IMPACT OF HEALTHCARE-ASSOCIATED INFECTIOUS DISEASE OUTBREAKS

THE IMPACT OF HEALTHCARE-ASSOCIATED INFECTIOUS DISEASE OUTBREAKS ON THE NATURE OF HEALTHCARE PROFESSIONALS' DAILY WORK

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A Thesis Submitted to the School of Graduate Studies in Partial Fulfilment of the Requirements for the Degree Master of Science (Nursing)

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McMaster University MASTER OF SCIENCE (2013) Hamilton, Ontario (Nursing)

TITLE: The Impact of Healthcare-Associated Infectious Disease Outbreaks on the Nature of Healthcare Professionals' Daily Work

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NUMBER OF PAGES: xiii, 144

ABSTRACT

Background: Healthcare-associated infections (HAIs) and HAI disease outbreaks present challenges for healthcare facilities. In 2008, a *Clostridium difficile* outbreak in Ontario resulted in the deaths of 91 patients and raised awareness of HAIs. Over the last 5 years, the outbreak rate has risen dramatically. Traditionally, HAI research has focused on epidemiology, healthcare systems, and the economic burden. Little is known about the impact HAI disease outbreaks have on the work of healthcare professionals.

Purpose: The purpose of this study was to examine the effects of HAI outbreaks on healthcare professionals in a large acute care hospital in Ontario.

Methods: A retrospective exploratory case study approach was used, including individual interviews, document analysis, and incidence analysis of HAIs hospital data. The sample was frontline nurses, clinical managers, infection control professionals, and environmental service staff. Document analysis included hospital policies and protocols related to infectious diseases and HAI disease outbreaks.

Findings: The incidence rates of Methicillin-resistant s*taphylococcus aureus*, *Clostridium difficile*, and Vancomycin-resistant enterococci have decreased but remained above the provincial benchmarks. The daily work of healthcare professionals was impacted by HAI outbreaks. Nurses experienced workload challenges, time pressures, and increased documentation. Infection control professionals' responsibilities have expanded. The environmental services staffs' cleaning processes have become more intensive. In response, several unique innovations were developed by hospital staff.

Conclusion: The daily work of healthcare professionals at the study site has been affected by HAI outbreaks. Implications for future research include the need to review healthcare professionals' workloads and evaluate contributing factors to HAI outbreaks.

ACKNOWLEDGMENTS

I wish to acknowledge a number of people who have supported me in the completion of this thesis. I would like to express my appreciation to Dr. Andrea Baumann, for her diligent supervision and encouragement, throughout my graduate studies. I would also like to thank Dr. Camille Kolotylo for her guidance and feedback during the research process, along with the other committee members Anne Bialachowski, and Dr. Tim O'Shea.

I am greatly indebted to the participants who volunteered information at the acute care facility. This study would not have been a success without the willingness of frontline nurses, infection control professionals, clinical managers, and environmental services staff to participate in the study. I learned a lot about infectious diseases and outbreaks through their shared experiences.

A special thank you to my family: Christopher (Dad), Peninah (Mom), Micheal, Mariana, Eric, and Brian for daily support and encouragement. To my many friends, thank you for encouraging me when I needed it most. I am very grateful for the funding for my graduate studies from the Aga Khan University. In particular, I thank the Dean of the School of Nursing Professor Yasmin Amarsi.

Finally, special thanks to the entire Nursing Health Services Research Unit for being a daily source of motivation and encouragement.

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ABBREVIATIONS AND SYMBOLS

C. difficile	*Clostridium difficile*
CDC	Centers for Disease Control and Prevention (USA)
CDI	*Clostridium difficile* infection
CUPE	Canadian Union of Public Employees
CNISP	Canadian Nosocomial Infection Surveillance Program
CDAD	*Clostridium difficile*-associated diarrhea
EVS	Environmental Services (formerly housekeeping)
HAI	Healthcare-associated infection
HA CDI	Healthcare-associated *Clostridium difficile* infection
HAI disease outbreaks	Healthcare-associated infectious disease outbreaks
HH	Hand hygiene
ICPs	Infection Control Professionals
IPAC	Infection Prevention and Control
LTC	Long-term care
MOHLTC	Ministry of Health and Long-Term Care (Ontario)
MRSA	Methicillin-resistant *Staphylococcus aureus*
NHSRU	Nursing Health Services Research Unit
PHAC	Public Health Agency of Canada
PIDAC	Provincial Infectious Diseases Advisory Committee
PHD	Public Health Department
PPE	Personal protective equipment
RN	Registered Nurse
RPN	Registered Practical Nurse

SARS	Severe Acute Respiratory Syndrome
VRE	Vancomycin-resistant enterococci

CHAPTER 1: BACKGROUND

Healthcare-associated infections (HAIs) occur worldwide causing significant morbidity, mortality, and economic costs (Ducel, Fabry, & Nicolle, 2002). Since the SARS epidemic in 2003, infectious disease was identified as a key patient safety issue. Healthcare facilities have experienced challenges due to HAIs and HAI disease outbreaks. A noteworthy infectious disease outbreak that raised the awareness of HAI disease outbreaks as a threat to patient safety was the HAI *Clostridium difficile (C. difficile*) outbreak at a community hospital in Ontario in which ninety-one patients died (McCarter, 2008). Over the last five years, the rate of these infectious disease outbreaks has risen dramatically. Healthcare facilities in Ontario have implemented active infection prevention and control programs and infectious disease prevention guidelines to combat HAI disease outbreaks. In the past, research regarding HAIs and HAI disease outbreaks has focused on epidemiology, healthcare systems, and the economic burden of infectious diseases (Gravel et al., 2009; Canadian Union of Public Employees [CUPE], 2009; Yokoe et al., 2008). Yet, emerging evidence demonstrates that healthcare professionals experience challenges in preventing and controlling HAIs in community hospitals (Kaba, 2011).

The current research study builds on findings from Kaba (2011) in which it was suggested that healthcare professionals' daily work had changed. This change was attributed to the proliferation of infectious diseases in community hospitals and the proliferation of infection control policies and practices (Kaba, 2011). This study will add to the understanding of how healthcare professionals' daily work in an acute care facility has changed as a result of HAI disease outbreaks.

Purpose

The purpose of this study was to examine the effects of nosocomial/healthcare-associated infectious (HAI) disease outbreaks on healthcare professionals' daily work in one large acute care hospital in Ontario, Canada.

Objectives

The research objectives for the study were as follows to:

1. Describe the incidence of HAI diseases in one urban acute care hospital from 2008 to 2012.
2. Describe the impact of nosocomial/HAI disease outbreaks (2010-2011 and 2012) at the acute care hospital on the:
    a) daily nursing care delivery through the perceptions of nurses at the point-of-care,
    b) healthcare professionals' daily work through the perceptions of clinical managers, environmental services staff (previously known as housekeeping), and infection control professionals.
3. Analyze the infection prevention and control policies and practice protocols related to the daily work of nurses and other healthcare professionals during nosocomial/HAI disease outbreaks at the acute care hospital.
4. Analyze the changes that occurred to infection prevention and control policies and practice protocols after the infectious disease outbreaks (2010-2011 and 2012) at the acute care hospital.
5. Describe the physical structure of the acute care hospital and the innovations introduced by the acute care hospital in relation to the control of HAI disease outbreaks.

Research Question

The aim of this case study was to understand the effect of HAI disease outbreaks on the daily work of healthcare professionals. In this study, the researcher sought to answer the following question: How have HAI disease outbreaks impacted the nature of healthcare professionals' daily work in an acute care facility?

Healthcare-Associated Infectious Diseases

During the past decade, HAIs have become a key patient safety issue (Yokoe et al., 2008). The commonly understood definition of HAI is a "localized or systemic condition occurring as an adverse reaction to the presence of an infectious agent(s) or its toxin(s) that was neither present nor incubating upon the patient's admission to the acute care facility" (US Centers for Disease Control and Prevention [CDC], 2013, p. 1). These infections occur on or after 72 hours (three days) following admission to an acute care facility and are caused by infectious agents from endogenous or exogenous sources (CDC, 2013). Common terms used for HAIs are nosocomial infections, hospital-acquired infections, and hospital superbugs (CDC, 2013; Collin, 2008; Public Health Agency of Canada[PHAC], 2012b).

Healthcare-associated infections occur worldwide. They affect developed and resource-poor countries and cause significant morbidity, mortality, longer hospital stays, and increased economic costs (CUPE, 2008; Ducel et al., 2002). The World Health Organization (WHO) estimated that at any given time at least 10% of patients or 1.4 million people worldwide suffer from infectious disease complications acquired in healthcare institutions (Ducel et al., 2002).

Definition of Infectious Disease Outbreaks

An infectious disease outbreak is defined as an increase in the number of cases above the number normally occurring in a particular healthcare facility over a defined period (Ducel et al.,

2002). Transmission of infections in healthcare facilities occurs when there is a susceptible host, a source of microorganisms, and a means of transmission (Collins, 2008). The definition of an HAI disease outbreak is further refined in each healthcare institution and is based on the specific infecting organism as clusters of HAIs occurring above a baseline or threshold level for a specific facility, unit, or ward (Ducel et al., 2002).

The HAI baseline for a particular setting is established according to what HAIs are normally observed in that setting and the number of infections over a specific time frame (Ducel et al., 2002). In Ontario, HAI disease outbreak definitions incorporate notification thresholds that optimally trigger dialogue and action between public health departments and hospitals (Ministry of Health and Long-Term Care [MOHLTC], 2012). Notification thresholds for HAI disease outbreaks vary for different types of infectious organisms. For example, one of the common organism-specific infectious disease outbreaks in Ontario is *C. difficile*. The notification threshold for *C. difficile* infections (CDIs) for hospital wards/units with greater than 20 beds is three cases of HAI CDI identified in one ward/unit within a seven-day period or five cases within a four-week period (MOHLTC, 2012).

The notification threshold for hospital units with less than 20 beds is two cases of HAI CDIs identified in one ward/unit within a seven-day period or four cases within a four-week period (MOHLTC, 2012). The notification threshold for infectious disease outbreaks in Ontario hospitals is a baseline HAI CDI rate for two months that is at or above the 80th percentile of comparator hospitals. In addition, Ontario hospitals with a facility rate greater than or equal to two standard deviations above their baseline are declared to be in infectious disease outbreak (MOHLTC, 2012). There is no gold standard for the baseline definition of outbreaks at present, and this can lead to the inconsistent declaring and reporting of outbreaks.

Evolution of Infectious Disease Outbreaks in Healthcare

Healthcare-associated infectious disease outbreaks can have many manifestations and have played a critical role in alerting the public and governments worldwide that infectious diseases are a threat. For example, the 2001 bioterrorism outbreak of anthrax in the United States (US) led to heightened awareness of infectious diseases and their effects (Jernigan et al., 2002; Swartz, 2001). In 2003, an infectious disease outbreak of Severe Acute Respiratory Syndrome (SARS) spread rapidly across the world, resulting in 8,096 cases and 774 deaths (Schumacher et al., 2005). Subsequent to this infectious disease outbreak, government policies, reports, and research studies emphasized systemic and organizational factors that contributed to the rapid spread of SARS in healthcare facilities (Ontario Expert Panel on SARS and Infectious Disease Control, 2004; SARS Commission, 2006).

Starting in 2000, four main organisms began causing infectious disease outbreaks in healthcare organizations in Canada and the US: *C. difficile*, methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), and norovirus. MRSA and *C. difficile* have caused infectious disease outbreaks in hospitals and communities (Klevens et al., 2007; Yokoe et al., 2008). In 1990, community-acquired MRSA strains emerged as a threat in hospitals throughout North America (D'Agata, Webb, Horn, Moellering, & Ruan, 2009).

The incidence of MRSA in healthcare facilities doubled between 1999 and 2006 in developed countries (Simor et al., 2001). An estimated 20% of patients who became colonized with MSRA developed the infection (Davis, Stewart, Crouch, Florez, & Hospenthal, 2004). Colonization is defined as the presence of an organism in or on a patient without resulting in clinical disease (Davis et al., 2004). The surge in MRSA infections led to the investigation of the possibility of a clone causing the infectious disease outbreaks. It also increased awareness of the

infection and catalyzed implementation of legislated MRSA screening and reporting in a number of states in the US and provinces in Canada (Kim & Simor, 2001; Syndor & Perl, 2011).

In Canada, a *C. difficile* outbreak in Quebec in 2003-2004 caused the death of 100 patients in healthcare facilities and led to increased public awareness of grave infectious diseases and massive infection control prevention efforts (Eggerston, 2005). During this period, a new strain of *C. difficile* (NAP1) was identified and caused infectious disease outbreaks that were associated with high levels of morbidity and mortality (Loo et al., 2005; McDonald et al., 2005). NAP1 strains produced higher levels of toxins A and B. The latter was a new toxin (binary toxin) that was reported to be resistant to fluoroquinolone antibiotics (Loo et al., 2005; McDonald et al., 2005). The discovery of the NAP1 strain spurred increased awareness and more robust infectious disease prevention programs for *C. difficile* in North America.

In Ontario, the first seminal event following SARS was a C. difficile outbreak in Joseph Brant Memorial Hospital in Burlington in 2006-2007 (McCarter, 2008). More than 200 in-hospital patients were infected with *C. difficile* in a 20-month period, and 91 infected patients died. Since 2008, HAI disease outbreaks in Ontario have drawn considerable media attention. The media focus is usually on insufficient infection control practices within hospitals such as inadequate cleanliness and poor hand hygiene (Butler, 2013; McCarter, 2008; Stastna, 2013). Owing to increased media reporting, the prevention and control of HAI disease outbreaks has become a major concern for healthcare organizations and governments. Healthcare facilities have implemented active infection prevention and control programs to combat HAI disease outbreaks. Additionally, in 2008, mandatory infectious disease reporting by healthcare facilities to the Ontario MOHLTC was implemented ("Ontario's Hospital Occupancy", 2008). However,

hospitals in the province of Ontario are still experiencing HAI disease outbreaks (Kaba, 2011; Stastna, 2013).

CHAPTER 2: LITERATURE REVIEW

The following literature review provides an overview of healthcare-associated infectious (HAI) diseases, with a particular focus on HAI disease outbreaks in acute healthcare facilities. The overall focus of the literature review was the impact of HAI disease outbreaks on the nature of healthcare professionals' daily work, including frontline nurses, clinical nurse managers, infection control professionals (ICPs), and environmental services (EVS) staff. Literature that addresses the objectives of this study was critiqued and research gaps were identified.

The literature review began with a search of the following electronic databases: Pubmed, MEDLINE, EMBASE, CINAHL, and the Canadian Public Policy Collection. The following keywords were used: healthcare-associated infectious disease (HAI), HAI disease outbreaks, nosocomial infection outbreaks, HAI control and prevention, *Clostridium difficile* (*C. difficile*) infectious disease outbreaks, methicillin-resistant *Staphylococcus aureus* (MRSA) outbreaks, vancomycin-resistant enterococci (VRE) outbreaks. The keywords were searched in conjunction with the following keywords - nurses, clinical managers, ICPs, healthcare professionals, and acute care hospitals. The inclusion criteria were journals and government reports published from 2000 to 2012 in English; with study settings in Canada, the US, and Europe; and in-hospital study settings. Excluded articles were written in a language other than English, were published earlier than 2000, and were not research-based.

In addition, published critical appraisal tools based on the study design were used to analyze the studies included in the literature review. For example, Letts et al. (2007) qualitative critical appraisal tool was used to critique the qualitative studies. This tool was chosen because it is detailed and systematic. To evaluate systematic review studies, the assessment of multiple systematic reviews (AMSTAR) tool was used (Kung et al., 2010). Studies meeting the inclusion

criteria and the systematic critical appraisal tools' criteria were included in the literature review. The total number of literature review articles meeting the criteria for inclusion was 30 empirical articles and 15 reports from relevant government websites, electronic documents, and newspaper articles from the grey literature.

The literature review provides an overview of HAI disease outbreaks and situates the current study in the context of acute care hospitals. The following topics are also addressed: the incidence of HAIs and HAI disease outbreaks; mandated public reporting of HAIs and HAI disease outbreaks; infection prevention and control policies and practices; and the impact of HAI disease outbreaks on healthcare professionals' daily work.

Incidence of HAIs and HAI Disease Outbreaks

Since 2001, research on HAIs and HAI disease outbreaks has been prolific and quite diverse, varying by location, patient sample, and research methodology. Much of the research is epidemiological and focuses on the prevalence and incidence of infectious diseases and HAIs. In the US, it is estimated that there are 1.7 million HAIs yearly and 98,987 deaths are linked to HAIs each year (Klevens, et al., 2007). The annual direct medical costs of HAIs in US hospitals ranges from 35.7 billion to 45 billion US dollars (Scott II, 2009).

In Canada, one in nine hospital patients acquires an HAI that may result in a longer hospital stay, increased pain, or lead to death (Zoutman et al., 2003). Moreover, 220,000 hospitalized patients in Canada are infected with HAIs annually and an estimated 8,500 to 12,000 people die as a result (Zoutman et al., 2003). Healthcare associated infections are the fourth leading cause of death in Canada (CUPE, 2009). *C. difficile* infections associated with diarrhea are the most frequent cause of HAIs in developed countries and have been responsible for a number of infectious disease outbreaks in Canadian hospitals (Gravel et al., 2009).

In a replication study, Gravel et al. (2009) conducted a large prospective survey in 29 acute care facilities across Canada with the aim of determining the incidence and burden of illness associated with healthcare-associated *C. difficile* infections (HA CDI). The initial study was conducted in 2007 (Gravel et al.). The replication study was multicentered and involved nine Canadian provinces (Gravel et al., 2009). Data were collected over a period of six months (Gravel et al., 2009). Forty-four percent of the hospitals included in the study were in Ontario. The remainder were in Quebec, Alberta, British Columbia, Saskatchewan, Manitoba, Newfoundland and Labrador, New Brunswick, and Nova Scotia. The overall HA CDI rate was 4.5 cases per 1,000 patient admissions and 65 cases per 100,000 patient days. Quebec had a higher HA CDI incidence rate than the rest of Canada, with 12.8 cases per 1,000 admissions and 130 cases per 100,000 patient days (Gravel et al., 2009).

The study by Gravel et al. (2009) had several limitations including that survey methodology was used which means that data were collected at one specific time; alternative factors that could contribute to a high burden of HA CDI were not identified by the researchers, which might have influenced the study findings (e.g., seasonal variations); and data collection was not monitored by the research team during the research process. Therefore, there may be inconsistencies in the identification of survey participants and in the definition of a HA CDI case used among the hospitals. Due to rising infection rates, the study hospitals had been experiencing more infectious disease outbreaks and needed to create alternative methods to prevent and control infections (Yokoe et al., 2008). Canada has redefined *C. difficile* infection outbreaks based on the number of patients affected and the institution admission capacity (MOHLTC, 2011). Hospitals in Ontario are required, under the "Health Protection and Promotion Act"

(2008), to report HAI disease outbreaks and infectious disease outbreak-associated cases to the local medical officer of health (MOHLTC, 2009).

Kwong et al. (2012) conducted a study on the burden of infectious diseases in Ontario using data from 2005-2007, with the purpose of providing a detailed comparison of a wide range of infectious diseases. The burden for each disease was quantified using the health-adjusted life year (HALY). HALY is defined as "a composite measure of the gap between ideal and actual health that incorporates both mortality and morbidity" (Kwong et al., 2012, p.2). In the study, HALY included years of life lost due to premature mortality (YLL); it also included year equivalents of reduced functioning due to disease (YERF). Fifty-one infectious agents were examined and ranked. The findings indicated that 729 per 100,000 population (88,956) HALYs were estimated to have been lost annually due to the 51 infectious agents and associated syndromes studied. The YLL were 74,297 (83.5%), and the YERF due to disease was 14,668 (16.5%). There was a moderate correlation between YLL and YERF (Pearson's product correlation coefficient, r = .56). The p value was not reported in the study. A relevant finding was that *C. difficile* and *Staphylococcus aureus* were ranked amongst the ten highest burden pathogens. Although the use of HALYs is an interesting approach, it does have limitations because of the different methods that can be used to calculate them. Another limitation, which the authors acknowledged, was that data were accessed from multiple datasets of varying quality.

Public Reporting of HAIs and HAI Disease Outbreaks

Public reporting of HAIs in healthcare facilities was mandated by Ontario's MOHLTC in 2008 as an incentive to improve care, allow comparison among healthcare facilities, and enable consumers to choose safer care (MOHLTC, 2008; Yokoe, 2008). Mandatory public reporting of

HAI rates by healthcare facilities is also a strategy used to improve the transparency and accountability of facilities (McKibben, Fowler, Horan, & Brennan, 2006).

In the US in 2011, only 28 states had mandatory public reporting of HAIs (McKibben et al., 2006). Since 2004, the US National Healthcare Safety Network, formerly known as the National Nosocomial Infections Surveillance System, has overseen the voluntary public reporting of HAIs (CDC, 2011. In support of HAI prevention, the "American Recovery and Reinvestment Act" (ARRA, 2009), Public Law 111-5, was signed into law. Fifty million US dollars was allocated to the Centers for Disease Control and Prevention (CDC) to endorse states in the prevention and reduction of HAIs (CDC, 2011). The funding was to promote increased HAI prevention capacity through surveillance, infrastructure, and collaborative strategies (CDC, 2011).

In Canada, a surveillance network of healthcare facilities for HAIs, known as the Canadian Nosocomial Infection Surveillance Program (CNISP), was established in 1994 (Public Health Agency of Canada [PHAC], 2013b). CNISP provides national rates and trends of HAIs in Canadian healthcare facilities. The data collected are intended to establish benchmark data to enable both the comparison of HAI rates among similar healthcare facilities and the development of national guidelines for HAIs (PHAC, 2013b).

Ontario introduced mandatory public reporting of HAIs by healthcare institutions in 2008. Hand hygiene compliance rates and incidence rates of HAIs are considered patient safety indicators and are included in the mandatory reporting (MOHLTC, 2009). Each healthcare facility is required to report organism-specific HAIs (i.e., *C. difficile*, MRSA, and VRE) and other communicable diseases to their local public health department on a monthly basis (MOHLTC, 2008).

The usefulness of mandatory public reporting of HAIs in reducing the number of infections and infectious disease outbreaks is controversial. In the US, the CDC conducted a systematic review of the literature to determine the effectiveness of public reporting systems in improving healthcare performance (McKibben et al., 2006). However, none of the reviewed studies had investigated the reduction of HAIs as an outcome of public reporting. Therefore, the evidence on the effectiveness of public reporting in improving healthcare performance in the US is inconclusive (McKibben et al., 2006).

Public reporting allows healthcare facilities in Ontario to monitor and compare their HAI rates to ensure the highest possible standards for patient safety (MOHLTC, 2008). The Ontario MOHLTC posts infectious disease incidence rates and other reportable communicable disease rates on the MOHLTC website under the patient safety section. This permits healthcare facilities to benchmark themselves against similar healthcare facilities (MOHLTC, 2012). In addition, healthcare facilities are strongly encouraged to post this information on their own public websites, especially when they have an HAI disease outbreak (MOHLTC, 2012).

A recent study conducted in Canada, examined the impact of public reporting on the hospital rates of *C. difficile* infections (Daneman, Stukel, Ma, Vermeulen, & Guttmann, 2012). The findings demonstrated that there was a decrease in the observed rates of *C. difficile* infections during the study period, from 12.16 to 8.92 cases per 10,000 patient days. Public reporting was associated with a 26.7% (95% CI: 21.4 - 31.6) reduction in *C. difficile* cases. However, the researchers found it difficult to attribute the reduction of *C. difficile* infections rates solely to public reporting since it was likely that other infectious disease preventive measures and infection control procedures were also implemented during the study period.

Infection Prevention and Control Policies and Practices

In response to increased HAIs and HAI disease outbreaks, various best practices have been implemented in acute healthcare facilities. Some of these best practices are examined and discussed in the following paragraphs. They include the continued surveillance of healthcare-associated infectious diseases and hand hygiene (HH) compliance, and the evolution of care bundles in the treatment of healthcare-associated infectious diseases.

Surveillance of Healthcare-Associated Infectious Diseases

Surveillance has become the cornerstone of infection prevention and control programs (IPAC) and epidemiology tracking in hospitals (Sydnor & Perl, 2011). The CDC (2001) in the US defines surveillance as "the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health related event for use in public health action to reduce morbidity and mortality and to improve health" (p. 2). Surveillance is essential in establishing baseline infectious disease and HAI disease outbreak rates and in identifying problem areas Sydnor & Perl, 2011). According to the CDC (2006), the essential elements of an infectious disease surveillance system are standardized definitions, identification of patient populations at risk for infectious diseases, statistical analysis, and feedback of results to the primary caregivers.

Different methods of infection surveillance can be implemented by IPAC departments in healthcare facilities. Hospital-wide surveillance is a comprehensive, continuous survey of all the hospital units or wards to identify HAIs or communicable diseases (Sydnor & Perl, 2011). Prevalence surveillance is used to determine the number of active cases of a particular infectious disease (new and existing) in a given unit or ward during a specified period (Sydnor & Perl, 2011). Prevalence surveillance can be used in unit or ward infectious disease outbreaks to assess and monitor the situation. Targeted surveillance focuses on selected areas or units of the hospital,

selected patient populations, or selected organisms such *C. difficile,* MRSA, or VRE (Sydnor & Perl, 2011). Examples of targeted surveillance include *C. difficile* infection surveillance for ICU patients or surveillance of infections associated with specific devices (e.g., catheters).

In Canada and US, healthcare facilities post infectious disease rates for national comparison on the public health website (Horan, Andrus, & Dudeck, 2008; Sydnor & Perl, 2011). Proper surveillance techniques allow for the comparison of data across facilities, provinces, and territories. In Canada, infectious disease rates are posted by CNISP, which collaborates with the Public Health Agency of Canada and the Association of Medical Microbiology and Infectious Diseases Canada. Additionally, the Provincial Infectious Disease Advisory Committee (PIDAC) has created infectious disease prevention and control best practice documents, reports, and recommendations on matters related to infectious diseases, infection prevention and control (IPAC), and infectious disease surveillance (PIDAC, 2013a).

Numerous studies completed in Europe explored changes in the rates of HAIs following the introduction of HAI surveillance (Gastmeier et al., 2006; Gastmeier et al., 2008; Haley et al., 1985; Huang et al., 2006). The reviewed studies employed survey and observational designs. The implementation of infectious disease surveillance programs was associated with the reduction of HAI rates. Factors attributed to reducing the rates of nosocomial infections were changes to IPAC practices which were informed by feedback provided by infection surveillance systems (Brandt, Daschner, Rüden, & Gastmeier, 2006; Gastmeier et al., 2006; Gastmeier et al., 2008; Haley et al., 1985).

Hand Hygiene Compliance

For roughly 150 years, hand hygiene (HH) has been identified as one of the most important practices in the prevention and control of the spread of HAIs (Jarvis, 1994). Hand

hygiene includes hand washing with soap and water and cleaning hands with alcohol-based products (WHO, 2009). Evidence has shown that most pathogen transmissions are mediated by the hands of healthcare workers (Clements et al., 2008; Pittet et al., 2006). Hence, HH compliance is a major component of IPAC programs in healthcare institutions (Ducel et al., 2002; Yokoe et al., 2008).

In 2004, WHO launched the global HH program to reduce HAIs and improve patient safety. WHO (2009) recommends hand washing with soap and water or alcohol-based hand rub before an interaction with a patient, before an antiseptic procedure, after the risk of exposure to bodily fluids, after patient-environment contact, and after contact with a patient's surroundings. Although, the use of alcohol-based hand rub is one of the recommended methods for HH, there are studies suggesting that it is not sporicidal and only soap and water can remove spores from hands (Oughton, Loo, Dendukuri, Fenn, & Libman, 2009; Samore, Venkataraman, DeGirolami, Arbeit, & Karchmer, 1996). Therefore, the WHO favours the use of soap and water to clean hands (2009).

Despite HH practices being considered as fundamental for the prevention of HAIs, healthcare workers' compliance with HH policies has been identified as deficient (McGuckin, 2009; Pittet et al., 2006). Factors associated with poor HH compliance include increased workloads, high activity levels, understaffing, and skin irritation (Cimiotti, Aiken, Sloane & Wu, 2012; Clements, 2008; Erasmus et al., 2010). The CDC in the US (2002) recommended that healthcare personnel who have contact with high-risk patients should not wear artificial fingernails or nail extenders due to the association with infectious disease outbreaks of gram negative bacilli and Candida infections. However, minimal research has focused on the

association between artificial fingernails and the risk of spreading infectious diseases and infectious disease outbreaks.

A comprehensive systematic review of 96 studies was conducted on HH compliance rates among nurses, physicians, and other healthcare workers (Erasmus et al., 2010). The studies included in the review were conducted in industrialized countries, 55% of the studies were from Canada and the US combined. The majority of the studies (n = 65) were in the intensive care unit (ICU) setting. The studies used cross-sectional and before-after intervention design. Ninety percent of the studies used observation to measure HH compliance (Erasmus et al., 2010). The overall HH compliance rate of healthcare workers was only 40 percent, the unadjusted compliance rate for ICU varied from 30% to 40%, and the HH compliance rate for other units in the hospital varied from 50% to 60% (Erasmus et al., 2010). Erasmus et al. (2010) reported that most of the methods used in the studies were not robust and the studies were often not well reported. An interesting finding was that HH compliance rates were higher with "dirty tasks" than with "clean tasks", although the authors did not describe what constituted dirty or clean tasks. All of the studies used researcher-developed tools to measure compliance which may have affected the comparability of the findings. A standardized, valid instrument for HH compliance, which is presently not available, would improve the validity and reliability of the data collected. Erasmus et al. concluded that noncompliance with HH guidelines is a universal problem.

The common methodologies used to evaluate HH compliance are direct observation and the use of surveys. Each method has advantages and disadvantages. Direct observation is considered to be the gold standard for HH compliance assessment (Boyce, 2011; Sax, 2009; Steed et al., 2011), but it is limited because of the likelihood of the Hawthorne effect. The Hawthorne effect is defined as "an increase in worker productivity produced by the

psychological stimulus of being singled out and made to feel important" (Franke & Kaul, 1978, p. 1).

Hand hygiene compliance to reduce HAI rates has been explored as a way to prevent the transmission of HAIs in healthcare facilities. A Cochrane systematic review was completed to assess strategies used to improve HH compliance and to determine whether a sustained increase in HH compliance could reduce the rate of healthcare-associated infectious diseases (Gould, Chudleigh, Moralejo, & Drey, 2009). Of the two studies that were included in the Cochrane review, one was a randomized controlled trial and the other was a controlled clinical trial. The studies were conducted in the Republic of China and the United Kingdom, respectively. The primary intervention in both studies was education relating to universal infection control precautions and hand hygiene. Gould et al. (2009) reported a statistically significant post-intervention increase in hand washing up to four months after the intervention ($p < .05$). A post-intervention increase in HH compliance was not reported in the second study. In both studies, the interventions were poorly controlled and the study periods were short (less than six months). Therefore, the reviewers rejected these study findings based on methodological weaknesses (Gould et al., 2009).

Two recently published studies on HH compliance and the reduction of HAIs produced conflicting findings. One was an intervention study conducted in a teaching hospital in the US, with the aim of improving HH compliance and reducing HAIs (Kirkland et al., 2012). Multiple interventions were implemented during the study period (three years). These included the measurement of HH compliance (audits); leadership/accountability; feedback to all staff and the leadership team regarding HH compliance audits; hand sanitizer availability (product accessibility); education regarding HH to all staff; and marketing and communication to raise

staff awareness about HH (Kirkland et al., 2012). The primary outcome measure was monthly HAIs index rates, which were calculated by total occurrences of HAIs divided by inpatient days (Kirkland et al., 2012).

Because multiple interventions were implemented during the study period, it was difficult to evaluate the true impact of one intervention separately from the other interventions. Nonetheless, it was reported that HH compliance increased from 41% to 87%; HAI rates declined from 4.8 to 3.3 per 1,000 inpatients days; and the pairwise correlation coefficient between the HAI index and HH compliance rates for all healthcare workers was $r = -.65$ ($p < .001$). This moderately strong statistically significant inverse correlation between HH compliance and healthcare-associated infection rates indicates that as hand hygiene compliance increases, HAI rates decrease (Kirkland et al., 2012).

In the second study, the association between HH compliance rates and the incidence of hospital-acquired infectious diseases was determined in 166 acute care hospitals across Ontario, from 2008 to 2011 (DiDiodata, 2013). In Ontario, it is mandatory for acute care hospitals to publicly report the rates of healthcare provider HH compliance, MRSA bacteremias, and CDIs (DiDiodata, 2013). The HH compliance rate in 2008 was reported as between 54.3% and 69.1% before and after environment/patient contact, respectively. Hand hygiene compliance rates continued to improve in the subsequent years (2009-2011). In 2011, the rates before and after environment/patient contact were 79.6% and 87.8%, respectively (DiDiodata, 2013). However, there was no corresponding decrease in the MRSA rates compared with the 2008 rate, and the CDI rate decreased only in 2009 (Incidence Rate Ratio = 0.778; 95% CI = 0.0645 - 0.938; Didiodato, 2013).

Consequently, there was no statistically significant association between improved HH compliance rates and decreased HAIs rates (MRSA and CDI; DiDiodata, 2013). A limitation of the study was that the data were extracted from a secondary database, the Ontario Patient Safety Indicator Database (DiDiodata, 2013). Thus, the positive study findings might be due to unobserved confounding variables such as the frequency of audits, the HH products used, and the antibiotic used. The findings from the two studies suggest that the reduction of HAIs is multifactorial and that HH compliance is just one of the factors.

Evolution of the Care Bundle in Healthcare-Associated Infectious Diseases

A "bundle" is the name of a concept that has been championed by the Institute for Healthcare Improvement (IHI) in the US (2011). It was initially used to refer to device-related infections, such as ventilator-associated pneumonia and central line infections. A "care bundle" is defined as, “to bundle together several scientifically grounded elements essential to improving the clinical outcome" (IHI, 2011, para. 1). In other words, several scientifically supported, effective interventions are combined to improve the efficacy of the outcome.

Because the transmission of HAIs is complex and multifactorial, care bundles could be used in these situations instead of using individual interventions (IHI, 2011). Examples of interventions that have been bundled together to reduce HAIs include HH compliance, environmental cleaning, antimicrobial management, and IPAC education (Griffin, 2007; Muto et al., 2007).

Several empirical studies were evaluated in a systematic review, in which the effectiveness of interventions aimed at reducing HAIs through changing healthcare workers' behaviours were tested (Aboelela, Stone, & Larson, 2007). The review included 33 published studies which were reviewed for study quality using quality assessment tools which the author

stated had been adapted from previously published reviews (Aboelela et al., 2007). Study quality was determined by assessing the following domains: representativeness, bias and confounding, description of interventions, outcome assessment, and statistical analysis (Aboelela et al., 2007). The articles were scored on each of the five domains and final scores were calculated as percentages of the total score possible. The exact details of the critical appraisal tool used and the method of scoring were not reported (Aboelela et al., 2007). Four of the 33 studies were deemed high quality studies (scored > 80%) on the quality assessment tool. Among the studies included in the review, 51.5% (n = 17) were conducted in North America. The others were conducted in Europe (n = 7), South America (n = 5), and the Middle East or Asia (n = 4).

The behavioural interventions that were tested included educational programs; the formation of multidisciplinary quality assurance teams aimed at reducing infectious disease rates by influencing healthcare workers' behaviours; compliance monitoring; staff performance and/or compliance feedback; and staff skill development and testing (Aboelela et al., 2007). Significant reductions in HAIs and infectious disease colonization rates were reported for the four studies that received the highest quality scores ($p < .0001$; Aboelela et al., 2007). The details of how the outcome measures were tested were not reported in the review.

Changes in healthcare workers' compliance with infection control practices were reported in three of the four studies. In one of the three studies, significant increases in healthcare workers' HH compliance and device care (i.e., properly placing a gauze bandage over the catheter insertion site) were reported (86.69% pre-intervention to 99.24% post-intervention; relative risk = 1.14, 95% CI = 1.07 - 1.22, $p < .0001$). The interventions that were implemented were education, process control, and performance feedback. In the other two of the three studies, the researchers reported mixed findings (Aboelela et al., 2007). Overall, the evidence on

interventions aimed at changing healthcare workers' behaviours to improve compliance with infection control practices was not robust. The authors recommended that further and more robust studies needed to be conducted.

Impact of HAI Disease Outbreaks on Healthcare Professionals

Healthcare professionals are at the forefront of the prevention and control of HAI disease outbreaks in acute care hospitals. Although guidelines exist for HAI prevention in acute care facilities, there is a gap between what is recommended by experts and what is practiced in clinical settings (Goldmann, 2006; Horan et al., 2008). In most of the research exploring healthcare professionals and HAI disease outbreaks, the samples consisted of frontline nurses (Cimiotti et al., 2012; Hugonnet, Chevrolet, & Pittet, 2007; Stone et al., 2006).

One of the main challenges affecting the compliance with infection prevention and control (IPAC) guidelines was the lack of consistent adherence to IPAC protocols, which is attributed to high nurse-patient ratios, heavy nursing workloads, inadequate nurse staffing, and high hospital bed occupancies (Andersen et al., 2002; Boyce et al., 2011; Hugonnet et al., 2007; Stone et al., 2006). Additionally, quantitative studies examining the effects of HAIs on frontline nurses' workloads and staffing levels demonstrated that frontline nurses were challenged by understaffing, the rise in HAIs, and the resulting increase in IPAC measures (Clements et al., 2008; Dikema, Long, Scharff, & Weinert, 2007; Morgan, Neill, & Taylor, 2009).

In a recent study evaluating the role of nursing workload on the occurrence of HAIs, the "Nursing Activities Score" (NAS) instrument was used to evaluate frontline nurses' workloads (Daud-Gallotti et al., 2012). In the NAS, nursing workload is measured by daily evaluations of nursing activities that takes into account 23 items, divided into seven categories: monitoring and controls, respiratory support, cardiac support, renal support, metabolic support, and specific

interventions performed inside and outside the ICU. The nurses completed the NAS after each shift. The scoring for the instrument estimated the proportion of time that the nursing staff was required to spend assisting the patient during the work shift (Daud-Gallotti et al., 2012).

The study was conducted in a medical ICU. One hundred and ninety-five patients were followed from admission until discharge, the development of an HAI, or death. Forty-three of these patients (22%) developed HAIs, nineteen of these patients died during their hospital stays, and one hundred and fifty two did not acquire an HAI (Daud-Gallotti et al., 2012). The average NAS score and the average proportion of non-compliance with the nurses' patient care plans were significantly higher in patients with HAIs. The multivariate chi-squared analysis of the factors indicated that the factors that were significantly associated with acquiring an HAI were excessive nursing workload (OR: 11.41; 95% CI: 1.49 - 87.28, p = .019) and the severity of the patients' conditions (OR: 1.13; 95% CI: 1.02 - 1.24, p = .015), although the latter had a slightly lower strength of association. A strength of this study is that the NAS instrument is a valid scale that has been used to evaluate nurses' workloads which was adapted from the "Therapeutic Intervention Scoring System" instrument (Miranda, Nap, de Rijk, Schaufeli, & Iapichino, 2003). A limitation of this study was that an average NAS score was used to analyze nursing workload instead of the daily NAS score for each patient. The use of summary statistics, such as the mean, incorporates less information than individual values. Therefore, it can decrease the power of the statistical tests (Hulley, Cummings, Browner, Grady, & Newman, 2007).

A systematic review was conducted with 42 research articles to determine the strength of the evidence concerning the relationship between hospital staffing and patients' risk for acquiring HAIs in hospital (Weinstein, Stone, Pogorzelska, Kunches, & Hirschhorn, 2008). Of these studies, 90% examined nurse staffing and patient acquisition of HAIs. The study authors did not

identify the other healthcare professionals included in their research. The studies included cross-sectional and cohort research designs. The quality of the studies included in the systematic review was not reported. How hospital staffing was defined and scored was also not reported by the study authors. The most common HAIs reported were bloodstream infections (n = 18), pneumonia (n = 17), and urinary tract infections (n = 17). Of the studies that examined nurse staffing (n = 38), 45% (n = 17) reported a statistically significant association ($p < .05$) between nurse staffing variables (i.e., level of nursing, use of float nurses, and skill mix) and patient risk of acquiring HAIs. While in 18% (n = 7) of the studies, no significant associations were found (Weinstein et al., 2008). The statistical tests used to test the significance between the nurse staffing variables and the patient risk of acquiring HAIs were not reported for individual studies.

The authors noted that the use of nonpermanent staff was associated with increased rates of HAIs (Weinstein et al., 2008). An interesting finding was that physician staffing was not associated with an increased risk of patients acquiring HAIs. The correlation values were not reported nor were the levels of significance. Physician staffing and patient risk of acquiring HAIs were examined in only two studies (Weinstein et al., 2008). A limitation of this systematic review is that only published studies were included. Therefore, there is a chance of missing studies that may have negative outcomes that were not published. Secondly, the quality of the studies included was not reported. The lack of statistical information reported by the authors makes it difficult to determine the relevance of this work.

Emotional and Psychological Effects of HAI Disease Outbreaks

Another concept that has been examined in the literature is the emotional and psychological effects of HAI disease outbreaks on healthcare workers, especially following the SARS outbreak in 2003 (Maunder et al., 2006; Nickell et al., 2004; Robertson, Hershenfield,

Grace, & Stewart, 2004). Both qualitative and quantitative methods have been used to examine this concept. Based on the results of this research, the effects differ with respect to worker occupation and the risk perception of acquiring an infectious disease.

In general, the emotional and psychological effects of HAI disease outbreaks on healthcare workers include high levels of burnout, reduced patient contact, fear, psychological distress, and posttraumatic stress (Maunder et al., 2006; Nickell et al., 2004; Robertson et al., 2004). The SARS outbreak emphasized that emerging infectious diseases are a global problem in healthcare facilities. The sudden appearance and rapid spread of SARS led to research focusing on its psychological effect on healthcare workers. While SARS is no longer a threat, infectious diseases and HAI disease outbreaks remain a challenge in acute care facilities.

The Changing Nature of Healthcare Professionals' Daily Work

A recent study by Kaba (2011) explored the effect of HAIs on the changing nature of healthcare professionals' daily work in a multisite community-based hospital system in Ontario. The focus was on the perceptions of frontline nurses, healthcare executives, infection control professionals, and laboratory professionals. Respondents indicated that work had changed for all healthcare professionals because of the continued increase of healthcare-associated infectious diseases. Respondents were also affected by the "proliferation of infection control policies and an increase in data management and data-based decisions" (Kaba, p. 140).

Kaba (2011) concluded that the increase in healthcare-associated infectious diseases in Ontario from 2004 to 2011 presented major challenges for healthcare professionals. For example, keeping current with and implementing new best practices, IPAC policies and protocols, and implementing the MOHLTC mandated transparency in public reporting. Kaba (2011) noted that, despite efforts by healthcare facilities, infectious disease outbreaks continued to occur. The field

epidemiologist from the Public Health Agency of Canada emphasized the need to determine whether there were particular problems with infection prevention methods or if active surveillance had led to the sudden upswing of HAI cases ("Ontario calls", 2011).

The focus of the current study is on the impact of HAI disease outbreaks on the daily work of healthcare professionals in one urban acute care hospital in Ontario. Based on the data presented in this literature review, the incidence of HAIs in Ontario healthcare facilities has increased over the past decade. The various approaches acute healthcare facilities have implemented to control and prevent HAIs and HAI disease outbreaks have been highlighted. However, there is little research focusing on how HAIs, HAI disease outbreaks, and the volume of IPAC initiatives have impacted on the daily work of healthcare professionals, particularly in acute care.

CHAPTER 3: METHODOLOGY

In the following chapter, the study design and methodological procedures are presented. Exploratory case study design was used in the current study. A detailed description of the study design, study setting, study sample, ethics board approval, data collection, data analysis, and rigour are provided.

Exploratory Retrospective Case Study Design

Case study design promotes the exploration of a phenomenon within its context (Yin, 2009). Case study methodology is based on the constructivist paradigm (Stake, 1995; Yin, 2009). The underlying assumption of the constructivist perspective is that the truth is subjective and based on one's experiences (Stake, 1995; Yin, 2009). However, the case study is influenced by interactions with people and historical and cultural norms (Creswell, 2007). Cases are studied in the context of people's lives and work and are based on the participant's perspective (Yin, 2009). One important concept of the case study method is that the phenomenon under study cannot be separated from the context in which the phenomenon is found (Yin, 2009). Miles and Huberman (1994) defined case as "a phenomenon of some sort occurring in a bounded context. The case is, “in effect, your unit of analysis” (p. 25).

A case study may be the descriptive, explanatory, or exploratory analysis of a person, group, or event (Yin, 2009). Exploratory retrospective case study design was used in the current study. This method is appropriate to answer the how, why, and what questions regarding a phenomenon (Yin, 2009). The present study sought to answer the following question: How have HAI disease outbreaks impacted the nature of healthcare professionals' daily work in an acute care facility?

A case is the object being studied. It can be an activity, an incident, or a person and is bound by a specific time and a specific place (Yin, 2009). The case or unit of analysis in this research study was each of the various healthcare professionals involved in the provision of healthcare during HAI disease outbreaks. The cases were bounded by time (2008-2012) and place (one acute care hospital in Ontario).

Compared to other qualitative methodologies, a unique strength of the case study method is the use of multiple sources of evidence (Yin, 2009). For example, individual and focus group interviews, documents, and observations (Stake, 1995; Yin, 2009).The three data collection strategies used in this study were semistructured individual interviews, document review, and infection rates.

Yin (2009) suggested that propositions can be used in case studies to focus the direction and scope of the research. Propositions reflect the researcher's assumptions or expectations regarding the research findings. Study propositions can be formulated from the literature, personal and professional experience, or theories (Yin, 2009). However, propositions are not feasible within an exploratory study (Yin, 2009). In an exploratory study, the researcher is seeking to discover and to understand the true nature of a phenomenon and the context in which it is situated. This type of research should be directed by the study's purpose (Yin, 2009). The current study was guided by the study's purpose, objectives, and research question as previously described (see Chapter 1).

The purpose of this study was to examine healthcare professionals' perceptions of the impact of HAI disease outbreaks on their daily work in one urban acute care hospital. The case study method was ideal for this purpose, given that this was a person-specific (healthcare professionals) and context-dependent (the acute care facility) study. The phenomenon of interest

was the impact of HAI disease outbreaks on the nature of the daily work of healthcare professionals.

Study Setting

The study was conducted in one acute care facility in Ontario, a teaching centre that provides emergency, acute, and mental healthcare to patients in Ontario. The acute care hospital has a bed capacity of 439, a total of 1,467 registered nurses (RNs) and registered practical nurses (RPNs), 8 ICPs, and 300 EVS staff. The participants in this study were from the hospital surgical, medical, nephrology, and psychiatric units.

This particular acute care facility was selected because it has experienced a number of HAI disease outbreaks since 2009. During one of the HAI disease outbreaks, it was reported that 16 patients succumbed to *C. difficile* infections (Walters, 2011). The healthcare facility conducts vigilant surveillance for infectious diseases and has implemented IPAC interventions for HAI disease outbreaks. However, research to examine how these interventions have affected the daily work of healthcare professionals has not been undertaken. Research exploring the impact of HAI disease outbreaks on the daily work of healthcare professionals was not found in the reviewed empirical or grey literature.

Study Sample

In an exploratory retrospective case study design, the objective is to obtain the greatest possible amount of information on a given problem or phenomenon (Yin, 2009). The selection of cases using purposeful sampling is the most appropriate strategy. The aim is to select cases with rich information because the typical or average case does not always have the richest information (Yin, 2009). Purposive sampling is a form of nonprobability sampling that involves searching for

specific cases or participants to be interviewed (Patton, 2002). Purposive sampling was used to select participants for this study.

Purposive sampling, specifically snowball sampling, facilitated the identification of case selection within the acute care facility (Yin, 2009). Snowball sampling relies on participant recommendations for further data sources to obtain rich information (Creswell, 2007). The sampling was aimed at identifying critical cases (Yin, 2009). Critical cases refers to identifying either the most likely or the least likely cases, that is, cases likely to either clearly confirm or irrefutably falsify the study's research question (Yin, 2009). In this case study, 37 participants were interviewed to reach data saturation. The cases included were 23 frontline nurses, five ICPs and the ICP manager, five clinical managers, and two EVS staff and the EVS manager.

Ethics and Confidentiality

The Hamilton Integrated Research Ethics Board provided ethical approval for the present study, following minor revisions to the study protocol and written materials. As is required by all student research, ethical approval was also granted from the McMaster University, Faculty of Health Sciences Research Ethics Board in July 2012. The participants were given and asked to read an information letter as part of the informed consent form (see Appendix D). In the informed consent form, the purpose of the study was described and it was reiterated that no harm or risks were associated with participating in the study. In the informed consent form, it was advised that confidentiality would be maintained and that the participants had the right to withdraw themselves or their data from the study at any time without repercussions. Prior to conducting the semistructured interviews, participants signed two copies of the informed consent form, one to keep for their files and one copy for the researchers' files. Study participants were

advised that a copy of the study results would be made available to them upon completion of the study.

All personal information such as names, email addresses, and telephone numbers were removed from the data collection material. Personal information was replaced with unique identification numbers on all data collection materials to ensure participant anonymity. A list linking the unique identifying numbers with the participants' names was kept in a secure place, separate from the interview data. Audiotapes, digital audio files, and transcripts from participant interviews were kept in locked file cabinets in the Nursing Health Services Research Unit (NHSRU) at McMaster University during the project. Data from the demographic data forms were kept anonymous, the hard copies were locked in file cabinets in the NHSRU, and the results were aggregated to ensure that the participant's responses could not be identified.

Confidentiality was protected. All participant interviews were conducted behind closed doors in designated rooms in the hospital and were audio-taped after participant approval had been granted. The electronic interview recordings and the interview transcripts were stored on a password-protected computer with access limited to the research team for the course of the study. All hard copies of the study material were kept in a locked cabinet in the NHSRU at McMaster University during the project and will be confidentially shredded in 10 years. All data on the computer will be permanently deleted in 10 years.

While there were no specific benefits or risks to participating in this study, it was explained to the participants that their participation would better their understanding of how healthcare professionals' daily work has been impacted by HAI disease outbreaks. The participants received a thank you letter for participating in the study (see Appendix E).

Data Collection

Recruitment of the Study Sample

To recruit the sample of interest, the manager of the Infection Prevention and Control (IPAC) Department was contacted during the early planning stages of the study. The IPAC manager was asked to help identify the study sample and act as the local principal contact for the study. Potential participants or cases selected for interviews were frontline nurses, clinical managers, ICPs, and EVS staff and manager. The sample was of either gender, of any age, fluent in English, and willing to participate in the study. The participants had to be employed at the acute care hospital and involved in at least one of the HAI disease outbreaks.

All unit clinical managers in the hospital were sent an introductory email describing the study purpose, the objectives, the potential participants required, and the proposed methods of data collection (see Appendix A). The unit clinical managers interested in participating in the study responded by email, suggesting methods to recruit the participants. Generally, the unit clinical managers scheduled a meeting time for the interviews and recruited frontline staff willing to participate in the study. During the interviews, if a participant recommended that a particular person be recruited into the study, because he/she had critical information regarding the phenomena of interest, the person would be contacted and an interview would be scheduled.

Incidence of HAIs

Cumulative data regarding the incidence of HAIs was obtained from the Infection Prevention and Control Department in the acute care hospital. These data included mandatory reportable data about infectious diseases from 2008 to 2012 that were sent monthly to the MOHLTC and data from HAI disease outbreaks in 2010-2011 and 2012. These data were used to

calculate the incidence of specific MRSA, VRE, and *C. difficile* infections and HAI disease outbreaks.

Demographic Data Form

The demographic data form used in this study was adapted from the "College of Nurses of Ontario Membership Survey" (2009). Prior to the semistructured interviews, 37 participants completed the demographic data form (see Appendix B). Participants included 23 frontline nurses, five ICPs and an ICP manager, five clinical managers, and two EVS staff and an EVS manager. In the demographic data form, the researchers asked for information on the participants' occupations, education, employment status, history of work experience, age, and gender.

Semistructured Individual Interviews

Interviews are considered the most important strategy for data collection in a case study (Merriam, 1998; Yin, 2009). Gangeness and Yurkovich (2005) described interviews as the "backbone of data sources in case study research" (p. 15). Good interviewing techniques, such as establishing rapport, following leads, and demonstrating interest, are important to obtain quality data during interviews (Partington, 2001). Some of the limitations of interviewing are that the interviewee's responses are subject to individual bias, inaccurate articulation, and recall bias (Yin, 2009). Therefore, Yin (2009) recommends corroborating interview data with data from multiple sources.

In this study, semistructured individual interviews were used to provide evidence of embodied, subjective perceptions of how healthcare professionals' daily work has been impacted by HAI disease outbreaks (Gangeness & Yurkovich, 2005; see Appendix C). In this case study, 37 individual tape-recorded interviews were conducted. In the majority of the interviews, a

second researcher was present to take field notes with which the coded, transcribed interviews were compared for accuracy. The interviews were scheduled during the working hours of the 37 participants. The unit clinical managers prearranged for available frontline staff to be interviewed and prearranged a conference room or small meeting room for the interviews.

The same interview protocol was followed for each interview and included introductions; a review of the combined participant information letter and informed consent form, including affirmation of privacy and confidentiality processes for data files; and clarification of any participant questions or issues. The informed consent form was then signed by the participant and witnessed by the researcher. A copy of the completed and signed informed consent form was given to the participant and the researcher kept the second signed copy of the informed consent form.

In addition, the participants completed the demographic data form prior to the interview (see Appendix B). A semistructured interview guide, with probes, was used during the interviews. This allowed depth to be achieved by providing an opportunity for the interviewer to probe and expand the participants' responses (Creswell, 2007). The timing of the digitally tape-recorded individual interviews ranged from 40 to 60 minutes. Field notes were taken by a second researcher for the purpose of cross-validation with the transcribed interview transcripts. After each interview, the research team held debriefing meetings to discuss the interview process, the initial perceptions of the interview content, and the evolving themes emerging from the interviews. Each interview recording was transcribed verbatim and the data were saved in a folder on a password-protected computer.

Document Analysis

Document analysis is used in combination with other research methods as a means of data triangulation in qualitative research (Bowen, 2009; Miller & Alvarado, 2005). Documentary information can be used to provide data on context, gather information to generate questions and supplement research, and track relevant changes (Bowen, 2009). According to Yin (2009), documents are useful in providing data to corroborate information from other sources. In this study, the acute care hospital policies and protocols specific to HAIs and HAI disease outbreaks were reviewed in depth and analyzed. In addition, grey literature sources were reviewed and analyzed, including provincial government reports and best practice guidelines related to HAI disease outbreaks.

Data Analysis

Incidence of HAIs and HAI Disease Outbreaks

Anonymous, aggregated cumulative incidence data was made available from the IPAC department in the study setting. Descriptive statistics were generated for HAIs: MRSA, VRE, and *C. difficile* specifically during periods of HAI disease outbreaks (2008 to 2012). Five graphs were generated and analyzed using the data provided (see Appendix E). In the first graph, the incidence rates of *C. difficile*, MRSA, and VRE infections, from 2008 to 2012, were analyzed and graphed per 1,000 patient days. In the second graph, the incidence of *C. difficile* infections per 1,000 patient days in 2010 was analyzed and graphed. In the third graph, the incidence of *C. difficile* infections per 1,000 patient days in 2012 was presented. In the fourth graph, the incidence of VRE infections per 1,000 patient days in 2011 is presented and in the fifth graph, the incidence of MRSA infections in 2011 and 2012 are presented.

Demographic Data Form

The participants' demographic data were entered into the computer statistical analysis program "SPSS Base 19.0 for Windows" (SPSS Inc., 2013). Descriptive statistics, frequencies, and measures of dispersion and central tendency were used to analyze the data. The demographic data were used to describe the sample and supplement the qualitative findings on the workforce characteristics of the participants.

Qualitative Semistructured Interviews

Data collection and data analysis of the individual interview data occurred concurrently. Data analysis included organizing and managing the transcribed interview data for data analysis. The audio-taped interviews were transcribed verbatim and imported into "NVivo Version 10 Qualitative Data Analysis Software" (NVivo, 2012). NVivo is a qualitative data management (QDM) software program that enables the researcher to format transcripts, identify text that requires coding, attach codes to the text, and retrieve identified segments of the text with greater ease when required for direct citation. For each transcript, the constant comparative method and thematic analysis were used to guide the identification and exploration of themes emerging from the data (Hsieh & Shannon, 2005).

The process of data reduction began with open coding. All transcripts were read and then re-read to identify possible meanings and concepts existing in the data. Open coding is the stage of data analysis in which initial categories, subcategories, and their properties are identified from the raw data (Strauss & Corbin, 1998; Walker & Myrick, 2006).

The transcribed data were analyzed and compared with the field notes taken during the interviews. Initially, three randomly-selected transcripts from each subgroup of participants were coded independently by two members of the research team to determine the reliability of the

coding process. While the researchers coded the majority of the transcripts alike, a small number of selected codes were slightly different. Agreement with the coding choices made by the researchers was reached through discussion. The committee members met regularly to discuss the emerging themes and to interpret the data to promote the rigour of the study. Concepts emerged from the data and the researchers interpreted the structure and relationships of these concepts through constant comparison (Patton, 2002; Strauss & Corbin, 1998).

A data analysis journal was maintained to track the progress of the analysis. The journal entries included an on-going discussion of the emerging themes, the categories and subcategories of the themes, and all decisions made throughout the data analysis. A list of the thematic codes was developed and the codes were combined to form categories (Miles & Huberman, 1994). Data were collected until thematic saturation occurred. Thematic saturation occurs when the researcher is no longer hearing or seeing new information emerging from the data (Miles & Heberman, 1994). All members of the research team agreed on the final themes and conclusions that were made based on the data.

Document Analysis

Analysis of selected documents involved exploratory examination of infection prevention and control (IPAC) policies and protocols specific to HAIs and HAI disease outbreaks. Relevant documents selected for analysis were agreed upon by the research team and were provided by the manager of the hospital Infection Prevention and Control Department. The selected documents were reviewed for their overall content regarding IPAC, IPAC procedures, policies, and protocols and recommendations made by the document author(s).

In the process of document analysis, documents cannot be analyzed outside of their original context (Bowen, 2009; Silverman, 2006). Therefore, examination of the documents

provides a contextual understanding of IPAC policies within the context of how HAI disease outbreaks have impacted healthcare professionals' daily work. Findings from the documentary sources were used to develop converging or diverging lines of inquiry by corroborating the findings from the qualitative semistructured interviews (Miller & Alvarado, 2005; Yin, 2009). The findings from the documentary sources were integrated into the findings section of this document. The documents were analyzed for either convergence or divergence from the interview findings. This approach promotes the corroboration of data sources and strengthens the overall findings by means of data triangulation (Bowen, 2009; Silverman, 2006).

Rigour

Study rigour is addressed by examining three criteria in qualitative research: credibility, transferability, and reliability (Creswell, 2007; Koch, 2006). Credibility is described as the assessment of how true the data are to the phenomenon of interest, meaning that the perception of how healthcare professionals' daily work has been impacted by HAI disease outbreaks is truly represented and not fabricated by the researcher (Creswell, 2007). During the interviews, the participants were encouraged to express their perceptions through a climate of openness, thus providing a true representation of the study topic. To ensure a high quality study, a study must include the triangulation of multiple sources of data to shed light on the themes (Yin, 2009). Individual face-to-face interviews were the primary data source for this study. Document analysis and the analysis of the incidence of HAIs and HAI disease outbreaks provided additional support for the interview findings.

Transferability refers to the degree in which data can be utilized in a similar context (Creswell, 2007). In order for readers to judge the transferability of the study's findings to their contexts, the study setting, main phenomenon under examination, and study participants have

been described in depth. The impact of HAI disease outbreaks on healthcare professionals' daily work is an important issue that could be studied in many healthcare facilities, and the findings of this study could be transferred to a similar context.

The reliability of a study is dependent on the consistency and reproducibility of the research design and analysis (Miles & Huberman, 1994). To ensure the reliability of a study, Yin (2009) recommends maintaining a chain of evidence. A record was maintained of the current study via consistent journaling by the researcher. Field notes and memos created during data collection and analysis were the methods used to keep a record of discussions and decisions made throughout the study(Koch, 2006). A record of the coding scheme and the interpretative processes used in the data analysis comprised the audit trail (Strauss & Corbin, 1998). A record of the committee meetings, meeting agendas, meeting minutes, and each subsequent draft of the thesis provide the chain of evidence.

CHAPTER 4: FINDINGS

In this chapter, the study findings are presented. The chapter sections include a description of the demographic data; a description of the incidence of *C. difficile*, MRSA, and VRE from 2008 to 2012; a description of emerging themes from the semistructured interview data; and a description of documentary sources of infection prevention and control policies and practices.

Demographic Data

Demographic data were collected from 37 participants: 23 frontline nurses, five clinical managers, six ICPs, and three EVS staff (see Table 1, Appendix F). Most of the participants were female (n = 36, 97.3%); only one participant was male (2.7%). The average age of the participants was 40.3 years (SD = 10.3, Mdn = 43.0 years). The average age for the various cohorts was 36.5 years (SD = 10.4 years) for registered nurses (RNs); 46.5 years (SD = 3.5 years) for registered practical nurses (RPNs); 46.4 years (SD = 4.6 years) for clinical managers; 44.8 years (SD = 11.1 years) for ICPs; and 47.0 years (SD = 10.0 years) for EVS staff. The highest level of education reported was a master's degree (n = 1); the lowest was a diploma (n = 19; see Table 4, Appendix F).

The majority of participants were employed in full-time positions (n = 33, 89.2%); only four (10.8%) were employed in a part-time capacity (see Table 5, Appendix F). The average number of years of work experience in their current occupations was 10.9 years (SD = 8.8 years) for RNs; 14.0 years (SD = 12.7 years) for RPNs; 18.7 years (SD = 10.6 years) for clinical managers; 11.6 years (SD = 10.4 years) for ICPs; and 14.7 years (SD = 11.6 years) for EVS staff (see Table 6, Appendix F). The average number of years participants had been in their current positions was 8.7 years (SD = 8.2 years) for RNs; 3.5 years (SD = 2.1 years) for RPNs; 3.5 years

(SD = 3.1 years) for clinical managers; 4.6 years (SD = 4.3 years) for ICPs; and 3.7 years (SD = 4.6 years) for EVS staff (see Table7, Appendix F). The average number of years of employment at the study setting for all participants was 10.2 years (SD = 8.5 years; see Table 8, Appendix F).

In summary, the findings of the demographic data indicate that the healthcare professionals in the study setting are a stable workforce: 89.2% of the healthcare professionals have full-time employment, the average number of years at their current occupation was 12.5 years, and the participants were employed at the study setting for an average of 10.2 years.

Incidence of MRSA, VRE, and *C. Difficile* in the Study Facility

One of the objectives of this study was to describe the incidence rates of HAIs at the study site from 2008 to 2012. An incidence rate is defined as the number of new cases of infections that develop during a specific time, divided by the size of the population under consideration (Hulley et al., 2007). The aggregated cumulative, anonymous data were obtained from the Infection Prevention and Control Department at the acute care facility. The incidence rates included both colonizations and infections of MRSA, VRE, and *C. difficile*.

The incidence rates of the *C. difficile*, MRSA, and VRE infections were reported per 1,000 total patient days for the whole hospital. Total patient days is defined as the sum of the number of days during which services were provided to all inpatients during the specific time period (PHAC, 2012b). The overall incidence rate per 1,000 patient days from 2008 to 2012 for MRSA varied from 0.97 to 1.56. From the beginning MRSA incidence rate in 2008 (0.97 per 1,000 patient days), the incidence rate increases slightly in 2009, and then rises sharply in 2010 (to 1.42 per 1,000 patient days). The incidence rate slows from the previous rates, but still increases in 2011 (to 1.56 per 1,000 patient days), and decreases again in 2012 to below the 2010 incidence rate (1.30 per 1,000 patient days; see Figure 1, Appendix G). The incidence rates for

C. difficile infections were reported to be less than the MRSA and VRE incidence rates in 2008 and 2009, and varied between 2008 to 2012 from 0.6 to 1.0 per 1,000 patient days. The *C. difficile* incidence rate then increased sharply in 2010, which is the first reported *C. difficile* outbreak, to above the VRE incidence rate, and then slowly decreased from 2010 to 2012, but did not decrease to the 2008-2009 levels. Following the sharp rise in 2010, the decreasing trend in *C. difficile* incidence since then indicates that the facility is making some progress in controlling this infectious disease; however, a *C. difficile* outbreak was declared in July 2012.

Compared with the MRSA and *C. difficile* incidence rates, the VRE incidence rate was higher than the incidence rates of both of these infectious diseases in 2008 (1.37 per 1,000 patient days). The VRE incidence rate decreased sharply in 2009 (0.69 per 1,000 patient days), remained approximately the same in 2010, rose slightly in 2011, and decreased sharply in 2012 to its lowest levels (0.33 per 1,000 patient days). This trend indicates that the facility has made good progress in preventing and controlling VRE infections (see Figure 1, appendix G). Comparing the incidence rates of these three infectious diseases in 2012, MRSA remained higher than the other two infectious diseases, VRE had the lowest incidence rate, and the *C. difficile* incidence rate fell between the incidence rates of the other two infectious diseases. The incidence rates for all three infectious diseases were lower than their peak incidence rates, which again indicates progress for the facility in the implementation of infectious disease prevention and control policies and protocols.

The study healthcare facility experienced two *C. difficile* facility-wide outbreaks in 2010-2011 and 2012. The *C. difficile* infection incidence rate at the month the outbreak was declared (November) in 2010 was 3.03 per 1,000 patient days, which is very high when compared with the hospital's average incidence rate for the year (1.00 per 1,000 patient days) and when

compared with the provincial benchmark (0.40 per 1,000 patient days; see Figure 2, Appendix G). This is the highest incidence rate the study facility experienced in the last five years. The subsequent facility-wide *C. difficile* infection outbreak was in July 2012. The incidence rate was 1.49 per 1,000 patient days when the 2012 infectious disease outbreak was declared, which was lower than the incidence rate when the 2010 infectious disease outbreak was declared, but slightly higher than the 2012 incidence rate of 0.83 per 1,000 patients days (see Figure 3, Appendix G).

Between February and November, 2011, the hospital experienced a total of eight VRE unit-based infectious disease outbreaks. The overall incidence rate per 1,000 patient days for VRE in 2011 was 0.77 per 1,000 patient days; which is only slightly higher than the provincial benchmark for VRE, which was 0.57 per 1,000 patient days (CNISP, 2011). The VRE incidence rate fluctuated during this time period (see Figure 4, Appendix G). This finding suggests that the patients with VRE infections were clustered in certain units, resulting in unit-based infectious disease outbreaks. The facility also experienced four unit-based MRSA outbreaks from July 2011 to August 2012. The MRSA incidence rate per 1,000 patient days during this period varied from 1.04 to 2.00 per 1,000 patient days, which varied from lower than to slightly higher than the provincial benchmark for MRSA (PHAC, 2012b), which was 1.21 per 1,000 patient days (see Figure 5, Appendix G). The MRSA incidence rate remained higher than the incidence rates for the two other infectious diseases that were tracked during this time period, *C. difficile* and VRE. The MRSA incidence rate in 2012 was lower than it was in 2011, which may suggest that the facility was successful in the implementation of their infectious disease prevention and control policies and protocols.

In summary, there was improvement, that is, a decrease in the incidence rates of the three tracked infectious diseases, *C. difficile*, VRE, and MRSA. However, more research needs to be completed to determine the contributing factors to high incidence rates leading to infectious disease outbreaks and the contributing factors that led to a decrease in the incidence rates.

Document Analysis

The third objective of this study was to analyze the infection prevention and control policies and practice protocols related to healthcare professionals' daily work and HAI disease outbreaks. The facility infection prevention and control policies and protocols were made readily available by the infection prevention and control manager. For this study, the facility HAI and HAI disease outbreak policies and protocols and the "Best Practices for Infection Prevention and Control Programs in Ontario: In All Health Care Settings" (PIDAC, 2012a) were selected for review.

A total of 40 infection prevention and control policies and protocols from the study facility and the Ontario provincial best practices guidelines were selected based on their relevance to the study objectives and purpose (see Appendix I). The facility infection prevention and control policies have been revised by the facility on a yearly basis, while the infection prevention and control protocols have been frequently reviewed in a response to infectious disease outbreaks and the current provincial guidelines. Thus, the documents were analyzed with reference to the cultural contexts of the acute care facility. The documentary findings were integrated into the interview findings, cross-validating the similarities and differences of the interview findings (Bowen, 2009).

Summary of the General Findings - Common Themes

The following is a description of the common findings from the semistructured individual interviews with frontline nurses, clinical managers, ICPs, and EVS staff. The findings demonstrate that daily work has changed for all healthcare professionals because of the emergence of HAI disease outbreaks, the increased incidence of HAIs, and the subsequent continual increase of IPAC policies, protocols, and practices. Additionally, the expansion of hospital infrastructures led to a proliferation of protocols, policies, and innovations regarding the prevention and control of infectious diseases.

Healthcare professionals' common themes include education of hospital staff, patients, and families; increased incidence of healthcare-associated infectious diseases; comparison of the 2010-2011 and 2012 HAI disease outbreaks; comparison of facility-wide and unit-based HAI disease outbreaks; healthcare professionals' perceptions of each other; stress and blaming during HAI disease outbreaks; innovations to clinical practice regarding IPAC; and IPAC protocol and policy reviews.

Education of Hospital Staff, Patients, and Families

Participants reported an increase in the amount of education they must provide and participate in regarding HAI prevention, which increases during HAI disease outbreaks. Participants reported that they participate in "huddles". Huddles are brief meetings that are held twice per day during infectious disease outbreaks and weekly during nonoutbreak periods to update the healthcare team on infectious disease issues. One participant elaborated,

> The daily unit huddles during infectious disease outbreaks are, on average, 15 to 20 minute meetings on specific hospital units where vital information regarding infectious

diseases is shared, necessary infection prevention and control practices are reiterated, and quick questions about infectious diseases can be asked and answered.

Infection control professionals and clinical managers reported the increased need to provide education to all hospital staff through formal organized in-service sessions, unit huddles, telephone calls, or other means of targeted communication. During infectious disease outbreaks, the in-service sessions are more frequent and are specific to the infectious disease outbreak. Education in the in-service sessions is tailored to reinforce compliance with IPAC protocols and policies. The topics for formal educational in-services are based on specific and evolving infectious disease organisms or the hospital's IPAC policies and protocols.

All of the healthcare professionals reported they were involved in educating patients, patients' families, and patients' visitors about infection control measures to prevent and control the transmission of infectious diseases. One nurse remarked, "During [infectious disease] outbreaks, we spend a lot of time educating patients' families and visitors about the necessity of infection control, patient isolation, and the use of personal protective equipment."

Increased Incidence of Healthcare-Associated Infectious Diseases

Some healthcare professionals noted that the number of infectious disease cases and the number of patients requiring isolation precautions had increased over the past five years. One ICP stated,

> When I began working in the hospital in 2000, there might have been 30 patients in isolation rooms on any given day. Currently, the number of patients requiring isolation rooms is approximately three times that number, on any given day.

The participants attributed the increase in infectious diseases to the emergence of new antibiotic-resistant organisms, the increased vigilance in monitoring infectious diseases, and

improved screening of HAIs and infectious diseases. However, some of the respondents perceived that the incidence of HAIs had not increased. Rather, they emphasized that there was more surveillance of infectious diseases and greater attention from the media, which led to heightened public awareness of infectious diseases and HAIs (e.g., *C. difficile*). One frontline nurse said,

> I think we [nurses] are screening people for infections more, whereas before, we weren't. So, for example, everyone that walks into our unit for admission is screened for MRSA and VRE. We never used to do that. So, obviously, that is bringing more awareness to HAIs because, the more we screen for infections, the more likely we are to find more infections. We are screening patients right away as soon as someone has loose bowel movements.

Thus, some participants argued that the incidence of HAIs had not increased, rather that more community-acquired infectious diseases were being observed on admission to healthcare facilities.

All participants agreed that the workload had increased because of infectious diseases. One clinical manager commented,

> We have seen increased patients with *C. difficile* [infections], but that is everywhere. We have so many patients who come to the hospital with community-acquired *C. difficile*…. It has been on the news for [infectious disease] outbreaks, but I don't honestly think that this hospital is unique to other hospitals.

There was some concern about the proliferation of infectious diseases. The participants reported that the emergence of new antibiotic-resistant organisms is more common now than in the past

five years. Participants cited the example of the most recent new organism, carbapenem-resistant enterobacteriaceae (CRE).

Comparison of the 2010-2011 and 2012 HAI Disease Outbreaks

The study site has experienced two facility-wide HAI disease outbreaks, one in 2010-2011 and the other in 2012. Participants reported that during the 2010-2011 infectious disease outbreak, all isolated patients were assigned to rooms in one specified area of each hospital unit. Frontline nurses from that unit were assigned to the specified isolation area, caring solely for patients who were in isolation. These frontline nurses were not assigned to nonisolated patients. The nurses assigned solely to patients in isolation reported that it was a difficult situation. This was largely because of the complex and time-consuming care each patient required. This assignment practice was changed following the 2010-2011 infectious disease outbreak. During the 2012 infectious disease outbreak, patients in isolation were not confined together in a specific area of the unit but were placed in isolation in private rooms throughout the unit and frontline nurses were assigned to care for both isolated and nonisolated patients. One participant observed,

> During the 2010-2011 outbreak, patients with the same infectious disease were routinely cohorted [assigned to the same room] in two- or four-bed rooms. During the 2012 [infectious disease] outbreak, and currently, the cohorting of patients with the same infectious disease is no longer done.

Most of the participants described that the 2012 facility-wide *C. difficile* infectious disease outbreak was shorter (it lasted a month) and less severe than the 2010-2011 infectious disease outbreak. The participants attributed the shorter duration of the infectious disease outbreak to infection prevention and control (IPAC) policies and practices that were instituted during and following the 2010-2011 infectious disease outbreak. IPAC policies and practices that

were instituted during the 2010-2011 infectious disease outbreak included patient-dedicated equipment, strict utilization of PPE, the use of private rooms for isolation, and higher expectations for HH compliance. One ICP confirmed this information,

> In the 2012 [infectious disease] outbreak, the hospital began infection control and containment from a position of greater strength because of the many [infectious disease] preventive measures that had been implemented after the 2010-2011 *C. difficile* outbreak and were sustained through the 2012 [*C. difficile* outbreak].

One of the clinical managers corroborated this information, "After the 2010-2011 *C. difficile* outbreak, there were consistent processes and improved communication among hospital departments and the [hospital] senior management team." The ICPs and clinical managers noted that, during the 2012 infectious disease outbreak, there was increased involvement and support of infection prevention and control practices by the senior management team at the hospital. The team was "not looking to blame" during the 2012 infectious disease outbreak. Rather, it was looking at how "to change and move forward" with the aim of preventing and controlling HAIs and HAI disease outbreaks.

The participants reported that during the 2012 *C. difficile* outbreak, there were clear infection control environmental and equipment cleaning guidelines and processes to be implemented during infectious disease outbreaks. These infection control guidelines and processes were not available during the 2010-2011 infectious disease outbreak. One participant made an interesting observation regarding the two infectious disease outbreaks, "It [comparing the 2010-2011 to the 2012 outbreak] is like comparing night and day." An EVS staff member commented further,

> During the 2012 HAI disease outbreak, we had faster and better responses from all staff in the facility. Unlike the 2010-2011 HAI disease outbreak, in which no one knew what was expected of them. During the 2012 [infectious disease] outbreak, we were able to bring [infection control] resources to bear from all the learning we have had over the years [from the 2010-2011 infectious disease outbreak to the 2012 infectious disease outbreak].

Comparison of Facility-Wide and Unit-Based HAI Disease Outbreaks

In addition to comparing the 2010-2011 and the 2012 *C. difficile* outbreaks, the study participants also compared facility-wide infectious disease outbreaks to unit-based infectious disease outbreaks. Participants reported that the unit-based infectious disease outbreaks were usually caused by MRSA, VRE, and norovirus and rarely drew media attention. The participants indicated that when there was a unit-based infectious disease outbreak, the infection prevention and control interventions to control and overcome the infectious disease outbreak were localized to that unit only, and often these outbreaks were short-lived, lasting less than a month. When facility-wide infectious disease outbreaks occurred, there was a wider implementation of IPAC practices and protocols across the entire facility, which impacts all healthcare professionals.

The participants reported that, for the last three years, the facility-wide infectious disease outbreaks at the hospital were caused by *C. difficile* infections. All healthcare professionals cited increased scrutiny and attention by the hospital administration, the public, and the media during facility-wide infectious disease outbreaks. They agreed with one ICP who stated that when a facility-wide infectious disease outbreak occurs, "The hospital public affairs department informs the media in a timely manner [about the infectious disease outbreak] to avert discovery of the

[infectious disease] outbreak by the media on their own and unnecessary speculation [by the media and the public]".

Healthcare Professionals' Perceptions of Each Other

Participants provided information about how they viewed one another. The ICPs reported that the workloads of nurses had been impacted by HAIs and HAI disease outbreaks more than the workloads of other healthcare professionals. Nevertheless, the ICPs reported that the nurse-patient ratio or patient assignments for nurses had remained unchanged. One ICP stated, "Providing care for isolated patients is a great deal of work for the nursing staff. Anything that we are asking them [nurses] to do is extra work."

The ICPs recalled that, in early 2000, they experienced a lot of resistance from other healthcare professionals at the study hospital concerning IPAC protocols, policies, and practices. However, most of the ICPs noted that there has been a noteworthy change since the early 2000's in the amount of resistance that they come up against from other healthcare professionals, with improvement in the attitudes of and much less resistance from all healthcare professionals towards the ICPs. Several ICPs reported that many healthcare professionals now consider them a resourceful part of the healthcare team.

Frontline nurses and clinical managers viewed ICPs as resourceful, especially during outbreaks. Frontline nurses and clinical managers acknowledged that ICPs were more visible on the hospital units during outbreaks and that they participated in huddles with them on a daily basis during outbreaks. They also reported that ICPs are specifically assigned to each hospital unit and found the assigned ICPs were accessible and approachable, providing necessary information regarding patient isolation for infection prevention and control. The EVS staff

mentioned that the hospital senior management team was supportive during the outbreaks. One EVS person commented,

> The hospital senior management team has been very supportive during all of the outbreaks. They continuously encourage us and told us, time and again, that we were doing an excellent job and, you know what, that little pat on the back here and there feels good.

Stress and Blaming during HAI Disease Outbreaks

Some participants expressed that increased scrutiny and attention during outbreaks caused emotional stress for healthcare professionals. They observed that negative media reports during HAI disease outbreaks made healthcare professionals feel constantly on the defensive with their friends, relatives, patients, and colleagues. One ICP stated, "When the unit I am assigned to had an MRSA outbreak, I felt partly responsible. I kept asking myself what could I have done differently that could have prevented the outbreak." A frontline nurse explained some of the causes of stress for nurses,

> Sometimes the patients and their families are upset because you didn't come to get their mother back to bed when you said you were coming, because you were busy doing something else, or because you decided to take a coffee break.

Frontline nurses reported that the hospital senior management team also contributed to this perception of culpability. One frontline nurse described the situation,

> The senior hospital management team is quick to call attention to issues of low HH compliance rates as the primary cause of HAI disease outbreaks. We [nurses] are audited for HH compliance more than other healthcare groups because we are always . . . at the patients' bedside."

Another nurse remarked,

> I feel, as nurses, we are responsible for a lot of things and we get blamed if the infection spreads, but we are not the only people responsible for providing care to patients. There are, like, 20 other healthcare professionals in one patient's room.

Environmental services staff indicated that during outbreaks, they are the first to be blamed by the media and the clinical staff. One EVS respondent emphasized, "The feeling by both the public and the clinical side of the hospital is that, if we were in an outbreak, it must be due to environmental factors." The participants reported that during the 2010-2011 HAI disease outbreak, there was negative media attention on the EVS staff of the hospital. This led to low morale for EVS staff.

The participants reported that the negative media attention on the EVS has improved over time, but blaming by the public is still noted. One EVS respondent gave an example: "During the last outbreak, the *C. difficile* outbreak in 2012, somebody said to me, where do you work? . . . Oh, they have a *C. difficile* outbreak, don't they clean?" The participants explained that when the hospital is experiencing an outbreak, it is multifactorial in nature and no one department can be or should be blamed. An EVS participant acknowledged, "We feel that we are often being used as a scapegoat for the HAI outbreaks".

Innovations in Clinical Practice

Implementation of Nurse Servers

Participants described that prior to the 2010-2011 *C. difficile* outbreak, PPE supplies were stored in carts in the hallway outside patients' rooms. The idea for "nurse servers" (i.e., shelves built into the wall outside each patient's room with doors protecting the cleanliness of the contents) came from a fire department directive, which called for clear hospital hallways to meet

the fire code. This led to the creation of unique hospital-designed nurse servers in which PPE supplies are stored, regardless of the patient's isolation status. The nurse servers are designed to fit useable space to relieve the hallways of clutter. Throughout the hospital, the nurse servers are stocked in a standard manner with PPE supplies. One unit clinical manager explained, "Some unit [clinical] managers stocked the nurse server in one unit, then took a picture and used the photo as an exemplar for the other units to stock their nurse servers." The participants expressed high satisfaction with the use of nurse servers.

HAI Prevention Audits

Participants described the HAI prevention audit that was implemented after the 2010-2011 HAI disease outbreak. A standardized HAI prevention audit tool was constructed for auditing units in the hospital that report new cases of HAIs. One ICP clarified, "The unit [clinical] manager and the ICPs assigned to the unit that reports a new HAI case do a 'walk about' [i.e., rounds] on the unit, with the aim of identifying gaps or factors that might be contributing to infectious disease transmission."

The use of the HAI prevention audit tool was supported by a documentary source from the study facility. The preventive audit tool is formulated as a checklist developed from the Five C Model - Method of Communication elements: clean equipment, clean environment, clean hands, clear communication, and consistent processes. Additionally, the use of the HAI prevention audit tool was also supported by a facility infection prevention and control protocol, "Algorithm Trigger Tool Response Protocol" (2012), which stipulates that, for hospital units on high alert, the unit clinical manager must complete and submit the HAI prevention audit to the Infection Prevention and Control Department. A unit with three or more patients with VRE or *C.*

difficile infections or with six patients in isolation due to any infectious disease is considered to be on high alert.

C. Difficile Infection Care

Participants reported that, after the 2012 facility-wide *C. difficile* outbreak, the facility implemented a *C. difficile* infection care plan for use by all healthcare professionals for documentation on patients who tested positive for a *C. difficile* infection. However, since this was a recent innovation, many of the participants could not comment on whether it was a valuable tool.

The participants described a unique role for an ICP pertaining to the *C. difficile* organism that was pilot tested for six months at the study hospital. In this role, an ICP with a nursing background was employed for six months to track and follow hospital patients diagnosed with *C. difficile* infections. The ICPs explained that the role of the "*C. difficile* ICP was to monitor all patients who were diagnosed with a *C. difficile* infection in the hospital and to educate patients and families about *C. difficile* infections. The *C. difficile* ICP continued to monitor patients when they were discharged from the hospital. One ICP commented, "It was important to have a healthcare professional from the hospital continue to monitor patients in the community to ensure continuity of care and to help them adapt back home [with having a *C. difficile* infection]." However, this was an innovative pilot project, which was discontinued after six months. The participants noted that the hospital was planning to incorporate this role into the responsibilities of ICPs.

The Five C Model - Method of Communication

The participants described the "Five C Model - Method of Communication" that was implemented in the hospital as a reminder about IPAC policies after the 2010-2011 outbreak.

The five C's in the model refers to clean hands, clean equipment, clean environment, clear communication, and consistent processes. The Five C Model - Method of Communication is displayed on all computers in the hospital as the monitor screen saver. One unit manager observed, "The Five C Model [- Method of Communication] flashes continuously when the computers are not in use to act as a type of subliminal communication."

Whiteboards

Participants reported that whiteboards were mounted on the walls at all nursing stations or unit hallways throughout the hospital. The whiteboards were used as a visual aid to track infectious diseases. The whiteboards displayed coloured graphs of the incidence of infectious diseases in the units and the units' HH compliance rates. The participants found the whiteboards were helpful for a quick update on the status of infection control issues on each of the hospital units. Given that some hospital units are very large, the whiteboards were an easy way of communication for the staff. The whiteboards were updated by the unit managers on a daily basis.

Flex Units

Some participants discussed the use of a "flex unit". Flex units are unoccupied units in the hospital that have 12 physical beds and are not normally in use. Frontline nurses noted that in the past, flex units had been used when there was an increased demand for isolation rooms in the hospital. For example, during the 2010-2011 outbreak, a flex unit was used for nonisolated patients from one of the hospital's units. One nurse said, "It was a great innovation. However, we did not like the splitting of the unit's staff to accommodate the staffing for the flex unit."

Infection Prevention and Control Protocol Reviews and Changes

Unique Colour Coding

Participants identified using the colours "pink and gold" in reference to patient basins and antibacterial bathing soap, respectively. Patients admitted to the hospital are assigned their own wash basins, which are pink in colour. Participants reported that after the 2010-2011 outbreak, it was mandated that pink washing basins were to be changed weekly for nonisolated patients and daily for patients in isolation. This policy was implemented because *C. difficile* spores are difficult to dispose of by simply cleaning the basin after use. One ICP commented,

> If the wash basin is not changed daily for patients with *C. difficile* infections . . . potentially, you are putting spores onto their [the patients'] faces the next day [after the wash basin had been used by the patient with a *C. difficile* infection] if you use the same wash basin because you cannot clean the [*C. difficile*] spores [off of the wash basin].

In addition, the respondents indicated that the hospital implemented IPAC policy of using special antibacterial soap (gold in colour) for patients with VRE and MRSA infections. The gold soap contains chlorhexidine gluconate and is to be used by the patient for 14 days to reduce the incidence and colonization (i.e., skin asepsis) of MRSA and VRE infections, thus reducing the risk of transmission of these infectious diseases.

Cleaning and Decontamination

Participants noted that bleach-based cleaning products were used for all hospital cleaning by EVS. Participants explained that isolation rooms are cleaned twice a day, including all surfaces and as high up as the cleaners can reach, excluding ceilings and privacy drapes. The ICPs indicated that a precautionary measure was implemented that involved the decontamination of beds that had been occupied by patients for 30 days. Respondents reported that after the 2010-

2011 outbreak, the hospital began using items that could be cleaned and disinfected easily, including curtains, plastic pulls, and wipeable computer keyboards. Chairs with fabric covering were replaced with materials that could be cleaned with strong disinfectants.

Isolation and Cohorting of Patients

Participants said that before the 2010-2011 outbreak, it was common practice to "cohort" patients with similar infections in the same hospital room. Cohorting is the assignment of a geographic area, such as a room, to two or more patients who are either colonized or infected with the same microorganism and assignment of staff to the cohorted group of patients (PIDAC, 2012c). However, after the 2010-2011 outbreak, patients were less likely to be cohorted. Patients who required isolation precautions were assigned to private rooms with dedicated bathrooms. Participants reported that patients in isolation rooms were encouraged to stay in their rooms. However, in order for patients to leave their rooms for any reason to go to common hospital areas, such as the cafeteria, they were required to wear clean gowns and wash their hands before leaving their isolation room ("Antibiotic Resistant Organism Protocol", 2012).

Evolution of Dedicated Patient Equipment

Participants reported that before the 2010-2011 outbreak, unit equipment was shared among all of the patients on a unit or ward. Previously, each hospital unit had three vital sign machines that were shared among as many as 30 unit patients. After the 2010-2011 outbreak, the hospital purchased equipment that was assigned to patients' rooms, so that two to four patients would share equipment that was cleaned and disinfected between patients.

In addition, the hospital implemented a "tagging and bagging" system to identify clean and disinfected shared equipment. Healthcare professionals are expected to clean and disinfect equipment after each patient use and to place a green tag on the equipment to indicate that it had

been cleaned and disinfected. The equipment is then placed in the unit clean supply room. Adequate equipment was purchased by the hospital so that each isolation room and each patient in isolation has their own dedicated equipment (e.g., a blood pressure machine) when needed.

Hand Sanitizers and De-cluttering of Hospital Units

Participants reported that it is common practice in the prevention and control of infectious diseases to de-clutter units as much as possible. On a daily basis, frontline nurses remove all unused equipment from patients' rooms. One nurse provided an example,

> We [nurses] got rid of excess equipment not required in the patient rooms. Previously, it was, you could go into a patient's room and there is an intravenous [IV] pole, but that patient has not been on IV for the last three days.

Participants described using hand sanitizers following patient care if their hands were not visibly soiled. Hand sanitizer dispensers were affixed to the walls inside and outside patients' rooms and throughout the units, at the entrances and exits to the hospital, and throughout the hospital corridors for easy access by hospital staff, visitors, and patients. Hand sanitizer dispensers were placed throughout the hospital to increase HH compliance rates and decrease infectious disease transmission. The participants agreed that the use of hand sanitizers has led to improved HH compliance because the dispensers are accessible and cleaning one's hands with a hand sanitizer is less time consuming than cleaning one's hands with soap and water.

Hygiene Bags

Participants described that, before the 2010-2011 HAI disease outbreak, the hospital did not use liners for bedpans. One ICP remarked,

As ICPs, we noticed that, when bedpans were cleaned, there was an increased risk of splashing of the bedpan contents and cross-contamination. To minimize this issue, the hospital implemented the use of hygiene bags to line the bedpans prior to patient use. The bedpan liners absorb any liquid in the bedpan, are tied closed, and are disposed of in the garbage, thus reducing the risk of contamination from the bedpans to the surrounding areas. The hospital also implemented a policy where individual patient commodes are disinfected weekly with a commode washer and disinfecting system to ensure the removal of *C. difficile* spores and all other contaminants, thus reducing the transmission of *C. difficile* and other infectious diseases.

Food in Clinical Areas

Participants reported that food was previously allowed in clinical areas in the hospital (e.g., nursing units) before the 2010-2011 HAI outbreak. This policy has since been changed. Eating has also been prohibited in the hospital hallways.

Infection Prevention and Control Policy Changes and Reviews

Hand Hygiene and Uniform Policy

The participants articulated that the hospital had always had a hand hygiene (HH) policy, that has been enforced and expanded over the years. Additionally, after the 2010-2011 HAI disease outbreak, the expectations for HH compliance were increased from 60% to 90% compliance for all healthcare professionals. Hand hygiene compliance is assessed through internal hand hygiene auditing. According to the revised policy (“Personal Appearance/Dress Code”, 2011), hospital staff were allowed to wear one plain wedding band and cannot wear rings with diamonds, nor can they wear nail polish or artificial nails. Only closed-toe shoes are permitted within the clinical areas. One ICP stated, "The staff that wear uniforms are encouraged

to change from their hospital uniforms and shoes to street clothes and shoes before leaving the hospital to go home." The participants reported it was not common practice to change from their hospital uniforms to street clothes because changing their clothes required time and the changing rooms were poorly maintained and not unisex.

The facility policy (documentary source), titled "Personal Appearance/Dress Code" (2011), reiterates the participant dress code in regards to being allowed one ring and no artificial nails or nail polish. This policy did not specify that staff needed to change from their uniforms and shoes to street clothes and shoes before leaving the facility.

In-Hospital Patient Transfer Policy

Participants acknowledged that the in-hospital "Patient Transfer Policy" (2012), was reviewed after the 2010-2011 HAI disease outbreak. This policy was subsequently changed to allow for the in-hospital transfer of patients for clinical reasons, only, and not for cohorting patients with the same infectious disease in the same isolation room. In addition, the policy further stipulated that patients were to be transferred on a stretcher or wheelchair and could not be transferred in their hospital beds, unless a bed was required for clinical reasons. As well, the furniture in the patient's room could no longer be transferred with the patients. One nurse explained how, previously, patients were transferred in order to cohort people in isolation with the same infectious disease,

> Years ago, we could just push a bed down the hall to create a male bed in order to put a male patient into a room with another male patient [because male and female patients previously could not be assigned to the same room]. We would move all the equipment and beds to the next room to make a room for the male.

Visitors Policy

Participants explained that the hospital policy regarding patient visitors typically allowed two visitors to visit a patient at a time. One participant explained, "We are usually lenient with patients' visitors during non-outbreak periods. We allow more than two visitors per patient and we are not strict about the time limit." However, during outbreaks, a "no visitors policy" may be implemented to restrict traffic in the units. Frontline nurses reported that ICPs and unit managers jointly made the decision to implement the no visitors policy. The participants mentioned challenges they experienced with visitors who were uncooperative concerning visiting hours. Difficulties also arose when the no visitors policy was implemented. One participant elaborated,

> When the no visitors policy is implemented, most of the patients' visitors call the hospital to speak to the patients or call to inquire about the patients regarding why the patient is in an isolation room or why they cannot be allowed to visit. A lot of our [nurses'] time is spent on phone calls.

Summary of Findings from Frontline Nurses and Clinical Managers

The Nature of Daily Work and HAI Disease Outbreaks

Patient assignments. Participants discussed the nurse-patient ratios for frontline nurses and patients, which varies throughout the facility. In the hospital units where frontline nurses were interviewed, the nurse-patient ratio on day shift was one nurse to five patients. On the night shift, the nurse-patient ratio was one nurse to six or seven patients. It was reported that during HAI disease outbreaks, the nurse-patient ratio remains the same as when there is not an outbreak. Consequently, nurses do not have fewer patients assigned to them during outbreaks. According to the frontline nurses interviewed, the hospital senior management team has discussed decreasing nurse-patient ratios to one nurse to four patients. These discussions are continuing.

The respondents observed that some hospital units had taken a proactive approach to dealing with nurses-patient ratios and had implemented the lesser nurse-patient ratio, even though it is not yet a hospital policy.

The participants reported that, in some hospital units, the patient assignments are based on patient acuity. In other units, patient assignments are based on the geographical setup of the unit. One nurse clarified the situation,

> A nurse can have all five isolated patients [for her/his daily assignment], by chance. The isolation rooms tend to be in a group [geographically]. Therefore, there is a likelihood that one nurse can have all the isolation patients, especially in the beginning of the outbreak. Toward the end of the outbreak, the nurses are likely to have nonisolated and isolated patients.

Respondents noted that it was not common practice to increase nursing staff during outbreaks. Frontline nurses remarked that their charge nurses or managers are allowed to call in personal support workers when their units have more than 11 isolated patients.

Increased documentation. Participants stated that documentation had increased in the facility in general, but particularly during HAI disease outbreaks. Some frontline nurses mentioned that bedside nursing has a lot of paper work, leaving little time for patient care. In addition, documentation is more detailed than before the proliferation of infectious diseases. For example, specific documentation of bowel movements is now required, which includes colour, consistency, odour, and amount, due to the nature of the infectious disease organisms. One frontline nurse explained,

> I find we have more documentation than when I started nursing 12 years ago. I honestly don't remember having a patient with *C. difficile* infection in my first three years of

> nursing. . . . I find that the documentation is reflective of the increased infectious diseases and outbreaks.

Participants described how the increase in infectious diseases and the surveillance surrounding infectious diseases has augmented the amount of documentation and the number of places they must document. For example, frontline nurses must obtain various swabs or samples from all patients on their admission to the hospital. Nurses acquire samples from patients' anterior nares, rectums, and surgical sites. Additionally, all patients admitted to the hospital are swabbed once a month for the duration of their hospital stay. Patients whose samples test positive for an infection are swabbed on a weekly basis. This leads to increased documentation inside the patients' charts and on additional documents outside the patients' charts. These practices were supported by a documentary source, the policy on "Antibiotic Resistant Organisms" (2012, App. A), “Point prevalence is to be done on a weekly basis when an outbreak is identified and continued on a weekly basis until no further transmission is detected."

Frontline nurses reported that, on each hospital unit, a form must be completed daily and faxed to the Infection Prevention and Control Team (IPAC). The form specifies the number of patients in isolation rooms; the reasons the patients are isolated; if present, the amount of diarrhea; and the kind of antibiotics patients are receiving, if any. Frontline nurses indicated that the hospital senior management team was reviewing and revising documentation requirements to ease the nurses' documentation load.

Cleaning and disinfection of patient equipment. Frontline nurses are expected to clean and disinfect patients' shared equipment after each use. They are then expected to tag the disinfected equipment with a blue bag or green tag to indicate that the equipment has been sanitized and, when appropriate, return the equipment to the clean supply room on the unit.

While frontline nurses acknowledged the importance of this practice in infection prevention and control, they reported that sanitizing equipment is very time consuming.

Patient care. There are various subspecialties in the nursing profession such as emergency department (ED) nursing, surgical nursing, medical nursing, and psychiatric nursing. Frontline nurses working on surgical units contended that surgical patients, or patients who have been hospitalized for surgery, who acquired an infectious disease while in the hospital required supplementary nursing interventions in addition to the normal accepted nursing care for surgical patients.

Frontline nurses working on the study hospital's medical units observed that the contraction of infectious diseases has complicated the medical conditions of their patients, often extending their hospital stays. Frontline nurses working with patients with psychiatric issues expressed that the addition of infectious diseases is an added responsibility. Because their patients' mental statuses are compromised, extra diligence is required to avoid cross-contamination and transmission of infectious diseases.

Fatigue and sensory overload. Frontline nurses admitted that, due to work demands and the complicated nature of their assigned patients' conditions, they felt fatigued even on days when there were no infectious disease outbreaks. One nurse stated, "When you have five patients, you may not have a physically busy day, but you leave at the end of the day and your brain hurts because you just feel like you are being bombarded."

Changing responsibilities. Some participants reported that they were assigned to be charge nurses for two weeks out of each month. The charge nurse role entails overseeing patient care on the unit, providing complete documentation of care, managing staff interactions, and to

participate as a member on the bed management team. Frontline nurses said their membership on the hospital bed management team complicated the charge nurse role.

Bed management involves two main responsibilities: assisting with the flow of patients from the ED to the hospital units and the effective discharge of patients from the hospital. Every day, charge nurses and ICPs meet in the morning to discuss the hospital bed status, the number of empty beds, the number of patients in isolation, and the number of patients waiting in the ED to be admitted into the hospital. The respondents reported that this can be challenging during HAI disease outbreaks because the patient transfer policy must also be enforced. The policy stipulates that all patient transfers must be for clinical reasons only. This policy had a documentary source ("Facility Bed Management Policy", 2005) in which it was stipulated that a bed management conference was to be held daily at 11am with the aim of reviewing bed statuses (i.e., patients' admissions, discharges, and transfers).

Some participants indicated they were "hand hygiene ambassadors". Hand hygiene ambassadors' responsibilities include advocating for HH compliance among healthcare professionals and conducting HH audits on their units. For frontline nurses who were ambassadors, this role was in addition to their day-to-day responsibilities of care provision.

Time Pressure During HAI Disease Outbreaks

Facility-Wide HAI Disease Outbreaks

The participants indicated that there had been two facility-wide HAI disease outbreaks during the study period; both of which were caused by *C. difficile* infections. Frontline nurses advised that most of the patients with *C. difficile* infections required assistance with toileting and changing of soiled bed linens and gowns. Frontline nurses remarked that during the two major facility-wide outbreaks, patients with *C. difficile* infections experienced an average of 10 to 15

loose bowel movements per shift. Each time there was a loose bowel movement, frontline nurses had to spend extra time to put on and remove PPE to assist patients with clean bed linens and gowns. Based on the complexity of patient care, this process took from 10 to 30 minutes per patient, per bowel movement.

Personal Protective Equipment and Hand Hygiene

Because of the requirement to wear PPE when caring for patients in isolation, frontline nurses reported that extra time was needed when providing nursing care to patients in isolation. These participants emphasized that they had to be organized. Everything necessary for patient care needed to be assembled prior to entering an isolation room because the procedures for entering and exiting patient rooms were time consuming. Each time a nurse entered and exited an isolation room, an additional three to four minutes was required for HH and for donning and doffing of PPE. Frontline nurses indicated that, on average, an hour of every shift was spent on HH and PPE. This is in contrast to what occurred with patients who were not in isolation, where nurses routinely exited and entered rooms to retrieve objects required for patient care. In these instances, nurses must perform HH only.

According to a documentary source, "Best Practices for Hand Hygiene in All Health Care Settings" (PIDAC, 2010), four moments for hand hygiene are recommended in all healthcare settings in Ontario. The four moments include: (a) before the initial contact with each client/patient/resident or items in their environment; (b) before performing an invasive/aseptic procedure; (c) after patient care involving the risk of exposure to, or contact with, body fluids; and (d) after contact with a client/patient/resident or their environment.

Heavy Workloads

The frontline nurse participants noted that it was common practice to work their entire shifts without the ability to take meal or beverage breaks. Owing to work demands, this occurred even on "good days" or days when there were few patients in isolation. During infectious disease outbreaks, frontline nurses found their workloads were even "heavier" due to the addition of IPAC measures. One nurse explained,

> We support each other in completing the care for patient assignments. Although, during infectious disease outbreaks, supporting each other is more difficult because everyone has heavier patient assignments and little time to help out other nurses with the provision of patient care.

Evening, Night, and Weekend Shifts

Frontline nurses stated that their workloads were heavier during evening, night, and weekend shifts. They surmised that this occurred because most other healthcare professionals, such as ICPs, physiotherapists, social workers, and unit managers, were not physically present at the hospital during these shifts. Frontline nurses must assume the roles of the absent healthcare professionals during these time periods, for example, the education of patients and the follow up of laboratory reports. The nurses acknowledged that most patients' visitors came to the hospital during the evening, night, and weekend shifts and nurses reported spending much of their time on these shifts educating visitors in more depth and answering their questions.

Frontline nurses were concerned during outbreaks because ICPs were not available physically or by telephone during evening, night, and weekend shifts. As per hospital directives, if IPAC issues arise during these shifts, frontline nurses are to consult with the nursing supervisor on call. However, the nurses noted that the supervisor on call may not be

knowledgeable about IPAC protocols and policies. One nurse remarked, "There is a reason that we have a department [in the hospital] completely devoted to infection control, because they are the experts. Therefore, I don't understand why, during outbreaks, there isn't somebody here to represent that department."

Nurse and Patient Safety during HAI Disease Outbreaks

Psychological and Emotional Care of Patients

Frontline nurses felt they were not meeting the psychosocial needs of patients, especially patients in isolation. Frontline nurses strive to complete total patient care for each patient and, due to excessive workloads, there is frequently little time for psychological patient care. The nurses mentioned having to rush through nursing care for one patient so they could go on to the nursing care for the next patient. This leaves little time to establish therapeutic nurse-patient relationships. One nurse commented, "We limit the number of times we enter isolation rooms because of the PPE requirement. Therefore, isolated patients may feel lonely and neglected."

Missed Care

The frontline nurses who participated in this study expressed concern that their patients' needs were not being met in a timely manner, especially when their workloads were very heavy. Frontline nurses reported that, occasionally, the provision of general nursing care was not completed in a timely manner or not at all. This included providing medications to patients. Frontline nurses explained that they care for the patients in isolation rooms for long periods and that they preferred not to leave the isolation rooms until patient care was completed. They reasoned that leaving an isolated patient's room to attend to another patient would entail performing hand hygiene, removing their personal protective equipment, performing hand hygiene prior to and after caring for the other patient, and performing hand hygiene and donning

new personal protective equipment prior to returning to the isolation room. Hand hygiene and donning and doffing personal protective equipment add additional time (from minutes to hours) to a frontline nurse's workday. One nurse explained how this practice could lead to missing nursing care for other patients,

> Sometimes I am in a room for 45 minutes and that is 45 minutes that I am not there for the other four patients to whom I am assigned or a family member that had a question to ask. Therefore, sometimes you may miss things or you don't get a chance to sit and get to know your patients.

Another nurse agreed that, sometimes, care is missed,

> During outbreaks, we are required to multi-task more. Sometimes, the care we provide to patients is affected. One [nurse] might miss certain things with some patients. Whether it is providing a patient a glass of water or delaying administering pain medication that was due 10 minutes ago.

Nurses' Health

Some frontline nurses contended that increased nursing workloads led to burnout, which, in turn, led to increased sick time and the potential for errors (e.g., medication errors).

Fear of Acquiring and Spreading Infectious Diseases

Frontline nurses were fearful of acquiring infectious diseases or transmitting infectious diseases to their loved ones at home. Frontline nurses perceived that the risk of acquiring or transmitting infectious diseases was higher during HAI disease outbreaks. Some participants commented that isolated patients tend to have fewer visitors and attributed this to the visitors' fears of acquiring infectious diseases. One frontline nurse noted that this fear extends to nurses as well,

> One of the patients that I am assigned to is being investigated for infectious disease. I am pregnant. . . . I do not want to place myself at risk of acquiring an infectious disease. Therefore, I spent most of my morning trying to figure out if it is safe for me to go into that room.

Challenges with Infection Prevention and Control Protocols

Hand Hygiene Audits

Frontline nurses recognized the importance of HH audits. Nonetheless, they were concerned about the HH audit process, specifically that HH auditors do not enter patients' rooms to observe the entire HH procedure. Therefore, when nurses wash their hands in the sink in a patient's room, rather than in the sink immediately outside the patient's room, the HH auditors assume that the nurse's HH was not completed. Nurses commented that most of the time, HH auditors do not provide feedback or educate the person being audited. One nurse recommended a solution to this issue,

> It would be helpful for HH auditors to educate the person being audited at the time of the audit if they are not compliant. Or have educational material, such as pamphlets, readily available for distribution to the person being audited.

The Dynamic Clinical Reality

Frontline nurses noted that sometimes the IPAC policies needed to be flexible enough to adapt to the continuously changing hospital environment. For example, when the ED is busy, changes need to be made to enhance the patient flow out of the ED and into the hospital. One nurse said,

> The policies during outbreaks change all the time, from day to day, based on the requirements of the emergency department [ED], or what new research they found out

there. I can honestly say that in every outbreak there have been different IPAC policies and once the outbreak is over, the policies do not apply.

Additionally, some IPAC policies are strictly observed during outbreaks. For example, the patient transfer policy, the visitor policy, and the environmental cleaning policy.

The New Normal

Frontline nurses emphasized there was a "new normal" for nursing care due to the proliferation of infectious diseases and the increased number of patients requiring isolation precautions. In addition to providing daily care for patients, frontline nurses described a supplementary level of added care, that of infection prevention and control policies, procedures, and protocols, which are adhered to at all times, with every patient and visitor, by all hospital staff. Nurses reported that, previously, there were few patients with infectious diseases like *C. difficile* or MRSA. Presently, having patients with infectious diseases is a common phenomenon, occurring on a daily basis. One nurse stated, "I don't find having a few patients with *C. difficile* or MRSA infections is anything unusual. On a daily basis, we are used to having these patients with infectious diseases."

Summary of Findings from Infection Control Professionals and Manager

Educational Background and Experience

The infection control professionals (ICPs) in this study had previous education in other healthcare disciplines, such as nursing and laboratory technology, and work experience in either nursing or laboratory technology. They indicated that their ICP role-specific training was either an in-class course offered by Queen's University (two-weeks duration) or an online course (six-months duration). Infection control professionals must get their IPAC certification after working for two years in an IPAC department. They explained that when they apply for certification, they

must demonstrate that the knowledge acquired through their educational pursuits has been applied and practical ICP experience has been gained.

Motivation for Becoming an Infection Control Practitioner

The ICPs described various reasons for choosing to be ICPs in their secondary careers. For example, encouragement from colleagues, a perceived future demand for ICPs, and increased funding for ICPs in healthcare facilities in Ontario, particularly following the 2003 SARS outbreak. Some ICPs compared their current responsibilities with their previous work experiences and revealed that one of the advantages of working in an IPAC department is the interaction with patients, nurses, and other allied healthcare professionals.

Roles and Responsibilities

Infectious disease surveillance. The ICPs are consulted about many issues relating to IPAC throughout the hospital. In addition, all the participants indicated that their jobs included IPAC-related surveillance and education on a daily basis. Infection control professionals are involved in two types of surveillance: emergency department (ED) surveillance and diarrhea surveillance. Each day at the study site, an ICP was assigned to each of these two types of surveillance. The ICPs described the parameters of diarrhea surveillance as encompassing the collection of data throughout the hospital for all patients with diarrhea. An ICP in this role is referred to as the "Duchess of Diarrhea", which is a term that was frequently used by the ICPs.

Emergency department surveillance involves assisting with the flow of patients in and out of the ED while ensuring proper infectious disease screening and thorough application of infection control isolation precautions. In addition, ICPs keep track of all of the admitted hospital patients' laboratory results to identify and follow-up patients with results that are positive for infectious diseases. One ICP remarked,

Surveillance carried out during HAI disease outbreaks is the same as routine surveillance that we do on daily basis. During HAI disease outbreaks, I find that there are strict deadlines for data availability and data presentation to the hospital senior management team.

Bed management. The ICPs explained how they are assigned to ED surveillance daily and, as part of this assignment, are expected to assist with hospital bed management. This consists of organizing the hospital beds of all admitted patients and patients in the ED waiting to be admitted. It may also require facilitating the discharge of hospital patients who no longer need to be in hospital. The main role of ICPs on the bed management team is to ensure that patients in the ED who require admission are admitted to the correct hospital unit, room, and bed to avoid unnecessary patient movements and transfers in the future. One ICP observed, "Bed management is more complex during infectious disease outbreaks because patient transfers are strictly limited solely for clinical reasons."

The President's report. The ICPs reported that they are required to send a daily email report to the hospital senior management team. This email, known as the "President's Report", was implemented after the 2010-2011 outbreak. This report provides information to the hospital senior management team about the status of patients with infectious diseases, HAIs, and any newly admitted patients put into isolation precautions.

Infection control audits. Participants indicated that they are involved in completing infection control audits on their assigned hospital units to evaluate the staff's compliance with IPAC policies, procedures, and protocols. The ICPs explained that they were mostly involved in HH compliance audits. Additionally, there is one ICP dedicated to HH compliance audits for the entire hospital. The respondents reported that the hospital has a target HH compliance rate of

90% or above for all hospital units. On a monthly basis, ICPs compile the healthcare professional HH compliance rates based on the HH compliance audits and send the reports to their respective unit managers. If a unit does not meet the targeted HH compliance rate, the unit manager is required to write an improvement strategy report. During outbreaks, all ICPs are expected to do extra HH compliance audits.

When a unit reports a new HAI case, the unit manager and ICP jointly conduct a preventive audit. The goal of preventive audits is to identify factors that could be contributing to HAI transmission. Preventive audits consist of the unit manager and the assigned ICP doing an environmental scan of the unit to identify gaps in infection control protocols, procedures, and policies or to identify environmental factors that could be contributing to the increased "bioburden." Bioburden is defined as the degree of microbial contamination or microbial load, which indicates the number of microorganisms contaminating an object (Piper, 2006).

Availability of ICPs on hospital units. Each ICP is assigned to and responsible for the IPAC measures on two or three hospital units. They are required to be physically available on their assigned units and to function as part of the unit's healthcare team. On a daily basis, the assigned ICP is responsible for identifying issues that might be contributing to increasing infection rates. Participants explained that they frequently do "walk abouts", which entails walking around the units they are assigned to and conducting environmental scans to identify issues that might contribute to an increased bioburden. During outbreaks, ICPs are also expected to be physically present on their respective assigned units to conduct environmental scans and to identify any issues or factors that might be contributing to the HAI cases and outbreak. Some of the common issues that may affect infectious disease transmission are lack of knowledge on the

part of new healthcare professionals or inadequate supplies of necessary paraphernalia needed for infection prevention and control, such as disinfectant wipes, PPE, and HH supplies.

To evaluate their assigned units, ICPs use the Five C Model - Method of Communication. Examples of tasks performed under this model include checking isolation rooms for mandated infection control precaution signage posted in the authorized places; ensuring the nurse servers, outside each patient's room, are well-stocked with PPE; and inspecting for unnecessary clutter in the halls and patient rooms.

Collaboration with the public health department. On a monthly basis, the ICPs communicate with the regional public health department (PHD) regarding all communicable diseases in the hospital and the HH compliance rates. The participants noted that the hospital has predetermined infectious disease threshold numbers for each unit and for the facility. If the threshold number for a specific infectious disease is reached and passed, an outbreak is declared based on the mutual agreement of the ICPs and the regional PHD liaison.

The ICPs explained that, during an infectious disease outbreak, one of the ways they communicate with the PHD daily is by faxing a "line list." The line list provides details about all of the patients involved in a particular outbreak, including when each patient was diagnosed as having an infectious disease, when and what testing was done, the results of the testing, when the symptoms were resolved, and the kind of treatment patients received.

The documentary source "Best practices for Infection Prevention and Control Programs in Ontario" (PIDAC, 2012a) supported the responsibilities reported by the ICPs.

Challenges of HAI Disease Outbreaks

Data Collection and Reporting

Among the challenges that occur during HAI disease outbreaks, ICPs cited the increased number of written reports and the increased amount of data that are required to be collected daily, which are required to be documented in more than one place. During outbreaks, ICPs are expected to communicate precise and comprehensive data to the hospital senior management team and the PHD. The ICPs indicated that during outbreaks there is an increased urgency for data and stricter data deadlines because data are required at specific times by the hospital senior management team.

Challenges for Infection Control Professionals

The majority of the ICPs reported that their greatest challenge was data management. Some of the ICPs spent a great deal of time on data collection and data entry, which took time away from their assigned units. Dealing with patients with complex issues was another challenge. One of the ICPs provided an example,

> Recently in the ward, we had a patient who was having 14 bowel movements a day, but the testing for the presence of an infectious disease was negative. This was a dilemma for the nursing staff and they continually consulted IPAC. As the ICP assigned to that unit, I, also, did not have a ready solution.

Summary of the Findings from the Environmental Services Staff and Manager

Cleaning Processes

The cleaning products and cleaning processes used in the facility meet the recommendations and best practice guidelines of the "Best Practices for Environmental Cleaning for Prevention and Control of Infections" (PIDAC, 2012b). The EVS respondents explained that

in the PIDAC best practice guidelines it is recommended that two levels of cleaning are performed within a healthcare facility in Ontario. One of the accepted levels of cleaning is known as "hotel clean", which is the cleaning standard for nonpatient areas. This entails that these areas are cleaned once per day using a recommended disinfectant.

The second level of cleaning is known as "hospital clean." Hospital clean is the cleaning standard for inpatient units and any areas where patients may be located. Hospital clean consists of a two-step cleaning procedure. Step one entails cleaning aimed at removal of visible soiling using microfiber products. Step two requires disinfection using a bleach-based product (e.g., sodium hypochlorite). Participants indicated that all patient areas are cleaned the same way. Thus, cleaning procedures are the same for areas with patients who have an infectious disease and areas with patients who do not have an infectious disease. One participant commented,

> We do not have different cleaning products or procedures for noninfectious cases and infectious cases. We use the same cleaning products and procedures for all cases, we use a sporicidal agent to clean, which kills infectious disease spores.

Participants reported that the hospital uses bleach-based cleaning products (i.e., sodium hypochloride) for cleaning the environment and equipment during both outbreak and nonoutbreak periods. One participant provided the rationale for using consistent products and processes,

> There are too many opportunities for gaps in cleaning processes when you have numerous types of chemicals and chemical strengths. That is why we consistently use the same product and strength of cleaner for all of the hospital clean areas. The only difference is for a room where there is patient with *C. difficile* infection, VRE, or MRSA, we clean the rooms twice a day.

According to a documentary source "Best Practices for Environmental Cleaning for Prevention and Control of Infections", *C. difficile* spores are only killed by sporicidal agents (PIDAC, 2012b). The chemical agents that have shown activity against *C. difficile* spores are sodium hypochlorite (1,000 - 5,000 parts per million for 10 to 30 minutes, depending on the concentration); hydrogen peroxide-enhanced action formulation (HP-EAF; 4.5%) for 10 minutes; and peracetic acid (0.26%) for 5 minutes (PIDAC, 2012b, p.111). The recommended environmental cleaning of rooms of patients with *C. difficile* infections is twice daily cleaning and disinfection using a sporicidal agent (PIDAC, 2012b).

High Alert Units

Participants indicated that EVS has an algorithm and trigger tool response for environmental cleaning, the "EVS Algorithm and Trigger Tool" protocol (2012). One of the extensive cleaning protocols described in the algorithm is the high alert response. The participants explained that when any unit has three or more patients with VRE or *C. difficile* infections or six patients in isolation rooms, such a unit is considered to be on high alert. One participant explained the high alert cleaning process,

> On the first day that a unit is recognized to be on high alert, we go into the unit and do a thorough cleaning of every room in that unit. The first intensive cleaning of the unit is followed with cleaning all rooms twice a day for a 24-hour period.

The aim of this type of cleaning is to reduce the bioburden of the unit. When high alert designations are placed on units, the EVS participants indicated that it increases their workload and the pressure they feel.

This process was supported by a documentary source, the facility "EVS Algorithm and Trigger Tool" protocol (2012b) that includes three trigger guidelines for EVS cleaning processes.

The three triggers are: (a) routine measures, which occurs when a unit reports one new HAI case; (b) a high alert unit, which occurs when a unit reports three or more case of *C. difficile* infection or six patients in isolation; and (c) a unit-based or campus outbreak, which occurs when a unit is declared to be in outbreak.

Decontamination of the Facility to Prevent HAI Disease Outbreaks

The EVS reported that during HAI disease outbreaks, it was common practice to decontaminate the entire hospital. They explained that decontamination involves extensive cleaning of the hospital environment to reduce the bioburden and HAI transmission. The respondents reported that the hospital has also introduced planned decontaminations of the hospital as a precautionary measure. The first planned decontamination was completed in December 2012. The next one is planned for the spring and summer of 2013.

Cleaning of Unit Equipment

The EVS participants reported that during the cleaningof patient rooms, if they find equipment in the patients' rooms that is not tagged (indicating it has been disinfected), they clean and disinfect it, tag it, and return it to the clean supply room. Participants explained that when a patient is discharged, the EVS are required to clean, disinfect, and tag the patient's equipment and store it in the clean supply room.

Evolution of Bleach-Based Cleaning

The EVS participants indicated their work had changed a great deal during the first *C. difficile* infection outbreak in 2010-2011. They reported that one of the major challenges during the 2010-2011 outbreak was the lack of environmental cleaning guidelines. Participants explained that the 2010 PIDAC guidelines lacked information on cleaning regarding *C. difficile* infections. They reported that before the 2010-2011 outbreak, the environmental and equipment

cleaning was completed using hydrogen peroxide agents, which are not effective in eradicating *C. difficile* spores. Therefore, the cleaning products needed to be changed to bleach-based solutions that are effective against *C. difficile* spores.

This change led to a multitude of other changes in the cleaning processes. One participant commented on the number of changes: "During the first outbreak, the 2010-2011 *C. difficile* outbreak, there were probably 10 to 12 different changes to the cleaning process throughout that period of time." The participants reported that the PIDAC guidelines were reviewed in 2012 to include guidelines to eradicate *C. difficile* spores (PIDAC, 2012b). Since then, the institution has been using the updated guidelines for environmental and equipment cleaning. A documentary source, "Best Practices for Environmental Cleaning for Prevention and Control of Infections", supported the participants' description of the PIDAC guideline on the methods of eradicating *C. difficile* spores (PIDAC, 2012b).

Environmental Service Audits

The EVS participants reported that the EVS has stringent auditing processes for environmental cleaning. The EVS audits are conducted by EVS supervisors and involve direct observation to evaluate the cleanliness of the environment. Every patient's room on every hospital unit is audited at least once a month. The participants reported that the environmental cleaning audits are more frequent during HAI disease outbreaks. One participant explained,

> Whenever we are in an HAI disease outbreak situation, we do a couple of different things. We do [EVS] visual audits. We also do a adenosine triphosphate [ATP] test, which is a quantitative method . . . that reflects the amount of bioburden present in the environment. The ATP is used to provide instant feedback on surface cleanliness, demonstrating deficiencies in cleaning protocols and techniques to EVS staff.

Staffing of the Environmental Service

The EVS participants discussed their room assignments for cleaning during outbreak and nonoutbreak periods. The EVS staff are allocated patient room assignments. The EVS staff-to-patient room ratio per shift is one EVS staff for 10 to 12 patient rooms. It was reported that during HAI disease outbreaks, the EVS-to-patient room ratio was dropped to one EVS for seven patient rooms. This indicates that EVS staffing was increased during HAI disease outbreaks to facilitate the intensive cleaning required. The EVS staffing was also increased for hospital units on high alert due to high numbers of isolated patients or three or more patients with *C. difficile* infections.

CHAPTER 5: DISCUSSION

The study findings revealed that, with the increasing trend in the incidence of HAIs and HAI disease outbreaks, the nature of healthcare professionals' daily work in an acute care facility is changing and becoming more complex. In this chapter, four key studying findings are discussed: (a) the increased incidence of HAIs and HAI disease outbreaks; (b) the manner in which daily work has changed for various healthcare professionals during outbreaks; (c) the unique strategies or innovations implemented in response to the increasing infection and outbreak rates; and (d) the effect of HAI disease outbreaks on patient care.

Incidence Rates of MRSA, VRE, and *C. difficile* in the Study Facility

Most of the healthcare professionals that were interviewed agreed that the number of infectious disease cases and the number of patients requiring isolation precautions due to infectious diseases had increased over the five year study period. This perception was supported in part by the incidence rates reported at the study facility. Both MRSA and *C. difficile* infection rates increased during four years of the five year study period before decreasing in the last year of the study period. MRSA incidence rate peaked in 2011 and the *C. difficile* incidence rate peaked in 2010. Since that time, the incidence rates for both infectious diseases decreased to their 2012 rates, which were still higher than their 2008 and 2009 incidence rates. Whereas, the VRE incidence rate, reported in 2008, was the highest rate in the five year study period, and this rate decreased steadily since then to the lowest incidence rate in 2012, except for a slight increase in 2011. Comparing the incidence rates of these three infectious diseases in 2012, MRSA remained higher than the other two infectious diseases, and VRE had the lowest incidence rate, with the *C. difficile* incidence rate falling between the incidence rates of the other two infectious diseases. The incidence rates for all three infectious diseases were lower in 2012

than their peak incidence rates, which again indicates progress for the facility in the implementation of infectious disease prevention and control policies and protocols. Although, the 2012 incidence rates were higher than the provincial benchmarks for these infectious diseases.

The study facility experienced two facility-wide outbreaks caused by *C. difficile* infections in 2010-2011 and 2012. The incidence rates during these facility-wide outbreaks were 3.03 and 1.49 per 1,000 patient days, respectively. These incidence rates were higher than the *C. difficile* benchmark for this region of 0.40 per 1,000 patient days in 2011 and 2012.

Other healthcare professionals contended that the incidence of HAIs had not increased. Rather, they indicated that there was more surveillance of infectious diseases and greater attention from the media, which led to heightened public awareness of infectious diseases and HAIs. According to the participants, another contributing factor to higher incidence rates of infectious diseases was that patients were colonized with community-acquired infectious diseases on admission to the healthcare facility and these infections were included in the incidence rate calculations. This hypothesis was supported by the literature where it is suggested that the prevalence of community-acquired MRSA is increasing (D'Agata et al., 2009). It is hypothesised that community-acquired MRSA will become the dominant MRSA strain in hospitals and healthcare facilities in the next decade (D'Agata et al., 2009). In addition, the province-wide increase in community-acquired *C. difficile* translated into more hospital cases than anticipated (D'Agata et al., 2009).

How Work has Changed During HAI Disease Outbreaks

Frontline Nurses and Clinical Nurse Managers

Frontline nurses have the most direct and continuous responsibility in performing the procedures and interventions of HAI prevention and control in acute care facilities, making them a critical component of infection prevention and control. Participants indicated that, on a daily basis, the volume of patients in isolation rooms has increased, requiring the implementation of more isolation precautions than there have been in the past. The cumulative effect of the additional time spent on infection prevention and control policies, procedures, and protocols has impacted on the daily work of frontline nurses.

During infectious disease outbreaks, frontline nurses found their workloads were even heavier than their daily workloads were due to the addition of infection prevention and control (IPAC) measures. This is consistent with the literature in which the risk of acquiring HAIs has been associated with excessive workloads and insufficient staffing (Daud-Gallotti et al., 2012). An interesting finding was that nurse-patient ratios were kept the same when there was a high volume of patients in isolation during outbreaks and during nonoutbreak periods.

The amount of documentation that frontline nurses must complete has increased in the facility in general, but particularly during HAI disease outbreaks. Some frontline nurses mentioned that bedside nursing has a lot of paper work, leaving little time for patient care. Examples of factors augmenting the amount of documentation were the increase in infectious diseases and the increased surveillance surrounding infectious diseases.

Healthcare professionals cited *C. difficile* outbreaks as impacting their daily work. Healthcare professional advised that most of the patients with *C. difficile* infections required assistance with toileting and changing of soiled bed linens and gowns. They remarked that

during the two major facility-wide outbreaks, patients with *C. difficile* infections experienced an average of 10 to 15 loose bowel movements per shift. Each time there was a loose bowel movement, frontline nurses had to spend extra time to put on and remove PPE to assist patients with clean bed linens and gowns. Based on the complexity of patient care, this process took from 10 to 30 minutes per patient, per bowel movement. The literature supports the notion that the workload for nurses providing care to patients with infectious diseases is increased because of the IPAC activities required (Haley, 2004; Daud-Gallotti et al., 2012).

Nurses were concerned that their workloads were heavier during evening, night, and weekend shifts than they were during day shifts. They surmised that this was because most other healthcare professionals such as ICPs, physiotherapists, social workers, and clinical nurse managers were not physically present at the hospital during these shifts. With the absence of the other healthcare professionals, nurses must perform some of their roles on these shifts.

ICPs and the ICP Manager

The responsibilities of ICPs have expanded in the acute care setting with the increasing incidence of infectious diseases and outbreaks. They play a major role in the prevention and control of HAI disease outbreaks. The ICP responsibilities consuming the greatest amount of time are surveillance, education, auditing infection control protocols and policies, interdepartmental and external communication, and implementing strategies to control and prevent infectious diseases and HAI disease outbreaks. In the study facility, there were a total of eight ICPs for the facility. There is no current literature on recommended staffing ratios for ICPs. In 2002, O'Boyle, Henly, and Jackson recommended that hospitals required one full-time ICP for every 100 occupied beds.

ICPs indicated that they spend most of their time collecting data and monitoring and tracking infectious diseases through surveillance. The literature supports the notion that surveillance is one of the major elements of a successful IPAC department in healthcare settings (Sydnor & Perl, 2011). ICPs cited two types of surveillance that have impacted their daily roles. The first is diarrhea surveillance, which encompasses the collection of data throughout the hospital for all patients with diarrhea. The second is emergency department (ED) surveillance, which involves assisting with the flow of patients in and out of the ED while ensuring proper infectious disease screening and proper placement of patients with the thorough application of infection control isolation precautions.

During HAI disease outbreaks, ICPs experience challenges owing to the increased amount of data that must be collected daily and documented in numerous places. Another challenge was the number of written reports ICPs were required to write for the hospital senior management team and the public health department (PHD). Outbreaks are politically charged in nature. ICPs cited that, during outbreaks, precise and comprehensive data are required urgently, in a compressed timeframe. Therefore, to meet the data deadlines, the ICPs must withdraw themselves from their assigned units, patients, and IPAC activities in order to collect and compile the required outbreak data. This finding was supported by the literature; Stone et al. (2009) found that ICPs spend the majority of their time collecting and analyzing data. Therefore, ICPs have less time available for the education of healthcare professionals and less involvement in IPAC interventions and policy implementation aimed at the prevention and control of infectious diseases. At odds with the focus on data collection and management is the finding that ICPs are required to be physically available on their assigned units to function as part of the

healthcare team. The ICPs are required to do walk abouts to conduct environmental scans or audits to identify issues that might contribute to an increased bioburden.

ICPs assist with increased communication among the healthcare professions. For example, on a daily basis ICPs must compile and send a daily email report to the hospital senior management team. This email includes information regarding the status of patients with infectious diseases and HAIs, and any newly admitted patients put into isolation precautions. Daily, during infectious disease outbreaks, ICPs communicate with the public health department by faxing a list of patients with diarrhea in the hospital. On a monthly basis, the ICPs communicate with the public health department regarding all communicable diseases in the hospital and the HH compliance rates of the healthcare professionals.

EVS Staff and the EVS Manager

The daily work of the EVS staff has changed owing to the multitude of revisions in the hospital cleaning processes brought about by the first *C. difficile* facility-wide outbreak in 2010-2011. During and following the first facility-wide *C. difficile* outbreak, numerous changes were made to the cleaning processes. At that time, guidelines on how to eradicate *C. difficile* spores from the environment did not exist. The first guidelines regarding environmental cleaning and the cleaning of *C. difficile* and *C. difficile* spores were published by PIDAC in 2012 (PIDAC, 2012b).

A finding from the present study indicated that the EVS staff were required to clean hospital isolation rooms twice a day, including all surfaces. The study facility implemented the precautionary measure of decontaminating the beds of patients in isolation when they had been occupied for 30 days. Further, the EVS staff intensively clean or decontaminate each hospital unit and the entire hospital at prescribed times throughout the year, when required. For example,

a unit that has three or more patients with VRE or *C. difficile* infections or six patients in isolation was considered a high alert unit and the EVS were required to do extensive decontamination of the unit.

During HAI disease outbreaks, it is common practice to decontaminate the entire hospital with the aim of reducing the bioburden and HAI transmissions. In addition, as a precautionary measure, the hospital also introduced planned decontaminations of the hospital. These changes to the infection prevention and control policies, procedures, and protocols have changed the daily work of the EVS staff. The hospital has invested a lot of money, time, and people on the cleaning and decontamination of the facility. This can be attributed partly to the fact that the media focuses on insufficient infection prevention and control practices within the hospital during outbreaks, such as inadequate hospital cleanliness (Butler, 2013; Stastna, 2013).

Unique Strategies to Control and Prevent HAI Disease Outbreaks

In response to HAI and HAI disease outbreaks, the study facility has implemented unique IPAC strategies. For example, the Five C Model - Method of Communication was created as a reminder about infection prevention and control. The Five C Model - Method of Communication is displayed on all computers in the hospital as the monitor screen saver to remind all staff for the need for clean hands, clean equipment, a clean environment, clear communication, and consistent processes.

Additionally, the Five C Model - Method of Communication was used to formulate a standardized HAI prevention audit tool for auditing units in the hospital that reported new cases of HAIs. The standardized HAI prevention audit tool is aimed at identifying gaps or factors that might be contributing to infectious disease transmission. Tasks performed using this model include checking isolation rooms for mandated infection control precaution signage in the

authorized places, ensuring that the personal protective equipment is well-stocked in the nurse servers outside each patient room, and inspecting for unnecessary clutter in the halls and patient rooms.

A second innovation was the tagging and bagging of decontaminated equipment. The hospital implemented this system to identify clean and disinfected shared equipment. Healthcare professionals are expected to clean and disinfect equipment after each patient use and to place a tag on the equipment to indicate that it has been cleaned and disinfected. The equipment is then placed in the unit clean supply room.

The third innovation was the hospital-designed nurse servers, which are shelves built into the wall outside each patient's room with doors protecting the cleanliness of the contents, in which PPE supplies are stored, regardless of whether the patient is isolated or not. The nurse servers are designed to fit useable space, instead of using free-standing carts in the unit hallway, with the intention of relieving the hallways of clutter.

Lastly, the use of whiteboards in healthcare facilities as a means of communication for healthcare teams has been in effect in healthcare facilities for a number of years. However, whiteboards in the study facility were uniquely used as a visual aid to track infectious diseases. The whiteboards were used to show coloured graphs of the incidence of infectious diseases in the unit and the unit's HH compliance rates. The participants found that the whiteboards were helpful for a quick update on the status of infectious control issues on each of the hospital units. Given that some hospital units are very large, whiteboards are an efficient way for communication among the staff.

Facility-Wide and Unit-Based Outbreaks

After the first facility-wide outbreak (2011-2010), the hospital responded by investing in the organizational structure. Most of the patient rooms in the study facility are private rooms with dedicated bathrooms. Hand sanitizer dispensers were placed in all hallways, directly outside and inside patients' rooms, and at the hospital's entrances and exits. A voice reminder system was instituted on entry to the hospital reminding everyone to clean their hands. The hospital uses the four moments for cleaning opportunities for hand hygiene: (a) before the initial contact with each client/patient/resident or items in their environment; (b) before performing an invasive/aseptic procedure; (c) after care involving the risk of exposure to, or contact with, body fluids; and (d) after contact with a client/patient/resident or their environment as recommended by the "Best Practices for Hand Hygiene in All Health Care Settings" protocol (PIDAC, 2010). Even though the hospital had experienced two facility-wide *C. difficile* outbreaks, the common method of hand hygiene used in the study facility was the use of hand sanitizers, unless the hands were visibly soiled. Interestingly, literature exists in which it is suggested that hand sanitizers do not eradicate *C. difficile* spores (Gerding, Muto, & Owens, 2008).

Even though the facility has experienced several unit-based outbreaks, the participants perceived the facility-wide outbreaks as having impacted their daily work the most. This was attributed to the fact that unit-based outbreaks rarely drew media attention. Interventions to control and overcome unit-based outbreaks are normally localized to the affected unit only. However, for facility-wide outbreaks there is wider implementation of additional IPAC practices and protocols across the entire facility and the media is always involved. This finding suggests that facility-wide outbreaks are associated with increased scrutiny and attention by the hospital administration, the public, and the media that is unwelcomed by the participants.

Another interesting finding reported by the participants regarding the facility-wide 2012 HAI disease outbreak is that there was a change in the attitudes and involvement of the hospital leadership. Participants indicated that the hospital leadership team was "not looking to blame" them during the 2012 outbreak. Participants indicated that the hospital leadership wanted "to change and move forward" with the aim of preventing and controlling HAIs and HAI disease outbreaks.

The 2010-2011 HAI disease outbreak had the most impact on the study facility and healthcare professionals' daily work. This is due to the fact that it was the first facility-wide outbreak at the study facility and patient morbidity and mortality were associated with the outbreak. During this outbreak, the facility requested an external IPAC auditor to evaluate the cause and contributing factors of the outbreak. Following this outbreak, additional and numerous IPAC policies and practices were instituted. Examples of the implemented IPAC policies and practices were patient-dedicated equipment, strict utilization of PPE, the use of private rooms for isolation, and increased requirements for HH compliance. The benefit of the use of external auditors is reflected in the literature which indicates that outbreak investigations often provide critical information about the epidemiology of important pathogens or contributing factors to infectious disease transmission (McDonald et al., 2005).

Stress and Blaming during HAI Disease Outbreaks

The concept of blaming and stress was a common finding for healthcare professionals during outbreaks in this study. The factors contributing to stress were the increased scrutiny and attention by the hospital senior leadership team and the media. Negative media reports during HAI disease outbreaks resulted in healthcare professionals feeling constantly on the defensive with their friends, relatives, patients, and colleagues. Participants reported that both the public

and the clinical side of the hospital thought that if an outbreak was occurring, it must be due to environmental factors such as improper cleaning. The concept of blaming has not been addressed a great deal in the literature. Hilton (1990) explained the concept of blaming as the process for explaining events and the associated behavioural and emotional consequences of those explanations. Reasons that blaming occurs is to avoid individual and facility recrimination, as a self-serving attribute (Hilton, 1990).

Impact of HAI Disease Outbreaks on Patient Care

Psychological and Emotional Care of Patients

An important study finding suggested that the psychosocial needs of patients were not being met, especially for patients in isolation. Frontline nurses strive to complete total patient care for each patient and, due to excessive workloads, there is frequently little time for psychological patient care. Frontline nurses mentioned having to rush through nursing care for one patient in order to rush to the nursing care of the next patient. This leaves little time to establish therapeutic nurse-patient relationships. The nurses projected that isolated patients may feel lonely and neglected.

Missed Care

The healthcare professionals in this study were concern when their patients' needs were not being met in a timely manner, especially when the healthcare professionals' workloads were very heavy. Frontline nurses reported that occasionally patients' medications or the provision of general nursing care was not completed in a timely manner or not at all. Frontline nurses explained that, even though they are caring for patients in isolation rooms for long periods, they prefer not to leave the isolation room until patient care is completed. The nurses reasoned that leaving an isolated patient's room to attend to another patient would entail performing hand

hygiene, removing their personal protective equipment, performing hand hygiene prior to and after caring for the other patient, and performing hand hygiene and donning new personal protective equipment prior to returning to the isolation room. This finding is consistent with error of omission which is "failing to do the right thing such as not ambulating a patient as needed that leads to an adverse outcome or has significant potential for such an outcome " (Kalisch, Landstrom, & Williams, 2009, p. 3).

The New Normal

An interesting finding is that the addition of infection prevention and control protocols, policies, and procedures has become an additional layer of care that must be provided. The new normal for nursing care is due to the proliferation of infectious diseases and the increasing number of patients requiring isolation due to infectious diseases. In addition to providing daily, standard care for patients, frontline nurses described a supplementary level of added care which entails the infection prevention and control protocols, policies, and procedures. Infection prevention and control policies are adhered to at all times, with every patient and visitor, by all hospital staff. Nurses reported that, previously, there were few patients with infectious diseases like *C. difficile* or MRSA. Presently, having patients with infectious diseases is a common phenomenon, occurring on a daily basis.

Infection Prevention and Control Policies and Protocols

The study hospital visiting regulations were an important issue for isolated patients during HAI disease outbreaks. In the study facility, during nonoutbreak periods, the healthcare professionals reported being very lenient with visitors, meaning more than two visitors per patient were allowed to visit at one time. However, during outbreaks, healthcare professionals

are stricter with visitors and, at times, a "no visitors policy" may be implemented to restrict traffic in the unit.

The in-hospital patient transfer policy was reviewed after the 2010-2011 HAI disease outbreak and was subsequently changed to allow the in-hospital transfer of patients for clinical reasons only. In addition, patients are to be transferred only on stretchers, not in their hospital beds. The other furniture in the patients' rooms is no longer transferred with the patients.

The study hospital has always had a hand hygiene policy, but, throughout the study time frame, it had been enforced more and expanded. Additionally, the expectations for hand hygiene compliance for healthcare professionals, assessed through internal audits, were increased from 60% to 90% compliance after the 2010-2011 HAI disease outbreak. In the revised policy, the jewelry worn by the staff was limited, as were the use of nail polish and the wearing of artificial nails. Only closed-toe shoes were permitted within the clinical areas of the study facility. In the facility, the use of hand sanitizers to disinfect hands following patient care when the hands were not visibly soiled was instituted. Hand sanitizer dispensers were made available inside and outside patients' rooms, throughout the hallways in the units and hospital, and at the hospital entrances and exits for easy access by hospital staff, visitors, and patients.

The "Antibiotic-Resistant Organism Protocol" (2012) was reviewed and contained the following mandated directive: that all patients must be assessed for the presence of AROs prior to admission to the hospital. In an effort to decrease infectious disease transmission, each isolation room and each patient in isolation has their own dedicated equipment (e.g., a blood pressure machine) and dedicated toileting facilities. Cohorting of patients with the same infectious diseases together in hospital rooms is avoided, when possible. When this cannot be avoided, cohorting is only done in collaboration with an ICP.

An interesting finding was that patients in isolation are encouraged to stay in their rooms. However, if patients have to leave their rooms and go to common hospital areas, such as the cafeteria, they are required to wear clean gowns and wash their hands before leaving their isolation rooms. This practice was supported by a facility IPAC "Antibiotic Resistant Organisms Protocol" (2012).

Limitations of the Study

The present study was confined to one large Ontario acute care hospital. Therefore, the findings may not be generalizable to other settings. Purposive and snowball sampling were used to select participants for this study in order to facilitate the identification of case selection by the clinical managers to obtain rich information. The participants were selected because of their convenient accessibility, experiences with the phenomenon of interest, and willingness to participate. Therefore, selection of the sample may have been subjected to volunteer bias. With volunteer bias, the participants who volunteered to participate in the research project may be different in some important ways from the general population. This is a challenge to the external validity of the study, that is, the extent that the study findings can be generalized to other situations or other people.

CHAPTER 6: CONCLUSION

The present study demonstrated that healthcare professionals' daily work has been affected by the ongoing issue of HAIs and HAI disease outbreaks in one acute care hospital. Although the study facility has invested heavily in active surveillance, environmental cleaning, infection prevention and control policies and protocols, infrastructure, and equipment, HAI disease outbreaks remain a challenge. The IPAC policies and protocols required to prevent and control HAIs and HAI disease outbreaks put additional pressure on healthcare professionals. This situation has impacted healthcare professionals' work on a number of different levels (point-of-care and management), at different times, and requires a coordinated effort to deliver comprehensive care to both patients and families. Despite multidisciplinary team involvement and many guiding policies, procedures, and protocols, the prevalence and incidence of HAIs and HAI disease outbreaks remains a constant challenge. Several innovations have been created by the study hospital staff to address this challenge. The literature supports the observations found in this study. However, the findings demonstrate that there remain areas that require further investigation.

Implications and Recommendations

The findings of the present study illustrate that the acute healthcare facility has invested heavily in preventing and controlling infectious disease transmission and outbreaks. However, despite all the efforts, the presence of infectious diseases in the hospital is a constant and HAI disease outbreaks remain a challenge. The study results indicate that HAI disease outbreaks have an effect on the daily work of healthcare professionals.

Viewing the Nursing Workload

Frontline nurses have the most direct and continuous responsibility to perform the infectious disease prevention and control procedures in the acute care facility. During HAI disease outbreaks, frontline nurses are likely to be assigned a high number of patients in isolation. The cumulative effect of the additional time spent on infection prevention and control policies, procedures, and protocols has impacted on the daily work of frontline nurses and increased nurses' workloads. Nurse-to-patient ratios have remained the same, both during the study time frame and during HAI disease outbreaks, while other healthcare professionals have seen their ratios drop. It is recommendation that the acute care facility conduct a research study that focuses on evaluating frontline nurses' workloads when caring for patients with infectious diseases requiring isolation and during HAI disease outbreaks.

Facility-Wide and Unit-Based Outbreaks

Extensive interventions have been implemented by the study facility focusing on the prevention and controlling of facility-wide outbreaks, which were caused by *C. difficile* infections. Yet, the study facility has experienced a larger number of unit-based outbreaks. A recommendation for the acute care facility is to conduct a secondary analysis of the unit-based infectious disease outbreaks, looking at the infectious disease cases occurring during each unit-based outbreak, and conducting an external audit to identify the root causes or contributing factors to the unit-based outbreaks in an effort to decrease their frequency. In addition, research to identify the contributing factors to the decreasing and lower incidence rates of certain infectious diseases compared with the contributing factors to the higher incidence rates of other infectious diseases leading to infectious disease outbreaks is also recommended. Contributing variables such as staffing characteristics and compliance with infection control and prevention

practices and policies could be examined as well as the identification of other contributing factors.

Exchange and Comparison of Innovations

The study facility has implemented a number of unique innovations in an effort to combat HAI disease outbreaks in the clinical areas. It is recommended that the facility conduct research to evaluate the efficacy of these innovations. Additionally, it is recommended that the acute care facility should disseminate what they have learned in dealing with HAI disease outbreaks, including their innovations, to similar institutions in the province. Lastly, the study facility has standardized infectious disease prevention and control protocols and policies that have changed healthcare professionals' daily work. It is recommended that research is conducted to determine the effectiveness of these infectious disease prevention and control protocols and policies and their effect on healthcare professional's daily work.

Frequently Asked Questions

The study findings demonstrate that infectious disease prevention and control measures have been added to the existing standard patient care, resulting in a new normal for healthcare professionals, especially frontline nurses. Currently, having an assignment of patients with infections and in isolation rooms is a common phenomenon, occurring on a daily basis. The study findings confirmed the notion that, much of the time healthcare professionals are consulting with others on issues related to the care of patients with infectious diseases. It is recommended that the study facility implement a website featuring frequently asked questions related to infectious diseases and HAI disease outbreaks.

In addition, healthcare professionals raised the issue of feeling blamed during outbreaks. Therefore, it is recommended that the study facility implement an interactive social forum for

healthcare professionals. For example, the institution of a healthcare professionals' blog focusing on infectious diseases and outbreaks with referenced facts about the transmission of infectious diseases and the cause of outbreaks is recommended.

Infectious Disease Organism-Specific Healthcare Professional Roles

The study facility pilot tested a unique role for an ICP dedicated to a specific infectious disease organism, the *C. difficile* ICP role. At the time, the ICP focused on patients with *C. difficile* infections and their families. The role of the ICP was that of monitoring and educating all patients who were diagnosed with *C. difficile* infection in the hospital and educating patients' families about *C. difficile* infection. It is recommended that the facility evaluate the value and impact of the six-month pilot project of the *C. difficile* ICP with the plan of reinstituting this role.

REFERENCES

Aboelela, S., Stone, P., & Larson, E. (2007). Effectiveness of bundled behavioural interventions to control healthcare-associated infections: A systematic review of the literature. *Journal of Hospital Infection, 66*(2), 101-108.

Andersen, B., Lindemann, R., Bergh, K., Nesheim, B., Syversen, G., Solheim, N., & Laugerud, F. (2002). Spread of methicillin-resistant *Staphylococcus aureus* in a neonatal intensive unit associated with understaffing, overcrowding and mixing of patients. *The Journal of Hospital Infection, 50*(1), 18.

Are Ontario's hospital occupancy rates a ticking time bomb? (2008, July 10). Are Ontario's hospital occupancy rates a ticking time bomb? New study links occupancy and understaffing to spread of superbugs. *OPSEU Health Care Divisional Council: Dialogue - An Update on Issues Affecting Health Care in Ontario*. Retrieved from http://www.opseu.org/bps/health/dialogue/071008dialogue48.pdf

Boyce, J. M. (2011). Measuring healthcare worker hand hygiene activity: Current practices and emerging technologies. *Infection Control and Hospital Epidemiology*, *32*(10), 1016-1028.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal, 9*(2), 27-40.

Brandt, M., Daschner, M., Rüden, M., & Gastmeier, M. (2006). Reduction of surgical site infection rates associated with active surveillance. *Infection Control and Hospital Epidemiology, 27*(12), 1347-1351.

Butler, D. (2013, July 3). Ottawa Hospital tops province in *C. difficile* infections. *Ottawa Citizen*. Retrieved from http://www.ottawacitizen.com/health/Ottawa+Hospital+tops+province+difficile+infections/8613120/story.html

Canadian Nosocomial Infection Surveillance Program. (2012a).*Clostridium difficile infection: Infection orevention and control quidance for management in acute care settings*. Public Health Agency of Canada (PHAC). Ottawa, Canada: PHAC. Retrieved in June 2012, from http://www.phac-aspc.gc.ca/nois-sinp/guide/c-dif-acs-esa/index-eng.php

Canadian Union of Public Employees. (2009). *Healthcare associated infections: A backgrounder*. CUPE: Canadian Union of Public Employees. Retrieved May 22, 2012, from http://cupe.ca/updir/healthcare-associated-infections-cupe-backgrounder.pdf

Centers for Disease Control and Prevention. (2001). Updated guidelines for evaluating public health surveillance systems. Recommendations and Reports. *Morbidity and Mortality Weekly Report, MMWR, 50*(RR13), 1-35. Retrieved on November 28, 2012, from http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5013a1.htm

Centers for Disease Control and Prevention. (2006, April). *Outline for healthcare-associated infections surveillance*. Centers for Disease Control and Prevention. Washington, DC: US Department of Health and Human Services. Retrieved on June 2012, from http://www.cdc.gov/nhsn/PDFS/OutlineForHAISurveillance.pdf

Centers for Disease Control and Prevention. (2011). Public health then and now: Celebrating 50 years of MMWR at CDC. *Morbidity and Mortality Weekly Report, MMWR, 60*(suppl.). Centers for Disease Control and Prevention. Washington, DC: US Department of Health and Human Services. Retrieved on November 28, 2012, from http://www.cdc.gov/mmwr/pdf/other/su6004.pdf

Centers for Disease Control and Prevention. (2013). *July 2013 CDC/NHSN Protocol Clarifications: CDC/NHSN surveillance definitions for specific types of infections*. Centers for Disease Control and Prevention..National Healthcare Safety Network. Retrieved on July 28, 2013, from http://www.cdc.gov/nhsn/pdfs/pscmanual/17pscnosinfdef_current.pdf

Cimiotti, J. P., Aiken, L. H., Sloane, D. M., & Wu, E. S. (2012). Nurse staffing, burnout, and health care-associated infection. *AJIC: American Journal of Infection Control, 40*(6), 486-490. doi: 10.1016/j.ajic.2012.02.029

Clements, A., Halton, K., Graves, N., Pettitt, A., Morton, A., Looke, D., & Whitby, M. (2008). Overcrowding and understaffing in modern health-care systems: Key determinants in methicillin-resistant staphylococcus aureus transmission. *The Lancet Infectious Diseases, 8*(7), 427-434. doi: 10.1016/S1473-3099(08)70151-8

Collins, A. S. (2008). Preventing health care-associated infections. In R. G. Hughes (Ed.). *Patient safety and quality: An evidence-based handbook for nurses* (pp. 547-575). Agency for Healthcare Research and Quality. Washington, DC: US Department of Health & Human Services. Retrieved September 29, 2013, from http://www.ahrq.gov/professionals/clinicians-providers/resources/nursing/resources/nurseshdbk/index.html

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five traditions* (2nd ed.). Thousand Oaks, CA: Sage.

Daneman, N., Stukel, T. A., Ma, X., Vermeulen, M., & Guttmann, A. (2012). Reduction in clostridium difficile infection rates after mandatory hospital public reporting: Findings from a longitudinal cohort study in Canada. *PLoS Medicine, 9*(7), e1001268.

Daud-Gallotti, R. M., Costa, S. F., Guimarães, T., Padilha, K. G., Inoue, E. N., Vasconcelos, T. N., . . . Levin, A. S. (2012). Nursing workload as a risk factor for healthcare associated infections in ICU: A prospective study. *PloS One, 7*(12), e52342.

Davis, K. A., Stewart, J. J., Crouch, H. K., Florez, C. E., & Hospenthal, D. R. (2004). Methicillin-resistant staphylococcus aureus (MRSA) nares colonization at hospital admission and its effect on subsequent MRSA infection. *Clinical Infectious Diseases, 39*(6), 776-782.

Didiodata, G. (2013). Has improved hand hygiene compliance reduced the risk of hospital-acquired infections among hospitalized patients in Ontario? Analysis of publicly reported patient safety data from 2008 to 2011. *Infection Control and Hospital Epidemiology, 34*(6), 605-610.

Dikema, M., Long, K. A., Scharff, J. E., & Weinert, C. (2007). Infection control practitioners' role in the management of C. difficile outbreak. *The Canadian Journal of Infection Control, 36*(4), 91-94.

D'Agata, E., Webb, G. F., Horn, M. A., Moellering, R. C., & Ruan, S. (2009). Modeling the invasion of community-acquired methicillin-resistant staphylococcus aureus into hospitals. *Clinical Infectious Diseases, 48*(3), 274-284.

Ducel, G., Fabry, J., & Nicolle, L. (Eds). (2002). *Prevention of hospital acquired infections: A practical guide,* (2nd ed.). (WHO/CDS/CSR/EPH/2002.12) Malta: WHO. Retrieved September 29, 2013, from http://www.who.int/csr/resources/publications/whocdscsreph200212.pdf

Eggertson, L. (2005). C. difficile may have killed 2000 in Quebec: Study. *Canadian Medical Association Journal, 173*(9), 1020-1021.

Erasmus, V., Daha, T. J., Brug, H., Richardus, J. H., Behrendt, M. D., Vos, M. C., & van Beeck, E. F. (2010). Systematic review of studies on compliance with hand hygiene guidelines in hospital care. *Infection Control and Hospital Epidemiology, 31*(3), 283-294. Retrieved from http://www.jstor.org/stable/10.1086/650451

Franke, R. H., & Kaul, J. D. (1978). The Hawthorne experiments: First statistical interpretation. *American Sociological Review* 48, 623-643.

Gangeness, J. E., & Yurkovich, E. (2005). Revisiting case study as a nursing research design. *Nurse researcher, 13*(4), 7-18.

Gastmeier, P., Geffers, C., Brandt, C., Zuschneid, I., Sohr, D., Schwab, F., . . . Rüden, H. (2006). Effectiveness of a nationwide nosocomial infection surveillance system for reducing nosocomial infections. *The Journal of Hospital Infection, 64*(1), 16-22.

Gastmeier, P., Sohr, D., Schwab, F., Behnke, M., Zuschneid, I., Brandt, C., . . . Geffers, C. (2008). Ten years of KISS: The most important requirements for success. *Journal of Hospital Infection, 70*, 11-16.

Gerding, D. N., Muto, C. A., & Owens, R. C. (2008). Measures to control and prevent clostridium difficile infection. *Clinical Infectious Diseases, 46*(Supplement 1), S43-S49.

Goldmann, D. (2006). System failure versus personal accountability - The case for clean hands. *The New England Journal of Medicine, 355*(2), 121-3.

Gould, F, D., Chudleigh, J. H., Moralejo, D., & Drey, N. (2009). *Interventions to improve hand hygiene compliance in patient care*. Cochrane Database of Systematic Reviews 2009, Art No: CD005186. (4) doi: 10.1002/14651858.CD005186.pub2

Gravel, D., Miller, M., Simor, A., Taylor, G., Gardam, M., McGeer, A., . . . (2009). Health care-associated clostridium difficile infection in adults admitted to acute care hospitals in Canada: A Canadian nosocomial infection surveillance program study. *Clinical Infectious Diseases, 48*(5), 568-576. doi: 10.1086/596703

Graves, N., Weinhold, D., Tong, E., Birrell, F., Doidge, S., Ramritu, P., . . . Whitby, M. (2007). Effect of healthcare-acquired infection on length of hospital stay and cost. *Infection Control and Hospital Epidemiology, 28*(3), 280-292. Retrieved from http://www.jstor.org/stable/10.1086/512642

Griffin, F. A. (2007). Reducing methicillin-resistant staphylococcus aureus (MRSA) infections. *Joint Commission Journal on Quality and Patient Safety, 33*(12), 726-731.

Haley, B. N. (2004). Effectiveness of infection control program in controlling nosocomial clostridium difficile. *American Journal of Infection, 26*(6), 588-93.

Haley, R. W., Culver, D. H., White, J. W., Morgan, W. M., Emori, T. G., Munn, V. P., & Hooton, T. M. (1985). The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *American Journal of Epidemiology, 121*(2), 182-205.

Hilton, D. J. (1990). Conversational processes and causal explanation. *Psychological Bulletin, 107*(1), 65.

Horan, T. C., Andrus, M., & Dudeck, M. A. (2008). CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. *AJIC: American Journal of Infection Control, 36*(5), 309-332. doi: 10.1016/j.ajic.2008.03.002

Hsieh, H., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277-1288.

Huang, S. S., Yokoe, D. S., Hinrichsen, V. L., Spurchise, L. S., Datta, R., Miroshnik, I., & Platt, R. (2006). Impact of routine intensive care unit surveillance cultures and resultant barrier precautions on hospital-wide methicillin-resistant staphylococcus aureus bacteremia. *Clinical Infectious Diseases, 43*(8), 971-978.

Hugonnet, S., Chevrolet, J., & Pittet, D. (2007). The effect of workload on infection risk in critically ill patients. *Critical Care Medicine, 35*(1), 76-81.

Hulley, S. B., Cummings, R. S., Browner, W. S., Grady, D. G. & Newman, T. B., (2007). *Designing clinical research* (3rd ed.). Sydney, Australia: Lippincott Williams & Wilkins.

Institute for Healthcare Improvement. (2011).What is a Bundle? Retrieved from http://www.ihi.org/knowledge/Pages/ImprovementStories/WhatIsaBundle.aspx

Jernigan, D. B., Raghunathan, P. L., Bell, B. P., Brechner, R., Bresnitz, E. A., Butler, J. C., . . . Fischer, M. (2002). Investigation of bioterrorism-related anthrax, United States, 2001: Epidemiologic findings. *Emerging Infectious Diseases, 8*(10), 1019.

Jarvis, W. (1994). Handwashing - The Semmelweis lesson forgotten? *The Lancet, 344*(8933), 1311-1312.

Kaba, A. (2011). *The changing nature of the health professionals' work: The impact of infectious diseases* (Unpublished master's thesis). McMaster University, Hamilton, ON, Canada.

Kalisch, B. J., Landstrom, G., & Williams, R. A. (2009). Missed nursing care: Errors of omission. *Nursing Outlook, 57*(1), 3-9.

Kim, T., Oh, P. I., & Simor, A. E. (2001). The economic impact of methicillin-resistant staphylococcus aureus in Canadian hospitals. *Infection Control and Hospital Epidemiology : The Official Journal of the Society of Hospital Epidemiologists of America, 22*(2), 99-104. doi: 10.1086/501871

Kirkland, K. B., Homa, K. A., Lasky, R. A., Ptak, J. A., Taylor, E. A., & Splaine, M. E. (2012). Impact of a hospital-wide hand hygiene initiative on healthcare-associated infections: Results of an interrupted time series. *BMJ Quality & Safety, 21*(12), 1019-1026.

Klevens, R. M., Edwards, J. R., Richards, C. L., Horan, T. C., Gaynes, R. P., Pollock, D. A., & Cardo, D. M. (2007). Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Reports, 122*(2), 160-166. doi: 10.2307/20057111

Kung, J., Chiappelli, F., Cajulis, O. O., Avezova, R., Kossan, G., Chew, L., & Maida, C. A. (2010). From systematic reviews to clinical recommendations for evidence-based health care: Validation of revised assessment of multiple systematic reviews (R-AMSTAR) for grading of clinical relevance. *The Open Dentistry Journal, 4*, 84.

Koch, T. (2006). Establishing rigour in qualitative research: The decision trail. *Journal of Advanced Nursing, 53*(1), 91-100. doi: 10.1111/j.1365-2648.2006.03681.x

Kwong, J. C., Ratnasingham, S., Campitelli, M. A., Daneman, N., Deeks, S. L., Manuel, D. G., . . . Fisman, D. N. (2012). The impact of infection on population health: Results of the Ontario burden of infectious diseases study. *PloS One, 7*(9), e44103.

Larson, E., & Killien, M. (1982). Factors influencing handwashing behavior of patient care personnel. *American Journal of Infection Control, 10*(3), 93-99.

Luby, R., Bialachowski, A., Clinker, K., LeBlanc, M., & McDonald, S. (2005). The audit process: Part III - Closing the loop. *The Canadian Journal of Infection Control*, *25*(3), 161-165.

Letts, L., Wilkins, S., Law, M., Stewart, D., Bosch, J., & Westmorland, M. (2007). Guidelines for critical review form: Qualitative studies (version 2.0). *McMaster University Qualitative Review Form Guidelines.* Hamilton, ON: McMaster University.

Loo, V. G., Poirier, L., Miller, M. A., Oughton, M., Libman, M. D., Michaud, S., . . . Kelly, M. (2005). A predominantly clonal multi-institutional outbreak of clostridium difficile–associated diarrhea with high morbidity and mortality. *New England Journal of Medicine, 353*(23), 2442-2449.

Maunder, R. G., Lancee, W. J., Balderson, K. E., Bennett, J. P., Borgundvaag, B., Evans, S., . . . Hunter, J. J. (2006). Long-term psychological and occupational effects of providing hospital healthcare during the SARS outbreak. *Emerging Infectious Diseases, 12*(12), 1924.

McCarter, D. (2008). Designing an infection control program to meet JCAHO standards. *Caring, 15*(7), 18-25.

McDonald, L. C., Killgore, G. E., Thompson, A., Owens Jr., R. C., Kazakova, S. V., Sambol, S. P., . . . Gerding, D. N. (2005). An epidemic, toxin gene-variant strain of clostridium difficile. *New England Journal of Medicine, 353*(23), 2433-2441.

McGuckin, M., Waterman, R., & Govednik, J. (2009). Hand hygiene compliance rates in the United States-A one-year multicenter collaboration using product/volume usage measurement and feedback. *American Journal of Medical Quality, 24*(3), 205-213.

McKibben, L., Fowler, G., Horan, T., & Brennan, P. J. (2006). Ensuring rational public reporting systems for health care-associated infections: Systematic literature review and evaluation recommendations. *American Journal of Infection Control, 34*(3), 142-149. doi: 10.1016/j.ajic.2005.09.006

Merriam, S. B. (1998). Qualitative research and case study application in education. San Francisco, CA: Josses-Bass.

Miles, M., & Huberman, M. (1994). *Qualitative data analysis*. Thousand Oaks, CA: Sage.

Miller, F. A., & Alvarado, K. (2005). Incorporating documents into qualitative nursing research. *Journal of Nursing Scholarship, 37*(4), 348-353.

Ministry of Health and Long Term Care. (2008). *Patient safety indicator public reporting*. Patient Safety. Ontario Ministry of Health and Long Term Care: Queen's Printer for Ontario. Retrieved May 23, 2012 from http://www.health.gov.on.ca/en/public/programs/patient_safety/

Ministry of Health and Long Term Care. (2009). *Control of clostridium difficile infection (CDI) outbreaks in hospitals: A guide for hospital and health unit staff*. Public Health Division: Public Health Protection and Prevention Branch. Ottawa, Ontario: MOHLTC. Retrieved

on May 29, 2012, from: http: http://www.rcdhu.com/HealthInformation/infdisease_outbreak-control-of-CDI-hospitals.pdf

Ministry of Health and Long Term Care. (2011). *Just clean your hands*. Health Care Professionals. Hand Hygiene. Retrieved on November 29, 2012, from: http://www.health.gov.on.ca/en/ms/handhygiene/

Ministry of Health and Long Term Care. (2012). *Disease: Clostridium difficile infection (CDI) outbreaks in public hospitals*. Appendix B: Provincial case definitions for reportable diseases. Infectious Diseases Protocol, 2009. Ottawa, Ontario: MOHLTC. Retrieved on December 29, 2012, from http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/cdi_cd.pdf

Ministry of Health and Long Term Care. (2013). *Infectious diseases protocol, 2013.* Catalogue No.015910. Toronto, ON: Queen's Printer for Ontario. Retrieved July 27, 2013 from http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/infectious_diseases.pdf.

Miranda, D. R., Nap, R., de Rijk, A., Schaufeli, W., & Iapichino, G. (2003). Nursing activities score. *Critical Care Medicine, 31*(2), 374-382.

Morgan, D. L. (2007). Paradigms lost and pragmatism regained. *Journal of Mixed Methods Research, 1*(1), 48-76.

Morgan, M., Neill, J., & Taylor, K. (2009). An evaluation of isolation precautions used on medical surgical wards to control outbreak of C. difficile. *The Canadian Journal of Public Health, 10,* 239-243.

Muto, C. A., Blank, M. K., Marsh, J. W., Vergis, E. N., O'Leary, M. M., Shutt, K. A., . . . Posey, K. (2007). Control of an outbreak of infection with the hypervirulent clostridium difficile BI strain in a university hospital using a comprehensive "bundle" approach. *Clinical Infectious Diseases, 45*(10), 1266-1273.

Nickell, L. A., Crighton, E. J., Tracy, C. S., Al-Enazy, H., Bolaji, Y., Hanjrah, S., . . . Upshur, R. E. (2004). Psychosocial effects of SARS on hospital staff: Survey of a large tertiary care institution. *Canadian Medical Association Journal, 170*(5), 793-798.

NVivo Version 10 (2012). *NVivo qualitative data analysis software*. Doncaster, Australia: QSR International Pty Ltd.

Ontario Calls in federal help in *C. difficile* outbreak (2011, July 7) CTV News. Retrieved from http://toronto.ctvnews.ca/ontario-calls-in-federal-help-in-c-difficile-outbreak-1.666992

O'Boyle, C., Henly, S. J., & Jackson, M. (2002). Staffing requirements for infection control programs in US health care facilities: Delphi project. *American Journal of Infection Control, 30*(6), 321-333.

Ontario Expert Panel on SARS and Infectious Disease Control. (2004). *For the public's health: A plan for action.* Toronto, ON: Government of Ontario.

Ontario Hospital Association & Ontario Medical Association. (2013). *Antibiotic resistant organisms surveillance protocol for Ontario hospitals*. (Pub. #296). OHA/OMA Joint Communicable Diseases Surveillance Protocols Committee. Retrieved from http://www.oha.com/Services/HealthSafety/Documents/Protocols/Antibiotic%20Resistant%20Organisms%20Protocol%20-%20Revised%20May%202013.pdf

Ontario Ministry of Finance. (2013). *Ontario population projections update*. 2012-2036 Ontario and Its 49 Census Divisions. Based on the 2006 Census. Toronto, ON: Queen's Printer for Ontario. Retrieved in May 2013, from http://www.fin.gov.on.ca/en/economy/demographics/projections/projections2012-2036.pdf

Oughton, M. T., Loo, V. G., Dendukuri, N., Fenn, M., & Libman, M. D. (2009). Hand hygiene with soap and water is superior to alcohol rub and antiseptic wipes for removal of clostridium difficile. *Hand, 30*(10), 939-944.

Partington, G. (2001). Qualitative research interviews: Identifying problems in technique. *Issue in Education Research, 11*(2), 32-44. Edith Cowan University. Research Online. ECU Publications, Pre. 2011. Retrieved on July 2012 from http://ro.ecu.edu.au/ecuworks/4368/

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Piper, T. (Ed.). (2006). *Stedman's medical dictionary* (28th ed.). Baltimore, MD: Lippincott, Williams & Wilkins.

Pittet, D., Allegranzi, B., Sax, H., Dharan, S., Pessoa-Silva, C. L., Donaldson, L., & Boyce, J. M. (2006). Evidence-based model for hand transmission during patient care and the role of improved practices. *The Lancet Infectious Diseases, 6*(10), 641-652.

Provincial Infectious Diseases Advisory Committee. (2009). *Best practice document for the management of clostridium difficile prevention in healthcare settings*. Toronto, ON: Ontario Ministry of Health and Long-Term Care. Retrieved on July, 20, 2012 from: http://www.tbdhu.com/NR/rdonlyres/317596DF-24C4-4B37-B23E-9F6EB6A3AAA8/0/bp_cdiff.pdf

Provincial Infectious Diseases Advisory Committee. (2010). *Best practices for hand hygiene in all healthcare settings* (version 2). Toronto, ON: Ontario Ministry of Health and Long-Term Care. From: http://www.publichealthontario.ca/en/BrowseByTopic/InfectiousDiseases/PIDAC/Pages/PIDAC_Documents.aspx

Provincial Infectious Diseases Advisory Committee. (2012a). *Best practices for infection prevention and control programs in Ontario*: *In all health care settings* (3rd ed.). Public Health Ontario. Toronto, Ontario: Queen's Printer for Ontario. From: http://www.publichealthontario.ca/en/eRepository/BP_IPAC_Ontario_HCSettings_2012.pdf

Provincial Infectious Diseases Advisory Committee. (2012b). *Best practices for environmental cleaning for prevention and control of infections: In all health care settings* (2nd ed.). Public Health Ontario. Toronto, Ontario: Queen's Printer for Ontario. Retrieved on August 29, 2012, from: http://www.publichealthontario.ca/en/eRepository/Best_Practices_Environmental_Cleaning_2012.pdf

Provincial Infectious Diseases Advisory Committee. (2012c). *Routine practices and additional precautions: In all health care settings*, (3rd ed). Ontario Agency for Health Protection and Promotion. Public Health Ontario. Ottawa, ON: Queen's Printer for Ontario. Retrieved from http://www.publichealthontario.ca/en/eRepository/RPAP_All_HealthCare_Settings_Eng2012.pdf

Provincial Infectious Diseases Advisory Committee. (2013a). Annex A: Screening, testing and surveillance for antibiotic-resistant organisms (AROs): In all healthcare settings. Ontario Agency for Health Protection and Promotion. Public Health Ontario. Ottawa, ON: Queen's Printer for Ontario. Retrieved from http://www.publichealthontario.ca/en/eRepository/PIDAC-IPC_Annex_A_Screening_Testing_Surveillance_AROs_2013.pdf

Provincial Infectious Diseases Advisory Committee. (2013b). *Best practices for cleaning, disinfection and sterilization of medical equipment/devices: In all health care settings*, (3rd ed). Agency for Health Protection and Promotion. Public Health Ontario. Ottawa, ON: Queen's Printer for Ontario. Retrieved from http://www.publichealthontario.ca/en/eRepository/PIDAC_Cleaning_Disinfection_and_Sterilization_2013.pdf

Public Health Agency of Canada. (2008). *Fact sheet - Methicillin-resistant Staphylococcus aureus.* Retrieved from http://www.phac-aspc.gc.ca/id-mi/mrsa-eng.php.

Public Health Agency of Canada. (2010). *Fact sheet - Vancomycin-resistant enterococci.* Retrieved from http://www.phac-aspc.gc.ca/nois-sinp/vre-erv-eng.php

Public Health Agency of Canada. (2011). *Fact sheet - Clostridium difficile*. Retrieved from http://www.phac-aspc.gc.ca/id-mi/cdiff-eng.php.

Public Health Agency of Canada. (2012). *Hand hygiene practice in healthcare settings*. Infectious Disease Prevention and Control - Protecting Canadians from Illness. (Cat. No. HP40-74/2012E-PDF). Retrieved from http://publications.gc.ca/collections/collection_2012/aspc-phac/HP40-74-2012-eng.pdf

Public Health Agency of Canada **(**2012b**).** The Canadian Nosocomial Infection Surveillance Program. Retrieved on January 4, 2013from http://www.phac-aspc.gc.ca/nois-sinp/survprog-eng.php

Public Health Agency of Canada. (2013a). *Clostridium difficile infection*: *Infection prevention and control guidance for management in acute care settings*. Retrieved on May 20, 2013, from: http://www.phac-aspc.gc.ca/nois-sinp/guide/c-dif-acs-esa/index-eng.php

Public Health Agency of Canada. (2013b). Surveillance: Canadian chronic disease surveillance system. Retrieved on January 18, 2013, from http://www.phac-aspc.gc.ca/surveillance-eng.php

Robertson, E., Hershenfield, K., Grace, S. L., & Stewart, D. E. (2004). The psychosocial effects of being quarantined following exposure to SARS: A qualitative study of Toronto health care workers. *Canadian Journal of Psychiatry*, *49*, 403-407.

SARS Commission. (2006). *SARS commission executive summary: Volume one – Spring of fear*. Toronto, ON: Ontario Ministry of Health and Long-Term Care.

Samore, M. H., Venkataraman, L., DeGirolami, P. C., Arbeit, R. D., & Karchmer, A. W. (1996). Clinical and molecular epidemiology of sporadic and clustered cases of nosocomial clostridium difficile diarrhea. *The American Journal of Medicine*, *100*(1), 32-40.

Sax, H., Allegranzi, B., Chraïti, M., Boyce, J., Larson, E., & Pittet, D. (2009). The World Health Organization hand hygiene observation method. *American Journal of Infection Control, 37*(10), 827-834.

Schumacher, K. L., Koresawa, S., West, C., Dodd, M., Paul, S. M., Tripathy, D., . . . Miaskowski, C. (2005). Qualitative research contribution to a randomized clinical trial. *Research in Nursing & Health, 28*(3), 268-280. doi: 10.1002/nur.20080

Scott II, D. R. (2009). *The direct medical cost of healthcare-associated infections in U.S. hospitals and the benefits of prevention*. (Vol. CS200891-A). Coordinating Center for Infectious Diseases. Centers for Disease Control and Prevention. Atlanta, GA: CDC. Retrieved on May 23, 2012, from http://www.cdc.gov/hai/pdfs/hai/scott_costpaper.pdf

Silverman, D. (2006). *Interpreting qualitative data. Methods for analyzing talk, text and interaction* (2nd ed.). London, UK: Sage.

Simor, A. E., Ofner-Agostini, M., Bryce, E., Green, K., McGeer, A., Mulvey, M., & Paton, S. (2001). The evolution of methicillin-resistant staphylococcus aureus in Canadian hospitals: 5 years of national surveillance. *Canadian Medical Association Journal, 165*(1), 21-26.

SPSS Inc. (2013). *SPSS base 19.0 for windows*. Chicago, IL: SPSS Inc.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage.

Stastna, K. (2013, April,9). *Exclusive: Dirty hospital a top concern for Canadians: One-third of respondents to CBC survey say patient room, bathroom not clean*. CBC News. Health. Retrieved from http://www.cbc.ca/news/health/story/2013/04/08/hospitals-patient-survey.html

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.

Steed, C., Kelly, J. W., Blackhurst, D., Boeker, S., Diller, T., Alper, P., & Larson, E. (2011). Hospital hand hygiene opportunities: Where and when (HOW2)? The HOW2 benchmark study. *American Journal of Infection Control, 39*(1), 19-26.

Stone, P. W., Dick, A., Pogorzelska, M., Horan, T. C., Furuya, E. Y., & Larson, E. (2009). Staffing and structure of infection prevention and control programs. *American Journal of Infection Control, 37*(5), 351-357.

Stone, P. W., Larson, E. L., Mooney-Kane, C., Smolowitz, J., Lin, S. X., & Dick, A. W. (2006). Organizational climate and intensive care unit nurses' intention to leave. *Critical Care Medicine, 34*(7), 1907-1912.

Swartz, M. N. (2001). Recognition and management of anthrax - An update. *New England Journal of Medicine, 345*(22), 1621-1626.

Sydnor, E. R., & Perl, T. M. (2011). Hospital epidemiology and infection control in acute-care settings. *Clinical Microbiology Reviews, 24*(1), 141-173.

Walker, D., & Myrick, F. (2006). Grounded theory: An exploration of process and procedure. *Qualitative Health Research, 16,* 547-559.

Walters, J. (2011, February 11). *C. diff outbreak declared over at St. Joe's*. thespec.com. Retrieved from http://www.thespec.com/news-story/2114418-c-diff-outbreak-declared-over-at-st-joe-s/

Weinstein, R. A., Stone, P. W., Pogorzelska, M., Kunches, L., & Hirschhorn, L. R. (2008). Hospital staffing and health care-associated infections: A systematic review of the literature. *Clinical Infectious Diseases, 47*(7), 937-944. doi: 10.1086/591696.

World Health Organization. (2009). *WHO guidelines on hand hygiene in health care: First global patient safety challenge: Clean care is safer care.* Patient Safety. Geneva: CH: WHO. Retrieved May 22, 2012, from http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

Yin, R. K. (2009). *Case study research: Design and method* (4th ed.). Thousand Oaks, CA: Sage.

Yokoe, D. S., Mermel, L. A., Anderson, D. J., Arias, K. M., Burstin, H., Calfee, D. P., . . . Gerding, D. N. (2008). A compendium of strategies to prevent healthcare-associated infections in acute care hospitals. *Infection Control and Hospital Epidemiology, 29*(S1), S12-S21.

Zoutman, D. E., Ford, B. D., Bryce, E., Gourdeau, M., Hébert, G., Henderson, E., & Paton, S. (2003). The state of infection surveillance and control in Canadian acute care hospitals. *American Journal of Infection Control, 31*(5), 266-273.

Appendix A. Introduction Email

Study Title: Impact of Nosocomial/Healthcare-Associated Infectious Disease Outbreaks on Healthcare Professionals' Daily Work

Email to: Registered Nurses, Registered Practical Nurses, Clinical Managers, and Infection Control Professionals

From: Joan Musau

Cc:

Subject: Invitation to participate in a study to understand your perceptions about the impact of healthcare-associated infectious disease outbreaks on the nature of healthcare professionals' daily work

We are pleased to invite you to participate in a study that is looking at the impact of nosocomial infectious diseases outbreaks on healthcare professionals' daily work. As part of my Master's in Nursing project at McMaster University, I am looking forward to speaking with you regarding your perceptions on the topic.

The objectives of the project are to:

1. Describe the incidence of healthcare associated infectious disease in one urban acute care hospital (2008 to 2012).
2. Describe the impact of nosocomial/HAI infectious disease outbreaks (2010 - 2011 and 2012) on (a) Daily nursing care delivery through the perceptions of nurses at the point-of-care. (b) Healthcare professionals' daily work through the perceptions of clinical managers, housekeeping and infection control professionals
3. Analyze the policies and practice protocols related to nurses' and other healthcare professionals' daily work during the nosocomial/HAI infectious disease outbreaks (2010 - 2011 and 2012).
4. Analyze the changes that occurred after the outbreak and the current policies and practice protocols in relation to healthcare associated infectious disease.
5. Describe the physical structure/ innovations of the hospital in relation to the control of healthcare-associated infectious disease outbreaks.

The interviews will be audio tape-recorded and transcribed for analysis by the research team. Preliminary consent for the interview will be obtained prior to setting the interview appointment; receipt of the signed informed consent form will be acknowledged during the interview. Publication of any result of the study will use aggregated data to ensure anonymity of the participants. The research project has received ethics approval by the St Joseph /McMaster University ethics committee. A copy of the interview guide, participant's information letter, and consent form are attached. The informed consent form will be signed prior to the interview and you will receive a copy for your files.

The interview will take approximately 40 - 60 minutes. I will provide you with a letter of appreciation for your time and participation in this study for your practice portfolio.

Thank you in advance for agreeing to participate.

Joan Musau

Appendix B. Demographic Data Form

General Demographic Information for Healthcare Professionals **ID No. _____**

Healthcare Professional Occupation (please mark one of the following)
Registered Nurse _____
Registered Practice Nurse _____
Clinical Manager (indicate your position) _____
Infection Control Professionals (indicate your position)_____

Education
_____ Certificate
_____ Diploma
_____ Baccalaureate Degree
_____ Masters
_____ PhD

Additional certificates obtained (list type of certificates currently held)
_____

Current Employment Status _____ Full-time
_____ Part-time
_____ Other (please list)

Average hours of work per week _____

Schedule:
_____ 8hr
_____ 10hr
_____ 12hr
_____ Other

Number of years of work experience in your current occupation _____

Number of years in your current position _____-_____

Number of years employed by this hospital_____

Sex Female _____ Male_____

What year were you born? _____

Appendix C. Key Informant Interview Guide

Preamble

I am interested in understanding how nosocomial or healthcare-associated infectious diseases outbreaks affect your daily nursing work. I have a few questions to ask that will take 40 - 60 minutes of your time to answer. Thank you again for agreeing to participate in this interview. If you are uncomfortable answering any of the questions, you have the option of not answering and proceeding to the following question. As a reminder, this interview will be tape-recorded for accuracy.

Study Title: The Impact of healthcare associated/nosocomial infectious disease outbreaks on the healthcare professional's daily work.

Tell me about the 2010-2011infectious disease outbreak in the institution.

Probe: how many wards were affected?
How did this affect your workload?
What support systems did you have to help you cope when you were caring for numerous patients during the outbreak?

Tell me about a typical day when you were caring for patients during the healthcare-associated infectious diseases outbreaks in 2010- 2011.

- Probe: What were the main nursing roles?
- Ask about detailed interactions with other staff, patients.
- Ask about # of pts they had in one shift, nurse-patient ratio, were there usually enough nurses on the unit?

Please identify how the healthcare-associated infectious diseases outbreak of 2010-2011 has impacted your (nurses') work? Can you provide me with some examples?

- Probe: what types of challenges has this caused for you (nurses)?
- Has there been an increase in staffing ratios, workloads, more resources allocated to prevent the transmission of infectious diseases?
- Has the practice related to infectious disease prevention and control changes?

How did the Infection Control Professionals (ICP) support you during the outbreaks?

- Probe: do you have ICP's in your organization?
- What is your understanding of the ICP's role in your organization?
- (If ICPs are present in the organization) ASK: how has the ICP affected your work related to infection control?
- Have you had any in-services about nosocomial infectious diseases?
- What is role of ICP during outbreaks?

What is your perception of how the care of patients with healthcare-associated infectious diseases changed since the last infectious disease outbreak of 2011-2012 in your workplace? Can you provide me with an example? Thank you. Other examples would be great if you have some.

- Probe: what are some examples of your impression of the nature of the care received by patients with HAIs?
- Does it seem to be as comprehensive as it should be?
- Are you able to give complete care as you would like to? Why?
- Or are there things you are not able to complete in the course of a day?

Please identify examples of recent infectious disease policies/mandates from your organization which have impacted your work and everyday practices as a nurse?

Probe: any rules, regulations or "official stuff" that has affected what you do?
What policies/protocols are challenging to implement?
What are some of the policies during nosocomial infectious disease outbreak?
After the last outbreak have there been policy reviews?

How long have you been an employee with St. Joseph's? Have you seen a rise in infectious disease since you started working at St. Joseph's?

- Probe: what specific infectious diseases have you seen a rise in? (MRSA, VRE, C difficile);
- Are you seeing any newly emerging infectious diseases

What is your perception of how the care of patients with hospital-associated infectious diseases has changed in the past 3 years because of the rise of hospital-associated infections (HAIs) in your workplace? Can you provide me with an example? Thank you. Other examples would be great if you have some.

- Probe: what are some examples of your impression of the nature of the care received by patients with HAIs?
- Does it seem to be as comprehensive as it should be?
- Are you able to give complete care as you would like to?
- Or are there things you are not able to complete in the course of a day?

How have polices on isolation precautions (isolating patients with healthcare-associated infectious diseases behind curtains or in separate rooms) affected your work?

- Probe: do you see any organizational challenges with isolating patients?
- Do you see any physical challenges with isolating patients?
- How has this policy changed how you provide nursing care to your patients?
- When you have a patient in isolation, how much more time do you estimate that you spend with that particular patient than with patients not in isolation?
- How does this affect your workload?
- How does this affect the care you provide to your other patients?
- During outbreak, how is isolation implemented?

How have policies on personal protective equipment (gowning, gloving, and wearing a mask) affected your work?

- Probe: Describe steps you take every time you use PPE before caring for an isolated patient?
- How much additional time do you think PPE adds to your work?
- What are the major challenges in implementing the PPE regularly?
- Do you find that nurses always adhere to these policies?
- Do adhere to PPE during infectious disease outbreaks?
- Do you find that families always adhere to these policies during outbreaks?
- What are the challenges you face in educating families/relatives about PPE policies during outbreaks?

What do you know about the 2008 public reporting mandates from the MOHLTC on HAIs?

- Probe: if you are aware of this mandate, how did you find out about it?
- Did your clinical managers or clinical vice presidents tell you about the mandate?
- What is your understanding of this mandate (new transparent reporting process)?
- How is the reporting done?

Infection Control Professionals (ICP) Specific Questions

1. **What is your primary role in preventing hospital-associated infectious diseases in this hospital?**
    - Probe: what strategies do ICP's utilize to prevent secondary infectious diseases?
2. **Describe your role in monitoring and surveillance of new incidences of HAIs and infectious disease outbreaks.**
    - Probe: has your role changed with the implementation of the 2008 MOHLTC public reporting guidelines?
3. **Describe your role in addressing organizational and environmental challenges of implementing infection control policies: specifically personal protective equipment and isolation precautions**.
4. **Describe your role in conducting a routine surveillance for a potential outbreak**.
    - Probe: would you be accessing all patient and hospital records?
5. **Describe your role during hospital-associated infectious disease outbreaks?**
    - Probe: explain the last outbreak in the institutions
    - What were some of the challenges?
6. **How did ICPs work with frontline nurses during the 2010-2011 hospital-associated infectious disease outbreaks?**
    - Probe: What was your expectation of the nurses?
    - How were the nurses coping?
7. **Is there anything else that you would like to discuss?**

Appendix D. Letter of Information/Consent

Study Title: Impact of Nosocomial/Healthcare-Associated Infectious Disease Outbreaks on Healthcare Professionals' Daily Work

Purpose of the Study

You are being invited to participate in a research project exploring the impact of healthcare associated infectious diseases outbreaks on healthcare professionals' work. The study will be conducted at St. Joseph's Healthcare in Hamilton. Approximately 25 participants will be interviewed including frontline nurses, clinical managers and infection control professionals. This study will provide baseline data to broaden the understanding of nurses, healthcare professionals, hospital administrators, and other stakeholders of the impact of infectious diseases outbreaks on nurses' work. Findings will assist decision makers and other stakeholders in forecasting future policy implications for the management of infectious diseases outbreaks, in an urban acute care hospital.

Procedures Involved in the Research

As a participant, you will be asked to take part in an interview lasting between 40 and 60 minutes at the institution. You will be asked questions about your everyday practices in the management of healthcare associated infectious diseases and outbreaks, your general experience regarding the nature of your work in this setting, and your perceptions of infection control policies and their impact on your role as a healthcare professional. The interview will be audiotape-recorded and hand written notes will be taken, with your permission.

Potential Harms, Risks, or Discomforts

There are no known risks to you for participating in this study. Questions will focus on your experiences as a healthcare professional working in urban acute care hospital. Taking part in the study is completely voluntary. You are free to choose whether you will participate. You do not need to answer questions that you do not want to answer. At any time throughout the research process, you may withdraw without any adverse consequences or questioning.

Potential Benefits

The research will not benefit you directly. The purpose is to learn more about healthcare associated infectious disease outbreaks' impacted on nurses' work. Following your participation in the interview, a letter of appreciation will be sent to you to include in your professional portfolio. Additionally, the results of this study will be shared with the institution in an effort to provide information on infectious diseases outbreaks and to aid decision makers in planning and guiding policy. Finally, study results will be disseminated in peer reviewed journals and presentations.

Confidentiality

Interviews will be conducted in a private room, audio tape-recorded and transcribed verbatim; however, all personal information will be kept confidential. All personal information such as names, emails, phone number will be removed from the collected data and will be coded with a number to ensure anonymity. A list linking the number with your name will be kept in a secure place, separate from interview data. Audiotapes, digital audio files, and transcripts from interviews will be kept in locked files in the Nursing Health Services Research Unit at McMaster University during the project. They will be destroyed 10 years after the project is completed. You have the right to listen to the tape of your session or read the transcript.

For the purpose of ensuring the proper monitoring of the study, it is possible that a member of the St. Joseph's Healthcare Hamilton Research Ethics Board may consult your research data. However, no records that identify you will be released. By signing this consent form, you legally accept such access.

Participation and Withdrawal

Your participation in this study is voluntary. It is your choice to be part of the study and you can withdraw at any time, even after signing the consent form or partway through the study. If you decide to withdraw, there will be no consequences to you. You have the option of removing data already collected.

Information about the Study Results

It is anticipated that the study will be completed by approximately August 2013. If you would like a brief summary of the findings, please provide information.

Questions about the Study.

If you have questions or need more information about the study, please contact us: Joan Musau, (905) 525-9140 ext. 22507, email: musaujk@mcmaster.ca

This study has been reviewed by the Research Ethics Board. The REB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair

CONSENT

Study Title: Impact of Nosocomial/Healthcare-Associated Infectious Disease Outbreaks on Healthcare Professionals' Daily Work

I understand the information given to me about this study. My questions about the study have been answered to my satisfaction. I understand whom to contact if I have any additional questions. I am willing to participate in an interview to talk about impact of nosocomial outbreaks on nurses' work. I know that the interview will be audio taped. I understand that all information gathered for this study will be confidential and that I will not be identified in reports or publications. I know that I can withdraw from the study at any time and this will not affect my employment in the organization. I understand that I will receive a signed copy of this form.

1. I agree that the interview can be audio/video recorded. Yes No

2. I would like to receive a summary of the study's results. Yes No

If yes, where would you like the findings sent:

Email: _____

Mailing address: _____

_____

3. I agree to be contacted about future research and

I understand that I can always decline the request. Yes No

Please contact me at: _____

_____	_____	_____
Name of Participant (Printed)	Signature	Date

Consent form explained in person by:

_____	_____	_____
Name and Role (Printed)	Signature	Date

Appendix E. Participant Thank you Letter

Date

Participant contact information

Dear

I would like to take this opportunity to thank you for your participation in our research study - The Impact of Healthcare-Associated Infectious Disease Outbreaks on the Nature of Healthcare Professionals' Work.

We appreciate the time you have taken out of your busy schedule to help us with our research study. The information you provided is very important and contributes to the understanding of the research topic.

We greatly appreciate your contribution.

Sincerely yours,

Andrea Baumann RN PhD
Scientific Director
Nursing Health Services Research Unit
McMaster University

Joan Musau RN BScN
Masters' Student
McMaster University

Appendix F. Healthcare Professionals' Demographic Data

Table 1

Healthcare Professionals: Occupation

Healthcare Professional	n	Percent (%)
Registered Nurses	21	56.8
Registered Practical Nurses	2	5.4
Clinical Managers	5	13.5
Infection Control Professionals	6	16.2
Environmental Services Staff	3	8.1
Total	37	100

Table 2

Healthcare Professionals: Gender

Gender	n	Percent (%)
Female	36	97.3
Male	1	2.7
Total	37	100.0

Table 3

Healthcare Professionals: Age in Years

Healthcare Professional	N	Mean	SD	Median
Registered Nurses	21	36.5	10.4	37.0
Registered Practical Nurses	2	46.5	3.5	46.5
Clinical Managers	5	46.4	4.6	49.0
Infection Control Professionals	6	44.8	11.1	44.0
Environmental Services Staff	3	47.0	10.0	47.0
Total	37	40.3	10.3	43.0

Table 4

Healthcare Professionals: Levels of Education

Healthcare Professional	**Certificate**	**Diploma**	**Bachelor's Degree**	**Masters**	**Total**
Registered Nurses	0	11	10	0	21
Registered Practical Nurses	0	2	0	0	2
Clinical Managers	0	1	3	1	5
Infection Control Professionals	0	3	3	0	6
Environmental Services Staff	0	2	1	0	3
Total	0	19	17	1	37

Table 5

Healthcare Professionals: Current Employment Status

Healthcare Professional	**Full-time**	**Part-time**	**Total**
Registered Nurses	19	2	21
Registered Practical Nurses	2	0	2
Clinical Managers	5	0	5
Infection Control Professionals	5	1	6
Environmental Services Staff	2	1	3
Total	33	4	37
Percent (%)	89.2	10.8	100

Table 6

Healthcare Professionals: Number of Years in their Current Occupations

Healthcare Professional	**n**	**Mean**	**SD**
Registered Nurses	21	10.9	8.8
Registered Practical Nurses	2	14.0	12.7
Clinical Managers	5	18.7	10.6
Infection Control Professionals	6	11.6	10.4
Environmental Services Staff	3	14.7	11.6
Total	37	12.5	9.5

Table 7

Healthcare Professionals: Number of Years at their Current Positions at the Study Setting

Healthcare Professional	**N**	**Mean**	**SD**
Registered Nurses	21	8.7	8.2
Registered Practical Nurses	2	3.5	2.1
Clinical Managers	5	3.5	3.1
Infection Control Professionals	6	4.6	4.3
Environmental Services Staff	3	3.7	4.6
Total	37	6.6	6.9

Table 8

Healthcare Professionals: Number of Years Employed at the Study Setting

Healthcare Professional	**N**	**Mean**	**SD**
Registered Nurses	21	10.9	8.5
Registered Practical Nurses	2	114	12.7
Clinical Managers	5	11.7	11.1
Infection Control Professionals	6	7.5	7.9
Environmental Services Staff	3	5.7	3.5
Total	37	10.2	8.5

Appendix G. Incidence of MRSA, VRE, and *C. difficile* Infections (2008-2012)*

Figure 1. Study Hospital Incidence Rate/1,000 Patient Days for MRSA, VRE, and *C. difficile* Infections

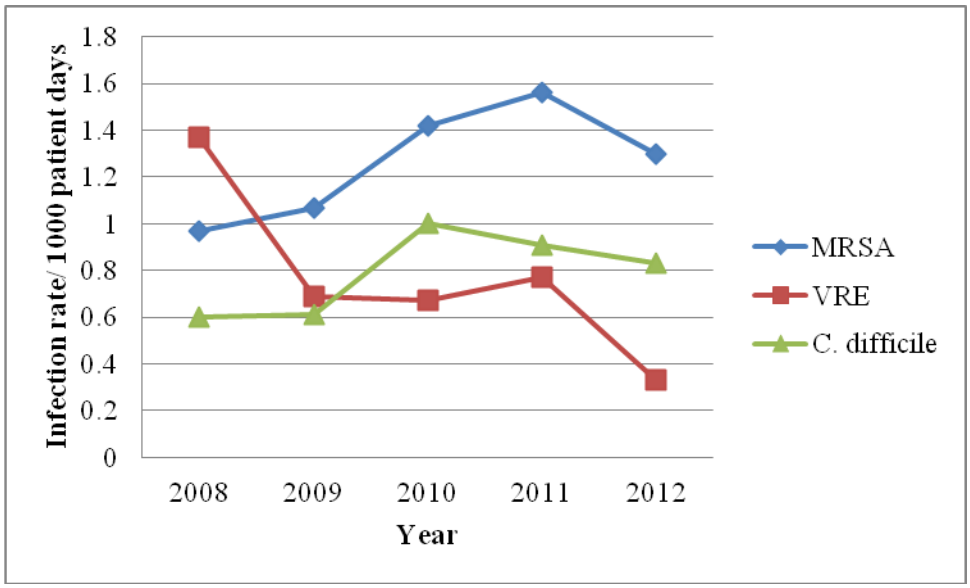
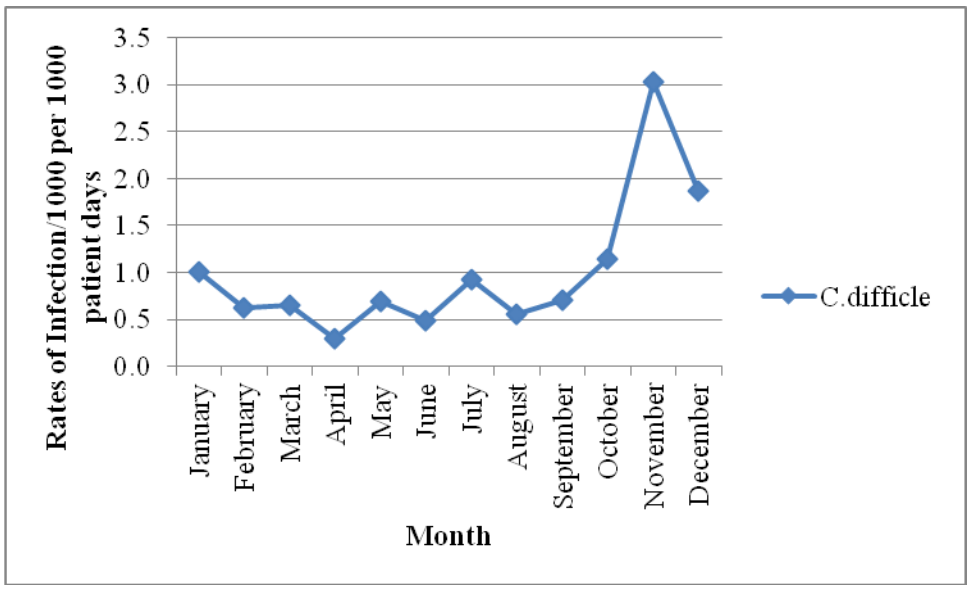


Figure 2. Study Hospital Incidence Rate/1,000 Patient Days for *C. difficile* Infections, 2010



CNISP (Canadian National Infection Surveillance Program) benchmark for: MRSA = 1.21 per 1000 patient days; VRE = 0.57 per 1000 patient days
CSICN (Central South Infection Control Network) mean rate for C. difficile = 0.40 per 1000 patient days

Figure 3. Study Hospital Incidence Rate/1,000 Patient Days for *C. difficile* Infections, 2012

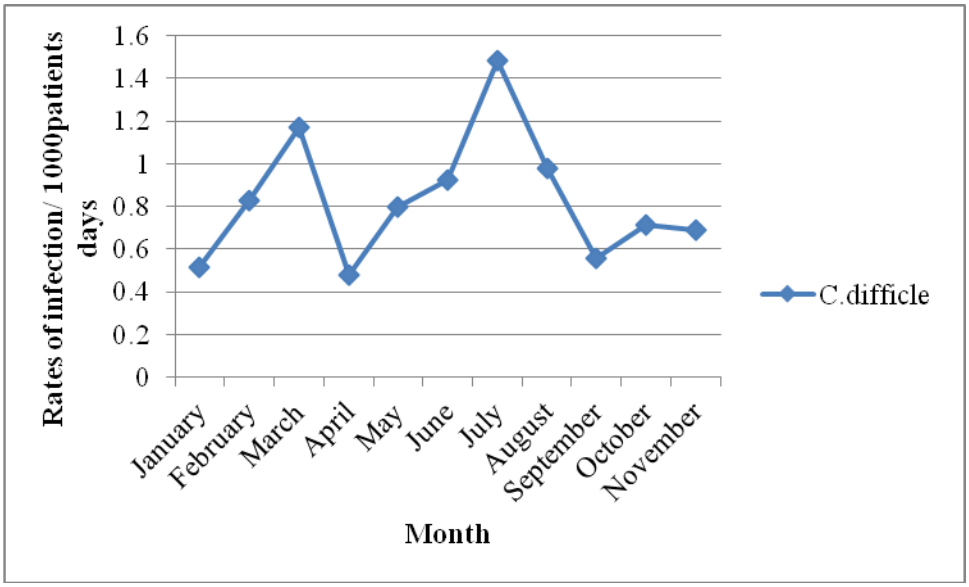
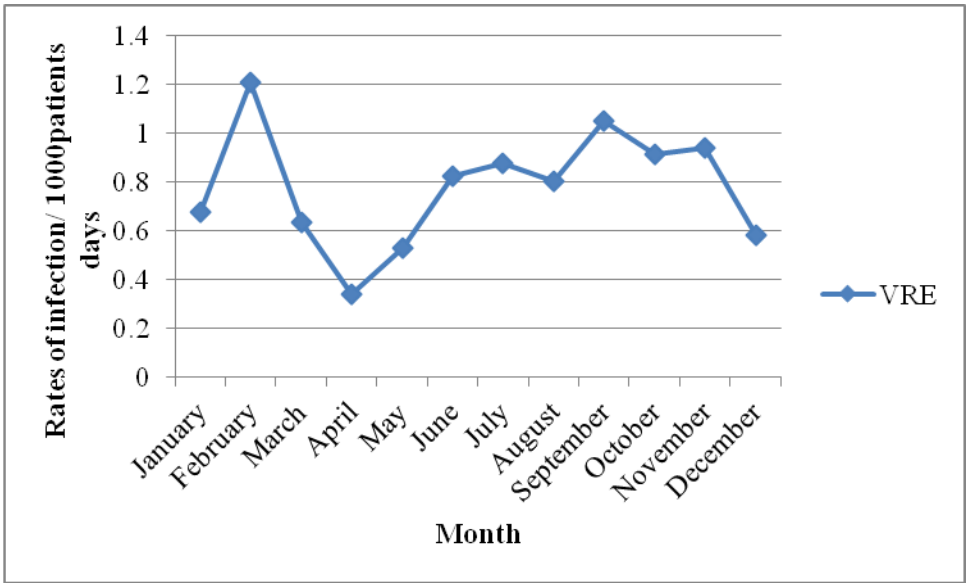
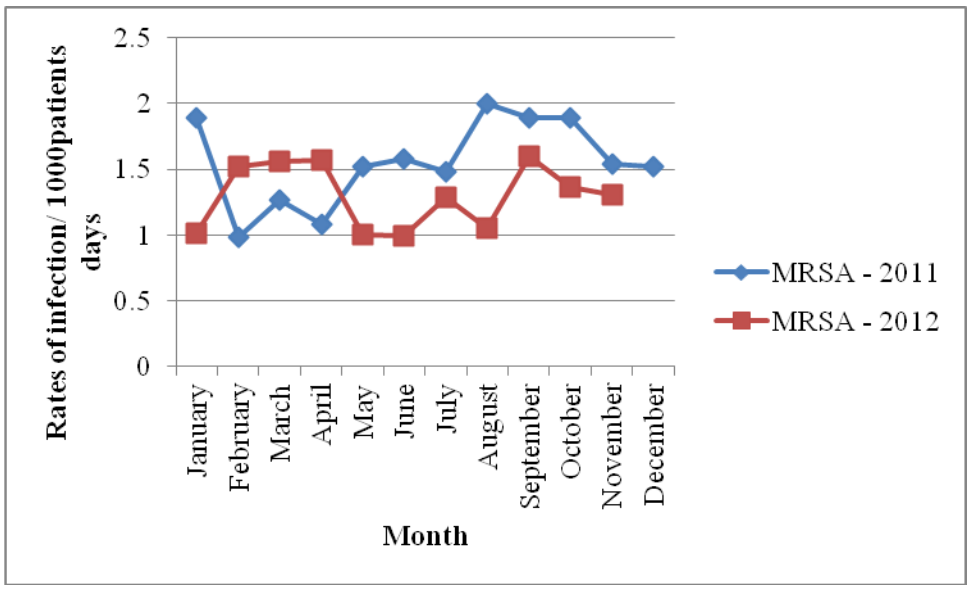


Figure 4. Study Hospital Incidence Rate/1,000 Patient Days for VRE Infections, 2011



*These references do not appear in the reference list to maintain the anonymity of the study facility.

Figure 5. Study Hospital Incidence Rate/1,000 Patient Days for MRSA Infections, 2011 and 2012



CNISP (Canadian National Infection Surveillance Program) benchmark for: MRSA = 1.21 per 1000 patient days; VRE = 0.57 per 1000 patient days
CSICN (Central South Infection Control Network) mean rate for C. difficile = 0.40 per 1000 patient days

*These references do not appear in the reference list to maintain the anonymity of the study facility.

Appendix H. Reviewed Study Facility Infectious Disease Prevention and Control Policies and Protocols

	Infectious Disease Prevention and Control Policies*	**Last Reviewed**
1	Visiting Regulations & Guidelines for Assessing Visiting Needs of Patients	07/01/2004
2	Bed Management	01/01/2005
3	Infection Control - Outbreak Investigation and Management Policy	03/03/2011
4	Personal Appearance/Dress Code	05/18/2011
5	Hand Hygiene Policy	05/12/2012
6	Clostridium Difficile Infection (CDI) care plan	08/01/2012
7	Outbreak Management Departmental or Unit Specific	12/18/2007
8	Gastrointestinal Outbreak (Outbreak Management Record)	12/18/2007
9	Respiratory Outbreak (Outbreak Management Record)	12/18/2007
10	Infection Control - Antibiotic Resistant Organisms (ARO) Protocol	01/26/2012
11	ARO Surveillance and Screening Protocol	01/26/2013
12	Management of ARO in Various Settings	01/26/2014
13	Infection Prevention and Control (IPAC) Interdisciplinary Care Protocol for Patients with Suspected or Confirmed Clostridium difficile	No date
14	Prevention Audit Tool	No date
15	Outbreak Notice	No date

*These references do not appear in the reference list to maintain the anonymity of the study facility.

Study Facility Infectious Disease Prevention and Control Policies and practice Protocols Reviewed by the Researcher

	EVS Algorithm and Trigger Tool Response*
1	Routine Measures EVS Response (1 New Healthcare Associated Case - HAI Case)
2	High Alert Unit EVS Response (3 or more Cases of *C. difficile*/VRE; HAI and Non-HAI), 6 or more Isolation (all types)
3	Unit-Based or Campus Out Break EVS Response (Outbreak Thresholds met for *C. difficile*)
	Algorithm and Trigger Tool Response
1	Routine Measures (1 New Healthcare Associated Case; HAI Case)
2	High Alert Unit EVS Response (3 or more Cases of *C. difficile*/VRE; HAI and Non-HAI), 6 or more Isolation (all types)
3	Unit-Based or Campus Out Break EVS Response (Outbreak Thresholds met for *C. difficile*)

*These references do not appear in the reference list to maintain the anonymity of the study facility.

Study Hospital Infectious Disease Prevention and Control Reports*

1. President's Reports
2. Outbreak Notices
3. Hand Hygiene Monthly Audits Reports
4. Preventive Audits Reports
5. Monthly Incidence of Infectious Diseases (VRE, *C. difficile*, and MRSA)
6. Environmental Service Monthly Audits Reports
7. In-Service Education Sessions Reports

*These references do not appear in the reference list to maintain the anonymity of the study facility.

Appendix I. Government Documents Reviewed by the Researcher

Provincial Infectious Diseases Advisory Committee (PIDAC) Documents

1. Best Practices for Cleaning, Disinfection and Sterilization of Medical Equipment/Devices in all Health Care Settings (2013b).
2. Best Practices for Environmental Cleaning for Prevention and Control of Infections: In all health care settings (2nd ed.). (2012b).
3. Best Practices For Hand Hygiene in All Health Care Settings (2010).
4. Best Practices for Infection Prevention and Control Programs in Ontario: In all Health Care Settings (3rd ed.). (2012a).
5. Infection Prevention and Control Guidance for Management of *Clostridium difficile* in all Health Care Settings (2009).
6. Annex A: Screening, Testing and Surveillance for Antibiotic-Resistant Organisms (AROs) in All Health Care Settings (2013a).
7. Routine Practices and Additional Precautions in All Health Care Settings (2012c).

Other Legislative Documents

1. Control of *Clostridium difficile* Infection (CDI) Outbreaks in Hospitals: A Guide for Hospital and Health Unit Staff (MOHLTC, 2009).
2. Just Clean Your Hands (MOHLTC, 2011).
3. Infectious Diseases Protocol, 2013 (MOHLTC, 2013).
4. *Clostridium difficile* Infection*:* Infection Prevention and Control Guidance for Management of *C. Difficile* in Acute Care Settings (Public Health Agency of Canada, 2013a).

5. Hand Hygiene Practice in Healthcare Settings (Public Health Agency of Canada, 2012a).
6. Antibiotic Resistant Organisms Surveillance Protocol for Ontario Hospitals (Ontario Hospital Association & Ontario Medical Association, 2013).

Fact Sheets by the Public Health Agency of Canada

1. Fact Sheet - *Clostridium difficile* (*C. difficile*; 2011).
2. Fact Sheet - Vancomycin-resistant Enterococci (2010).
3. Fact Sheet - Methicillin-Resistant *Staphylococcus aureus* (2008).

GLOSSARY OF TERMS

Additional Precautions: Precautions (i.e., Contact Precautions, Droplet Precautions, Airborne Precautions) that are necessary in addition to Routine Practices for certain pathogens or clinical presentations. These precautions are based on the method of transmission (e.g., contact, droplet, airborne; PIDAC, 2012c).

Alcohol-Based Hand-Rub (ABHR): A liquid, gel or foam formulation of alcohol (e.g., ethanol, isopropanol) which is used to reduce the number of microorganisms on hands in clinical situations when the hands are not visibly soiled. ABHRs contain emollients to reduce skin irritation and are less time-consuming to use than washing with soap and water (PIDAC, 2010).

Antibiotic-Resistant Organism (ARO): A microorganism that has developed resistance to the action of several antimicrobial agents and that is of special clinical or epidemiological significance (e.g., MRSA, VRE; PIDAC, 2012a).

Audit: In the context of this document, an audit is a tool used to examine a process for errors or omissions. An audit tool usually consists of a checklist of items which must be completed or be in place in order for a process to be considered to be correct (PIDAC, 2012a).

Benchmark: A validated figure that may be used for comparison provided data are collected in the same way as that of the benchmark data. Benchmarks are used to compare infection rates to a standardized database that uses the same definitions for infection and is appropriately adjusted for patient risk factors so that meaningful comparisons can be made. Comparing infection rates to a validated benchmark will indicate whether the rates are below or above the recognized average (PIDAC, 2012a).

Bioburden: A bioburden is the degree of microbial contamination or microbial load which indicates the number of microorganisms contaminating an object (Piper, 2006).

Canadian Nosocomial Infection Surveillance Program (CNISP): The national monitoring of important nosocomial pathogens (e.g., MRSA, *C. difficile*, VRE; PHAC, 2012b).

Cleaning: The physical removal of foreign material (e.g., dust, soil) and organic material (e.g., blood, secretions, excretions, and microorganisms). Cleaning physically removes rather than kills microorganisms. It is accomplished with water, detergents, and mechanical action (PIDAC, 2012b).

Cluster: A grouping of cases of a disease within a specific time frame and geographic location, suggesting a possible association between the cases with respect to transmission (PIDAC, 2012a).

Cohorting: The assignment of a geographic area, such as a room or a patient care area, to two or more patients who are either colonized or infected with the same microorganism, with staffing assignments restricted to the cohorted group of patients (PIDAC, 2012c).

Colonization: Colonization is defined as the presence of an organism in or on a patient without resulting in clinical disease (Davis et al., 2004).

Contact Precautions: Contact precautions are additional practices to reduce the risk of the transmission of infectious agents via contact with an infected person. Contact Precautions are used in addition to Routine Practices (PIDAC, 2012c).

Contamination: Contamination is the presence of an infectious agent on hands or on a surface, such as clothing, gowns, gloves, bedding, toys, surgical instruments, patient care equipment, dressings or other inanimate objects (PIDAC, 2012c).

Hand Hygiene: Hand hygiene is a general term referring to any action of hand cleaning. Hand hygiene relates to the removal of visible soil and removal or killing of transient microorganisms from the hands. Hand hygiene may be accomplished using soap and running water or an alcohol-based hand rub (ABHR). Hand hygiene also includes surgical hand antisepsis (PIDAC, 2012a).

Healthcare-Associated Infection (HAI): This is a term relating to an infection that is acquired during the delivery of healthcare (also known as nosocomial infection; PIDAC, 2012a).

Healthcare Professional: A healthcare professional is any person delivering care to a client/patient/resident. This includes, but is not limited to, the following: frontline nurses, infection control professionals, and clinical managers (PIDAC, 2012a).

Healthcare Setting: A healthcare setting is any location where healthcare is provided, including settings where emergency care is provided, such as hospitals, complex continuing care, rehabilitation hospitals, long-term care homes, mental health facilities, outpatient clinics, community health centers and clinics, physician offices, dental offices, offices of allied health professionals, and home healthcare (PIDAC, 2012a).

High Alert Unit: A high alert unit is a unit with three or more patients with documented VRE or *C. difficile* infections or six patients under isolation precautions in isolation rooms is considered to be on high alert.

Infection: An infection is defined as the entry and multiplication of an infectious agent in the tissues of the host or person. Asymptomatic or subclinical infection is an infectious process running a course similar to that of clinical disease but below the threshold of clinical symptoms. Symptomatic or clinical infection is one resulting in clinical signs and symptoms of infectious diseases presented the patient (PIDAC, 2012a).

Infection Prevention and Control Professional (ICP): ICPs are individuals responsible for a healthcare setting's infection prevention and control activities. In Ontario, an ICP must receive a minimum of 80 hours of instruction in Community and Hospital Infection Control Association - Canadaendorsed infection control program within six months of entering the role and must acquire and maintain certification in infection control, when eligible, which is usually following at least two years of infection control experience (PIDAC, 2012a).

Infection Prevention and Control (IPAC): Evidence-based practices and procedures that, when applied consistently in healthcare settings can prevent or reduce the risk of transmission of microorganisms to healthcare providers, clients/patients/residents, and visitors (PIDAC, 2012a).

Incidence Rate: A measurement of new cases of disease occurring within a population over a given period of time. The numerator is the number of new cases detected and the denominator is the initial population at risk for developing the particular infection or event during a given time frame (PIDAC,2012a).

Isolation Precautions: Also referred to as "contact isolation", is to prevent the potential transmission of HAIs to other patients. The physical separation of isolating a patient is intended to reduce the likelihood of direct contact between patients and to eliminate the possibility of transmission through a shared environment (PIDAC, 2012c).

Ministry of Health and Long Term Care (MOHLTC) of Ontario: The Ministry of Health and Long-Term Care is the patient-focused, results-driven, integrated, and sustainable publicly funded health system in Ontario. The MOHLTC provides overall direction and leadership for the healthcare system, focusing on planning and on guiding resources to bring value to the healthcare system (PIDAC, 2012a).

Methicillin-Resistant *Staphylococcus aureus* (MRSA): A strain of *S. aureus* that has a minimal inhibitory concentration (MIC) to oxacillin of ≥ 4 mcg/ml and contains the *mecA* gene coding for penicillin-binding protein 2a (PBP 2a). MRSA is resistant to all of the beta-lactam classes of antibiotics, such as the penicillins, penicillinase-resistant penicillins (e.g., cloxacillin) and cephalosporins (PIDAC, 2012a).

Infectious Disease Outbreak: An infectious disease outbreak is an increase in the number of cases above the number normally occurring in a particular healthcare setting over a defined period of time (PIDAC, 2012a).

Personal Protective Equipment (PPE): Clothing or equipment worn for protection against a hazard, including an infectious hazard (PIDAC, 2012c).

Infection Control Precautions: Interventions to reduce the risk of transmission of microorganisms (e.g., patient-to-patient, patient-to-staff, staff-to-patient, contact with the environment, contact with contaminated equipment; PIDAC, 2010).

Provincial Infectious Diseases Advisory Committee (PIDAC): A multidisciplinary scientific advisory body that provides to the Chief Medical Officer of Health evidence-based advice regarding multiple aspects of infectious disease identification, prevention, and control (PIDAC, 2012a).

Public Health Agency of Canada (PHAC): A national agency which promotes improvement in the health status of Canadians through public health action and the development of national guidelines (PIDAC, 2012)a.

Regional Infection Control Networks (RICN): The RICN of Ontario coordinates and integrates resources related to the prevention, surveillance, and control of infectious diseases across all healthcare sectors and for all healthcare providers, promoting a common approach to infection prevention and control and the utilization of best-practices within the region. There are 14 regional networks in Ontario (PIDAC, 2012a).

Staff: Anyone conducting activities in settings where healthcare is provided, including healthcare providers (PIDAC, 2012a).

Surveillance: The on-going, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health (PIDAC, 2012a).

Vancomycin-Resistant Enterococci (VRE): Strains of *Enterococcus faecium* or *Enterococcus faecalis* that have a minimal inhibitory concentration (MIC) to vancomycin of ≥ 32 mcg/ml and/or contain the resistance genes *vanA* or *vanB* (PIDAC, 2012a).