study is that the summary of findings from your school, which will be provided to you, may be used to strengthen your existing curriculum in the area of IP&C.

Has this study been approved by an ethics committee?
Yes. This study has been approved by the Memorial University of Newfoundland Human Investigation Committee. Approval for participation in this study has also been granted by the appropriate individual(s) at your school.

Who should I contact for more information?
Should you require any additional information, please contact:
Moira Chiasson
Master of Nursing student
Memorial University of Newfoundland
mchiasson@mun.ca
(902) 224-1053

Appendix F: Curriculum Review Questionnaire

Instructions
Please complete the following questionnaire, using assistance from others in your school as needed. You may input your answers directly into the Word file and email your completed questionnaire to the researcher at the following email address: mchiasson@mun.ca

You are also welcome to print the questionnaire and complete it by hand. Completed questionnaires can be mailed to the researcher at the following address:
Moira Chiasson
PO Box 82
Cheticamp, NS
B0E 1H0

Please return your completed questionnaire prior to ***Date to be inserted here***.

A school-specific summary of findings for your school will be provided to you upon completion of the research study.

Should you have any questions or concerns when completing the questionnaire, please contact the researcher by email (mchiasson@mun.ca) or by phone (902-224-1053) at your convenience.

Thank you.

Curriculum Review Questionnaire

1. Area of Competency: Basic Microbiology

Criteria for Content Areas in Questions 1.2 and 1.4
1. Chain of Infection: Students can describe the three components required for infection transmission: presence of a microorganism, route of transmission of the microorganism from one person to another, and a host that is susceptible to infection.
2. Common Infections: Students can distinguish between pathogenic and non-pathogenic microorganisms, and are familiar with common infections (microorganism, signs and symptoms, and risk factors).
3. Cough Etiquette: Students are aware of the technique and rationale for respiratory hygiene/ cough etiquette.

1.1 Does your curriculum include a separate microbiology course ? Yes [ ] No [ ]

1.2 Please identify, for each content area, when it is covered, number of hours, and how each is evaluated. Write: NO if not covered, UNK if unknown, or INF if informally covered.

Initial Learning Experiences	**1. Chain of Infection**	**2. Common Infections**	**3. Cough Etiquette**
Year/Level when first taught			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			
Additional Experiences	**1. Chain of Infection**	**2. Common Infections**	**3. Cough Etiquette**
Year/Level when reinforced			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			

* 1=short answer questions, 2=multiple choice questions, 3=case-based scenarios, 4=demonstration, 5=other (list)

1.3 Comments:

1.4 Please indicate, using a √ or x, which teaching methods are used to deliver material in each of the content areas listed below. Check all that apply.

Content Area	Lecture	Multi-media	Demo	Case Study	Readings	*Other
1. Chain of infection						
2. Common infections						
3. Cough Etiquette						

*** If other please specify in comments section below.**

1.5 Comments:

2. Area of Competency: Hand Hygiene

Criteria for Content Areas in Questions 2.1 and 2.2
1. Indications for Hand Hygiene (HH): Students can identify the indications and rationale for hand hygiene.
2. Technique for use of Alcohol-based Hand Rub (ABHR): Students can demonstrate the proper steps for hand hygiene using an alcohol-based hand rub.
3. Technique for Hand Washing (HW): Students can demonstrate the proper steps for hand washing.

2.1 Please identify, for each content area, when it is covered, number of hours, and how each is evaluated. Write: NO if not covered, UNK if unknown, or INF if informally covered.

Initial Learning Experiences	**1. Indications for HH**	**2. Technique ABHR**	**3. Technique HW**
Year/Level when first taught			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			
Additional Experiences	**1. Indications for HH**	**2. Technique ABHR**	**3. Technique HW**
Year/Level when reinforced			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			

* 1=short answer questions, 2=multiple choice questions, 3=case-based scenarios, 4=demonstration, 5=other(list)

2.2 Comments:

2.3 Please indicate, using a √ or x, which teaching methods are used to deliver material in each of the content areas listed below. Check all that apply.

Content Area	Lecture	Multi-media	Demo	Case Study	Readings	*Other
1. Indications for HH						
2. Technique ABHR						
3. Technique HW						

*** If other please specify in comments section below.**

2.4 Comments:

3. Area of Competency: Routine Practices and Additional Precautions

Criteria for Content Areas in Questions 3.1 and 3.3
1. Point of Care Risk Assessment (PCRA): Students are able to assess the need for Routine Practices based on what activities are to be done with a patient and context.
2. Routine Practices (RP): Students can explain the rationale for RP, identify the components of RP, and apply RP.
3. Additional Precautions (AP): Students can identify the components of AP, identify when AP are necessary, and apply AP when necessary.

3.1 Please identify, for each content area, when it is covered, number of hours, and how each is evaluated. Write: NO if not covered, UNK if unknown, or INF if informally covered.

Initial Learning Experiences	1. PCRA	2. Routine Practices	3. Additional Precautions
Year/Level when first taught			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			
Additional Experiences	**1. PCRA**	**2. Routine Practices**	**3. Additional Precautions**
Year/Level when reinforced			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			

* 1=short answer questions, 2=multiple choice questions, 3=case-based scenarios, 4=demonstration, 5=other (list)

3.2 Comments:

3.3 Please indicate, using a √ or x, which teaching methods are used to deliver material in each of the content areas listed below. Check all that apply.

Content Area	Lecture	Multi-media	Demo	Case Study	Readings	*Other
1. PCRA						
2. Routine Practices						
3. Additional Precautions						

*** If other please specify in comments section below.**

3.4 Comments:

4. Area of Competency: Personal Protective Equipment

Criteria for Content Areas in Questions 4.2 and 4.4
1. Selection of PPE: Students are able to identify PPE required based on patient condition and activities that are to be done with the patient.
2. Application of PPE: Students are able demonstrate the proper steps for application and wearing of personal protective equipment.
3. Removal of PPE: Students are able to demonstrate the proper steps for removal of personal protective equipment, preventing self-contamination.

4.1 Does your program require fit-testing of all students for an NIOSH equivalent high filtration mask (e.g., N95 respirator)? Yes [ ] No [ ]

4.2 Please identify, for each content area, when it is covered, number of hours, and how each is evaluated. Write: NO if not covered, UNK if unknown, or INF if informally covered.

Initial Learning Experiences	1. Selection of PPE	2. PPE Application	3. Removal of PPE
Year/Level when first taught			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			
Additional Experiences	**1. Selection of PPE**	**2. PPE Application**	**3. Removal of PPE**
Year/Level when reinforced			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			

* 1=short answer questions, 2=multiple choice questions, 3=case-based scenarios, 4=demonstration, 5=other (list)

4.3 Comments:

4.4 Please indicate, using a √ or x, which teaching methods are used to deliver material in each of the content areas listed below. Check all that apply.

Content Area	Lecture	Multi-media	Demo	Case Study	Readings	*Other
1. Selection of PPE						
2. PPE Application						
3. Removal of PPE						

*** If other please specify in comments section below.**

4.5 Comments:

5. Area of Competency: Personal Safety

Criteria for Content Areas in Questions 5.1 and 5.3
1. Sharps: Students are able to safely manage sharps, including proper use and disposal.
2. Post-Exposure protocols: Students are familiar with first aid and follow-up protocols following possible exposure to blood and body fluids, including sharps incidents.
3. Vaccinations: Students can explain why vaccination is important for healthcare workers.
4. Self-care: Students can explain self-care measures to take when ill, e.g., not going to work or school when ill.

5.1 Please identify, for each content area, when it is covered, number of hours, and how each is evaluated. Write: NO if not covered, UNK if unknown, or INF if informally covered.

Initial Learning Experiences	**1. Sharps**	**2. Post-Exposure**	**3. Vaccinations**	**4. Self-Care**
Year/Level when first taught				
No. of hours (theory)				
No. of hours (practice)				
*Evaluation of student learning				
Additional Experiences	**1. Sharps**	**2. Post-Exposure**	**3. Vaccinations**	**4. Self-Care**
Year/Level when reinforced				
No. of hours (theory)				
No. of hours (practice)				
*Evaluation of student learning				

* 1=short answer questions, 2=multiple choice questions, 3=case-based scenarios, 4=demonstration, 5=other (list)

5.2 Comments:

5.3 Please indicate, using a √ or x, which teaching methods are used to deliver material in each of the content areas listed below. Check all that apply.

Content Area	Lecture	Multi-media	Demo	Case Study	Readings	*Other
1. Sharps						
2. Post-Exposure						
3. Vaccinations						
4. Self-Care						

*** If other please specify in comments section below.**

5.4 Comments:

6. Area of Competency: Sterilization and Disinfection

Criteria for Content Areas in Questions 6.1 and 6.3
1. Indications for Cleaning: Students are able to distinguish between patient care items that require cleaning, disinfection (low, medium, or high level), or sterilization.
2. Waste Management: Students can differentiate between, and are able to properly dispose of, regular waste and biohazard waste.

6.1 Please identify, for each content area, when it is covered, number of hours, and how each is evaluated. Write: NO if not covered, UNK if unknown, or INF if informally covered.

Initial Learning Experiences	1. Indications for Cleaning	2. Waste Management
Year/Level when first taught		
No. of hours (theory)		
No. of hours (practice)		
*Evaluation of student learning		
Additional Experiences	**1. Indications for Cleaning**	**2. Waste Management**
Year/Level when reinforced		
No. of hours (theory)		
No. of hours (practice)		
*Evaluation of student learning		

* 1=short answer questions, 2=multiple choice questions, 3=case-based scenarios, 4=demonstration, 5=other (list)

6.2 Comments:

6.3 Please indicate, using a √ or x, which teaching methods are used to deliver material in each of the content areas listed below. Check all that apply.

Content Area	Lecture	Multi-media	Demo	Case Study	Readings	*Other
1. Indications for cleaning						
2. Waste Management						

*** If other please specify in comments section below.**

6.4 Comments:

7. Area of Competency: Critical Assessment Skills

Criteria for Content Areas in Questions 7.1 and 7.3
1. Critical Thinking: Students are able to demonstrate problem solving and critical thinking skills when presented with an infectious disease, or infection control case study.
2. Role in Outbreaks: Students are able to identify unusual clusters of illnesses and are familiar with their roles and responsibilities in an outbreak situation.
3. Use of Infection Prevention and Control (IP&C) Resources: Students are able to access and use IP&C resources and protocols as needed.

7.1 Please identify, for each content area, when it is covered, number of hours, and how each is evaluated. Write: NO if not covered, UNK if unknown, or INF if informally covered.

Initial Learning Experiences	**1. Critical Thinking**	**2. Role in Outbreaks**	**3. IP&C Resources**
Year/Level when first taught			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			
Additional Experiences	**1. Critical Thinking**	**2. Role in Outbreaks**	**3. IP&C Resources**
Year/Level when reinforced			
No. of hours (theory)			
No. of hours (practice)			
*Evaluation of student learning			

* 1=short answer questions, 2=multiple choice questions, 3=case-based scenarios, 4=demonstration, 5=other (list)

7.2 Comments:

7.3 Please indicate, using a √ or x, which teaching methods are used to deliver material in each of the content areas listed below. Check all that apply.

Content Area	Lecture	Multi-media	Demo	Case Study	Readings	*Other
1. Critical Thinking						
2. Role in Outbreaks						
3. IP&C Resources						

*** If other please specify in comments section below.**

7.4 Comments:

Additional Questions

1. **How many students are registered in the final year of your program? Please include students in regular stream only. Do not include students in the post-RN or other streams.**

2. **How many nurse educators are there in your school/program? This includes all persons who provide educational learning experiences for students in theory, practice, or clinical areas of your program.**

3. **Has your program implemented any changes in IP&C content, either in general or specific to influenza, in response to the H1N1 pandemic? If yes, please elaborate.**

4. **How, if at all, are the CHICA-Canada core competencies for IP&C used to guide IP&C education in your program?**

5. **What role, if any, do local infection control practitioners play in the planning and/or delivery of IP&C content in the curriculum?**

Appendix G: Recruitment Emails for Educators and Students

School of Nursing
Memorial University of Newfoundland

Dear Nurse Educator:
My name is Moira Chiasson. I am a Master of Nursing student at the Memorial University of Newfoundland. In partial fulfillment of my Master of Nursing degree, I am conducting a thesis research study in the area of infection prevention and control (IP&C) education in undergraduate nursing education programs. The purpose of this research project is to identify whether or not undergraduate nursing education curricula adequately prepare nursing students to meet the CHICA-Canada core competencies for IP&C. I will also be assessing faculty development needs related to teaching IP&C.

I am contacting you today to invite you to take part in my research study. Approval for this research study has been granted by your school. It is up to you to decide whether to be in the study or not – participation is voluntary. Before you decide, you need to understand what the study is for, what risks you might take and what benefits you might receive. For your reference, I have attached an information sheet to provide you with that information. Please do not hesitate to contact me at your convenience with any questions or concerns regarding your possible participation in this research study.

Should you wish to participate in the study, please follow the link below to begin the questionnaire:
https://moirassurveyataskitonlinetobeaddedwhenknown.com

I thank you in advance for your time in considering my request.

Sincerely,

Moira Chiasson, B.Sc.N., RN
Graduate Student

Master of Nursing
Memorial University of Newfoundland
(902) 224-1053
Email: mchiasson@mun.ca

This study has been reviewed by, and received ethics clearance through, the Human Investigation Committee, Memorial University of Newfoundland.

Why is this study an important research study?

As background to the study, healthcare associated infections (HAIs) are a serious concern. Annually they account for significant personal and economic costs in areas such as quality of life, morbidity and mortality, and increased burden on the healthcare system. The need for adequate knowledge, skills, and behaviors in areas of infection prevention and control (IP&C) among healthcare workers (HCWs), specifically nurses, is well documented. However, equally well documented is the fact that serious deficiencies in this area exist in the nursing profession. While numerous studies have addressed this issue within the context of practicing nurses, there is a minimal amount of literature, from both Canada and elsewhere, that addresses the knowledge, skills, behaviors, and confidence of undergraduate nursing students and faculty, or that addresses the curricular content of undergraduate nursing programs in relation to education specific to IP&C. In order to develop an understanding of the issue, research is needed in this area. The purpose of this research project is to identify whether or not undergraduate nursing education curricula adequately prepare nursing students to meet the CHICA-Canada core competencies for IP&C.

How will data be collected?

This research study involves data collection from multiple stakeholders in Atlantic Canadian undergraduate nursing education programs: directors, nurse educators, and students in the final year of their program. Directors will be asked to complete a curriculum questionnaire. This questionnaire will serve as an audit tool for curriculum content specific to IP&C. Upon completion of the study, the researcher will provide each director with a school-specific summary of results for their respective program.

Through email communication via a pre-identified third party contact person, nurse educators and students will be asked to complete an online questionnaire that will assess their knowledge and confidence in several key IP&C-related content areas. These questionnaires, comprised of short answer, multiple choice, and true/false questions, will take approximately 20 minutes to complete. Upon completion of the data collection phase of the study, the researcher will forward an email containing the correct answers to the knowledge questions to the third party contact person, for distribution to nurse educators and students.

If I choose to participate, what will I need to do?

As a nurse educator, if you choose to participate, you will be asked to complete an online questionnaire. The questionnaire, which will take approximately twenty minutes to complete, consists of four categories of questions: demographics, knowledge, confidence, and general knowledge. Questions will be asked in short answer, multiple choice, and true/false formats.

You will be asked to complete the questionnaire within two weeks. After two weeks, a reminder email will be sent to all possible participants. Completion of the questionnaire

implies consent. Upon completion of the data collection phase, correct answers for all knowledge questions will be emailed to all nurse educators and students.

Should I be worried about who will know my questionnaire results?
Please note that your identity will remain anonymous in this research study. In using a third-party contact person for communication, the researcher is prevented from knowing any identifying information. The researcher will not have access to the names of eligible participants. At no time will the researcher know who has or has not participated in the study. At the end of the research study, the researcher will provide the director of your program with a school-specific summary of results. This information could be used to identify areas that could be strengthened within your program. However, the director will not receive individual results or raw data from any one participant. All data provided specific to the questionnaires for your group will be provided in a summary format. In addition, the name of your specific school will never be used in any public reports of study findings.

What about privacy concerns related to online data collection?
In compliance with section 30.1 of the *Freedom of Information and Protection of Privacy Act*, data will be stored in Canada. The survey platform, www.askitonline.com, is a Canadian online survey provider. There will be no link to the participant's identifying information. The questionnaires will be developed using a SSL-encrypted site. Integrity of the dataset will be assured by limiting access to data files through passwords and account control. Upon completion of the survey, all data files will be deleted from the servers of www.askitonline.com.

What about any negative consequences to participating in the study if the findings for our school are not favorable?
Please be assured that all data collected throughout this research study will be handled with sensitivity and discretion. The confidentiality of participants will be ensured at all times. Data files will only be accessible to the research team, and access will be controlled as per the research ethics boards' requirements. Data will only be reported at the aggregate level. Findings of the study may result in some concern from participants, but recommendations will be made that address identified limitations. At no time will any individual results be made available to the general public. Participation in the study will help to identify areas in your program curriculum that may be strengthened.

Has this study been approved by an ethics committee?
Yes. This study has been approved by the Memorial University of Newfoundland Human Investigation Committee. Approval for school participation in this study has also been granted by the appropriate individual(s) at your school.

Who should I contact for more information?
Should you require any additional information, please contact:
Moira Chiasson
Master of Nursing student
Memorial University of Newfoundland
mchiasson@mun.ca
(902) 224-1053

School of Nursing
Memorial University of Newfoundland

Dear Student:

My name is Moira Chiasson. I am a Master of Nursing student at the Memorial University of Newfoundland. In partial fulfillment of my Master of Nursing degree, I am conducting a thesis research study in the area of infection prevention and control (IP&C) education in undergraduate nursing education programs. The purpose of this research project is to identify whether or not undergraduate nursing education curricula adequately prepare nursing students to meet the CHICA-Canada core competencies for IP&C.

I am contacting you today to invite you to take part in my research study. Approval for this research study has been granted by your school. It is up to you to decide whether to be in the study or not – participation is voluntary. Before you decide, you need to understand what the study is for, what risks you might take and what benefits you might receive. For your reference, I have attached an information sheet to provide you with that information. Please do not hesitate to contact me at your convenience with any questions or concerns regarding your possible participation in this research study.

Should you wish to participate in the study, please follow the link below to begin the questionnaire:
https://moirassurveyataskitonlinetobeaddedwhenknown.com

I thank you in advance for your time in considering my request.

Sincerely,

Moira Chiasson, B.Sc.N., RN
Graduate Student

Master of Nursing
Memorial University of Newfoundland
(902) 224-1053
Email: mchiasson@mun.ca

This study has been reviewed by, and received ethics clearance through, the Human Investigation Committee, Memorial University of Newfoundland.

Why is this study an important research study?

As background to the study, healthcare associated infections (HAIs) are a serious concern. Annually they account for significant personal and economic costs in areas such as quality of life, morbidity and mortality, and increased burden on the healthcare system. The need for adequate knowledge, skills, and behaviors in areas of infection prevention and control (IP&C) among healthcare workers (HCWs), specifically nurses, is well documented. However, equally well documented is the fact that serious deficiencies in this area exist in the nursing profession. While numerous studies have addressed this issue within the context of practicing nurses, there is a minimal amount of literature, from both Canada and elsewhere, that addresses the knowledge, skills, behaviors, and confidence of undergraduate nursing students and faculty, or that addresses the curricular content of undergraduate nursing programs in relation to education specific to IP&C. In order to develop an understanding of the issue, research is needed in this area. The purpose of this research project is to identify whether or not undergraduate nursing education curricula adequately prepare nursing students to meet the CHICA-Canada core competencies for IP&C.

How will data be collected?

This research study involves data collection from multiple stakeholders in Atlantic Canadian undergraduate nursing education programs: directors, nurse educators, and students in the final year of their program. Directors will be asked to complete a curriculum questionnaire. This questionnaire will serve as an audit tool for curriculum content specific to IP&C. Upon completion of the study, the researcher will provide each director with a school-specific summary of results for their respective program.

Through email communication via a pre-identified third party contact person, nurse educators and students will be asked to complete an online questionnaire that will assess their knowledge and confidence in several key IP&C-related content areas. These questionnaires, comprised of short answer, multiple choice, and true/false questions, will take approximately 20 minutes to complete. Upon completion of the data collection phase of the study, the researcher will forward an email containing the correct answers to the knowledge questions to the third party contact person, for distribution to nurse educators and students.

If I choose to participate, what will I need to do?

As a student, if you choose to participate, you will be asked to complete an online questionnaire. The questionnaire, which will take approximately twenty minutes to complete, consists of four categories of questions: demographics, knowledge, confidence, and general knowledge. Questions will be asked in short answer, multiple choice, and true/false formats.

You will be asked to complete the questionnaire within two weeks. After two weeks, a reminder email will be sent to all possible participants. Completion of the questionnaire

implies consent. Upon completion of the data collection phase, correct answers for all knowledge questions will be emailed to all nurse educators and students.

Should I be worried about who will know my questionnaire results?
Please note that your identity will remain anonymous in this research study. In using a third-party contact person for communication, the researcher is prevented from knowing any identifying information. The researcher will not have access to the names of eligible participants. At no time will the researcher know who has or has not participated in the study. At the end of the research study, the researcher will provide the director of your program with a school-specific summary of results. This information could be used to identify areas that could be strengthened within your program. However, the director will not receive individual results or raw data from any one participant. All data provided specific to the questionnaires for your group will be provided in a summary format. In addition, the name of your specific school will never be used in any public reports of study findings.

What about privacy concerns related to online data collection?
In compliance with section 30.1 of the *Freedom of Information and Protection of Privacy Act*, data will be stored in Canada. The survey platform, www.askitonline.com, is a Canadian online survey provider. There will be no link to the participant's identifying information. The questionnaires will be developed using a SSL-encrypted site. Integrity of the dataset will be assured by limiting access to data files through passwords and account control. Upon completion of the survey, all data files will be deleted from the servers of www.askitonline.com.

What about any negative consequences to participating in the study if the findings for our school are not favorable?
Please be assured that all data collected throughout this research study will be handled with sensitivity and discretion. The confidentiality of participants will be ensured at all times. Data files will only be accessible to the research team, and access will be controlled as per the research ethics boards' requirements. Data will only be reported at the aggregate level. Findings of the study may result in some concern from participants, but recommendations will be made that address identified limitations. At no time will any individual results be made available to the general public. Participation in the study will help to identify areas in your program curriculum that may be strengthened.

Has this study been approved by an ethics committee?
Yes. This study has been approved by the Memorial University of Newfoundland Human Investigation Committee. Approval for school participation in this study has also been granted by the appropriate individual(s) at your school.

Who should I contact for more information?
Should you require any additional information, please contact:
Moira Chiasson
Master of Nursing student
Memorial University of Newfoundland
mchiasson@mun.ca
(902) 224-1053

Appendix H: Educator and Student Questionnaires

Instructions

Thank you for agreeing to participate in this research study. The purpose of this questionnaire is to capture your current knowledge and confidence in the area of infection prevention and control (IP&C). For that reason, we ask that you please complete the questionnaire without referring to other sources of information for your responses. Upon completion of the data collection phase of the study, a general email will be sent to all nurse educators and students outlining the correct responses for the knowledge questions included in this questionnaire.

Once you begin completion of the questionnaire, you will not be able to return to it for completion at a later date. Please note that, once you select the "next" button at the bottom of a page, you are not able to return to the previous page. A progress bar has been included within the questionnaire so that you can track your progress as you complete the questionnaire.

Should you encounter any technical difficulties when completing the questionnaire, please contact the help desk at www.askitonline.com.

Thank you.

Demographic Questions – Nurse Educators

1. Please indicate the school with which you are currently employed.

- Memorial University of Newfoundland
- Western School of Nursing
- Centre for Nursing Studies
- University of Prince Edward Island
- University of New Brunswick
- Cape Breton University
- St. Francis Xavier University
- Dalhousie University

2. What is your educational background (please check all that apply)?

- RN Diploma Program
- BN/BSN
- MN
- PhD
- Other Bachelor's Degree
- Other Master's Degree
- Other

3. Please state your nursing practice background (e.g. area of practice).
4. Have you taught the theory portion of a basic undergraduate program within the past 3 years?
5. Have you taught in the clinical area of an undergraduate program within the past 3 years?

Demographic Questions – Students

1. Please indicate the school in which you are currently a student.
   - Memorial University of Newfoundland
   - Western School of Nursing
   - Centre for Nursing Studies
   - University of Prince Edward Island
   - University of New Brunswick
   - Cape Breton University
   - St. Francis Xavier University
   - Dalhousie University
2. Excluding your current nursing education program, have you completed other post-secondary education (e.g. diploma, undergraduate, graduate)? If yes, please specify.

3. Excluding any clinical practice experiences you have had in completing your current nursing education program, have you had any additional healthcare-related practice experiences? If yes, please specify.

Confidence Questions

Please check the box that reflects how confident you are in the following areas:

Procedure	Not confident	Somewhat Confident	Very Confident	Not applicable
Performing hand hygiene when indicated	O	O	O	O
Using correct technique for hand washing	O	O	O	O
Using correct technique for use of alcohol-based hand rub	O	O	O	O
Wearing Gloves	O	O	O	O
Removing a mask without contaminating self	O	O	O	O
Removing other personal protective equipment (PPE) without contaminating self	O	O	O	O
Choosing right PPE for patient care interaction	O	O	O	O
Applying Droplet Precautions	O	O	O	O
Applying Airborne Precautions	O	O	O	O
Applying Contact Precautions	O	O	O	O
Disposing of Contaminated Waste	O	O	O	O
Properly cleaning equipment between patient use	O	O	O	O
Preventing needlestick injuries	O	O	O	O
Initiating first aid for punctures	O	O	O	O

Procedure	Not confident	Somewhat Confident	Very Confident	Not applicable
Initiating first aid for fluid exposure to eyes, nose or mouth	O	O	O	O
Performing point of care risk assessment	O	O	O	O
Knowing where to find more info r/t IP&C	O	O	O	O
Problem solving r/t IP&C	O	O	O	O

Basic Microbiology and Clinical Infectious Diseases

1. **Please type in your answers to complete the following table:**

	Influenza	*Clostridium difficile*
Route of transmission		
One factor that increases host susceptibility		

2. **Complete the following table by selecting which items are related to droplet transmission, and which are related to airborne transmission:**

	Droplet Transmission	Airborne Transmission
Secretions are > 5 microns	O	O
Droplet nuclei or dust	O	O
Particles land on mucous membranes of nose and mouth	O	O
Particles enter the lower respiratory tract	O	O

3. **List one microorganism transmitted by the airborne route of transmission**:
4. **What are the main components of respiratory hygiene, also known as cough etiquette? Check all that apply.**

- Turn away and cough into hands
- Cough into your elbow or sleeve
- Cough into a tissue
- Say “excuse me” after you cough

Hand Hygiene

5. **List 5 indicators for, or examples of, when the nurse should perform hand hygiene.**
6. **What are the important aspects of technique for use of alcohol-based hand rub (ABHR)? Select all that apply.**

    - Wipe hands with paper towel if they are still wet after 5 seconds.
    - Use enough product to cover all surfaces.
    - Use ABHR on hands that are wet.
    - After applying ABHR, rub hands until they are dry (~ 15 seconds).

Routine Practices and Transmission-Based Precautions

7. **Other than hand hygiene or use of personal protective equipment (PPE), list 2 examples of "Routine Practices".**

8. **A patient is on Droplet Precautions. The nurse is going in to check the patient's vital signs and to help her to sit up in bed for breakfast. What PPE will the nurse need to wear?**

Personal Protective Equipment (PPE)

Please select "True" or "False" for the following statements:

9. **Gloves should be worn during all patient care activities.**
10. **Gloves should be worn when handling contaminated items.**
11. **It is not necessary to perform hand hygiene after removing your gloves.**
12. **Gloves should be worn when touching intact skin.**

13. **If the nurse is wearing a mask for protection from respiratory secretions, the nurse should also wear eye protection (e.g., goggles).**

14. **A gown can be worn for the care of multiple patients as long as the gown has not been in contact with blood or body fluids.**

15. **Eye glasses provide adequate protection from splashes/sprays of blood and body fluids (e.g., secretions, excretions).**

Personal Safety

16. **Please answer True/False: Nurses who are not immune for chickenpox should not care for a patient with shingles (zoster).**

17. **If a nurse experiences a blood or body fluid exposure, why should he/she contact occupational health?**

Sterilization and Disinfection

18. **Please indicate, by checking the appropriate box, the level of cleaning required for each item if it is used for multiple patients.**

Item	a) Low level cleaning (e.g. soap and water, alcohol wipe)	b) Medium level cleaning (e.g., reprocessing or chemical disinfectant)	c) High level cleaning (e.g. sterilization)	d) Does not need to be cleaned between patients.
Stethoscope	O	O	O	O
Blood Pressure Cuff	O	O	O	O
Commode	O	O	O	O

Critical Assessment Skills

19. **If a nurse were going to be providing care for a patient with an infectious disease, list 3 resources the nurse could use for information related to care of the patient (e.g., infection prevention and control precautions, information about the infectious agent).**

END OF KNOWLEDGE QUESTIONS

Pandemic Influenza Questions

1. **Have you received any formal education related to Pandemic (H1N1) influenza? Yes/No If yes, how many hours of instruction did you receive? From which sources? How was the material taught and/or provided to you? Was your learning evaluated? Do you feel that any formal education you have received thus far adequately addressed your learning needs?**

Please complete the following table:

Did you receive formal education in the following areas?	**Yes or No (please select)**
Topic area: Routine Practices	
Topic area: Additional Precautions	
Topic area: Transmission	
Topic area: Prevention	
Topic area: Management	

2. **Please check the box that reflects the effect pandemic influenza has had on your:**

	Increased	Decreased	Stayed Same
General IP&C knowledge			
IP&C knowledge specific to influenza			
General confidence in IP&C			
Confidence in IP&C specific to influenza			
General compliance with IP&C			
Influenza-specific IP&C compliance			

3. **What have been your primary sources of information for pandemic influenza, outside of formal education?**

4. **Have you been immunized with the pandemic influenza vaccine?**

5. **Have you been, or do you plan to be, immunized with the seasonal influenza vaccine this year?**

Questions for Faculty

1. **What is your role in teaching IP&C material to students (e.g., course, clinical, no direct teaching – reinforce only)?**

2. **Do you feel adequately prepared for your role identified above? If no, please comment.**

3. **Do you see yourself as a role model for students in the area of IP&C? Yes/No/Don't Know. If yes, in what way?**

4. **Do you link with your local IP&C professionals? Yes/No Comments:**

5. **Would you be interested in receiving additional education related to IP&C? Yes/No If yes, about what?**

6. **Have you modified the IP&C content of your teaching in response to pandemic influenza? Yes/No/Does Not Apply. If yes, please comment.**

7. **Are you familiar with the CHICA-Canada infection prevention and control core competencies for health care workers?**

Questions for Students

1. **Do you feel that your educators are knowledgeable in the area of IP&C? Yes/No**

2. **Do you feel that you are able to apply your knowledge and skills related to IP&C within the practice setting? If no, why not?**

3. **Are you familiar with the CHICA-Canada infection prevention and control core competencies for health care workers?**

4. **Are there changes you would recommend for IP&C education in your program?**