THE CHANGING NATURE OF HEALTH PROFESSIONALS' WORK

THE CHANGING NATURE OF HEALTH PROFESSIONALS' WORK: THE IMPACT OF INFECTIOUS DISEASE

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ABSTRACT

Background. As disease patterns change, healthcare facilities have had to adapt and create new strategies. Little is known about the impact of infectious disease on the changing nature of work for frontline nurses, healthcare executives laboratory staff, and infection control practitioners (ICPs), in these disciplines in community hospitals. In the past seven years, there has been an increase in the incidence of infectious disease in Ontario (MRSA, VRE, C. difficile). As a result, there has been implementation of new infection control policies and practices, and transparency in the public reporting systems (Ministry of Health and Long-Term Care [MOHLTC], 2008). However, no research has focused on how these changes have impacted the work of health professionals.

Purpose. The purpose of this study is to explore the impact of hospital-acquired infections (HAIs) on the changing nature of work of frontline nurses, healthcare executives, laboratory staff, and infection control practitioners.

Methods. The study uses an exploratory descriptive case study design and is situated in South Eastern Ontario (Niagara Health System). The methodology includes document analysis, demographic workforce questionnaires, and semi-structured interviews.

Findings. The findings demonstrate that work has changed for all health professionals because of (1) the continued increase in infectious diseases, (2) the proliferation of infection control policies and practices, (3) the increase in data management and data-based decisions, and (4) increased communication and connectivity required across disciplines.

Conclusion. Implications for future research include the need to address streamlining changes at the healthcare system, institutional, and clinical level. There needs to be an evaluation of the evidence supporting existing institutional policies and procedures, and of the care structures in the management of infectious diseases.

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ABBREVIATIONS AND SYMBOLS

ABHR	Alcohol-Based Hand-Rub
ARO	Antibiotic-Resistant Organism
CA-MRSA	Community Acquired Methicillin-Resistant *Staphylococcus aureus*
CDI	*Clostridium difficile* Infection
CDAD	C. difficile Associated diarrhea
HAI	Hospital-Acquired Infection
ICP	Infection Control Practitioner
LHIN	Local Health Integration Network
LTC	Long-Term Care
MOHLTC	Ministry of Health and Long-Term Care (Ontario)
MRSA	Methicillin-Resistant Staphylococcus *aureus*
PHAC	Public Health Agency of Canada
PHO	Public Health Ontario
PIDAC	Provincial Infectious Diseases Advisory Committee
PPE	Personal Protective Equipment
RICN	Regional Infection Control Networks
SARS	Severe acute respiratory syndrome
VRE	Vancomycin-Resistant Enterococci

DECLARATION OF ACADEMIC ACHIEVEMENT

The following is a declaration that the content of the research in this document has been completed by Alyshah Kaba and recognizes the contributions of Dr. Andrea Baumann, Dr. Noori Akhtar-Danesh, Dr. Camille Kolotylo and Dr. Mabel Hunsberger in both the research process and the completion of the thesis.

CHAPTER 1: INTRODUCTION

Prior to the SARS epidemic in 2003, most healthcare systems in Ontario had experienced only a few incidences of antibiotic-resistant hospital-acquired infection (HAI) outbreaks in their hospitals (National Advisory Committee on SARS and Public Health, 2003). This emerging trend of iatrogenic infections has had an impact on the work of nurses, infection control practitioners' (ICPs), and laboratory staff's (Canadian Institute of Health Information [CIHI], 2005; Daniels, Peter, & Smith, 2007). In the past, the focus of health systems research, including health human resources research, has focused on large acute care urban hospitals (Baumann et al., 2006). However, emerging evidence demonstrates that community hospitals face unique challenges compared to large acute care urban hospitals (Montour, Baumann, & Blythe, 2008).

This study builds on findings from Montour et al. (2008) which suggest that the recent emergence of *super infections* in community hospitals have had an impact on the work of the multidisciplinary team including registered nurses (RNs), registered practical nurses (RPNs), nursing (clinical vice presidents and managers) and healthcare executives, laboratory staff, and ICPs. The previous study outlined that critical infection control issues relate to surges in patient censuses, patient transfers, aging physical structures, and limited fiscal and human resources (Montour et al., 2008). This study will add to the understanding of the work of various healthcare personnel and suggest clinical and policy implications for the management of infectious diseases in community hospitals.

Overall Goal/Purpose

To explore the impact of HAIs and antibiotic-resistant HAIs on the changing nature of work for frontline nurses, healthcare and nursing executives, laboratory staff, and infection control practitioners.

Study Objectives

The following are research objectives for this study in order to further understand the impact of infectious disease on the changing nature of frontline nurses', healthcare executives, laboratory staff, and ICP's work.

The objectives of this exploratory study are to:

1. Describe the incidence of HAIs and antibiotic-resistant HAIs in selected community hospital sites in the Niagara Health System, from 2008 to 2011[1].
2. Describe the workforce profiles and demographic characteristics of frontline nurses, healthcare executives, laboratory staff, and ICPs in selected community hospital sites in the Niagara Health System.
3. Describe infection control policies and practices, specifically isolation precautions and personal protective equipment (PPE), in selected community hospital sites in the Niagara Health System, from 2008 to 2011.
4. Explore and describe the perceptions of frontline nurses, healthcare executives, laboratory staff, and ICPs about the change in their work, in selected community hospital sites in the Niagara Health System.

[1] Data collected will be specific to Methicillin-resistant *Staphylococcus* aureus (MRSA), Vancomycin-Resistant *Enterococci* (VRE), and *Clostridium* difficile (C. difficile).

Study Gaps

As disease patterns change, healthcare facilities must adapt and create new strategies to ensure they have sufficient surge capacity to cope with the changing work patterns. Most HAI studies in the literature focus on large urban, acute care hospitals (Baumann et al., 2006). Little is known about the organizational context of disease management of antibiotic-resistant HAIs and the delivery of care by frontline nurses, healthcare executives, infection control staff, and ICPs in community hospitals. Current trends suggest that community hospitals require innovative healthcare policies, greater surge capacity, and an increase in health human resources (Baumann et al., 2006). In these community hospitals, frontline nurses frequently work with minimal support and resources (MacLeod, 2006). Even though the autonomy experienced by frontline nurses in community hospitals is a source of satisfaction, bearing the sole responsibility for patients in isolated settings is stressful (Daniels et al., 2007). Additionally, with the recent MOHLTC mandates on public infectious disease reporting, the roles of the ICP and laboratory staff have become increasingly demanding (MOHLTC, 2008). They face challenges in the monitoring and surveillance of new incidences of HAIs, including antibiotic-resistant HAIs, and outbreaks.

Even though infection prevention and control measures have grown out of necessity to limit the rampant spread of infection both of a national and global nature (SARS Commission, 2006), there has been little research that explores the effects that these changes pose on the nature of the work of laboratory staff, infection control practitioners, nurses, and nurse executives. New infection control policies, specifically

isolation precautions and PPE, and public reporting systems have been implemented (MOHLTC, 2008), but research has not evaluated the perceptions of nurses, nurse and healthcare executives, laboratory staff, and ICPs about the changing nature of their work following the implementation of infection control policies and procedures for HAIs.

Although there has been a minimal attempt in the literature to understand the nature of laboratory staff's and ICPs' work, there has been some attempt through quantitative studies to understand the effects of HAIs on nurses' workloads and staffing levels (Dikema et al., 2007; Morgan, Neill, & Taylor, 2009). These studies have shown that nurses experience challenges produced by the increasing incidence of HAIs and increasing prevention measures instituted in response to the rise in HAIs (Dikema, Long, Scharff, & Weinert, 2007; Morgan et al., 2009). Yet, there are no known qualitative studies that have more fully explored the perceptions of nurses, nurse and healthcare executives, laboratory staff, and ICPs on this subject. Studies have shown that workload increases when patients are in isolation due to HAIs (Dikema et al., 2007; Morgan et al., 2009). Yet, considering the changing nature of nurses' work and working environments with the emergence of antibiotic-resistant HAIs, little attention has been paid in the literature to how nurses perceive that their work and their work environments have changed. Similarly, many gaps remain in the infection control literature about the changing roles and nature of work for nurses, nursing and healthcare executives, ICPs, and laboratory staff in community hospitals. With the rise in superbug outbreaks, ICPs and laboratory staff are at the forefront of infection control surveillance, public reporting, and managing the implementation of infection control policies. Their perspectives are

critical to understanding how the challenges of isolation due to antibiotic-resistant HAIs and the necessary PPE policies are affecting the organization and how they impact the nature of work of healthcare personnel. The proposed exploratory study will focus on the changing nature of various healthcare professionals' work in community hospitals in Local Health Integration Network (LHIN) 4. It will provide baseline data for future planning.

CHAPTER 2: BACKGROUND

This chapter provides an overview of the geographical environment, study hospitals, incidence of HAIs, and national and provincial policy context in which this study took place. The background information was extracted from government, organizational, and community prepared documents.

Geographical Setting

The study settings were selected hospital sites in the Niagara Health System (NHS), within Local Health Integration Network (LHIN 4). LHIN 4 boundaries encompass Hamilton, Niagara, Haldimand, and Brant counties (HNHB), the city of Burlington, and a large portion of Norfolk County (HNHB LHIN, 2010). Local Health Integration Network 4 has 20 hospitals with bed capacity ranging from 22 to 529 (see Appendix A). This area covers 20 census subdivisions with populations ranging from 6,300 to 490,300 (Dall, Lefebvre, Pacey, & Sahai, 2009). A total of 1,352,500 people or 10.9% of the Ontario population reside within this LHIN's boundaries (HNHB LHIN, 2010). Two large corporations, Hamilton Health Sciences and the NHS have formal agreements for consolidation with 11 of the 20 hospitals.

The NHS is Ontario's largest multi-site hospital system, comprised of seven sites, with a total of 900 beds including acute care, complex continuing care, mental health, long-term care, and addiction treatment beds serving residents across the 12 municipalities making up the Regional Municipality of Niagara (NHS, 2010). It has only been since 2008, the each of the 7 separate sites hospital sites were amalgamated into one hospital system (NHS, 2010). In addition, the NHS sites comprise a teaching hospital

site(s) for the McMaster University, DeGroote School of Medicine. NHS also has affiliations with Niagara College Canada and Brock University.

Study Hospitals

The four study hospitals selected in the NHS are located in the following communities in LHIN 4: St. Catharines, Niagara Falls, Fort Erie and Port Colborne. The selected units are at the St. Catharines General Hospital Site (SCGH), the Greater Niagara General Hospital Site (GNGH), the Douglas Memorial Hospital Site (DMH), and the Port Colborne Hospital Site (PCGH; see Appendix B). The units within the study hospital sites were chosen based on the recommendations of the Chief Nursing Executive/Vice President Patient Services. Each of the five units and laboratory site were selected based on the criteria listed below.

Hospital Unit One

The first study setting is a unit located in Niagara Falls and had recently been in HAI outbreak. Unit C/D is a medical unit that is situated at the Greater Niagara General Hospital Site, a 180 bed hospital. Unit C/D services 30 complex continuing care inpatient beds. There is one clinical manager, two ICPs for the hospital, seven RNs/RPNs working on the unit during the day shift, and five during the night shift.

Hospital Unit Two

The second study setting is a unit located in Fort Erie and has recently been in HAI outbreak. The medical unit at the Douglas Memorial Hospital Site is a complex continuing care unit, which offers general services for chronic medical patients. The hospital has 46 inpatient medical beds. There is one clinical manager for the entire

hospital, one ICP for the hospital, and 10 nurses (RN/RPNs) working on the unit during the day shift, and eight during the night shift.

Hospital Unit Three

The third study setting is located near Lake Erie in Port Colborne and has also recently been in HAI outbreak. The medical unit at the Port Colborne Hospital Site offers 46 inpatient medical beds for complex continuing care patients. There is one clinical manager for the entire hospital, one ICP for the hospital, nine nurses (RNs/ RPNs) working on the unit during the day shift, and seven during the night shift.

Hospital Unit Four

The fourth unit is situated in Niagara Falls and was identified as a unit with no outbreaks from 2008 to 2011. The unit is a 30 bed surgical unit, situated at the Greater Niagara General Site, a 180 bed hospital. The unit provides primarily services to post-operative surgical patients. There is one clinical manager, two ICPs for the hospital, seven nurses (RNs/RPNs) working on the unit during the day shift and five during the night shift.

Hospital Unit Five

The fifth unit is the Emergency Department (ED), located in St. Catharines. The St. Catharines General Hospital Site has 200 acute care beds and was chosen for the study because it has the largest ED of all the study sites. The ED provides services to a catchment area of more than 160,000 people. The ED has one nurse manager, two ICPs for the hospital, nine nurses (RNs/RPNs) working during the day shift, and eight during the night shift.

Laboratory Site

Interviews of laboratory personnel took place at LifeLabs, which is an independent medical laboratory service, located in St. Catharines with 100 technologists providing microbiology testing and surveillance to the NHS. This site was chosen because LifeLabs receives the outsourced laboratory samples on a daily basis for all of the NHS hospital sites.

The Emergence of Antibiotic-Resistant Infections in Hospitals and in the Community

In the post-SARS environment, there was an increasing emergence of outbreaks of infectious disease from organisms categorized as hospital-acquired infections (HAIs), which are also known as *nosocomial* or *healthcare-associated* infections. The definition of the general term HAI encompasses all iatrogenic infections (antibiotic-resistant and non antibiotic-resistant) that a patient acquires while in hospital being treated for some other condition (McCarter, 2008).

The literature on emerging infectious diseases focuses primarily on the impact of the incidence of three epidemiologically important antibiotic-resistant HAIs, which include VRE, MRSA, and *Clostridium* difficile. The surge in antibiotic-resistant HAIs has given rise to multidrug-resistant organisms (MDROs) which are predominantly bacteria resistant to one or more classes of antimicrobial agents (Gonzales et al., 2008). Vancomycin or glycopeptides-resistant enterococcus (VRE or GRE) are bacterial strains of the genus *Enterococcus* that is resistant to the antibiotic vancomycin and all but a few commercially available antimicrobial agents (Gonzales et al., 2008). VRE is a MDRO

that can be carried by healthy people who have been exposed to the bacteria. The most likely place where such contact occurs is in a hospital as a HAI infection, and it is particularly dangerous to immunocompromised individuals.

MRSA is also a MDRO resistant to antibiotics such as glycopeptides, cephalosporins, and especially quinolones (Gonzales et al., 2008). MRSA is an example of a *superbug* that was relatively uncommon through the 1960s and 1970s (Rautakorpi et al., 2006). A few incidences appeared in the 1980s, but the problem exploded in the mid-1990s and early 2000s when particular epidemic strains of MRSA became established in hospitals throughout North America (Rautakorpi et al., 2006). These strains became easily transmissible in colonising both patients and hospital staff (Gould, 2002).

MRSA can be sub-categorized as community-acquired MRSA (CA-MRSA) or healthcare-acquired MRSA (HAI-MRSA), although the distinction is complex (Zinderman, Conner, Malakooti, LaMar, Armstrong, & Bohnker, 2004). Some researchers have distinguished CA-MRSA by the types of organisms that affect patients, while others define it by the genetic characteristics of these bacteria (Zinderman et al., 2004). The first reported cases of CA-MRSA appeared in the mid-1990s in Canada in aboriginal communities and were notable because they involved people who had not been exposed to a healthcare setting (Raygada & Levine, 2009). Over the next two decades, it became clear that CA-MRSA superbugs were caused by strains of MRSA that differed from the hospital-acquired strains of MRSA (Raygada & Levine, 2009).

CA-MRSA did not evolve on its own in the community; rather it represents a hybrid between MRSA that spread from the hospital environment and strains that were

once easily treatable in the community (Zinderman et al., 2004). Most of the hybrid strains also acquired a factor that increases their virulence, resulting in the development of deep-tissue infections from minor scrapes and cuts, as well as many cases of fatal pneumonia (Zinderman et al., 2004). About 75 percent of CA-MRSA infections are localized to skin and soft tissue and usually can be treated effectively (Zinderman et al., 2004). CA-MRSA is more easily treated, though more virulent, than HAI-MRSA (Zinderman,et al., 2004). Both CA-MRSA and HAI-MRSA are resistant to traditional anti-staphylococcal beta-lactam antibiotics, such as cephalexin (Zinderman et al., 2004).

CA-MRSA has a greater spectrum of antimicrobial susceptibility to sulfa drugs, tetracyclines, and clindamycin, but the drug of choice for treating CA-MRSA is vancomycin (Zinderman et al., 2004). However, some CA-MRSA strains display enhanced virulence, spreading more rapidly, and causing much more severe illness than traditional HAI-MRSA infections (Raygada & Levine, 2009). CA-MRSA strains can potentially affect vital organs and lead to widespread infection (sepsis), toxic shock syndrome, and necrotizing pneumonia (Raygada & Levine, 2009). The literature suggests that the prevalence of CA-MRSA is increasing and it is hypothesised that CA-MRSA will become the dominant MRSA strain in hospitals and healthcare facilities in the next decade (D'Agata, MacLeod, Browne, & Leipert, 2009). This reversal of dominant strain HAI- MRSA will occur as a result of the documented expanding endogenous community reservoir and increasing influx into the hospital of individuals who harbour CA-MRSA (D'Agata et al., 2009).

Another antibiotic-resistant organism that has more recently become problematic is *Clostridium difficile,* a species of Gram-positive bacteria of the genus *Clostridium* that causes severe diarrhea and other intestinal diseases when competing bacteria in the gut flora have been destroyed by antibiotics (CDC, 2010). C. difficile-associated diarrhea (CDAD) is most strongly associated with overuse and misuse of the antibiotic class fluoroquinolones (CDC, 2010). Usually, normal gut flora resists overgrowth and colonization by this organism. However, antibiotic use that suppresses the normal gut flora allows the proliferation of C. difficile (CDC, 2010). The organism releases toxins that cause inflammation and damage to the mucosal lining of the colon, leading to severe diarrhea.

A new antibiotic-resistant strain has developed that can result in colitis, sepsis, and death. This strain is known as BI/NAP1 and has contributed to outbreaks in North America, the United Kingdom, and the Netherlands (Thompson et al., 2009). The notable virulence characteristics associated with the BI/NAP1 strain include increased toxin production (TcdA and TcdB), the presence of a binary toxin, extensive environmental contamination, altered antimicrobial resistance patterns (fluoroquinolone resistance), and increased production of spores that are viable for months on surfaces and equipment (Thompson et al., 2009). Elderly patients, patients with severe underlying illness, and patients undergoing immunosuppressive therapy are at higher risk of infection since their immune response to the bacteria and its toxins is diminished (Thompson et al., 2009). In adults, the clinical presentation for C. difficile includes severe diarrhea, new onset of

greater than three, partially-formed, or watery stools, per 24 hour period; recent antibiotic exposure; abdominal pain; fever (up to 40.5°C), and foul stool odour (CDC, 2010).

The increase research and identification of new forms of resistance is raising alarming concern globally (Canadian Broadcasting Corporation [CBC], 2010). For example, there has been the threat of a new emerging MDRO. As timely as August 2010, a new gene detected in Japan, which had not been previously identified, known as NDM-1, was found to make certain bacteria resistant to all antibiotics. The gene has been seen largely on the deadly *Escherichia* coli (E. coli) bacteria on DNA structures that can be easily copied and passed onto other types of bacteria (CBC, 2010).

Incidence of HAIs

Incidence is defined as the frequency that an infection appears in a particular population or area. It is the number of newly diagnosed cases during a specific time period (Roberts et al., 2008). According to data reported by the Canadian Nocosomial Infection Surveillance Program (CNISP, 2010), the incidence of MRSA has approximately doubled between 1999 and 2006 and the incidence of VRE has more than tripled in the same time period. In 2009, there were 9.96 MRSA cases per 1,000 admissions and 1.4 VRE cases per 1,000 admissions in hospitals across Canada (CNISP, 2009). Recent information indicates that the incidence of C. difficile outbreaks may be higher in Ontario than the rest of Canada (CNISP, 2009). The number of C. difficile infections in Ontario in 2009 was 5.53 per 1,000 admissions in comparison to the Canadian average of 4.47 per 1,000 admissions (CNISP, 2009). Additionally, data presented by Miller et al. (2009) from CNISP reported that the prevalence of North

America's most virulent strain of *C. difficile*, the pulsed-field type 1 (NAP1), was approximately 20% in Ontario, Canada.

The Impact of HAIs

HAIs have a significant impact on patients' health, human resource capacity, and the province's healthcare system (McCarter, 2008). Estimates suggest that there were 250,000 cases of HAIs in Canadian hospitals over the four years from 2004 to 2008, resulting in at least 8,000 deaths annually (CIHI, 2009). More recently, CIHI (2010) reported, that in 2009, 1 in 9 adults and 1 in 12 children would contract an infection while in a Canadian hospital. In the United States, the Centers for Disease Control and Prevention (CDC, 2008) estimate that each year there are 1.7 million HAIs in American hospitals resulting in 99,000 deaths. Antibiotic-resistant organisms add $40 to $52 million to the annual direct and indirect costs of providing care in Canada (MOHLTC, 2010). The average cost of managing a patient infected with MRSA has increased from $14,360 in 1997 to $25,661 in 2007 (MOHLTC, 2010).

The high incidence and mortality caused by antibiotic-resistant HAIs, specifically C. difficile infections in Ontario, became of noticeable concern in the media in 2008, when Joseph Brant Memorial Hospital in Burlington, Ontario reported an outbreak of C. difficile, in which over ninety patients died of complications from the infection (McCarter, 2008). The media has drawn increasing attention to C. difficile by highlighting the high mortality rates caused by C. difficile outbreaks. The outbreaks are reported to be preventable, and the media focuses on the hospitals, emphasizing two factors; poor infection control practices and poor hand hygiene (McCarter, 2008).

Targeted hospitals were labelled *unsafe* by the media stirring up fears in the public for their safety and care being provided in hospitals. An example is the outbreak that took place in Quebec at the Centre Hospitalier Universitaire de Sherbrooke in August, 2004 in which the C. difficile outbreak was associated with the death of 100 patients (Eggertson, 2005). Recently in Hamilton, in 2010, St. Joseph's Hospital reported an outbreak in which 16 patients succumbed to their C. difficile infections (O'Reilly, 2010).

A timely example is currently taking place in the NHS. As of July 8th, 2011, 21 patients have died from C. difficile since the outbreak was declared in the NHS on May 28, 2011 (CTV News, July 8, 2011). There has been increased media coverage and provincial, regional, and national attention focusing on the public's outcry for the delay in reporting the outbreak to the community, the outsourcing of housekeeping staff, overcrowding, and poor hand washing compliance of health professionals and visitors (CTV News, July 8, 2011). An epidemiologist from the Public Health Agency of Canada will be examining the NHS outbreak data to determine the methods the NHS used to collect, trend, and interpret data and will offer recommendations to improve the outbreak incidence in the NHS (St. Catharines Standard, July 8, 2011).

Thus, with increased media reporting of hospital outbreaks of C. difficile, and the high mortality rate of these infections, the prevention and control of transmission of superbugs has become a major concern to both healthcare organizations and governments.

Review of Global Infection Control Policy Initiatives

The issue of antibiotic resistance and patient safety has increasingly become a global problem (World Health Organization [WHO], 2008). In 2002, the 55th World Health Assembly adopted a resolution urging countries to pay attention to antibiotic resistance and to strengthen safety and monitoring systems (WHO, 2008). In 2004, WHO took the lead in the development of the World Alliance for Patient Safety by generating global norms and standards and by supporting country efforts in their development of patient safety policies and practices to control and prevent infectious diseases on a global scale (WHO, 2008). More recently, in 2011, the WHO developed a policy on combating antimicrobial resistance which has been made available for international healthcare providers. Recommendations from this policy (WHO, 2008) include the development of a comprehensive plan that is inclusive of a financed national plan to create accountability and civil society engagement; strengthen surveillance and laboratory capacity; ensure uninterrupted access to essential medicines of assured quality; regulate and promote rational use of medicines and ensure proper patient care; enhance infection prevention and control; and foster innovations, research, and the development of new tools. These are only a few of the initiatives to target the prevention and control of infectious disease that have taken place on a global scale (WHO, 2011).

At the country-specific level, numerous programs and initiatives have emerged (Brown et al. 2005; Ducel et al., 2009; Plowman et al., 2007). HAIs are roughly as prevalent in other countries as they are in the Canada. However, European countries, such as the Netherlands, Denmark, and Finland, have managed to decrease the percentage

of MRSA infections from 30% to 1% in the last five years (Khan et al., 2010). For example, the Netherlands has lowered its rates of MRSA in the last couple of decades by implementing an aggressive strategy, which includes screening of all potential carriers; isolating patients known to be infected and 'at risk'; cohorting of patients and personnel based on similar infections; and intensive disinfection and decontamination (Sohn et al., 2009). More recently, the United Kingdom (UK) released *Model Infection Control Policies* (2011), an example plan for action to guide those wishing to develop, refine, or compare their own policies, with a view to encouraging standardization of policies across the UK (Health Protection Scotland, 2010). Two model infection control policies that have been implemented in the UK include the *Standard Infection Control Precautions* (SICPs) and *Transmission Based Precautions* (TBPs; Health Protection Scotland, 2010). The application of these policies drastically decreased the rates of ARO infections in the UK (Health Protection Scotland, 2010). These policies have decreased the incident rate of bacteraemias by 33%; and caused an annual decrease of 38% in the overall incidence of C. difficile infection, in 2010, in patients aged 65 and over. These policies are not mandatory for healthcare institutions but are intended to provide a common, evidence-based approach to infection control and to support a more uniform country-wide response for the prevention and management of infections within organizations (Health Protection Scotland, 2010). The Infection Control Team at Health Protection Scotland is receiving unprecedented attention for the institution of these above mentioned policies, which suggests that new standardized infection control policies may have the greatest impact on the decrease of HAI rates (Raymond et al., 2010).

Universal screening is a polarizing issue for debate in the infection control literature, globally (Sanders et al., 2009; Staton et al., 2010; Thompson et al., 2009). There are supporters of universal screening programs that suggest that mandatory screening of all patients has the potential to decrease MRSA nosocomial infections by 70% in hospitals (Agnus, 2008). Other studies have found that screening patients on admission does little to reduce MRSA infection rates (Evanston, 2009). Healthcare organizations and healthcare systems are divided on whether to screen every admitted patient, particularly in the United States of America (US). Currently, only 29% of states in the US screen all patients universally for MRSA (CDC, 2011). The federal Centre for Disease Control and Prevention in the US does not endorse the MRSA screening protocol (CDC, 2006).

Review of Relevant Government Initiatives in Controlling and Preventing Antibiotic-Resistant HAIs in Canada

A number of policies and program initiatives for preventing and controlling infections were created after the SARS outbreak in Ontario and across Canada, in 2003. HAIs have become a noteworthy patient safety concern as the incidence of HAIs and antibiotic-resistant HAIs have been gradually reported more in the media. Government initiatives, at both the federal and provincial levels, created policies and directives to control the transmission of emerging infectious diseases and to focus their attention on the prevention of HAIs.

The Federal Level: The Canadian Patient Safety Institute (CPSI)

At a macro level, the issue of patient safety in hospitals became a growing concern**.** As early as September 2001, research evidence began to emerge about the high incidence of HAIs, and it was recognized that there was a need for a coordinated federal strategy to improve patient safety for Canadians (CPSI, 2010). While the issue of patient safety did not only focus on infection, it became clear that the government was committed to the wellbeing of patients receiving care in hospital. The 2003 First Ministers Accord on Healthcare Renewal report provided an impetus for change as its authors urged that "the implementation of a national strategy for improving patient safety is critical" (Romano, 2003, p. 59). In response, in the 2003 federal budget, the annual provision of 10 million dollars to support patient safety initiatives was announced, which included the creation of the CPSI (2010). CPSI has a national mandate to build and advance a safer healthcare system for Canadians. It fosters collaboration between provincial governments and stakeholders, and supports the development of patient safety initiatives. CPSI is dedicated to achieve measurable improvement in the rate of patients experiencing adverse events, including HAIs, while in the Canadian healthcare system (CPSI, 2010).

The Provincial Level: The Emergence of the Ontario Agency for Health Protection and Promotion (OAHPP)

A number of MOHLTC initiatives for preventing and controlling infections emerged after the outbreak of SARS in Ontario (SARS Commission, 2006). From 2003 to 2006, several high profile reports recommended the need for improvements in the coordination and integration of infection prevention and control activities across the

provincial healthcare system, and called for the establishment of a public health agency in Ontario in addition to the current provincial public health agency (MOHLTC, 2011). The reports include the National Advisory Committee on SARS and Public Health chaired by Dr. David Naylor, the Expert Panel on SARS and Infectious Disease Control chaired by Dr. David Walker, and the Interim Report of Mr. Justice Archie Campbell from the National Advisory Committee on SARS and Public Health, and the SARS Commission. In January 2006, building on the advice of experts and following the implementation of the recommendations of the SARS Commission Task Force, the government created Ontario's first provincial public health agency.

Public Health Ontario's (PHO), formally known as the Ontario Agency for Health Protection and Promotion (OAHPP), role is as a hub organization that strengthens Ontario's response to health emergencies and localized outbreaks, giving timely scientific and technical advice to frontline healthcare workers in areas, such as, infectious disease (MOHLTC, 2011). Within PHO, the Infectious Disease Prevention and Control (IDPC; 2010) team works with partners in government to create a unified infection control strategy for the province. Their mandate is to provide a more comprehensive and systematic approach to dealing with infectious diseases in Ontario, in every sector of the healthcare system, including community health (especially public health), long-term care, and acute care settings (OAHPP, 2010). Several of the IDPC initiatives include reducing the risk of transmission and incidence of antibiotic-resistant HAIs, designing safer hospitals in terms of patient safety and infection control, creating infection control resource teams, and developing new treatment options for C. difficile. PHO is

responsible for connecting public health practitioners, frontline hospital healthcare workers, and researchers to the best scientific intelligence and knowledge from around the world (OAHPP, 2010).

Another MOHLTC initiative is the establishment of a Provincial Infectious Diseases Advisory Committee (PIDAC), in 2004, whose mandate was to standardize the growing amount of research and expert advice on matters related to infectious disease prevention, surveillance, and control measures necessary to protect Ontario (PIDAC, 2011). The role of PIDAC has been to develop best practice documents, fact sheets, and presentations that support environmental cleaning, hand hygiene, routine best practices, screening, testing and surveillance, prevention of transmission, and management of HAIs (PIDAC, 2011). PIDAC developed literature, and provided external recommendations and reports for infection control for the province of Ontario. PIDAC developed guidelines, algorithmic procedures, and recommendations for infection control that were disseminated across the province. PIDAC recently became a branch of the PHO, in April 2011.

Additionally, in 2004, the MOHLTC invested in the creation of fourteen Regional Infection Control Networks (RICNs) across the province in each LHIN to promote the best approaches to infection prevention and control (RICN, 2011). The developments of the RICNs were funded by the MOHLTC and their role is to assist hospitals by coordinating activities and promoting standardization in infection control practices across the province (RICN, 2011). The leadership of the PHO governs the RICNs. Therefore, to support the knowledge transfer and implementation of these new protocols and

practices, the MOHLTC provided funding for 166 infection prevention and control practitioners (ICPs) in hospitals across the province (MOHLTC, 2011).

Additionally, there are two mandatory monthly public reporting requirements in the province: hand hygiene compliance rates and patient safety indicators, which include the incidence rates of HAIs. In March 2007, under the proposed new standards for infection prevention and control, developed by the Canadian Council on Health Services Accreditation, hospitals were required to monitor infection rates and participate in hand hygiene initiatives in order to maintain their accreditation (MOHLTC, 2007). The *Just Clean your Hands Program* was implemented and healthcare professionals were encouraged to clean their hands at the point-of-care with patients (MOHLTC, 2007). Likewise, as of 2008, the Ontario government introduced a full public reporting system on patient safety indicators (MOHLTC, 2008). Each hospital in Ontario is now required to report on three antibiotic-resistant HAIs (i.e., C. difficile, MRSA, and VRE) to their local public health units on a monthly basis (MOHLTC, 2008).

Public reporting started in 2009 for other HAIs, such as ventilator-associated pneumonia and central-line infections, and is part of a campaign by the MOHLTC called *Safe Healthcare Now!* This campaign aims to improve overall patient safety by integrating best practices into the delivery of patient care in Ontario hospitals (MOHLTC, 2008). On the last day of each month, all Ontario hospitals are required to report any new cases of MRSA, VRE, and C. difficile in their organizations to the MOHLTC. This report includes a summary of the number of new antibiotic-resistant HAI cases associated with the reporting facility for each separate hospital site using the Web Enabled

Reporting System (WERS) database (MOHLTC, 2008). Hospitals can identify this information through their existing infection prevention and control surveillance programs. The MOHLTC reports the antibiotic-resistant HAI rates for each hospital site and the number of new antibiotic-resistant HAI cases associated with the reporting facility for each hospital site on its own website. While it is not mandatory, hospitals are also strongly encouraged to post information on their public website when they are actively in an outbreak, identify the ward/unit, or the entire facility if affected, and when the outbreak is declared over (MOHLTC, 2008).

Outbreak definitions have been redefined to incorporate notification thresholds that optimally trigger dialogue and action between Ontario public health authorities and hospitals to determine if an outbreak has occurred in a hospital (MOHLTC, 2010). Notification thresholds for outbreaks differ for each type of antibiotic-resistant HAI. For example, the notification threshold for C. difficile infections (CDI) for units with greater than 20 beds is three cases of CDI identified on one ward/unit within a seven day period or five CDI cases within a four week period. In comparison, the notification threshold for units with less than 20 beds is two cases of CDI identified on one ward/unit within a seven day period or four CDI cases within a four week period (MOHLTC, 2010). The notification threshold for outbreaks in hospitals that have a baseline CDI rate for two months that is at or above the 80^{th} percentile for comparator hospitals. As well, hospitals that have a facility rate that is greater than or equal to two standard deviations above their baseline, are also considered to be in outbreak (MOHLTC, 2010). Hospitals use the comparator data on the MOHLTC's public website for outbreak determination when

provincial baselines are established after several months of data reporting (MOHLTC, 2010). Facilities that are under the 80th percentile for comparator hospitals, but have experienced a doubling of their new antibiotic-resistant HAI cases for two consecutive months, must also trigger an investigation and the notification of the regional public health officer (MOHLTC, 2010). The MOHLTC (2010) calculates the rates of HAIs and outbreaks using the hospital data and forwards the calculated rate to the hospital. The MOHLTC also posts on its website hospitals that have been in outbreak for the previous month (MOHLTC, 2010). Therefore, regional Medical Officers of Health have the information they need to monitor and respond to emergent outbreaks (MOHLTC, 2010).

Additionally, since 2008, PIDAC has implemented the *Best Practice Active Approach* to universal screening programs in hospitals in Ontario (PIDAC, 2008). PIDAC recommends the active screening of all admitted patients with ARO infections who may have been colonized with MRSA and VRE, because it is understood that unidentified colonized patients are a reservoir for antibiotic-resistant pathogens (Myer et al., 2010).

Costs of Services to Manage Infectious Disease

A 2007 Canadian study found laboratory and nursing costs were $8.34 CDN per specimen, for a total cost of $30,632 CDN for one year of HAI screening per patient (Morgan et al., 2007). The average cost per year, in 2007, of implementing the recommended infection control measures for patients colonized with MRSA was approximately $5,235 per patient (Morgan et al., 2007). Avoiding additional costs by preventing further colonization and infection was accomplished in Canada by active

screening of all patients for AROs (Morgan et al., 2007). PIDAC recommends that hospitals actively screen all patients who have a previous history of MRSA or VRE colonization or infection; have been admitted to or have spent more than 12 continuous hours as a patient in any healthcare facility in the past 12 months; have recently been exposed to a unit/area of a healthcare facility with MRSA or VRE outbreak; as well as, other risk factors, which include having a compromised immune system (PIDAC, 2008).

CHAPTER 3: LITERATURE REVIEW

Search Strategy

A search of the electronic databases Web of Science, CINAHL, EMBASE, Medline, Canadian Public Policy Collection, and Psych Info was conducted using the following keywords: infection control, prevention, surveillance, hospital-acquired infections, nosocomial infections, methicillin-resistant *Staphylococcus* aureus (MRSA), vancomycin-resistant enterococci (VRE), *Clostridium* difficile (C. difficile), isolation precautions, personal protective equipment (PPE), nursing, executives, infection control practitioners, and laboratory. Inclusion criteria included empirical published articles, electronic journals, electronic tables of content alerts from publishers, government reports, and grey literature from relevant government websites, from 2000 to 2011, in the English language, with study settings in Canada, the US, and Europe. Excluded articles were those written in a language other than English or published prior to 2000.

From the search of these databases, a total of 30 articles, government reports, and grey literature were selected for final review. An additional 15 articles were abstracted from the article reference lists and from the provincial and federal infection control reports. A table of contents search of the electronic journal, the *Canadian Journal of Infection Control*, yielded 15 additional articles for review. The literature review was updated through weekly scanning of electronic tables of content alerts from publishers and grey literature from relevant government websites.

The following literature provides an overview of infectious disease, situates the study in the context of community hospitals, and traces the evolution of emerging

infectious diseases and their effects on the work of nurses, nursing and healthcare executives, laboratory staff, and infection control practitioners in Ontario. The evolution of infectious disease within hospital settings; epidemiologically important organisms; the transmission of HAIs; infection control policies, specifically PPE and isolation precautions; and the roles of healthcare professionals in managing infections will be reviewed.

The Evolution of Infectious Disease within Hospital Settings

Since the original discovery of the existence of bacteria in 1676 and viruses in 1931 (Porter, 1976), there has been intense worldwide clinical observation and research tracking of the prevalence and incidence of infectious diseases and impetus to study adverse outcomes of hospital-acquired infections and their impact on patient safety. During the last decade, there have been a series of significant events in the context of emerging infectious disease in North America (Sinson et al., 2010). Hospital-acquired or iatrogenic infections are defined as infections caused from *within the hospital*.

Infections Caused from within the Hospital (Iatrogenic Infections)

In one of the earliest works that identified hospital-acquired infectious disease, Illich (1976) identified the phenomena as "medically-inflicted injuries or iatrogenic disease" (p. 11). Illich introduced the idea of clinical iatrogenic disease, which he described as "a plethora of non therapeutic side effects acquired in hospitals" (p. 211). Illich explained that clinical iatrogenic diseases were "illnesses that would not have arisen if sound and professionally recommended treatment had *not* been applied" (p. 231). Clinical iatrogenic disease is comprised of "all clinical conditions for which medical

treatments, physicians, or hospitals are the pathogens or sickening agents" (p. 212). Illich's text set the stage for the realization that infections could be acquired within a clinical setting that could cause further problems for patients and staff.

Infection Introduced from Outside of the Hospital Environment- The Impact of Severe Acute Respiratory Syndrome (SARS)

In the last decade, the population in Ontario has been vulnerable to several epidemics and pandemics caused by infectious diseases that have been introduced from outside the hospital environment. The bioterrorism outbreak of anthrax in the US in the latter part of 2001 and the sudden appearance and rapid spread of SARS in 2003, served to alert the world that emerging infectious disease was a global problem (SARS Commission, 2006). Following the SARS outbreak, government policies, reports, and research studies highlighted systemic and organizational factors that influenced infectious disease patterns in hospitals (Ontario Expert Panel on SARS and Infectious Disease Control, 2004; SARS Commission, 2006). These factors included the availability of epidemiological data, patient mobility, physical plant design, nursing mobility, and workforce capacity (Baumann, Blythe, & Underwood, 2006; Robinson, MacDonald, Manuel & Goel, 2006; SARS Commission, 2006; Wigglesworth & Wilcox, 2006).

Among many important lessons learned from the SARS pandemic, most important was that being prepared and having a global culture of safe healthcare practices can prevent and control pathogen dissemination (WHO, 2011). Following SARS, the WHO highlighted the urgent need for efficient infection control practices in healthcare. It supported the creation of a coordinated global alert and response system, Global Alert and

Response (GAR), for epidemics and other public health emergencies (WHO, 2011). GAR developed international policies for infection control and, since 2005, has collaborated with International Health Regulations (IHR) to provide a framework for the surveillance of epidemic alerts and rapid response activities for WHO. The framework, for the surveillance of epidemic alerts and rapid response activities, is implemented within countries to control international outbreaks and to strengthen international public health security. Although SARS no longer poses an imminent threat to Ontario's current healthcare system, it serves as an exemplary global case study because many of the factors that were identified as challenges in dealing with SARS continue to impede the success of infection control measures today (Montour, Baumann, & Blythe, 2008). In the post-SARS environment, while there has been an emergence of new provincial and regional infrastructure to mange infectious disease and to standardize practices and procedures throughout agencies, such as PHO, PIDACC and RICNs, little has been done to study the impact of emerging infectious diseases and infection control policies and procedures on clinical care and hospital work.

Epidemiological Important Organisms: The Surge of Antibiotic-Resistant HAIs

New infectious diseases are constantly emerging and healthcare organizations have created infection control policies to prevent and control infectious disease outbreaks. All of these organisms cause outbreaks and some of the organisms develop resistance to antibiotic therapy, and, thus, are called antibiotic-resistant infections (HAIs) or *superbugs*. Superbugs are infectious agents that become targeted for control because of their rapid transmission within healthcares facilities (Grifiths, 2007). What separates

superbugs from other bacteria – when a patient is treated with an antibiotic, the superbug continues to "live happy and free" (Wright, 2008, p. 2). Wright explains that superbugs "are not necessarily any more infectious, but you just can't treat them with normal antibiotics" (2008, p. 3). Antibiotic resistance occurs when an individual's own normal flora (i.e., bacteria) become resistant to a particular class of antibiotics (e.g., penicillin) used to treat a specific infection (Johnsen et al., 2009).

Many issues contribute to the increase of HAIs and antibiotic resistance. Although antibiotic-resistant bacteria are not new, they have increased rapidly in the last five to ten years, posing serious threats to the treatment of infectious diseases (Conley, 2009; Gould, 2002). Antibiotic resistance can cause severe infections, which most often occur among debilitated, elderly, immunocompromised, hospitalized patients (Conley, 2009). Pneumonia and urinary tract infections are examples of patient infections that can be resistant to antibiotic treatment (Wright, 2008). The inability of a patient's immune system to respond to the antibiotic treatment of an infectious disease because of the bacteria's resistance to antibiotic treatment can increase the patient's chances of morbidity and mortality (Wright, 2008).

Transmission of Hospital-Acquired Infections (HAIs)

Hospital-acquired infectious diseases are spread through the transmission of a microorganism from a source to a host, commonly referred to as the cycle of transmission. There are three modes of HAI transmission, contact, droplet, and airborne. 1. Contact transmission of microorganisms occurs with the physical transfer of

microorganisms from the body surface of one person to the body surface of another person, that is, between a colonised person and a susceptible host.

2. Droplet transmission of microorganisms occurs when the source patient coughs, sneezes, or talks and droplets, containing microorganisms generated from the infected source person, are propelled through the air, and are deposited on the host person's conjunctivae, nasal mucosa, or mouth (PIDAC, 2010). This can occur between patients or from staff to patient when performing patient care activities (PIDAC, 2010).

3. Airborne transmission of microorganisms occurs when respiratory secretions containing the infecting agent remain suspended in the air for long periods and are inhaled by the host. In this situation, the microorganism is present in an aerosol, small particle residue of evaporated droplets containing microorganisms, or dust particles (PIDAC, 2010).

Transmission to the patient can also occur from outside of the hospital environment. Therefore, the types of infectious disease and their modes of transmission have influenced the development and implementation of infection control policies and procedures.

Routine practices are infection control procedures that help to reduce the risk of being exposed to blood, body fluids, and non-intact skin of patients. Routine practices include hand hygiene, the use of face masks and gloves, and the environmental cleaning of surfaces. Routine practices are based on the premise that all patients are potentially infectious, even when asymptomatic, and that the same safe standards of practice should be used routinely with all patients to prevent exposure to blood, body fluids, secretions,

excretions, mucous membranes, non-intact skin, and soiled items to prevent the spread of microorganisms (PIDAC, 2010).

Interventions to Control the Transmission of HAIs

Hand hygiene has been the common focus of infection control and has been considered the most effective measure to use to combat the transmission of infectious disease. Hand washing with soap and water is the preferred and accepted hand hygiene method recommended by the WHO (2010). There are "four moments of hand hygiene" which include: before interacting with a patient, before an antiseptic procedure, after a body fluid exposure, and after a patient-environment contact (WHO, 2010, p.29). Despite the importance of hand hygiene in the prevention of healthcare-associated infections (HAIs), compliance with hand hygiene by healthcare providers in Canada has been, and continues to be, unacceptably low at 20% to 50% (Pittet et al, 2010; Vernon et al., 2009).

Research has provided evidence that a multifaceted, multidisciplinary, facility-wide hand hygiene program, which includes demonstrable administrative leadership, education, infection control champions, and environmental enablers, can be effective at reducing the incidence of HAIs (Pittet et a1., 2010). To make it possible for healthcare providers to clean their hands at the preferred and recommended times to prevent the transmission of HAIs, alcohol-based hand-rub (ABHR) or a hand hygiene sink must be provided at the point-of-care, where busy healthcare providers can clean their hands without leaving the patient (Picheansthian et al., 2004). ABHR is the preferred method to decontaminate hands routinely in clinical situations when hands are not visibly soiled

because this method provides rapid killing of most microorganisms. ABHR is less time-consuming than washing hands with soap and water, and leads to less skin breakdown with use (Picheansthian et al., 2004). However, empirical evidence has not supported the use of ABHRs against C. difficile because the chemical action of the alcohol does not kill C. difficile spores (Oughton et al., 2008).

The Risk of Microorganism Transmission

The risk of microorganism transmission involves multimodal factors related to the microbe, the population, the patient, the healthcare environment, and the new host (PIDAC, 2010). Numerous factors influence the HAI transmission risk in hospital settings. These factors include population characteristics e.g., increased susceptibility to infections, the type and prevalence of indwelling devices. In addition the risk of transmission increases with the complexity of patient care, exposure to environmental sources, the length of hospital stay, the number of patients admitted per ward, the availability of beds for admitted patients, and the frequency of interaction between patients and between patients and healthcare workers (Aboelela et al., 2007; Pittet et al., 2010).

The risk of HAI transmission between hospital inpatients involves factors that are related to the presence of large amounts of the microorganism in the environment, more virulent microorganisms, airborne-spread of the microorganism, and the ability of the microorganism to survive in the environment (Berg et al., 2009). Additionally, the risk of microorganism transmission is increased if the patient is incontinent of stool, has skin lesions or wounds, has increased respiratory secretions, and is cognitively unable to

understand the practice of infection prevention and control procedures (Aboelela et al., 2007). Likewise, a high patient-nurse ratio and noncompliant, uneducated staff can increase the risk of transmission of HAIs (Boyce et al., 2009). Additionally, the susceptibility of the host is a major factor in the risk of microorganism transmission. This includes factors such as patients who require increasingly more complex care leading to increased nurse-patient contact; patients with invasive, indwelling devices and severe underlying diseases; patients at the extremes of age, that is, the very young or very old patients; patients who have had recent antibiotic therapy; and patients who are immunosuppressed (Berg et al., 2009). Finally, the environment is critical in the decrease of HAI transmission (Aboelela et al., 2007). A growing body of evidence provides support for the statement that the overcrowding of hospitals directly influences many HAI transmission risk factors and impedes the implementation of infection control practices used for MRSA and other HAIs (Demon et al., 2006; McPherson, 2008; Ryer et al., 2009). Overcrowding of healthcare facilities, leads to increased inpatient and staff movement and intermixing of medical specialties on hospital units, increasing the transmission risk for HAIs (Bignardi, 2009). Moreover, high bed occupancy rates are associated with an increased incidence of infectious disease and the occurrence of outbreaks of MRSA (Ryer et al., 2009; Vicca et al., 2010).

Microorganism Transmission through Patient Equipment

Sharing of equipment without decontamination between patients and multi-bed rooms with shared toilets, sinks, and baths increases the transmission of HAIs between patients (Paterson et al., 2010). According to the *Best Practice Document for the*

Management of Clostridium difficile Prevention in Healthcare Settings (PIDAC, 2006), hand hygiene should not be carried out at patient's sinks because doing so will recontaminate the healthcare worker's hands. Ideally, each patient's room should have two sinks: one in the toilet area and one in the patient's room at least two meters from the patient's bed. In addition, sinks should be accessible to the nurses' station, soiled utility room, and medication area (PIDAC, 2006).

Transporting patients for investigative tests or to other hospital units, moving beds within the unit to accommodate patient isolation requirements, and the moving and sharing of equipment between patients in the absence of decontamination spreads infectious diseases and exposes patients to more patients and their microorganisms (Conly, 2009).

The multimodal factors in the transmission of HAIs, as well as organizational priorities, goals, and resources influence how various healthcare settings adapt infectious disease prevention guidelines to meet their specific needs (Sheng et al., 2005). Infection control management decisions are informed by data regarding institutional experience/epidemiology; HAI trends in the community and institution; local, regional, and national epidemiology; and emerging infectious disease threats (Aboelela et al., 2006). Evidence also suggests that organizational characteristics (e.g., nurse staffing levels and composition, the establishment of a safety culture) influence the adherence of healthcare personnel to recommended infection control practices, and, therefore, are important factors in preventing the transmission of infectious agents (Aboelela et al., 2007). For example, Hugonnet et al. (2007) conducted a narrative review of seven multi-

centre studies to assess the association between understaffing and healthcare-associated infections. The authors concluded that there is sufficient evidence for a relationship between staff downsizing and an increase in nosocomial infections (Hugonnet et al., 2007). However, the authors concluded that there is insufficient evidence regarding the absolute number of staff needed for optimal staffing (Hugonnet et al., 2007).

It is important to note that much of the evidence cited for the prevention of the transmission of infectious agents in healthcare settings is derived from studies that employed nonexperimental, nonrandomized study designs or observational studies (MacDonald et al., 2009). Even though these types of observational studies provide valuable information regarding the effectiveness of various interventions, several limitations decrease the certainty of attributing an improved outcome to a specific intervention. These limitations include difficulty in controlling for important confounding variables and the use of multiple interventions during an outbreak which makes it difficult to identify the influence of one specific intervention in the transmission of HAIs (MacDonald et al., 2009).

Use of Cleaning Agents to Decrease the Transmission of HAIs

Inadequate cleaning, especially the use of conventional cleaning methods and disinfectant agents, including the use of bleaching agents that leave considerable contamination behind on cleaned surfaces (Manian et al., 2010), are insufficient in decreasing the transmission of HAIs. Studies have found that 20% to 50% of sampled surface locations in hospitals remained contaminated after having been terminally cleaned with bleach solutions (Manian et al., 2010; Olsen et al, 2009). Hydrogen peroxide vapour

(HPV) decontamination has been found to be much more effective at surface decontamination, especially of C. difficile whose spores cannot be destroyed by bleach-based products (Shapeley et al., 2008). Recent studies, comparing the effectiveness of bleach-based products and HPV for eradicating C. difficile, found that bleach-based products eliminated C. difficile from 50% of sampled surfaces and HPV eliminated C. difficile from 91% of the surfaces (Barbut et al., 2009; Shapeley et al., 2008). Barbut et al. (2009) found that bleach-based products removed 74.4% of the C. difficile and HPV eliminated 100% of the C. difficile from sampled surfaces

Selected Infectious Disease Prevention and Control Policies

The increased involvement and support of healthcare administration and management, in the prevention and control of infectious disease, have expanded the range of infectious disease control activities that are required by healthcare professionals (CPSI, 2010). The expanded range of infectious disease control activities include following an increased number of infectious disease prevention and control policies in order to maintain effective patient safety in the current healthcare system. The concept of *surge capacity* is used to describe sufficient capacity or appropriate resources for day-to-day operation and an ability to redirect resources in times of need (OAHPP, 2010). Despite the need for more resources for effective infectious disease prevention and control, an emphasis on surge capacity is required to effectively implement the infection control policies mandated by the provincial government (CPSI, 2010).

There are two main infection control policies that contribute to the increasing workload demands placed on nurses and allied healthcare workers, isolation precautions

and the use of PPE (CPSI, 2010). These policies require nurses to perform an increased number of interventions and procedures while caring for their patients (CPSI, 2010). The policies are aimed at limiting the transmission of infectious diseases patient-to-patient and between patients and staff (CPSI, 2010). Even though these policies translate into nurses and other healthcare professionals having more work, there is not enough surge capacity in institutions to manage the care for an increasing number of patients with HAIs and antibiotic-resistant HAIs (CPSI, 2010).

Infection Control Policies and Practices: Isolation Precautions

The overarching goal of isolation precautions, also referred to as "contact isolation", is to prevent the transmission of HAIs to other patients (Myer et al., 2010). As mentioned previously, for a HAI to occur, a pathogen must reach a patient and then gain access to the patient, often through portals created by invasive devices, procedures, or through a breakdown in skin integrity (Webster et al., 2009). 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 (Webster et al., 2009). Because the goal of isolating patients is to prevent infections, not simply to interrupt the transmission of HAIs, it is important to understand that the role of isolation precautions is limited to only interrupting the transmission of new HAIs to patients.

Isolation precautions have long been employed to control the spread of infectious diseases (Cooper et al., 2004). During epidemics, isolation precautions have been implemented for short durations to many patients (Siegel et al., 2007). Isolation precautions are particularly important in managing outbreaks. The most intensive forms

of isolating patients are isolation wards or units (designated for the treatment of known or suspected carriers of MRSA) and nurse cohorting, which is the physical segregation of MRSA patients in one part of a ward with nursing care performed by designated staff who care exclusively for these patients (Harris et al., 2008). Other isolation measures include the use of single bedded rooms and the cohorting of patients on general hospital units (without designated nursing staff).

Single Patient Rooms

According to the literature, the use of single rooms, with dedicated bathroom and sink, are preferred for the placement of all patients with an infection or are suspected of having an infection (Zaidail et al., 2008). Studies have shown a clear relationship between the use of single rooms and the reduced number of HAIs (Larson et al., 2006; Luby et al., 2005; McDonald et al., 2008). According to the *Guidelines for Isolation Precautions* (CDC, 2007) and the best practice document for the *Management of Clostridium difficile Prevention in all Healthcare Settings* (PIDAC, 2006), all patients suspected of having CDAD should be placed in a single room with dedicated toileting facilities, if available. If a single room is not available, patients with confirmed CDAD may be cohorted with other patients with CDAD. This directive is supported by numerous studies supporting the use of single rooms to reduce the transmission of antibiotic-resistant infectious disease (Luby et al., 2005; Starfield et al., 2007; Won, 2009).

A well controlled, rigorous research study by Teltsch et al. (2011), found that, when a 25 bed intensive care unit (ICU) was renovated to all single rooms, the incidence

of C. difficile declined by 43%, the incidence of MRSA dropped by 47%, and the overall length of hospital stay for patients dropped by 10%. Similarly, Hamel and colleague's (2010) retrospective study assessed 94,784 Canadian hospital inpatients (adults) and found that the increase number of exposures to different roommates (i.e., the number of roommate exposures per day), the more likely the colonization of MRSA, VRE, and C. difficile infection. Having even one roommate increased the infection risk by 11%, which was true regardless of whether the roommate was infected or not. The exposure to six or more roommates increased the infection risk by 87%. Similarly, several studies reported that a patient's C. difficile risk increased by 86% if one roommate had a positive antibiotic culture (McKenzie et al., 2006; Nelson, 2007; Teltch et al., 2011).

Most healthcare facilities do not have a sufficient number of single rooms to accommodate all of the patients who require isolation precautions because bed occupancy rates in most Ontario hospitals is above capacity (MOHLTC, 2010). Patients needing isolation are placed in multi-bed rooms, which present a risk for the transmission of infectious disease (Hamel et al., 2010). Therefore, clear infection control protocols must be in place for patient placement in order to minimize the transmission risk of infectious disease to others (PIDAC, 2010). In healthcare settings that do not have a sufficient number of available single rooms for the isolation of patients with HAIs, decisions must be made about room assignments and the selection of roommates based on the route of transmission of the infectious agent (known or suspected; Nelson, 2007). Other selection criteria include patient risk factors for infectious disease transmission to other patients (e.g., hygiene, cognitive status), patient risk factors for infectious disease acquisition from

other patients in the unit (e.g., compromised immunity), and the availability of single rooms for patient isolation (Nelson, 2007).

Cohorting Practices

Cohorting practices can be utilized as an isolation precaution when single rooms are not available or during outbreak situations (Won, 2009). Cohorting has contributed to the control of a number of infectious disease outbreaks (Seto, 2008; Young et al., 2009) and must be considered when infectious disease transmission is documented and continues despite alternative interventions, and when available facilities and staffing allow for the establishment of cohorting (McDonald et al., 2008).

Cohorting consists of three forms: patient cohorting, geographic cohorting, and staff cohorting (Larson et al., 2006). Patient cohorting is applicable in acute care settings for the control of the transmission of microorganisms or infectious disease outbreaks (Luby et al., 2005). Patient cohorting refers to the placement and care of individuals who are infected or colonized with the same microorganism in the same room; or placing those who have been exposed together to limit the risk of further infectious disease transmission (Luby et al., 2005).

Whereas, geographical cohorting refers to restricting patients who are colonized with the same microorganism to several rooms along a corridor or restricting patients within an entire clinical unit (Larson et al., 2006). Use of this practice can limit the transmission of infectious disease by segregating those who are infected or colonized to a specified area away from those patients who are not infected or colonized (Larson et al., 2006). Dedicated patient care equipment, or equipment that is cleaned between use on

patients/residents in the same room, and protective barriers such as gowns and gloves must be worn for the care of one patient only, not worn from patient to patient within the cohort (Luby et al., 2005). Staff cohorting involves the designation of specifically assigned staff for patients with HAIs, in all healthcare facilities (Luby et al., 2005).

Issues with Isolation Precautions

Patient isolation for infection control places substantial burdens on hospital resources. The value of the continued use of these practices has been questioned (Harris et al., 2008). The intended benefits of isolation are not for the isolated patient; rather, the benefits are for other patients who may be at risk of acquiring infectious diseases, if isolation precautions are not imposed (Harris et al., 2008). There is an exception in the case of a patient who is immunocompromised.

However, isolation is not without risk to the isolated patient. At best, isolation precautions are restrictive to the patient's free movement; at worst, the isolated patient may suffer psychologically or may receive a different level of care (Brown et al., 2011; Ducel et al., 2010). Studies in both the nursing and medical literature have reported that some isolated patients describe loneliness, stigmatization, boredom, anxiety, and depression (Richardson et al., 2010; Ryerson 2009). Several observational studies present evidence that contact isolation reduces the frequency and duration of encounters between healthcare professionals and patients (Campbell, 2008; Simpson et al., 2009).

Studies in both medical and surgical units demonstrate that patients in contact isolation were seen by healthcare professionals half as often as patients who were not isolated (Biggs et al., 2007; Thompson et al., 2008). There are high costs associated with

the use of healthcare resources for isolation. There is a substantial amount of fiscal, organizational resources and human capacity that is dedicated to preventing and controlling infectious diseases in hospitals (Ryerson, 2009). For example, in situations where the incidence of HAIs exceeds the capacity of isolation facilities, multi-bed rooms may be used for isolation, preventing the use of both the occupied and unoccupied beds, (Bauer, 2008), a phenomenon called *bed blocking* (Arnold et al., 2009). A blocked bed of an isolated patient represents an opportunity cost (i.e., a lost opportunity to provide services to another patient). With the average duration of isolation reported at between 20 and 36 days (Arnold et al., 2009), beds can be blocked for extended periods for patients with HAIs.

Cooper et al. (2010) systematically assessed 46 studies, 45 of which reported on multiple, often simultaneous, interventions; in one-third of the studies, no conclusions could be made about the effectiveness of isolation precautions. The other two-thirds of the studies provided some weak correlations that suggest some intended benefits of the isolation precautions. The strongest evidence was found in six interrupted time-series studies. Of these, four studies concluded that aggressive infection control measures that included isolation precautions were effective in controlling MRSA (Anil et al., 2007; Peterson et al., 2009; Plowman et al., 2010). Two studies, conducted in settings where MRSA was endemic, failed to show an effect of isolation (Boyce et al., 2008; Gopal et al., 2007). These reviewers concluded that the evidence was inadequate to demonstrate the efficacy of isolation alone.

The review of the literature demonstrates that the effectiveness of isolation measures in reducing transmission and in controlling HAIs has not been assessed systematically (Bent et al., 2009). Moreover, since research in this area is non experimental, researchers cannot determine causation between the exposure and the outcome (Siegel et al., 2007).

Infection Control Policies and Practices: PPE

Personal protective equipment is specialized clothing or equipment worn by any healthcare worker for protection against infectious materials or diseases (Denton et al., 2008). In healthcare environments, PPE is used to prevent exposure and contact with an infectious agent or body fluid by creating a physical barrier between the potential infectious sources and the healthcare worker's mucous membranes, airways, skin, and clothing (Cooper et al., 2004; Denton et al., 2008). Frontline nurses and allied health workers use PPE to prevent the transmission of infectious diseases in their clinical environments, which has changed their daily routine practices (Siegel et al., 2007). PPE policies mandate that any healthcare staff in direct contact with patients with infectious disease must wear specialized clothing or equipment for their own protection (Denton et al., 2008). The selection of PPE is based on the nature of the interaction with the patient and the likely mode(s) of transmission of infectious agents. Selection of the appropriate PPE is based on the risk assessment (e.g., interaction, status of client/patient/resident) that dictates what is worn to break the chain of transmission (Cooper et al., 2004).

Components of PPE may include gloves, gowns, bonnets, shoe covers, face shields, cardiopulmonary resuscitation (CPR) masks, goggles, surgical masks, and

respirators (Cooper et al., 2004). How many of these practices are used and how often is determined by the infection control policies and regulations of each healthcare facility (Siegel et al., 2007). According to most hospital policies in Ontario, hospital personnel's protective equipment should be applied just prior to their interaction with the patient (PIDAC, 2010).

Gloves. The most commonly used form of PPE are gloves which are intended to reduce the risk that a healthcare professional's hands or clothing will become contaminated during patient care and they will inadvertently carry organisms to the next patient's environment (PIDAC, 2010). Gloves must be worn when it is anticipated that the hands will be in contact with mucous membranes, non-intact skin, tissue, blood, body fluids, secretions, excretions, or equipment and environmental surfaces that have been contaminated (Zoutman et al., 2009). Improper glove use has been linked to the transmission of pathogens (Suh et al., 2007). Since the uses of gloves are task-specific and single-use for the task, the reusing of gloves has been associated with the transmission of MRSA and Gram-negative bacilli (Mcgeer et al., 2007; Roth et al., 2008). Additionally, because gloves are not completely sealed, making them free of holes; hands may become contaminated when removing gloves (Mcgeer et al., 2007). Hands must be cleaned before putting on gloves for an aseptic/clean procedure and after glove removal (Roth et al., 2008). Gloves must be removed immediately and discarded into a waste receptacle after the activity for which they were used and before exiting a patient's environment (Roth et al., 2008).

Masks. Masks are another form of commonly used PPE (PIDAC, 2010). A mask is used by a healthcare provider to protect the mucous membranes of the nose and mouth when it is anticipated that a procedure or care activity is likely to generate splashes or sprays of blood, body fluids, secretions, excretions, or being within two metres of a coughing patient (Katz et al., 2010; OHAPP, 2010). An N95 respirator is used to prevent inhalation of small particles that may contain infectious agents transmitted via the airborne route (Katz et al., 2010).

Gowns. One form of PPE that has been utilized for patients with MRSA, VRE, and C. difficile since the early 1970s is the use of isolation gowns, which are always worn in combination with gloves (OAHPP, 2010). A gown is recommended when it is anticipated that a procedure or care activity is likely to generate splashes or sprays of blood, body fluids, secretions, or excretions (Katz et al., 2010). Full coverage of the arms and front body, from the neck to the mid-thigh or below, will ensure that clothing and exposed upper body areas are protected (Katz et al., 2010). PPE policies mandate that before entering the room of a patient with C. difficile, MRSA, or VRE, a healthcare worker must wear gloves and gowns (OAHPP, 2010). The healthcare workers must also remove their gloves and gowns before exiting the patient's room (OAHPP, 2010). Several studies have reported problems with nursing staff's compliance with consistently wearing isolation gowns (Cepeda et al., 2005; Herr, 2008; Smith et al., 2008). Healthcare facilities have monitored nursing compliance regarding the use of PPE and found that poor PPE compliance rates are associated with staffing shortages, decreased resources,

and an increased use of acute emergency care services (Cepeda et al., 2005; Herr, 2008; Smith et al., 2008).

Despite the existence of dozens of published reports and a series of provincial government guidelines (OHAPP, 2010; MOHLTC, 2010; PIDAC 2010; RICN, 2009) that cite these reports, evidence that isolation gowns are necessary for the prevention of HAIs is inconclusive. The available evidence has significant limitations much of which represents the describing of experiences in individual hospitals during outbreaks. Other weaknesses of published studies include the lack of clarity about specific interventions and targeted populations, use of multiple simultaneous interventions, failure to specify specific outcomes, and generally weak statistical significance of the reported studies. In their review, Marshall et al. (2009) concluded that the articles cited as the evidence for using PPE to control MRSA were methodologically weak. Moreover, the authors indicated that the use of gloves and gowns should not be necessary if the hands of healthcare professionals pose the greatest risk for the transmission of pathogens, highlighting the lack of research addressing the issue of whether the use of gowns and gloves provides additional benefit beyond the practice of hand hygiene (Marshal et al., 2009). Thus, unfortunately, currently available evidence is not compelling enough to support a firm conclusion regarding whether the benefits of PPE consistently outweigh the harm or whether the harm outweighs the benefits in all cases.

The Roles of the Laboratory Staff and Infection Control Practitioners in HAIs

The clinical microbiology laboratory is an essential component of an effective infection control program (Anderson et al., 2009). For HAIs, laboratory-based

surveillance is recognized as essential to confirm an outbreak (Archabal, 2008). Laboratory personnel have a broad range of technologies, from traditional methods of detecting and identifying organisms to modern molecular typing methods, used to support and enhance the monitoring and reporting efforts of the infection control and healthcare staff (Gill et al., 2010). Therefore, the role of the clinical laboratory is key in infection control monitoring, reporting, and in the surveillance of infection rates and outbreaks (Griffiths et al., 2009). The success of a hospital's infection control efforts hinges largely on the active involvement of the laboratory in all aspects of an infection control program (Anderson et al., 2009).

Laboratory staff often work with infection control practitioners in developing approaches to reduce HAIs (Gill et al., 2010). One of the major new challenges for laboratory staff, with the increased emergence of HAIs, is the turnover time required in providing timely tests results to healthcare providers (Bontovicks et al., 2010). The results produced by the laboratory impacts the confirmation of a patient's positive status, the duration of the patient's isolation, the availability of beds for the patient, and cross-contamination between positive and negative patients. Furthermore, in the literature it is stated that the use of different technologies, such as polymerase chain reaction (PCR) which has shown to increase the sensitivity of the test results and to provide faster turnover time of test results to healthcare providers (Roth et al., 2011). Currently, the use of PCR is being tested in several hospitals across Ontario (PIDAC, 2010). Laboratory staff may increasingly use this new technology as the demand for faster surveillance results are needed with higher incidences of HAIs in hospitals.

The Role of Infection Control Practitioners

In most cases, physicians, medical technologists, registered nurses, or epidemiologists serve as infection control practitioners. One of the primary roles of the ICP is to help prevent infections acquired by patients once hospitalized. There is always a danger of secondary infections that have nothing to do with the primary reason the patients are in the hospital (Anderson et al., 2009). An ICP's primary concern is how to keep these healthcare-associated infections from infecting other patients (Archabal, 2008). As discussed previously, the ICP's role has become increasingly demanding (MOHLTC, 2008).

Medical facilities such as hospitals, community clinics, and long-term care facilities, have a responsibility to report infectious diseases, as well as to have procedures in place to prevent and isolate infections (Anderson et al., 2009). Many outbreaks are recognized by laboratory workers who have access to positive specimen results (Archabal, 2008). The ICP must have access to all patient and hospital records and the full cooperation of all hospital personnel and departments to obtain the necessary data to conduct routine surveillance or to investigate an outbreak. For routine surveillance, the ICP uses laboratory and clinical data for two reasons: case finding (i.e., screening for patients with possible infections) and determining the site of infection, associated risk factors, and outcomes (Welsh et al., 2009).

The diagnostic practices of the physicians practicing in the hospital are an important factor in detecting infections. It is only when a physician initially orders microbiologic cultures that a sample is sent to the laboratory for analysis, and HAIs are

then identified through microbiology cultures (Pollak et al., 2009). As a result of the rise in HAIs and antibiotic-resistant HAIs in Canada in the last decade, a hospital's overall low rate of infectious disease has become a standard of assessment of the quality of the healthcare environment (Welsh et al., 2009). Therefore, the roles of ICPs' and laboratory staff have continued to grow and become even more prominent in healthcare institutions across Canada (Denton et al., 2010).

CHAPTER 4: METHODS

Overview of Descriptive Case Study Design

The purpose of this study was to describe the changing nature of the work of healthcare professionals within the context of increasing antibiotic-resistant infectious diseases in community hospitals. Currently, research exploring these phenomena in community hospitals in LHIN 4, does not exist. In this exploratory study, a descriptive case study design was used to describe the changing nature of work for frontline nurses, nursing and other healthcare executives, laboratory staff, and infection control practitioners. A descriptive case study is a strategic qualitative research methodology used to describe a contemporary phenomenon within its real life context using multiple sources of evidence (Yin, 2009).

Case studies are often criticised by methodologists as not addressing issues of generalizability (Stake, 1995). However, a case study design is useful in understanding a problem or situation in great depth; whereby cases rich in information are identified (Yin, 2009). One of the strengths of this design is that it allows for a holistic view of the study phenomenon. Case studies are useful in capturing the emergent properties of life in the organization and the ebb and flow of organizational activities (Barharein, 2008), in response to the emergence of antibiotic-resistant HAIs and the changing nature of healthcare professionals' work.

Protection of Human Subjects

The NHS Research Ethics Board (REB) granted approval for the proposed study in the Niagara Region, in LHIN 4, in February, 2011, following minor revisions to the

study protocol and written materials. Authorization was granted to conduct the study in four hospital sites in the NHS. Ethics approval was also granted from the McMaster University, Hamilton Health Sciences/Faculty of Health Sciences REB in February, 2011. Participants were given two copies of the consent form, which they signed and then returned one copy to the researchers (see Appendix C). The participants were informed that no harm or risks were associated with participating in the study. The form also stated that participants had the right to withdraw themselves or their data from the study at any time. Study participants were informed that a copy of the study results would be made available to them upon completion of the study.

To ensure participant anonymity, identification numbers were added to the interview tapes and transcription records. Linkages of the participants' personal information and the study identification numbers remained confidential and the participants were not identifiable through the study identification numbers. The data from the workforce demographic questionnaire was kept anonymous and confidential and the results have been aggregated, to ensure that the participant's responses cannot be identified.

To ensure confidentiality, the electronic interview material, specifically the electronic versions of the transcripts and digital audio files, have been stored on a password-protected computer with access limited to the research team for the course of the study. All data will be deleted from the computer seven years after completion of the study. Hard copies of the transcripts from the interviews will be kept in a locked cabinet

in the Nursing Health Services Research Unit at McMaster University during the project and will be destroyed seven years after the study is completed.

Sample

Recruitment of the Sample

In order to gain access to the NHS and to recruit the sample of interest, early in the study's planning stages, the Chief Nursing Executive/Vice President Patient Services of the Niagara Health System was contacted to discuss the study. Properties of the study, including potential participants and study settings, the study purpose, research questions, and objectives were discussed. Further discussion of participant selection and potential participants with the Chief Nursing Executive/Vice President Patient Services facilitated the study's progress. Managers and vice presidents from the selected disciplines and hospital sites agreed to participate in the study. In order to facilitate the selection of cases, the managers and vice presidents agreed to contact potential frontline nurses, ICPs and laboratory staff, by electronic mail, and provide them with study information letters for recruitment into the study (see Appendix D).

Purposive sampling, specifically snowball sampling facilitated the identification of the case selection within the Niagara Health System (Yin, 2009). Purposive sampling is a form of nonprobability sampling that involves searching for specific cases or participants to be interviewed (Patton, 2002). Snowball sampling relies on participant recommendations for further data sources (Streubert-Speziale & Carpenter, 2007). The recruitment of a critical case requires experience, and no universal methodological principles exist by which one can, with certainty, identify a critical case (Yin, 2009).

Generally, when looking for critical cases, it is a good idea to look for 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). Therefore, in descriptive case study design, when the objective is to obtain the greatest possible amount of information on a given problem or phenomenon, the selection of cases using purposeful sampling is the most appropriate sampling strategy because the typical or average case is often not the richest in information (Yin, 2009).

Selection of Study Sample

Identified cases who were selected to be interviewed for this study were nursing and healthcare executives (Clinical Vice Presidents and managers), frontline RNs and RPNs, of either gender, of any age, who were fluent in English, and who were willing to participate in the study. The cases also had primary employment in one of the selected NHS hospital sites and were in direct contact or involved in the management of patients with antibiotic-resistant HAIs. Nurses employed in casual or contractual positions, nurses not involved in the management of patients with antibiotic-resistant HAIs, or nurses who were unwilling to participate were not included in the study sample.

The laboratory staff and ICP cases interviewed for the study were participants of either gender whose primary employment was in the NHS or LifeLabs and who were involved in either monitoring, surveillance, reporting, or preventing the transmission of antibiotic-resistant HAIs. Further criteria included fluency in English and willingness to participate in the study. Laboratory staff and ICPs who were not involved in these activities or who were unwilling to participate were not included in the study sample.

Sample Size

Determining the number of cases needed was dependent on the study objectives and the exploratory research design (Patton, 2002). From a review of the literature, it was determined that an initial 15 to 20 cases would be an appropriate number to achieve saturation of emergent themes (Strauss & Corbin, 1998). Data saturation occurs when the researcher is no longer hearing or seeing new information emerging from the data (Strauss & Corbin, 1998). However, in an exploratory case study design, the objective was to obtain the greatest possible amount of information about a given phenomenon. Thus, the total number of interviews depended on the emerging data from the participants' interviews and the ability to reach data saturation (Strauss & Corbin, 1998). In this case study, the total number of participants interviewed to reach data saturation was 30 cases. For each of the selected cohorts, 13 frontline nurses, 6 ICPs who worked across all sites, 5 laboratory technologists/technicians, and 6 executives and managers were interviewed.

Data Collection

The combination of multiple techniques to collect data in case study research strengthens and confirms the results (Stake, 1995). Based on the study objectives, multiple sources of evidence were collected to address the objectives. The study data sources and data collection methods included:

1. Available cumulative anonymous data were accessed from Decision Support at the NHS which was reported on a monthly basis to MOHLTC, describing

the incidence of antibiotic-resistant HAIs, specifically MRSA, VRE, and C. difficile, in selected hospital sites, from 2008 to 2011.

2. Workforce profile and demographic data questionnaires administered to frontline nurses (RNs & RPNs) and nursing and healthcare executives, laboratory staff, and ICPs in selected hospital sites.
3. Policy documents were analyzed, specifically, isolation precautions and PPE policies, and procedures for infection control of antibiotic-resistant HAIs in selected hospital sites, from 2008 to 2011.
4. Semi-structured interviews with probes, using an interview schedule developed by the researchers, conducted with frontline nurses (RNs and RPNs) and nursing and healthcare executives (Clinical Vice Presidents and managers), laboratory staff, and ICPs in selected hospital sites.

Description of Data Collection Methods

Incidence Data of Antibiotic-Resistant HAIs

Cumulative anonymous data was made available to the researchers by the NHS Decision Support department. These data included mandatory reportable data that are sent monthly to the Ministry of Health and Long-Term Care. Descriptive statistics were calculated to denote the incidence of antibiotic-resistant HAIs, specifically MRSA, VRE, and C. difficile, in selected hospital sites from 2008 to 2011.

Demographic and Workforce Questionnaires

The 30 participants which included frontline nurses (13), healthcare executives (6), ICPs (5), and laboratory staff (5) completed the demographic questionnaire prior to

the interview (see Appendix E). A questionnaire was designed to gather workforce demographic data from the participants and their employing organizations. The demographic data form was adapted from the College of Nurses of Ontario Membership Survey (CNO, 2009). The demographic data form asked for information on the participants' occupation, education, employment status, history of work experience, and age. This quantitative dataset supplements the qualitative findings in providing a description of the workforce characteristics within the context of the employing organizations. The supplementary use of quantitative data in qualitative studies is appropriate when it is incorporated into the initial research design to obtain different levels of data on the topic of interest (Patton, 2002). All participants' demographic information was entered into the statistical program SPSS 19.0.

Documentary Analysis

Because of their overall variety, documents play an explicit role in the data collection phase of case study research (Yin, 2009). Documentary information can take many forms and should be the object of explicit data collection plans (Yin, 2009). Documents are useful in case studies because they can provide specific details to corroborate information from other sources (Yin, 2009). In this case study, the NHS's internal written reports and policies specific to PPE and isolation precautions for antibiotic-resistant organisms (AROs) and C. difficile in selected hospital sites, from 2008 to 2011, were reviewed. In addition, grey literature sources that included provincial government reports and best practice guidelines were reviewed. Limitations of documentary sources include the potential irretrievability of the sources because they are

often difficult to locate. Additionally, document analysis is subject to research-biased selectivity because in some cases important documents may be withheld from the research team (Yin, 2009).

Semi-Structured Interviews

One of the most important sources of case study information is the interview (Yin, 2009). Interviews are an essential source of case study evidence because most case studies are about human affairs and behavioural events (Yin, 2009). Well-informed interviewees can provide in-depth understanding of situations, and identify new relevant sources of evidences (Yin, 2009). A semi-structured interview guide was developed for frontline nurses and nursing and healthcare executives (see Appendix F). A separate semi-structured interview guide for ICPs and laboratory staff was developed (see Appendix G). Time efficiency is maximized through the interview guide approach, which facilitates systematic data collection and focuses on specific issues for discussion. In addition, the degree of structure and style of the interview is controlled by the researcher (Patton, 2002). According to Yin, (2009) this technique encourages the integration of structural questions into an informal, open-ended conversational style of interviewing. However, the limitations of semi-structured interviews are that they are only verbal reports and, thus, the interviewee's responses are subject to individual bias, recall bias, and poor or inaccurate articulation (Yin, 2009). Therefore, in case studies it is important to corroborate interview data from multiple data sources (Yin, 2009).

In this case study, 30 individual interviews were conducted on site at the four hospital sites. The interviews were scheduled during working hours for all 30 of the

participants. The nursing managers at each hospital site had prearranged boardrooms and small meeting rooms for the interviews. Two of the frontline nurses' interviews and two of the ICP interviews were conducted in dyads. Additionally, one interview was held with three laboratory staff simultaneously at LifeLabs in their work environment. Patton (2002) contends that this type of design flexibility is appropriate to maintain responsiveness of the participants in unpredictable situations.

Prior to being interviewed, informed consent forms were completed by the participants and a copy was given to them. Throughout the semi-structured interviews, probes were used, which offered clarification and encouraged participant elaboration of the specific phenomenon being discussed (Strauss & Corbin, 1998). The participants were asked specific questions to explore how the implementation of infection control policies and procedures has changed the nature of their work. The interviews ranged from forty-five minutes to one hour for individual interviews and were digitally tape-recorded and, subsequently, transcribed verbatim to secure accurate participant accounts. Audiotapes provide a more accurate rendition of an interview than any other method (Yin, 2002). A short debriefing among the members of the research team occurred after each interview to share initial perceptions of the content and process of the interviews. Hand written notes were taken during the interviews for the purpose of cross validation with the interview transcripts.

In summary, a major strength of case study data collection is the use of multiple sources of evidence (Yin, 2009). The most important advantage is the use of multiple sources of evidence in the development of converging lines of inquiry, a process of

corroboration of several different data sources (Yin, 2009). The convergence of findings from different sources (incidence data, demographic workforce questionnaires, document analysis and qualitative interviews) increases the construct validity of the findings. Ultimately, the results from this study are more convincing and accurate because they are based on several different sources of information measuring the same phenomenon (Yin, 2009).

Data Analysis

Incidence Data of Antibiotic-Resistant HAIs

Anonymous, aggregated cumulative incidence data was made available from the Infection Control and Decision Support Department. Descriptive statistics were generated for HAIs, specifically MRSA, VRE, and C. difficile, from 2008 to 2011 for the selected NHS hospital sites. Four graphs were generated and analyzed using the data provided. The first graph analyzed the incidence rates of the average colonization of C. difficile, MRSA, and VRE and were graphed per 1,000 patient days and compared across all sites. The second graph analyzed incidence of hospital-acquired C. difficile per 1,000 patient days against the provincial average. The third graph analyzed MRSA colonization incidence per 1,000 patient days across all NHS sites, and the fourth graph analyzed incidence of VRE colonization per 1,000 patient days across all NHS sites.

Demographic and Workforce Questionnaires

Responses from the demographic/workforce profile questionnaire for frontline nurses, executives, laboratory staff, and ICPs were analysed using SPSS for Windows®

19.0 (SPSS, 2011). Descriptive statistics, frequencies, and measures of dispersion and central tendency were compared to interview data to link demographic and human resource data to the participant descriptions (Miles & Huberman, 1994). The quantitative data substantiated and clarified the participants' perceptions of demographic characteristics and workforce factors in this context.

Document Analysis

Document analysis of the policy documents involved an exploratory examination of isolation precautions and PPE infection control policies in the NHS. The documents, which included both policies and reports, were given to the the researcher by the vice president (VP) of Patient Services and reviewed for their overall content, procedures, and recommendations for the organization. According to Silverman (2006) documents cannot be analyzed outside of their original context. A review of the documents provides a contextual understanding of infection control policies, within the context of how HAIs are changing health professional's work. Findings from the documentary sources were used to develop converging lines of inquiry, by corroborating the findings from the qualitative semi- structured interviews (Yin, 2009). According to Silverman (2006) in any analysis of a text, it is important to choose a particular approach and treat it as a framework that can be used to examine the data. Detailed summaries of the documentary sourcers were integrated within the findings section of this document, analyzing either the documents concurrence or divergence from the interview findings. This approach promotes the corroboration of data sources and strengthens the overall findings of the analysis (Silverman, 2006).

Qualitative Interviews

Data analysis for the qualitative interviews occurred concurrently with data collection. Prior to data analysis, all electronic transcripts were transcribed verbatim. For the qualitative semi-structured interviews with frontline nurses, nursing and healthcare exectutives, laboratory staff, and ICPs, the constant comparative method (Glaser & Strauss, 1967) and thematic analysis (Boyzatis, 1998) were the techniques used to guide the identification and exploration of themes emerging from the transcribed data (Sandleowski, 2000). During data collection, the techniques described by Strauss and Corbin (1998), an iterative process of collecting data, comparing it to the literature and participant accounts, reflection, and continual refinement of method and process was utilized. This type of analysis requires the recognition of bias and assumptions held by the researcher and their influence on the emerging theoretical concepts in the data (Strauss & Corbin, 1998). It also requires the ability of the researcher to conduct inductive and deductive analysis simultaneously. Concepts and processes emerged from the data and the researcher interpreted the structure and relationships of these concepts through a constant comparison method (Patton, 2002; Strauss & Corbin, 1998).

The process of data reduction began with open coding; all transcripts were read and re-read to identify possible meanings and concepts within the data. Open coding is the stage of analysis in which initial categories, subcategories, and their properties are identified from the raw data (Strauss & Corbin, 1998; Walker & Myrick, 2006). In this study, the process of open coding was concurrent with memo writing. A detailed journal was maintained to track the progress of the study and included memos related to the

analysis of the data. The memos include a discussion of the relevance and applicability of the concepts, categories, and properties emerging from the data.

The interviews passed through three readings during the process of open coding which guided the input and sorting of data into NVivo 9.0 (NVivo 9.0., 2011). This software is a qualitative data program, which helped the researchers to organize the volume of qualitative data from the interviews. The use of computer programs in qualitative research augments the audit trail and facilitates organization of data, thereby strengthening the rigor of the study (Bringer, Johnston, & Brackenridge, 2004). Open coding continued through this initial phase with NVivo 9.0 as subcategories and conceptual relationships began to appear in the data and coding scheme.

The transcribed data were analyzed in two stages using both the transcripts and field notes taken during the interviews. Two senior researchers informally compared perceptions of the data and developed a coding scheme (Patton, 2002). Transcripts and field notes were coded separately by two members of the research team and differences were resolved through discussion. Thus, to assess the credibility of the transcript analysis, analyst triangulation was utilized in which multiple analysts reviewed findings from transcribed interviews to ensure the credibility of findings (Patton, 1999).

In the second phase of analysis, axial coding, the interactions of the phenomenon, environment, and social processes are identified and their relationships are explicated (Strauss & Corbin, 1998). The observations and questions raised in the memos assisted in the development of an initial coding scheme. Consensus was achieved on the third version of the coding scheme. The major categories aggregated from the raw data were

further reduced in NVivo 9.0. Themes were then identified and compared across interviews to determine relevance and value in describing the nature of health professional's work. The remaining themes were then clustered by characteristic similarity to inform the interpretation of the data (Boyzatis, 1998).

Rigour

In descriptive qualitative studies, the researcher is the main instrument of data collection and analysis (Patton, 2002; Sandelowski, 2000). According to Yin (2009), a researcher must utilize one's own expert knowledge in the case study analysis. Therefore, the reflexive researcher must use their own personal assumptions that may influence data interpretation (Finlay, 2002). The acknowledgment and disclosure of the researcher's perspective enhances the credibility and confirmability of the study (Patton, 2002; Sandelowski, 2000; Strauss & Corbin, 1998). According to Yin (2009), to ensure a high quality case study, the analysis must include the triangulation of multiple forms of data to enhance the authenticity of the research process and findings.

The reliability of a study is dependent on the consistency and reproducibility of the research design and analysis (Miles & Huberman, 1994). A record of the study was maintained through consistent journaling. The purpose of the journal was to maintain a process log and capture on-site observations after each interview. In addition, memos created during data collection and analysis maintained a record of analytic decisions and discussions. This written and electronic record (in NVivo 9.0) of the coding scheme and interpretative processes used in the data analysis comprise the audit trail (Strauss & Corbin, 1998). Furthermore, the timeline for the study became a guide for the expected

completion of tasks. This timeline also provided a detailed plan for completion of the analysis and final thesis submission.

CHAPTER 5: FINDINGS

In this chapter, the findings describe the impact of antibiotic-resistant hospital-acquired infections on the daily work of nurses, executives, laboratory technicians and technologists, and ICPs. The findings from four sources are presented to address the study objectives through (a) a description of the incidence of C. difficile, MRSA, and VRE, from 2008-2011, in the NHS; (b) a description of workforce demographic data; (c) a description of documentary sources of infection control policies and practices in the NHS; and (d) a description of content analysis and the emerging themes from the semi-structured interview data regarding the perceptions of healthcare professionals.

The Incidence of MRSA, VRE, C. Difficile in the NHS

The first objective was to describe the incidence of HAIs and antibiotic-resistant HAIs in selected community hospital sites in the NHS, from 2008 to 2011. Incidence is defined as the number of new cases of hospital-acquired infections that develop during a specific time period divided by the size of the population under consideration (Polen, 2011). Aggregated, cumulative, anonymous data were made available by the Decision Support and Infection Control departments at the NHS. It is important to note that the data only describes the number of confirmed cases of HAIs and is not a reflection of the number of outbreaks or mortality figures which are associated with MRSA, VRE and C.difficile.

Using the data provided by the NHS, a description of the incidence rates of the average colonization of C. difficile, MRSA, and VRE were graphed per 1,000 patient days and compared across all sites. The incidence, from 2008 to 2011, was found to be

variable (see Table 1, Appendix H). Fluctuating rising and falling peaks and troughs for all three HAIs, from 2008 to 2011, illustrates that the number of cases of MRSA, VRE, C. difficile are not constant across each site and month. The sudden spikes and drops in incidence rates suggest that the NHS is trying to cope with the challenge of controlling infectious diseases within the organization (see Table 1, Appendix H). The average trend line for the three HAIs was not apparent in the graph or raw data. When comparing the incidence of the three HAIs, the incidence of C. difficile is the least fluctuating HAI, remaining consistently at or below 1.0 per 1,000 patient days, with no sudden rise or fall between 2008 and 2011. Whereas, the incidence of MRSA varies between 0.50 and 2.50 and the incidence of VRE varies from 0.50 to 3.40 per 1,000 patient days. Therefore, there is larger variability in the incidence of the AROs when compared to the incidence of C. difficile (see Table 1, Appendix H). This suggests that the NHS is effectively managing C. difficile incidence rates through the implementation of infection control procedures and policies however, different targeted strategies may be necessary for controlling AROs.

When the incidence of hospital-acquired C. difficile per 1,000 patient days for the NHS (averaged across sites) was graphed against the provincial average it was found that, since 2008, the NHS incidence of C. difficile per 1,000 patient days had decreased from 0.45 in August 2008 to 0.29 in March 2011. Similarly, the provincial average for C. difficile incidence per 1,000 patient days was 0.39 in 2008 and 0.34 in 2011. Even though both incidences appear to be decreasing, it can be concluded that the incident rate is higher overall for C. difficile in the NHS when compared to the provincial incident rate

per 1,000 patient days (see Table 2, Appendix H). This suggests that the NHS is trying to cope with the challenge of controlling the incidence of C. difficile compared to other hospitals in Ontario. It can be assumed that there are a myriad factors that contribute to this increase, which include patients with numerous co-morbidities or factors contributing to underlying chronic illnesses, poor compliance with infection control protocols and procedures, patient's lengths of hospital stay, and the overuse and misuse of antibiotics.

Since monthly provincial data for MRSA and VRE are not available and only bacteraemia with these microorganisms is reported to the MOHLTC on a quarterly basis, the incidence of these two HAIs has only been graphed for the NHS hospital sites. When MRSA colonization incidence per 1,000 patient days across all NHS sites was graphed, the mean incidence showed a trend of increasing incidence from 2008 to 2011 (see Table 3, Appendix H). The incidence of VRE colonization per 1,000 patient days has continued to decrease from 2008 to 2011 across all NHS sites. The large rising peaks on the graph indicate that certain NHS sites have a higher incidence of VRE than other sites (see Table 4, Appendix H).

In summary, the incident rates of MRSA, VRE, and C. difficile demonstrate a generally increasing trend of these infectious diseases in the NHS from 2008 to 2011. The monthly fluctuating incidence rates suggest that the current management of infection diseases within the organization needs to be further assessed.

Workforce Demographic Data

The second objective was to describe the workforce profiles and demographic characteristics of selected healthcare professionals in the NHS. Demographic data were

collected from 13 frontline nurses, 6 healthcare executives, 6 ICPs, and 5 laboratory staff (see Table 1, Appendix I). The average ages of the 10 RN and 5 RPN participants was 52.1 (SD = 4.5, Mdn = 53.0) and 46.0 (SD = 11.4, Mdn = 44.0) years, respectively. The average age of the executives was 52 years (SD = 4.4, Mdn = 55.0), of the ICPs, was 48.3 years (S.D = 3.1, Mdn = 5.4), and, of the laboratory staff, was 54.3 years (SD = 9.2, Mdn = 49.0; see Table 10, Appendix I). The highest reported level of education for RNs was a nursing baccalaureate, for RPNs was a diploma, for executives was a doctorate, for ICPs was a master's degree, and for laboratory medical sciences was a baccalaureate degree (see Table 2, Appendix I). The majority of healthcare professionals were employed in full-time positions (n = 26, 86.7%) and 13.3% (n = 4) were employed in a part-time capacity (see Table 3, Appendix I). The reported average number of hours worked per week by RNs was 44.2 hours (SD = 9.5) and by RPNs was 39.3 hours (SD = 2.8). The average number of hours worked per week for executives was 47.5 hours (SD = 10.0), for laboratory staff was 32.9 hours (SD = 5.3), and for ICPs was 38.0 hours (SD = 1.8; see Table 4, Appendix I). It should be noted that the hours of work per week were self-reported by the participants and were often higher than the number of hours that they were required to work by the NHS.

The average number of years of work experience reported by participants in their current occupation was 22.6 years (SD = 8.1) for RNs, 22.4 years (SD = 13.1) for RPNs, 19.5 years (SD = 15.1) for executives, 15.4 years (SD = 10.9) for laboratory staff, and 11.5 years (SD = 1.1) for ICPs (see Table 6, Appendix I). Nurses reported that the average number of years in their current position, for RNs, was 14.6 years (SD = 11.3),

for RPNs was 17.8 years (SD = 12.3), for executives was 5.0 years (SD = 3.6), for laboratory staff was 15.4 years (SD = 8.7), and for ICPs was 5.5 years (SD = 1.1) years (see Table 7, Appendix I). The average number of years working in the NHS for RNs was 16.7 years (SD = 10.9), for RPNs was 18.2 years (SD = 11.6), for executives was 13.3 years (SD = 10.8), for laboratory staff was 16.0 years (SD = 0), and for ICPs was 19.3 years (SD = 0.35; see Table 8, Appendix I). The gender of the study sample of healthcare professionals was 90.0% female and 10% males (see Table 9, Appendix I). Examination of the data suggests that the professions of nursing (n = 14), ICPs (n = 5), and laboratory staff (n = 5) was mainly female. There were very few males (n = 3) across all disciplines surveyed.

In summary, the findings from the workforce demographic data forms indicate that healthcare professionals in the NHS are a stable workforce. In this particular sample, stable is defined as not being a large variation in age, employment status, or years of work experiences amongst the healthcare professionals. The study sample is representative of the health professionals across the NHS. The nursing workforce is described as aging because the mean age of nurses in the NHS is 52 years. In the literature, there is evidence of an aging nursing workforce because there are more nurses over the age of 50 than under age 35 in Ontario (Statistics Canada, 2009). In 2009, Ontario had more RNs employed in nursing aged 50 to 54 than any other age group (Statistics Canada, 2009). The majority of healthcare professionals in the NHS are employed full-time, except for the laboratory staff, who are mostly employed in a part-time capacity.

Infection Control Policies and Procedures Documents, 2008 - 2011

The third objective was to describe infection control policies and practices in the NHS that were implemented between 2008 and 2011. Infection control policies and procedure documents were made readily available by the infection control executives at the NHS. Documentary sources, such as files, records, and policies from the NHS, described the organization's current initiatives, goals, and activities used in managing HAIs. Due to the large number of documents, only a select number of key policies were reviewed for this study.

A total of 46 policies, were selected based on their relevance to the study objectives. Policies on infection control procedures, isolation precautions, and PPE for C. difficile, MRSA, and VRE were chosen for review (see Appendix J). These algorithmic policies are constantly changing in response to the provincial and regional committees and networks recommendations. Thus, in the case of the NHS, it is important to analyze the infection control policies, annual reports, and summaries with reference to the cultural contexts and organizational systems in which they have been developed. Therefore, data from documentary sources were analyzed in tandem with the semi-structured interviews. Document analysis included the grouping of policies into themes and cross validating the similarities and differences of these findings with the interview transcripts.

Content Analysis: Qualitative Semi-Structured Interviews - Perceptions

The fourth objective sought to explore and describe the perceptions of frontline nurses, ICPs, laboratory staff, and executives about the changing nature of their work

with the emergence of antibiotic-resistant HAIs. Content analysis of data from the semi-structured interviews was divided into subheadings in order to summarize the major findings. The supporting findings from the document analysis were triangulated with the relevant themes from the interviews. Triangulation is defined as the use of two or more methods to cross validate study findings (Stake, 1995). The overall themes emerging from the data have been categorized into (a) common themes, (b) themes of frontline nurses, (c) themes of ICPs and laboratory staff, and (d) themes of executives.

Summary of Findings - Common Themes

The following is the description of the common findings from the semi-structured, qualitative interviews with frontline nurses, ICPs, laboratory staff, and executives. The findings demonstrate that work has changed for all healthcare professionals because the profile of infectious disease in Ontario is shifting with the rise in infectious diseases. The institution of new provincial, regional, and hospital infrastructures has led to the proliferation of protocols and practices regarding the management of infectious diseases. An increased amount of data and synthesis of data has led to the emergence of a data-driven organizational culture that focuses more on infectious disease reporting and surveillance than on clinical care. Controlling the transmission of infectious disease has become increasingly cumbersome for the NHS, as there are many organizational challenges in maintaining infection control policies.

Perceptions of the Profile of Infectious Disease in Ontario

In summary, the findings from this section demonstrate that there has been an increase in HAIs in Ontario. In response, new provincial and regional infrastructure has

been created to support the development of numerous protocols and practices to manage infectious disease. While the findings show an increased emphasis on data, surveillance, and transmission, there are many uncontrollable factors that challenge the effectiveness of the management of HAIs in community hospitals.

Emergence of an Increased Incidence of Hospital-Acquired Infections (HAIs)

Healthcare professionals reported an increase in hospital-acquired infectious disease in the NHS, specifically MRSA and VRE. According to the study participants, the approximate year that an increase in HAIs was first perceived ranged from 2003 to 2006. The increase in HAIs is believed to be cyclical by season (e.g., an increase in the winter) amongst the sample of healthcare professionals interviewed. One nurse noted:

> "We have more MRSA in the emergency department . . . it varies, it comes and goes - it's intermittent."

Study participants also reported an increase in community-acquired MRSA (CA-MRSA) when compared to hospital-acquired MRSA. One participant stated:

> I think the community-acquired MRSA has increased. . . . Nurses will tell you that they've seen an increase, more from the community-acquired versus the hospital-acquired, which is good because we've actually seen a decrease in our hospital-acquired, which is a good thing.

Additionally, a perceived increase in C. difficile was reported in the hospitals. One infection control officer explained:

> "We have a lot of C. difficile lately, lots of C. difficile patients coming in and with vomiting and diarrhea, or just diarrhea, or onset symptoms of diarrhea, especially this past month."

Furthermore, a new hospital-acquired infection which is becoming a growing concern is called *extended spectrum beta lactamase* (ESBL) microorganism.

Nevertheless, some health professionals do not think there has been an increase in infectious disease, just more attentiveness paid to the presence of infections in hospital settings. It is not known if there has been a true increase in infectious disease or if the apparent increase results from increased vigilance in monitoring ARO infections, making the problem seem more evident. One nurse noted:

> It is a real question if we have more infection now, or is that we are doing a better job at swabbing patients. I don't know that in my day we were as concerned about infection. Maybe we are just looking for it now.

Participants explained that infectious diseases have become a global problem and that the rise in HAIs occurred approximately eight years ago, following the advent of the SARS global pandemic. Since that time, the media has focussed more public attention on HAIs and, consequently, infection control has become a major priority for hospital administration and senior leadership within the NHS. A nursing manager noted:

> "But there's a reality too, you know if the outside world is watching, it's something you're going to pay more attention to, absolutely."

Uncontrollable Variables: "The Perfect Storm"

Healthcare professionals found it difficult to name only one factor that they thought increased the incidence of infectious diseases in the hospital. There may be many extraneous, potentially uncontrollable variables related to the increase in infectious disease. Examples of extraneous variables are the effectiveness of cleaning, older hospital physical structures, and staff's and visitors' inconsistency or noncompliance with infection control procedures. According to the study participants, other multi-factoral variables perceived to be contributing to the issue are an aging population, who may have been hospitalized for an extended stay, who have many comorbidities (e.g., pneumonia),

and underlying chronic conditions. Another contributing factor is the misuse and overuse of antibiotics by physicians who need to be more accountable and responsible when prescribing these drugs. Study participants have observed that older patients' specimens became positive for C. difficile as soon as they were prescribed antibiotics. The hypothesis is that antibiotics destroy the *good* microorganisms, or normal flora, in the gut, which then becomes overpopulated with dangerous microorganisms, such as C. difficile. Additionally, the inconsistent adherence to and noncompliance of staff with hand hygiene protocols is the most salient factor contributing to the spread of HAIs. One nursing manager remarked:

> Other than hand washing, I think we're pretty clear that we know that when that goes down we go into outbreak. But the rest, we know it's a bit of this, it's a bit of that, it might be the one individual who missed something, the cleaning of, you know, whatever it is. It may be patient- or family-related, it may be nurse related. There are so many factors, you can't pinpoint one.

The Ubiquitous Nature of Infectious Disease

Health professionals perceived that C. difficile was endemic in the community, and that MRSA had increased in the community as well. Controlling HAI transmission is difficult because when patients return to their homes they no longer wear personal protective equipment (PPE). A frontline nurse stated:

> "When the patient leaves our hospitals . . . he doesn't wear a gown or a mask, so we can't control the spread [of] MRSA . . . it's everywhere."

According to healthcare professionals, new emerging infections are ubiquitous and are becoming endemic in the environment (e.g., grocery stores). The NHS continues to implement and monitor infection control precautions and procedures, regardless of the uncontrolled rise of superbugs in the community. Participants indicated that more

research is needed to determine if patients need to be isolated in hospital when the HAIs are already very prevalent and being spread readily in the community. One nurse explained the dilemma;

> So, if I'm more likely to get it at a grocery store than I am in the hospital, that would make a difference in how we control it . . . what is the risk of not controlling for it, if we don't even know from public health how rampant MRSA is in the community.

The Development of New Provincial and Regional Infrastructures

Healthcare professionals reported three historical events: bioterrorism in 2001, SARS in 2003, and the H1N1 pandemic in 2009, when they observed that infection control received increased attention and a higher profile within the NHS. Subsequent to these events, the MOHLTC invested more resources in infection control. Consequently, the government hired more infection control staff and developed provincial agencies whose mandate was infection control (e.g., PIDAC). These agencies developed literature and provided external recommendations and reports for infection control for the province of Ontario. The reports were disseminated and integrated within the NHS with the aim of promoting the congruence of evidence-based practice and infection control procedures in the province. An ICP explained:

> "All [of] our policies were on the CDC and when SARS came, PIDAC developed . . . they started to develop best practice guidelines."

Additionally, there has been the development of new advisory committees and networks to support infection control initiatives regionally (e.g., RICNs). An infection control executive noted:

> "Post SARS, there has been a lot of changes that stimulated these new groups and associations. So, one of them is the Regional Infection Control Network."

Proliferation of Infection Control Policies and Protocols

The development of new provincial and regional infrastructure for infection control, has promoted the proliferation of numerous policies and protocols. The NHS uses best practices guidelines from PIDAC to update their policies on how to manage HAIs. An ICP explained:

> "So, then we update our protocols according to what, as each best practice comes out. For example, VRE will be updated according to the antibiotic-resistant organism [policy] of PIDAC. The C. diff is now updated because of PIDAC."

According to documentary sources (NHS Strategic Plan, 2009 - 2011), the organization has mandated that the infection prevention and control policies and procedures be consistent with relevant legislation and standards and be based on sound scientific knowledge. It was noted that 100% of all infection control policies and procedures are reviewed annually and that the organization action plan needs to be compliant with accreditation standards, including infection control policies and procedures.

A Data-Driven Organizational Culture: Increased Data Information Needs

The findings in this section demonstrate an emergence of a data-driven organizational culture that has changed the nature of health professionals' work. The participants reported changing responsibilities and requirements related to the amount of data, data synthesis, data collection, surveillance, and reporting of data. The findings demonstrate that the expansion of data information needs is changing within the organization.

Data Amount and Data Synthesis

The participants reported an increased amount of infection control data that are synthesized to make decisions about patients clinically. One source of synthesized data is census sheets. Census sheets are prepared for the entire hospital, per unit, every day and are updated throughout the day by the ICPs and by people who monitor full and available inpatient hospital beds. One ICP explained:

> Everything is written on that [census sheet], basically yes, the diagnosis, the date of admission, patient's name, the isolation. So we all write all the notes on it. It's the daily bible . . . carry it everywhere we go.

Another source of documentary data are the Health Records and Databases. Specifically, Meditech, which is an electronic database that includes volumes of data such as the patient's full chart, tests, history, status, and laboratory results. The external microbiology laboratory, LifeLabs, imports their surveillance data directly into Meditech. An ICP described:

> "[Meditech] tells you from the admission where the patient has been, all the rooms, and it tells everything."

The participants reported that infectious disease data are synthesized and updated frequently throughout the day. For example, test results that report a change made to a patient's infection status are available within 15 minutes to 1 hour to the ICPs and all members of the healthcare team. The hospital's health information databases and census sheets are updated manually by the ICPs, 15 to 20 times in one day. One ICP stated:

> "We have access to that . . . by the minute, daily, we can print out anything."

Screening Patients: Collection of Swabs and Samples

Study participants reported that it is important to screen patients on admission to the hospital to determine where the patient acquired the infection, in hospital or before admission to the hospital. It is important to collect baseline data (swabs and/or stool samples) from all patients to determine if a new nosocomial infection has been acquired over the course of the patient's stay in hospital. Documentary sources support this procedure (NHS Management of a Single New Case of MRSA and VRE, 2009) and recommend that an algorithm be followed to prevent the transmission of infectious disease if a new case is identified within 72 hours of hospital admission. An ICP executive explains:

> Monitoring of everyone who is positive . . . we need to know if its community acquired or if its nosocomial . . . it's only bad if it happened here, meaning its nosocomial. . . . In this case, then we're one step closer to an outbreak.

According to documentary sources (NHS Infection Control Patient Screening and Admission Algorithm, 2009), screening by healthcare professionals is required of patients with an ARO infection on admission to the NHS. This includes screening for symptoms (which includes the onset of a new/worse cough or shortness of breath, fever, shakes, and chills in the past 24 hours), present or previous history of an ARO infection, history of hospitalization in another country in the last 12 months, direct contact with a patient who is positive for an ARO infection, and a history of being a patient on an outbreak facility/unit. The patient's previous history determines their isolation status when admitted to hospital.

Likewise, according to documentary sources (CDI Policy, 2008), to control CDI cases within the NHS, it requires early identification and monitoring of cases. This includes screening patients for diarrhea (i.e., loose/watery bowel movements), laboratory confirmation of positive toxin assay (A/B), and monitoring new nosocomial cases (i.e., not present on admission, onset of symptoms is greater 72 hours after admission, and no previous history of CDI). Moreover, it is a requirement that patients are swabbed routinely if they have spent 12 hours waiting in the ER for an available bed on a hospital unit before they are admitted to hospital.

Laboratory staff reported that there are challenges for them when nurses collect blood and stool samples. It is frustrating for the laboratory staff because they do not have any control about how samples are collected, with many blood cultures and stool samples arriving at the laboratory under-filled. This affects the type and number of tests that can be conducted on the samples.

Screening: Specialized Laboratory Instruments

New laboratory instruments are more specific and efficient for screening for infectious disease. The testing mediums (e.g., agar plates) are more specific, which increases the accuracy of the results. Therefore, because of this improved medium and new forms of testing, the turnover time for reporting results to the hospital is faster. A staff member from the laboratory explained:

> Chromogenic augrophy plates for MRSA and VRE are more specific to the bacterium, which makes things easier because now we can isolate for the MRSA and VRE . . . it is a colour indicator, so it makes it easier to get the results back to the hospitals.

The decrease in turnover time is corroborated by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009). This document states that, due to LifeLabs improved testing; VRE results are provided to the NHS within 36 to 48 hours instead of the previously reported four to five days turnover time. Once the patient's test results are received at the hospital from the laboratory, the ICPs determine the number of cases with confirmed positive results. Cases that are positive for infectious disease are tracked on a daily and monthly basis by the ICPs. Tracking of the number of cases daily and over the course of a month provides a summary of the total number of HAIs within a hospital. One ICP explained:

> "Every month when all the data are entered . . . we can look back and say, okay, last month we have two nosocomial, one community-acquired."

According to documentary sources (CDI Policy, 2008), clustering cases of infectious disease are monitored. This occurs when there is a grouping of cases within a specific time frame and geographic location.

Reportable Data: Incidence of HAIs and Hand Hygiene Compliance

Since 2008 to 2009, the NHS has been required to provide monthly public reports for MRSA, VRE, and C. difficile data to the MOHLTC. Mandatory public reporting of infectious disease data has increased the perception that there has been a rise in HAIs. Mandatory reporting of infectious disease data on hospital websites, which is readily available to the public, has made patients and families more aware of the status of HAIs in their hospitals. The NHS does not publically report MRSA and VRE colonization, although there has been increased public mandated reporting of the emergence of

bacteraemia, which are bloodstream infections. Patients with C. difficile infections are the only mandated reportable HAIs to the Niagara Regional Public Health Department. The public health departments now have access to the ER C. difficile surveillance data, enabling them to do their own trending in the region for the presence of C. difficile outbreaks. According to documentary sources, for hospital units with more than 20 beds, ICPs must notify the public health department when there are three cases of nosocomial CDIs (*Clostridium* difficile infection) identified within a seven day period or five cases within a four week period (NHS CDI Policy, 2011). For hospital units with less than 20 beds, the public health department must be notified if there are two cases of nosocomial CDIs identified within a seven day period or four cases within a four week period. Finally, if the site has a baseline CDI rate for two months at or above the 80th percentile for comparator hospitals or if the CDI rate is greater than or equal to two standard deviations above the hospital's CDI baseline, the public health department must be notified.

Additionally, the MOHLTC developed the *Just Clean your Hands* program in 2008. The purpose of the program is to teach organizations about auditing hand hygiene and to provide a method to educate and train auditors, who can be any staff member or student. The NHS implemented this program in 2008. The NHS collects hand hygiene data using the *Hand Hygiene Auditing Observation Checklist* (MOHLTC, 2008). Once hand hygiene for all health professionals is audited, the decision support manager tallies the data, which the MOHLTC and NHS senior leadership team then reviews. The NHS uses the data summary of hand hygiene as a benchmark to compare all the sites to the site

with the highest hand hygiene compliance. According to the participating healthcare professionals, the transparency of data have encouraged labelling of hospital sites based on the presence or absence of HAIs. The resulting stigma has associated "dirty patients" within "dirty hospitals" in the NHS. Consequently, NHS hospital sites compete with each other to have fewer incidences of nosocomial infections.

Information Management and Data Assimilation

The management and assimilation of mandated reportable infectious disease data requires a stepwise process for the entering and recording of data. Overall, the amount of data and the detail required for data reporting has changed over time. To manage the volume and various sources of data, a coordinated effort must take place between collaborating stakeholders, such as frontline staff, charge nurses, ICPs, infection control managers, an administrative assistant, and the decision support department. ICPs manually record and enter infectious disease data daily into the *Microsoft Excel*® computer database, which an administrative assistant then uploads and sends to the ICP manager. The ICP manager then reports the data to the MOHLTC on a monthly basis. The MOHLTC posts these data on their website, making them available to the public. Data are also available to the public through the NHS website. Additionally, ICPs keep their own manual logs, recording any new infectious disease cases or increases in infectious diseases. The amount of time spent manually entering data into computers ranges from 10 minutes to 1 hour daily. Two ICPs typically enter data together, which serves as a source of verification to ensure data accuracy.

Regulating Patient Flow: Bed Occupancy Management Meetings

Patients admitted to the hospital through the ER must remain in the ER until an inpatient bed in the hospital becomes available. When the ER admits an increasing number of patients, the patient waiting time for an available bed is longer. One ICP stated:

> If there is more than 15 admit no-beds [15 patients to admit with no available beds in the hospital] in the emergency department, we'll have more additional meetings throughout the day. So, we will have to go to these bed meetings more frequently, to try to accommodate these patients in others areas of the hospital.

Therefore, more "bed occupancy management meetings" (aka *bed meetings*) are held during the day when unoccupied hospital beds are not available. Patient flow is regulated with bed occupancy management meetings. Bed occupancy management meetings are necessary for decision making about room assignment and the reorganizing of the current hospital patients to accommodate the newly admitted patients waiting in the ER for an inpatient bed in the hospital. In attendance at the meetings are senior administration, charge nurses, ICPs, and a representative from the department of room bookings. A nurse manager mentioned:

> The issue of beds has gotten worse, as we try to manage all the ARO patients being admitted to the hospital. I have to meet the managers of all the units at least 2 times a day to try to find a place for everyone.

Bed occupancy meetings take place twice a day, usually at 9:15am and 1:30pm, lasting 30 minutes to 1 hour. Coordination of the members for the bed occupancy meetings is a major daily organizational challenge. An ICP reported:

> So, basically we get to know all the patients first thing when we come in, in the morning, and we have a meeting every morning and every

> afternoon. . . . It's quite the organizational challenge and a lot of people to get to meet twice a day.

Members of the bed occupancy meetings discuss changes in the patient census. The members review each hospital unit, patients ready for discharge, and patients requiring further hospital care. They also require the number of newly admitted patients currently waiting in the ER. Decisions are made about how patients will be redistributed and cohorted on hospital units in order to clear out the surge in admitted patients waiting in the ER. Facilitation of the movement of patients admitted in the ER into hospital beds is difficult due to the unavailability of empty hospital beds. Therefore, this process can involve moving several hospital inpatients to different rooms to accommodate the pairing of patients with similar HAIs (e.g., two positive MRSA patients). A nurse executive reported:

> "When we have 20 people at the Emerge and not too many people discharged, so it's a real puzzle -- to match all those people."

Factors that Impact the Transmission of HAIs

In the following section, several factors that impact the transmission of infectious diseases will be described. The limited number of available beds creates challenges for the organization in maintaining infection control procedures, specifically PPE and hand hygiene. The volume of patients, lack of appropriate isolation facilities, and the number of cleaning staff in the ER are factors that impact the spread of HAIs. When a unit is on outbreak, several strategies are implemented to prevent the nosocomial transmission of HAIs. All these interwoven factors impact healthcare professional's daily work.

Sources of Increased Transmission of Infectious Disease

The increased number of "Admit No Beds", which is shorthand that refers to the number of admitted patients in the ER with no available beds in the hospital, results in an increased volume of patients in the ER who are backlogged and awaiting admission to empty hospital beds. One frontline nurse stated:

> "It gets pretty bad I tell you. . . . Imagine having 30 people waiting for beds in the ER. . . . There is just no where for them to go at that point . . . we're all stuck; no one is moving at that point."

Therefore, increased transmission of infectious disease takes place in the ER, because patients often wait for five to six days to be admitted to a bed on one of the medical units. One nurse manager explained:

> I mean, I'd love to say to you that people don't wait 12 hours in our emerg but we have them overnight, two days, sometimes longer and hopefully not all the time but that's the reality. So, we've got our infection control saying you can't do this. We've got our emerg pressure saying you have to do this.

Furthermore, the *bed pressures* caused by admitted patients waiting in the ER and other factors, such as the availability of beds in nursing homes, can delay the discharge of patients from the hospital, which increases the risk of HAI transmission.

> Everything is different, according to what is happening in the emergency department, by bed pressure or if patients are not discharged, nursing homes or retirement facilities are not taking patients. These are all risk factors that delays patients from leaving the building and it impacts infections.

Additionally, increased transmission of nosocomial infections occurs in the ER. To alleviate the *bed pressure* in the ER, there is a lot of *bed moving*, that is, the moving of

patients and beds on hospital inpatient units, to try to provide inpatient rooms with appropriate isolation precautions for the patients waiting in the ER. This constant shuffling, moving around of patients and furniture, increases the likelihood of transmission of HAIs between patients. This results in a constant traffic flow of patients, which makes it difficult to contain the spread of infectious disease. The most important challenge for controlling the transmission of infectious disease in the ER is the cross contamination of patients awaiting care and patients awaiting admission. The ER is believed to be a source of HAI transmission because of the limited physical space and the close contact with other patients. One nursing manager noted:

> The ER is a breeding ground for infection. Think how many patients are in contact with each other and moving from room to room . . . with all that acuity and it is hard to get them to follow infection control procedures.

Moreover, there is limited space in the ER to separate patients who are isolated for HAIs. There are also challenges in the ER in providing separate semi-private or private rooms for patients who are positive for HAIs. A frontline nurse stated:

> "In the ER, they don't have separate rooms for positive patients. So we've had to, it's makeshift, its how do you do it properly to keep the clean from the dirty and because there's no place."

Patient Room Transfers: "Activity Tracing"

The constant movement of patients and beds increases the spread of organisms. Data, recording the number of patient transfers and roommates, are needed for each patient. An ICP explained:

> "To see which patients was [sic] with that patient and there's so many transfers too. So that when we have a very positive, we want to find out who was the roommate."

The recording of each patient transfer is entered into Meditech, which is an electronic database providing a central location for all patient data, to monitor the movement of the patient, to different rooms and units in the hospital, and all of the patients' activities. The activity tracing of patient transfers is further corroborated by documentary sources (NHS Management of Suspected Nosocomial MRSA and VRE Policy, 2009). For the management of a suspected nosocomial case of an ARO, an algorithm is followed to determine if the patient's roommates have had a previous history of ARO and if screening of the patient and their roommates is required.

Controlling Nosocomial Transmission during an Infectious Disease Outbreak

The study findings illustrate that there is an enhanced response to control the nosocomial transmissions of HAIs when a unit is declared to be on infectious disease outbreak (aka *outbreak*). According to the healthcare professionals, outbreak behaviour requires a hyper-vigilant state that involves increased staff education; one to two extra healthcare aids, and increased staffing based on the burden of the outbreak. In addition, the hospital unit does not accept new patients, family visiting hours are limited, and the number of hand washing audits is increased. Patients, families, and healthcare professionals also report poor staff morale when a unit is declared to be in outbreak.

Preventing Nosocomial Transmission of HAIs after an Outbreak

To sustain infection control practices after an outbreak, and to prevent nosocomial transmission of HAIs, there must be consistent hand hygiene auditing on a quarterly

basis. It is important for organizations to make hand hygiene a habit. Inconsistent hand hygiene compliance results in an increased number of outbreaks. According to documentary sources (NHS Management of an Outbreak of ARO Policy, 2010), outbreak control measures, including enhanced environmental cleaning, use of Ready Bath®, hand hygiene audits, and PPE audits, are implemented on a unit for a minimum of four weeks after an outbreak has been identified.

Challenges of Infection Control Protocols and Practices

The findings in this section demonstrate that the maintenance of isolation precautions and PPE in the NHS is challenging. The isolation of patients with HAIs in the ER is a complex task because the only physical separation between patients is the use of a "magic curtain." The inconsistent use of infection control procedures, specifically PPE and hand hygiene, by staff, patients, and visitors are all factors that impact healthcare professionals' daily work.

Isolation Precautions in the ER

The ER is a very public space, whose size and small physical layout make it difficult to isolate patients with HAIs. The lack of appropriate isolation rooms in the ER makes the isolation of patients with HAIs difficult. For example, in the ER there are no private rooms for patients with C. difficile or semi-private rooms to cohort patients with like infections such as MRSA. However, in an inpatient unit, patients who test positive for HAIs and patients who test negative for HAIs cannot be cohorted in the same room. This is supported by documentary sources that state (NHS ARO MRSA, VRE Policy, 2011), if a single room is not available, patients who are known to be colonized with

MRSA or VRE may be cohorted with other patients with the same infection. Thus, patients who have MRSA-positive or VRE-positive culture results should not share rooms with patients who have MRSA-negative or VRE- negative culture results.

For patients with C. Difficile, according to CDI Policy (2011), a private room with dedicated toileting facilities is recommended (i.e., private bathroom or dedicated commode chair). If these accommodations are not available, the priority for accommodation should be cohorting CDI lab-confirmed cases, only under the direction of the ICPs. Regardless of the isolation policies existing on all inpatient units, in the ER, these same policies cannot be followed. A nurse manager mentioned:

> "Upstairs our expectations are higher . . . we have the ability to make it better, put you in the right place for the right resources and the right staff."

For example, when a patient who has C. difficile is admitted to an inpatient unit, they would be moved to their own private room or be cohorted with another patient with C. difficile. However, in the ER the patients with HAIs are isolated from the other patients only by the separation of a curtain. One frontline nurse described this phenomenon:

> "I had a patient down in emerg with VRE. They can't go up [to the medical unit] and be roommates, but they can be roommates in the [emergency] department."

Therefore, in the emergency department, patients with HAIs and patients without HAIs are all in the same rooms. The nurses describe that the only physical barrier between patients with positive and negative cultures is the *magic curtain*. The term - magic curtain - is unique vocabulary that nurses have developed to describe the curtains

that separate patients' beds in the ER, and are the only form of isolation procedure employed. The proximity between patients is described by one nurse as:

> "The patients are so close together in the ER that from the mouth of 1 patient to the mouth of the next is about 6 feet."

There are many contradicting opinions regarding the magic curtains. Healthcare professionals use the euphemism *magic curtains* because the curtains used to isolate patients, with positive results, in the ER are described as having a "supernatural" ability to prevent the transmission of nosocomial infections. One nurse explained:

> The reason we say magic curtains is because in the emerg department I don't have walls and I don't have rooms for patients. So I have six patients in a room and the only thing that separates them, patients, is a curtain around my spot. So if you have VRE, they draw the curtain around, they put the sign outside the curtain, they put all the stuff outside the curtain, and they call that the *magic zone* because it's the only way we have of putting that zone in some kind of isolation.

Several ethical issues arise when patients who do not have HAIs feel they are at risk of acquiring an HAI from patients who do have HAIs. These patients may refuse to be in the same physical space as a patient who does have a HAI. One nurse manager explained:

> "Right, that is an ethical dilemma. If I'm the patient with no infection, and I know that everybody has it, we have patients that say I don't want to be in this room, get me out of this room."

The findings from frontline staff are supported by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009) which state that ICPs must make the final decision regarding cohorting patients and need to collaborate with the clinical manager as necessary when beds are not unavailable.

Breaks-in-Procedure: Issues in Following PPE and Hand Hygiene

Breaks-in-procedure, the inconsistent use of infection control procedures, is the short form routinely used by NHS staff. The inconsistent compliance with the hand hygiene protocol is a challenge. Nurses reported that visitors and families, physicians, nursing students, elderly patients with dementia, and porters inconsistently follow hand hygiene procedures. Although, according to documentary sources (NHS strategic Plan 2009-2011), the compliance of NHS nurses with the hand hygiene protocol has increased from 69% to 76%, from 2009 to 2011.

The healthcare professionals reported that compliance with the hand hygiene protocol and wearing gowns, gloves, and masks (i.e., the PPE protocol) are challenges for visitors and families. Nurses reported that visitors often did not see the value of cleaning their hands and had a philosophy that "if they can't see it, they think it doesn't occur." One nurse stated:

> "When visitors break infection control procedures, I call security."

Another nurse reported that visitors:

> "[Visitors] will enter a room with no gown, gloves, or mask, even if there is a sign on the door."

In addition, many physicians are often noncompliant with infection control protocols and procedures and are resistant to being reminded to wear their PPEs by nurses. According to the nurse participants, there is no excuse for a physician not to follow infection control policies and procedures. One nurse manager reported:

> The physicians are the worse with complying with the infection control policies. They will just walk into a patient's room. I think physicians

> forget that they are part of the process that they need to be part of the solution and not part of the problem.

NHS's strategic plan (2009 - 2011) includes the increase of physician compliance with hospital infection prevention and control policies and procedures, most notably with consistent hand hygiene, as a goal. Documentary sources support the interview findings of an increase in hand hygiene noncompliance by physicians and reported that the organization's physicians hand hygiene compliance decreased slightly, from 56% to 55%, from 2009 to 2011. Nurse executives reported that nursing students had the worst compliance with the hand hygiene protocol and suggested that nursing educational institutions need to support hospital policies by teaching their students the importance of infection control.

Elderly patients, who are cognitively impaired, have dementia, or do not understand the need for PPE, present an ethical dilemma, that is, the conflict between restraining a patient who can potentially infect other patients and the patient's own freedom.

Healthcare professionals who *cut corners*, that is, they are noncompliant with infection control procedures, rationalize that compliance with full infection control policies and procedures is not necessary if direct contact is not made with patients. An infection control executive reported:

> If they are just going in to give a med and they don't touch anything. . . . They somehow got the idea they don't need to put on . . . gowns, just their gloves. . . . I am not sure how that procedure has evolved and is now become accepted among nurses.

Participants reported that the culture of the NHS needs to change into one of compliance with all infection control policies and procedures. As an infection control manager noted:

> "If there were no break in protocol, there would never be another infected patient."

The documentary sources validate the perceptions of the interviewees. In an NHS policy, (Public Health Agency Infection Control Resource Team Recommendations, 2009) it states that *routine* infection control procedures, fundamental to the prevention of infectious disease transmission, must be utilized by all staff, physicians, and visitors, at all times. Routine infection control procedures include hand hygiene and the use of personal protective equipment.

Perceptions of Organizational Challenges

The findings in this section demonstrate that there are several organizational challenges, related to the implementation of infection control procedures, which have changed the nature of health professionals' daily work. These include resource limitations, the increased fiscal costs resultant from managing infections, the restructuring of laboratory services, and the use of inconsistent outbreak definitions. High patient occupancy rates, patient transfers, the ageing physical hospital structures, and the decreased number of housekeeping staff and the outsourcing of housekeeping staff have affected the organization's capacity to control HAIs.

Fiscal Costs and Resources for Infectious Disease Management

Fiscal constraints of the current NHS budget limit the number of strategies and resources that the organization can invest towards managing infectious diseases. Staffing costs are tied to the base budget, which makes it difficult for the NHS to hire more

nursing staff to manage the emerging infectious diseases. According to a nurse executive:

> "The current staff mix we have is not working. Ideally we need more nurses to care for our complex patients."

Because the NHS is not publically funded, the organization needs more government funding to match their needs for more staffing, which is difficult because governments are unable to provide increased funding. A nurse executive mentioned:

> "I don't think that any government in the next ten years, or five years anyway, is going to give additional dollars to hospitals."

Participants indicated that there are increased fiscal investments and costs associated with the increase in infectious diseases. Costs for purchasing new equipment, products (e.g., macerators), and antimicrobial agents (e.g., bath-in-a-bag®) further increase the financial challenges in dealing with infectious disease. A nurse manager reported:

> "It's quite a big investment . . . massive, I can't imagine, on a system without the amount of resource dedicated to controlling infections."

Further pressure on the system is the result of increasing fiscal pressure on the NHS administration to cut costs. In addition, there is external governmental budget pressure from the MOHLTC and tension between quality patient care and maintaining the budget within necessary limits. When considering added funding for infection control, the NHS is compared with other hospitals in the province that are managing without an increase in staffing or resources. A nurse manager reported:

> "The biggest challenge is the workload that it has added to everyone and without the requisite resources to go with it."

Outsourcing of Microbiology to LifeLabs

Before the amalgamation of the NHS, every hospital had full laboratory services. About eight years ago, microbiology was outsourced to a private laboratory. According to healthcare professionals' the use of a private laboratory for microbiological testing has lengthened the turnaround time for the microbiological test results to the hospitals. A nurse manager indicated:

> It can take up to 2 days for a patient's swab to get back to us. . . . By that time, think how many times that patient has moved rooms, and the number of patients he/she could have infected in the meantime.

The lag in test results means that patients are isolated who may not need to be isolated. They are in an isolation bed instead of a patient who needs to be isolated. An ICP reported:

> The problem right now is that, given the bed pressures in Emerg, we want to have results. So, if somebody is either a positive or contact patient, we isolate them. So, we're isolating and could potentially block a bed on the floor because you've got to match like to like.

Declaration of Infectious Disease Outbreak

Participants indicated that the criteria used to declare an infectious disease outbreak is inconsistent across the hospital sites. In hospital, infectious disease outbreaks are declared by ICPs in collaboration with the Niagara Public Health department. According to documentary sources (NHS Management of an Outbreak of ARO Policy, 2010), upon notification of an outbreak, an alert memo is sent to all NHS staff, NHS physicians, and the Niagara Regional Infection Control Committee who shares the information with the LHIN.

When the ICP and the public health department declare a hospital unit to be in *outbreak* (a short form that is routinely used), the incidence of new nosocomial infectious disease has exceeded the unit's previous outbreak threshold. Declaring outbreak status is dependent upon the patient's length of time on the unit and when the patient was last swabbed. The declaration of an outbreak is considered on a case-by-case basis because the outbreak definition is individual to each unit. One ICP explained:

> "Let's say if I have three cases and we have never been in an outbreak before, that would be my limit. I would declare an outbreak."

According to documentary sources (NHS Management of an Outbreak of ARO Policy, 2010), the most common definition of outbreak is three or more nosocomially-acquired infectious disease cases in a seven day period. However, for units without a history of outbreak, one case would warrant the declaration of an outbreak and an investigation. The baseline data threshold for outbreak declaration has evolved and changed with time and with an increased incidence of infectious disease. For example, one ICP stated:

> "Originally, it was nosocomial transmission of two or more cases on a specific unit in a seven day period. . . . Now, our threshold has increased to 3 - 4 in the same time period."

Increases in the threshold when an outbreak is declared are necessary because, if not, every unit would always be on outbreak, if it met the original criteria. This is because there has been an overall increased incidence of HAIs in the NHS. One ICP mentioned:

> "Everyone ended up being in outbreak for about two or three years with that definition [the original definition] and we established baseline data and on our baseline data thresholds increased, so certain floors have certain definitions."

Therefore, with inconsistent definitions for the declaration of an infectious disease outbreak across the NHS sites, it may be difficult for healthcare professionals to understand when a unit is actually in outbreak. This may also mislead and alarm the public.

The NHS' Aging Physical Structures

A major challenge to managing infectious disease is the aging physical plant, or hospital structures, within the NHS. Healthcare professionals are cognizant of the many issues with the physical plant, which include an old infrastructure of buildings, problems with ceiling grates, seeping sewer pipes, and the required fumigation in the spring. Other issues with the physical structure include an insufficient number of sinks in patients' rooms, a lack of ante-rooms for staff to change into and out of their PPE, a lack of changing rooms for staff that would enable them to leave their uniforms and shoes at work, and very narrow hallways crowded with equipment. The old infrastructure and physical layout of the NHS is constantly in need of renovation. It is also difficult to keep the physical environment clean. A frontline nurse stated:

> We had a rainstorm in our OR the other day, a couple of weeks ago, when the snow was all melting. So, we had to close an OR . . . and then we had to clean it completely and gut it, it was just, old hospitals are dealing with that.

Nurses reported increased clutter, with equipment and linen storage carts in the hallways of hospital units with very limited space for storage. For example, an isolation cart is required for each patient room, which greatly increases the clutter in the hallways, and has become a safety concern. A frontline nurse reported:

> So, we used to have one cart, we had the anteroom for supplies. Well, now if you've got 18 rooms out of 30, you've got 18 carts. . . . The clutter, like I wouldn't want to work in it. It would drive me insane.

Increasing Hospital Bed Occupancy Rates due to HAIs

Older hospital sites in the NHS were originally built to house many fewer patients. Now, the hospital sites have a higher volume of patients, but do not have the physical space to accommodate the increased number of patients coming into the ER. One nurse manager explained:

> "When we have an emergency department that was built for about 25,000 visits and we now see 60,000 people in that emergency department . . . it wasn't built for the [increased] population."

Because the daily bed occupancy rate has increased, there are challenges to finding rooms and spaces for patients to receive care. A nurse manger reported:

> "We're very stretched. We are operating, right now, at about 115% occupancy, day to day. That is challenging."

The Infection Control Practices of the Housekeeping Staff

One considerable challenge is the insufficient number of housekeeping staff, which has decreased since 2009. According to the participants, the MOHLTC does not provide criteria to gauge the number of housekeeping staff required per patient bed. Housekeeping staff are not available, at some sites, on night shifts to *terminally* clean patient rooms when a patient with an infectious disease has been moved out of the room, Terminal cleaning refers to the cleaning of all surfaces in the patient's room, including walls, ceiling, floor, privacy curtains, all furniture, and any other surfaces in the room. As a result, nurses perform additional non nursing tasks by daily and cleaning rooms to compensate for the insufficient number of housekeeping staff. In addition, housekeeping

staff do not always clean equipment between patients, such as wheel chairs and blood pressure cuffs. This task becomes another nonnursing task for the frontline nurse to complete.

The documentary sources (NHS CDI Policy, 2011) do not support these findings and state that, for patients with a C. difficile infection, housekeeping staff must clean all horizontal surfaces in the patient's room and all items within a patient's reach twice daily while the patient is assigned to that room and must document these actions on the hospitality checklists. Housekeeping is also required to use sporicidal agents (e.g., STBC gels on toilet, sinks, and commodes) twice daily. After a patient is discharged, terminal cleaning of the vacant patient's room is required using hospital-approved sporicide for disinfection. Regardless of these existing policies, there are inconsistencies in the expected current practices of housekeeping staff by nurses on the hospital units. Furthermore, the NHS Restructuring Committee delegated the management of housekeeping staff to an organization outside of the NHS, making the implementation of any changes in their current practice and policies difficult.

Transferring of Patients

Another major challenge is the transfer of aging patient to and from long-term care (LTC) facilities. Patients are waiting on NHS inpatient units to be transferred to LTC facilities. Many of these vulnerable and at risk patients were transferred from home or a LTC facility to the NHS to receive antibiotic treatment. Healthcare professionals suggested the need for increased home care and access to medication treatment in patients' homes or in long-term care facilities to help alleviate the burden of transferring

patients to acute care facilities and increasing their risk of acquiring HAIs. Healthcare professionals stated that home care may be a solution to extended lengths of stay of patients in hospitals, which increases the likelihood of transmission and acquiring an nosocomial infection.

Many patients in the NHS are being repatriated when they are transferred from hospitals in the city of Hamilton back to the NHS. It is not known what infection control precautions are taken while the patient is transferred by ambulance between hospitals. Also, according to participants, the transferring of patients within facilities and between units is an area that needs further research to understand, specifically, the role of porters in transporting patients and their role in infection control. Research to understand the ambulance transfer of patients between facilities and the role of paramedics in infection control is also needed.

Summary of Findings – How Work has Changed

The following three sections will describe the perceptions of how work has changed for (a) frontline nurses, (b) ICPs and laboratory staff, and (c) executives. The unique findings for each group of healthcare professionals and the impact of emerging infectious disease on the changing nature of their work will be described.

Summary of Perceptions from Frontline Nurses

The following is a description of themes that emerged from the content analysis of interviews with frontline nurses in the NHS. The findings in this section demonstrate that the nature of nursing work has changed for frontline because it has shifted away from clinical care to managing infectious disease. The cumulative effect of spending extra

time on infection control procedures has had an impact on the quality and quantity of patient care. It was noted that the burden of infectious disease on nurses' work has created both physical and emotional risk factors. However, with the rise in HAIs there has been an increase in new responsibilities for frontline nurses at the point-of-care.

Changes to the Nature of Nursing Work

The findings in this section demonstrate that, with the rise in HAIs, the nature of nursing work has changed. Work has been redistributed from clinical care to a focus on infection control procedures. With increased time spent on putting on and removing PPE, increasing workloads, and hand hygiene audits, the quality of patient care has been compromised.

Redistribution of Nurses' Workload

Nurses reported that increasing infection rates have redistributed their nursing workload. The focus of nursing work has shifted from clinical care to managing infections. A frontline nurse explained:

> It's made nursing, and I use nursing, but all of the healthcare, it's made it very difficult for all of us, and families and patients included, we have units that have had 70% burden for six months, eight months. It's just every single patient that comes in has either been a contact or an acquired [hospital-acquired infection] or coming in with it.

The number of patients who have HAIs that nurses care for daily has increased dramatically. A frontline nurse explained:

> "You know, we often have 70, 80% burden on one of our floors, any one of our floors can have 50% burden, 70, 80% burden and the work on nurses has increased exponentially."

According to participants, workloads have shifted, as the high volume of evolving infection control practices and protocols have been added to the work of frontline nurses to control the transmission of increasing rates of infectious disease. A frontline nurse stated:

> Because rates have increased, because there's more community-acquired, just the work for the nurses is completely different than it used to be when I graduated 27 years ago, I mean an isolation patient was rare, you know.

Nurses reported engaging in a new type of nursing care that focuses heavily on managing and controlling infections. A frontline nurse stated:

> "It's a different kind of nursing and, for many of you; it's not what you went into nursing for."

It was reported that there has been an unpleasant change in the nature of nurses' work and more work for nurses to do at the point-of-care. There has been a decrease in the hands-on care of patients. This impacts the amount of time nurses spend with patients. Participants reported that, while there are more tasks for nurses to complete, there are more non-nursing tasks that nurses feel obligated to perform that other disciplines do not necessarily want to do. For example, nurses reported having to perform additional tasks, such as transporting food trays into patient rooms, putting garbage into bags for removal, and cleansing and disinfecting patient equipment on the night shift, because other disciplines have policies that regulate them from entering isolated patients' rooms. A frontline nurse reported:

> "Dietary won't take the trays into rooms where patients are isolated . . . that means I got to do it."

Impact on Patient Care

The cumulative effect of nurses spending extra time on infection control procedures (i.e., hand washing, cleaning, PPE) has had an impact on the quality of patient care. A nurse manager reported:

> "If they're washing their hands 40 times an hour they're moving you know, a patient an hour. When you think about it, when are they actually doing care?"

Frontline nurses reported a decrease in the amount of time given to patients at the point-of-care. Nurses felt that they were not meeting the psychosocial needs of the isolated patient. Some nurses felt that patients were "neglected when isolated" and "felt lonely." Nurses reported feeling the loss of close contact with a patient when wearing a gown, gloves, and mask. A frontline nurse explained:

> I think everybody gets less care. I think, you know, just the fact that I have to spend six minutes to put my gown and gloves and hand wash and mask and everything is in isolation and I have to have a separate this and a separate that, I think the actual hands-on care has to have decreased because you're spending so much of your time doing all the other stuff.

Nurses reported that they felt that patient care needs were changing, and the type of nursing care they were providing to the patient may have decreased because they were focused on controlling outbreaks and following infection control procedures. As a nurse executive said:

> For every hospital, it's about, well they're managing to do it and they're doing it well and they don't have outbreaks. But to me, that doesn't mean that the patients are getting what they need and, I guess, I wear my nursing hat you know, going back to, does that really mean that we're doing what we should be doing overall.

Nurses reported that patients "realize that their care is being compromised" when they are in isolation and patients get annoyed with isolation. Sometimes they have to wait "half and hour to get a bedpan." Likewise, patients were described as angry and frustrated when they needed to wait a long time for nurses to respond to their call bells.

According to nurses, patients in isolation do not meet with their physician because the physician will go to the nurses' desk and will not gown or glove to go into the patient's room. Additionally, it is difficult for nurses to advocate for the care of their patients with HAIs because other professions associate them with being "dirty." For example, a nurse reported that physiotherapy told her they did not work with "dirty" patients and the nurse knew that her patient could really use physiotherapy. Yet, on the other hand, there are some nurses that felt isolated patients received more care, or at least as much as the rest of the patients. They reported that the care of "non-infected" patients was the care that was compromised and every patient received less care, overall.

Patient Load

Frontline nurses reported that the acuity of their patient load is dependent on the number of patients in isolation for which they cared. Nurses explained that the assignment of patients in isolation was not evenly distributed among the nurses working on a unit per shift. A frontline nurse said:

"It's the luck of the draw. I could get all isolation rooms."

Frontline nurses recognized that, when patients were assigned to them on a shift, the patients were divided based on the complexity of the patient diagnosis. Yet, if a patient who had a stable diagnosis was isolated for an HAI, the required isolation precautions and

procedures were not considered in addition to the complexity of the patient diagnosis when assigning the patient load. A frontline nurse elaborated saying:

> Your assignment may be 3 heavy patients and 2 light patients. But, if those light patients are isolated, you have full heavy load. No one takes that into consideration when you're given your assignment for the day.

As well, nurses said that the patient load of HAI patients could change several times a day. If patients are moved into your assigned rooms, then you will have to prepare yourself to care for these new patients whenever they arrive. As a frontline nurse said:

> "You may have a whole new set of patients at the end of the day."

Infection Control Protocols and Practices – Time Required

Nurses reported that, when a patient with a HAI has isolation precautions in place, extra time is spent on infection control procedures, such as putting on and removing PPE. A nurse manager described this as "donning and doffing of gowns and gloves." It was reported that a patient with isolation precautions would require an additional three to six minutes to put on PPE and remove PPE, per patient per entry into the patient's room. It was estimated that an additional 15 minutes to half an hour was required for each complex patient per day. In addition, all of a nurse's assigned patients are not necessarily located in the same general area on a hospital unit. Nurses can spend a lot of time running to and from rooms located in different areas of the unit when caring for patients with isolation precautions. A frontline nurse noted that:

> The gowning, gloving, in an 8 hour, 12 hour shift is horrific . . . you know, it's not an insignificant amount of time, it might be three minutes. But still, if you're doing that three minutes for this patient when you start, three minutes when you finish, that's six minutes a patient.

Thus, frontline nurses indicated that there was an increase in workload due to the amount of extra time it took to wash one's hands, put an isolation gown, gloves, and mask on and then to take them off, and wash your hands again. Nurses needed to accommodate for the extra time it took for the additional infection control procedures to prevent the transmission of HAIs. As one frontline nurse related:

> It does take a lot of time going in and out of rooms . . . taking on and off those yellow gowns. I would estimate 12 extra minutes for each of my patients every time I see them . . . it all adds up at the end of my shift.

The average amount of extra time that is added to a nurse's day for infection control procedures, as reported by frontline nurses, ranged from 20 minutes to 2 hours. Nurses reported that infection control procedures are often not completely followed. Nurses needed to sometimes "cut corners", or not follow infection control procedures completely, in order to get their work done before the end of their shifts. Nurses sometimes ran out of a patient room to retrieve a forgotten item while still wearing their gowns, mask, and gloves. For example, nurses just "pop in" to put a medication cup on the patient's bed table and, as long as they do not touch anything, they think this practice is acceptable. Amazingly, one nurse was seen emptying a urinary catheter bag without using PPE, which places the nurses at risk for contaminating his/her hands and clothes and also increasing the risk of transmission of the microorganism.

Nurses reported having to increase their multitasking skills when caring for patients who in isolation precautions. A frontline nurse stated:

> If you are caring for someone with MRSA, then its essential that you give them a bath, medications, and change their dressings all at once. So, it is important that you are organized to plan in advance everything you need to go in, so you don't have to come out. . . . that is just a lot of extra time

> added if you had to keep going in and out. So, you need to plan for it in advance or you will never get it all done.

One of the reported challenges of wearing cloth gowns is that they are made of a lot of fabric and are "so billowy" that, when caring for one patient in a semi-private room, the gown touches the other patient's bed and bedding.

Hand Hygiene Auditing of Nurses

Frontline nurses reported that, on some units, nurses' hand hygiene audits were completed every week for four weeks after if the unit had recently been on outbreak. Nurses reported feeling that they are being "watched" when they were being audited. Some nurses are concerned about the increase in auditing. They feel they are not treated like professionals. A nurse manager noted:

> "Audits change the behaviour of the staff for that hour."

Nurses felt that hand hygiene audits were intrusive and felt that immediate feedback from the auditor would be more useful to them. Nurses reported that the current manner in which auditing is completed is "offensive". In addition, nurses reported that auditors needed to behave like members of the unit, to introduce themselves prior to an audit, and to provide feedback immediately following the audit. Nurses also objected to the current manner in which an audit is conducted, where the auditor does not view the hand hygiene procedure in its entirety. The auditor was not in full view of the healthcare professional when they were providing care for the patient; still, hand hygiene compliance was evaluated.

Nursing's Impact on Infection Control Policy

Some nurses reported that they have not had any input into the organizational policies and procedures regarding infection control. The nursing staff does not feel supported by management when the manager "always sides with the families" regarding visiting times, infection control policies, and the use of PPE. It was reported that families refuse to view the educational visitor infection control video, visit outside of posted visiting hours, and bring children to units with isolation precautions in place and, regardless, allow the children to roll around on the floor, for example. Yet, nurses reported feeling unsupported by their manager when they attempt to enforce infection control policies.

The Infection Control Procedure -- Cleaning

Nurses reported that they are expected to complete a number of nonnursing, housekeeping tasks, specially cleaning. Nurses explained that, when other healthcare workers refused to complete tasks that were not specific to their disciplines, for example additional housekeeping work, nurses felt that these tasks were "always" left for the them to complete. Nurses reported that they routinely perform housekeeping duties, including cleaning spilled products, removing laundry and garbage from patients' rooms, and disinfecting patient equipment. A frontline nurse stated:

> "I always find myself viroxing [disinfecting] the equipment in my patient's room several times a day. We only have 6 blood pressure cuffs, if we don't clean them then no one else will."

Nurses reported doing these other housekeeping tasks because of an NHS policy that states that housekeeping staff cannot enter isolated patient rooms. A frontline nurse stated:

> "It should not be my job to take out the dirty linens for my patients, but housekeeping staff won't go into isolated patient's room. . . . It's just another task that I have to now do."

Personal Risk of Infectious Disease: Physical and Emotional Factors

The findings in this section demonstrate that the changing nature of work for frontline nurses (RNs & RPNs) is associated with increased personal risk factors that include both physical and emotional risks.

Physical Risk Factors

Frontline nurses reported that one of the major changes in the nature of their work was the phenomenon of constant *bed moving* of patients with HAIs, their beds and their furniture, as described earlier. The frequent moving of heavy patients, beds, furniture, and equipment to cohort patients for infection control has resulted in reports of increased musculoskeletal strains and injuries, workers compensation, and short- and long-term absences from work by frontline nurses. Some nurses return to work following injury in modified work positions. On some wards, cohorting and moving patients is based on patient complexity, not the patient's infectious disease status. A frontline nurse stated:

> If you ask me, what has changed the most, it has to be all the bed moving, in one of my shifts, there can be up to 15 bed moves of ARO patients, that's a lot of extra pushing and pulling on my back.

Nurses, in the aging nursing workforce in the NHS, reported that the expected activities of moving, lifting, pulling, and pushing are physically more difficult for them to

perform than when they were younger. Nurses also indicated that new patient mattresses are heavier than the previous mattresses, making moving beds even more difficult for older nurses. Other disciplines refuse to enter the rooms of patients in isolation to assist with moving beds and stated that it is not part of their jobs. A frontline nurse mentioned:

> Usually, nurses are the ones who are moving the patients. So, there are times when we have to get one patient into a bed, five different moves . . . some of our inpatient units will say, 13, 14, 15, [moves] a day. Nurses reported several factors that contributed to the constant bed shifting, which has "had a profound impact on nursing practice."

These include having to match patients with like infections (e.g., MRSA) in semi-private rooms; placing patients with VRE or C. difficile in single rooms; and separating the genders, with male and female only rooms. A frontline nurse stated:

> To get one patient out of the emergency department on a medical unit, they had to move 17 patients, at seven o'clock at night, to get one patient out [of ER]. . . . Imagine that, one decision to move 17 patients when you have not enough staff, [and] housekeeping is generally not available.

The constant changing of patients, from room to room, impacts frontline staff because patients may change rooms several times during one shift, and, each time rooms are changed, there is the possibility that the patient's nurse might change. This is because nurses are assigned to rooms, not patients, which causes disruption to patients' care and disruption to the continuity of care provided. One nurse reported:

> "It's a constant shuffling game, it's hard to keep organized when the patients you are caring on one shift may change 2 or 3 times. The bed moving situation is extremely frustrating for patients."

Nurses also reported that, with the emergence of HAIs, they have growing concerns of infecting their own families with "bugs" brought home from their workplace, especially MRSA, VRE, and C. difficile. NHS staff are reportedly not swabbed for

infectious disease. Nurses' fear of infecting their own families is reportedly because they have not presented with any signs or symptoms of infectious disease. Evidence of nurses' worry regarding HAI transmission risk to their children's wellbeing was found in the interviews. A frontline nurse stated:

> "I have a two month old child at home; it scares me to bring those bugs from work into my house and make my kids sick."

Frontline nurses, who wear their uniforms and shoes to their homes from work, were also concerned about infecting any contacts they encountered after work, in the subway or the supermarket, for example. Some frontline nurses perceived that whatever comes in contact with them, their uniforms, or their shoes might be at risk for acquiring an infectious disease.

Emotional Risk Factors

Nurses, working on hospital medical units or complex continuing care units, specifically reported that caring for an increasing number of inpatients with HAIs has led to feelings of burnout. They described burnout as being emotionally drained from the increasing everyday tasks of caring for patients with MRSA, VRE, and C. difficile that are now the *new normal* of their jobs. A frontline nurse explained:

"My job wipes me out; some days it makes me not want to come back to work."

Additionally, this has resulted in increased sick time and "mental health days" reported by nurses. Nurses reported feelings of being overwhelmed, overworked, and undervalued for the additional work required in caring properly for patients with HAIs. On some units, a high nurse turnover was reported. A frontline nurse reported:

> You can see that we are all just getting tired of being overworked and underappreciated for all that extra work. . . . it just gets too much you know? Sometimes, you just need a personal day to regain your sanity.

Finally, frontline nurses described the insular nature of their roles in caring for patients in isolation. Nurses reported that they do not receive help from other nurses when they are in a patient's room with isolation precautions. With the increased volume of isolated patients, nurses reported no longer working together in teams. Nurses reported that isolation from their colleagues caused emotional strain because, when caring for isolated patients with HAIs, they work individually, on their own. A frontline nurse noted:

> "You don't really feel like you are working in a team of nurses, when you're taking care of isolated patients. . . .The work and the emotional strain becomes that much harder when you're working alone all the time."

Increased Responsibilities for Frontline Nurses at the Point-of-Care

The findings in this section demonstrate that HAIs have increased the number of responsibilities for nurses at the point-of-care. These responsibilities include education and public protection, increased interprofessional collaboration, and an extended scope of practice.

Education and Public Protection: Monitoring Infection Control Policy Compliance

Nurses reported new responsibilities in educating and role modelling infection control procedures to families, visitors, and other healthcare professionals in an effort to increase compliance with infection control policies. Nurses believe that they are viewed as role models and set the tone for infection control policy compliance on patient units. Nurses reported that families, visitors, and other healthcare professionals must make

compliance with infection control policies an expectation and then a habit, including isolation precautions and the use of PPE.

A new role has emerged for frontline medical, surgical, and acute care nurses in public protection, which is directed towards monitoring compliance with infection control policies, specifically isolation precautions and the use of PPE. Nurses are responsible for observing, reporting, and providing feedback for the infection control behaviours of physicians, visitors, and patients in very cramped hospital units. Documentary sources support these findings (NHS Hand Hygiene Policy, 2009) and indicate that nurses are required to provide education to their patients and visitors on the importance of hand hygiene through written and verbal communication. A frontline nurse stated:

> I know if I don't set an example and wear my gown, families and visitors, won't wear their garb either. . . . As nurses, it is important, to not only educate families, but do as you [the nurse] preach, because that's the only way they [families, visitors] will listen.

Nurse reported that they felt personally responsible to ensure that their patients did not acquire an HAI. A frontline nurse stated:

> "It's important to be vigilant in reminding your patients to wear their gown and gloves. . . . I have responsibility, as their nurse, to ensure they don't get one of those bugs under my watch."

Interprofessional Collaboration

Interprofessional collaboration among healthcare professionals in managing HAI transmission has increased the level of connectivity amongst the disciplines. There have been increased support systems for frontline nurses from the ICPs who provide increased education and foster staff awareness. Frontline staff receive in-service education from ICPs who provide them with self-directed educational packages. Additionally, there is

consistent communication between ICPs and nurse managers throughout the day. One manager reported:

> "My ICP is the person I communicate with the most throughout the day. I don't think I could manage all my isolated patients without her, it would be a nightmare to figure out the beds!"

Furthermore, the interaction of nurses with ICPs is more frequent during outbreaks. A nurse manager stated:

> "During an outbreak my ICP is present daily, educating staff on hand washing, and providing in-services."

The Extended Scope of Practice for Frontline Nurses – Infection Control Champions

The NHS has developed a new role for frontline nurses in managing infectious disease. An extended scope of practice for nurses was introduced through the development of Infection Control Champions (ICC), in the spring of 2011. A frontline nurse explained:

> "I think we all need more knowledge about how to stop the spread of infections. . . . It is great that the administration is implementing the role of infection control champion for nurses."

According to documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009), NHS nursing leadership is working with frontline nurses on hospital units to identify unit ICC to assist with infection control auditing and to increase healthcare professionals' compliance with infection control policies and procedures, NHS-wide. Nurse ICC will increase compliance with infection control policies and procedures through coaching and supporting their peers , families and visitors.

Nurses have reported an increase in decision making regarding patient care and infection control procedures. For example, they can make decisions about when to place patients in isolation precautions. A frontline nurse stated:

> "It is not about following an algorithm, you know, when it comes to deciding who needs to be isolated or swabbed. . . . Sometimes nursing throws you a curveball you really need to be able to think on your feet."

Additionally, the role of acute care nurses in the ER has changed because ER nurses are now caring for medical patients in the ER as they wait for in-hospital beds. Therefore, with lengthy patient stays in the ER, it "changes the experience of the ER nurse" from acute care to medical and even palliative care. A frontline nurse reported:

> Three years ago, you would never have a medical patient waiting in the ER for 4 to 5 days. Now, I am taking care of admitted medical patients who are waiting for a bed. My role has changed; I was an acute care ER nurse, now I spend a lot more time with my patients.

The Evolving Role of the Charge Nurse

The role of the charge nurse has evolved with the increase of HAIs in the NHS. Now, charge nurses need to know the updated status of every patient on the unit, at all times. The charge nurse's role has evolved to include the constant coordination of the ICPs with the frontline nurses and increased interprofessional collaboration. With the increased moving of patients and patients' beds, the role of the charge nurse has become the "traffic controller for beds."

Summary of Perceptions of Infection Control Practitioners and Laboratory Staff

The following is a description of the themes that emerged from the interviews with ICP and laboratory staff participants. The findings in this section demonstrate that

the nature of ICPs work is changing because of the increase in infectious disease and the subsequent increase in their numbers within the organization; their educational requirements and infection control certification; and increased interprofessional communication and collaboration. With the increased emphasis on the management of data, ICPs spend more time on epidemiological trending and making data-based decisions that impact clinical care than on clinical care itself.

The nature of laboratory work has changed with the increase in the amount of surveillance of infectious diseases. There has been a shift in the laboratory from manual work to the use of a greater number of new technologies. At the same times, however, there is an increased demand for faster turnover time for specimen samples, which has impacted their workload and workflow.

Changes to the Work of Infection Control Practitioners in the NHS

The findings in this section demonstrate that, overall, the profile of ICPs has changed in the organization. Seven ICPs have been hired and have increased educational training and education than previously. The role of the ICPs involves daily communication and collaboration of infectious disease-related data with frontline staff and management, as well as, interdisciplinary education of staff.

The Increased Number of ICPs

The profile of ICPs in the NHS has changed since SARS in 2006. With increased funding from the MOHLTC, the NHS has recruited new ICPs positions. Prior to SARS, the NHS employed two ICPs for the entire NHS. Following SARS, the NHS received

funding for one additional ICP and, since 2008, the NHS has had a total of seven ICPs. Currently, there are three ICPs that are employed at the St. Catharines General Hospital Site who also service the Niagara-on-the-Lake Hospital Site; two ICPs are employed for the Welland General Hospital Site and the Port Colborne Hospital Site; and two ICPs are employed at the Greater Niagara General Site and also service the Douglas Memorial Hospital Site. ICPs reported that the additional number of ICPs has decreased the workload for individual ICPs.

Educational Background and ICP Education

Originally, only nurses were employed as ICPs. Currently, the educational backgrounds of ICPs may include nursing, occupational health nursing, ICU nursing, laboratory technology, or respiratory therapy and those who have completed the educational requirements and certification to be an ICP. The credibility and visibility of the ICPs in the NHS has increased over the years. ICPs also receive more training than previously; including a six month course and Community and Hospital and Infection Control Association (CHICA) certification. Currently, six of seven ICPs hold the required CHICA certificate. According to documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009), all current ICPs will be board certified by CHICA by the end of 2011.

The Role of Infection Control Practitioners: Interprofessional Communication and Collaboration

The role of an ICP involves the sharing of daily assignments on the hospital units and teamwork. Each hospital site has an assigned ICP who alternates between two

assigned sites. ICPs report that they consistently provide ICP coverage for other ICP's hospital sites and units, when the other ICP cannot attend to their designated hospital site or units. Additionally, ICPs reported that on every seventh weekend, they alternate between being on call for all hospital sites in the NHS and being at home. An ICP comments on their teamwork:

"If you don't work in a team, especially in this facility, you cannot function."

Communication among ICPs includes weekly teleconferences with all seven NHS ICPs. In-person meetings are scheduled once a month with the entire team, including ICPs, the ICP manager, and senior hospital executives. This is supported by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009), which state that the ICP team must meet weekly, either face-to-face or through teleconferencing, to facilitate consistent communication.

In addition, with the increased availability and amount of infection control data, the NHS leadership has promoted increased communication and coordination between ICPs, nurses, managers, senior administration, and laboratory staff. For example, ICPs report consistent contact with the bed booking department throughout the day. An ICP reported:

> "[We] were on the line [telephone] at least 12 times a day that she'll [the charge nurse] call and say, okay, can I move that patient with that patient. So we [ICP & nurse manager] constantly communicate."

There is also increased communication with laboratory technologists. With the outsourcing of microbiology to an independent laboratory, ICPs need to communicate

constantly with the laboratory technologists to confirm known cases of microorganism infections or new cases of HAIs. An ICP stated:

> Because its filtered out, to an outsource, they call us for everything, whether it's known case, or an old case, because those people at LifeLabs [outsourced laboratory], they don't have that knowledge base to know if it's [a patient] a known case [patient with confirmed HAI].

Therefore, there is increased accountability and connectivity between ICPs and the organization's hospital sites.

Infection Control Education provided by ICPs

ICPs engage in interdisciplinary collaboration by providing education for frontline nurses, physicians, students, rehabilitation staff and auxiliary staff. The education on each unit includes an in-service *self-learning education package*, issued when there has been a unit outbreak of HAIs. Examples of educational packages include infection control measures for airborne, droplet, and contact precautions; charts for stool monitoring; a module for hand hygiene; and presentations about the appropriate manner in which to employ PPE, and how to initiate additional infection control precautions. Sign-in sheets for each unit are used to monitor the healthcare professionals' use of the material. The use of educational updates for frontline nursing staff from ICPs for the initiation of additional infection control precautions is supported by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009).

ICPs report that the amount of education required per site varies. ICPs often provide one-to-one education in the ER because the ER staff report that are they too busy to leave the ER to attend educational sessions. Yet, surprisingly, some nurses in the ER stated that they had not even met the ICP assigned to their unit and that very few

educational in-services were offered to nurses on their units. Thus, there are contrary reports about the ICP's in-hospital presence and the education provided and nurses' reports about the ICPs engagement and involvement in providing education to the frontline staff. Site-specific education involves ICPs providing education at clinical rounds. An ICP reported:

> We makes clinical rounds, we go to the floors [hospital units] to make sure the board [visual management board or *white board*] is updated, if there's any questions because that's where you learn a lot. We do a lot of education on the floor - we do formal education throughout the year.

Perception of the ICPs Role within the NHS

The role of the ICPs was perceived by some frontline nurses as rigid and was described as "one-dimensional and militaristic". Some nurses' felt belittled by the ICPs, as if they do not know what they are doing. A nurse manager stated:

> "I sense from the point-of-care staff [nurses] that they're [ICPs] just so rigid that, you know, there's got to be a way that, you know, to bend the rule or to look at it a different way."

In addition, according to the frontline nursing staff there are inconsistencies in infection control policies and procedures being implemented between hospital sites in the NHS and being enforced by infection control practitioners at different hospital sites in the NHS. The variation in educational content is dependent on individual site needs and the education background and training of the ICP.

The perception of ICPs has changed since SARS. There is recognition within the organization that ICPs have a very important role because of the increased attention that has been placed on the issue of managing infectious disease.

Changes to the Work of Laboratory Staff in the NHS

The findings in this section demonstrate that the overall work of laboratory staff has changed with an increase in the amount of surveillance of AROS. While the use of new technologies and electronic worksheets has simplified the amount of manual work, their bench workflow has continued to increase with the rise of HAIs.

Bench Workflow

There has been an increase in the workflow of laboratory staff who perform their duties on benches (work stations), each workup for laboratory staff takes longer than it did before. Once LifeLabs started working with hospitals, additional areas for work, work benches, were dedicated to the surveillance of MRSA and VRE. Microbiology gradually became a bigger part of their workflow. New technologies have emerged as laboratory staff reported an increase in the number of microbiology specimens that required new surveillance technologies and procedures. Laboratories perform an increasing amount of infectious disease surveillance. One laboratory staff member explained:

> Because organisms are changing, we need to change our workflow and how we identify things . . . procedures change because organisms have changed. . . . When I started 20 years ago at LifeLabs, we had very little MRSA and pretty much no VRE. We only had one test to test for MRSA, We didn't have to do so many extra steps to test if the patient was MRSA positive, but now, we also test MRSA for the presence of vancomycin, which is just one more step that we have to do because the bacteria have changed.

In spite of new technology that increases the speed of work, workloads have increased, with more required surveillance from the hospitals, which increased regular monitoring, which is known as *sweeps* for AROs. A laboratory worker explained:

> "New technology speeds up work, but we still get more work. . . . Hospitals keep getting patients so we have to keep testing."

Change from Manual Reporting to Standardized Electronic Worksheets

Laboratory staff reported changes in their work as they moved from more manual working and manual reporting to standardized electronic worksheets and the use of a call centre for reporting results. Since data are now available electronically, all of the patient's information is entered in a computer. The microbiology agar plates for each patient have barcodes that are scannable and record all work on the specimens. A report is generated with results that are interfaced with electronic databases (Meditech). Healthcare professionals have access to these databases at the hospital sites. Previously, laboratory reports used to be hand written, which was time consuming, and resulted in transcription errors. The laboratory staff stated:

> "It is a lot easier now, with the electronic worksheets, to follow someone else's work . . . if the specimen goes through different hands it's more easier [sic] to follow up."

Nevertheless, staff are still engaged in manual laboratory procedures. In addition, LifeLabs has instituted a telephone call centre to make telephone calls when a patient has a positive test result. Therefore, the laboratory staff no longer make telephone calls themselves to inform the ICPs at the hospitals of positive cases, it is now done via a telephone call centre.

Challenges for Laboratory Staff

The challenges for laboratory staff are that everyday work is more challenging because the workflow and work on the bench has increased. Laboratory staff believe that their workload is constantly changing and, even though there is less manual work, there is

a redistribution of work. Therefore, the overall amount of work has increased. Laboratory staff reported that, now, work on weekends and on night shifts has increased due to the increase in number of specimens for infectious disease surveillance. There is increasing time pressure to do things faster and pressure to know about a positive or a negative result quickly.

Summary of Perceptions from Executive

The following is a description of the themes that emerged from the content analysis of interviews with executives within the NHS. The findings demonstrate that the organization has initiated positive administrative practices to prevent the transmission of infectious diseases within the NHS. Some of these strategies include infectious disease outbreak strategies, auditing strategies, piloting new technologies, education of cleaning staff, changes to the physical plant, redistribution of emergency services, removal of human waste strategies, antibiotic stewardship programs, consultation services, and participating in regional councils.

Positive Administrative Practices: Organizational Approaches to the Prevention of HAIs

The findings in this section demonstrate that provincial and regional bodies have introduced standardized infection control protocols and procedures in the management of HAIs. In response to the numerous infection control policies and recommendations, NHS has invested both human infrastructure and organizational capacity in the management of infectious disease. The strategies that have been supported by the executives in the NHS are: an increase in staffing, an increased number of ICPs on a unit and increased

communication of management with staff during outbreaks, the purchase of new infection control products, an increase in auditing of healthcare professionals, an increase in patient safety walkabouts by executives, new clinical innovations, changes to the physical plant, redistribution of acute care services, education of staff, an increase in nursing leadership, more effective removal of human wastes, an increase in consultation with infection control teams, and the hiring of an infectious disease physician for medical direction within the organization.

Outbreak Strategies

During an infectious disease outbreak (aka *outbreak*), the NHS administration increases the availability of ICPs on hospital units. During an outbreak, there is heightened consciousness of all staff to get the unit out of outbreak as quickly as possible. The staff are more aware, and more vigilant in tracking infectious diseases. The resources to control infectious disease transmission during an outbreak include the:

1. use of the Bath-in-a-bag®, which are antimicrobial wet cloths used to clean patients.
2. use of glow-germ® audits, in which an increased concentration of cleanser is applied to exposed areas in a patient room that has not been thoroughly cleaned to discover where further cleaning is necessary.
3. terminal cleaning of patient rooms, which involves sanitation of the patient room with a germicidal agent after the patient is discharged or transferred to another unit.
4. increase in staffing during an outbreak.

5. cohorting of staff caring for patients with specific HAIs, as recommended during an outbreak.

An infection control executive stated:

> "So what we've tended to do is, on outbreak times, we increase staffing when the burden is particularly heavy."

This is supported by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009) which state that the funding requirement for increased staffing is currently being reviewed by the senior NHS management team. Increased staffing is being piloted on a number of units to evaluate the effectiveness of this strategy in controlling infectious disease transmission during an outbreak.

According to documentary sources (ARO, MRSA, and VRE policy, 2011), outbreak interventions include identifying colonized patients and interrupting nosocomial transmission of infectious disease. Patient swabs are obtained on day one and day seven of a patient's hospital admission and, then, weekly until consecutive weeks of negative MRSA/VRE results are obtained from patients.

Furthermore, during an infectious disease outbreak, there is increased communication between ICPs and frontline staff, with the executive leadership of NHS. This is supported by documentary sources (NHS Management of an Outbreak of ARO Policy, 2010) which explain that a multidisciplinary committee (Outbreak Management Team) is formed to review the outbreak situation and to provide guidance. This includes weekly teleconferences for every hospital unit that has an infectious disease outbreak: manager, charge nurse, the ICP director, and the vice president (senior site administration) for that site. Additionally, according to the policy, environmental

services, which includes housekeeping, laundry services, and dietary services, need to be included in the outbreak management team, as well as case management, the laboratory executive, and a person from patient registration. An infection control executive explained:

"We have meetings with ICPs once a week during outbreaks."

The meetings during infectious disease outbreak include standing agenda items: who should attend the meetings, the measures that need to be taken, and an outbreak management plan that should put into place during an outbreak. According to documentary sources (NHS Management of an Outbreak of ARO Policy, 2010), a checklist is provided to each hospital unit that includes outbreak control measures, housekeeping audits, communication reports, and summaries. At the end of each infectious disease outbreak, a *Summary Report of Outbreaks* is created that includes details regarding outbreak data, strategies used during the outbreak, and recommendations to be instituted following declaration of the end of the outbreak. This report is shared with the organization and the *Infection Control Steering Committee.*

This is supported by a documentary source (NHS Management of an Outbreak of ARO Policy, 2010, p. 4) that state: "following outbreaks, outbreak summary/debriefing will take place with an emphasis on [the] lessons learned and feedback to staff." Additionally, according to the NHS (Management of an Outbreak ARO Policy, 2010), the summary of outbreak metrics are recorded and compared to provincial standards. During previous outbreaks, the NHS has consulted with the regional public health department and the Public Health Ontario's: *Ontario Agency Quick Response Team* which developed

a report with recommendations for the NHS. Following this consultation, the NHS Steering Committee must implement the recommendations from the report.

The review of the documentary sources and interview findings support the organization's efforts in controlling and managing infectious disease. It was noted in the *NHS Infection Prevention and Control Strategic Plan* (2009 - 2011) that the organization is committed to reducing HAIs, to developing a coordinated approach to infectious disease prevention and control, and to strengthening the healthcare system's infectious disease prevention and control capacity. Accordingly, the number of weeks of ARO outbreak, during the 2009 to 2010 and the 2010 to 2011 fiscal years, have been reported to be reduced by 81%.

Auditing and Monitoring the Transmission of Nosocomial Infections

The NHS administration has developed internal checking and auditing systems to monitor the transmission of nosocomial infections. According to the documentary sources within the NHS, the organization tracks the compliance of NHS personnel with hospital infectious disease prevention and control policies and procedures regarding PPE and hand hygiene. The NHS's hand hygiene compliance was 74% as of the March 2011 audit.

These data result from hand hygiene audits that are publically reported to the MOHLTC and the NHS hospital administration. According to documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009), ongoing focused auditing is occurring, particularly on outbreak units. Quarterly auditing

is completed organization-wide and quarterly auditing is completed across the hospital sites. Two hospital sites per month, per quarter are audited for hand hygiene. Updated data on hand hygiene compliance is provided to the NHS senior administration daily and reports of hand hygiene compliance are published on the NHS website monthly. A nurse executive stated:

> "And when you first observed it, comparing the data to today, you will see that it has improved. . . . Because it wasn't that way, even two years ago."

Increasing hand hygiene auditing has promoted compliance with the infection control procedures and with increased auditing; there is decreased infectious disease. An infection control executive stated:

> "People are alert when they see an auditor . . . policing works . . . we have the stats to show -- it can get us out of outbreaks."

Another form of auditing that was put into place by the NHS administration is the random *glow-germ*® audits for housekeeping staff. The glow-germ® audits expose areas that have not been cleaned appropriately by housekeeping staff. According to the administration, when the glow germ audits are poor, there are an increased number of infectious disease outbreaks or nosocomial transmissions. An infection control executive reported:

> So, housekeeping has a substance that you wipe on, you let it dry, and then, you take this ultra light and it will show you where the cleaning didn't touch. So, we do those audits regularly, randomly, sporadically and when we have an outbreak. And, we know that when the glow germ audits are poor, our outbreaks increase.

This is supported by data in documentary sources (NHS Strategic Plan 2009-2011), which suggest that compliance with environmental auditing of cleaning practices has decreased, from 97% to 94% from 2008 to 2009. Monitoring of the concentration of cleaning solutions of housekeeping staff are also randomly and routinely performed.

Furthermore, the organization has implemented PPE audits during outbreaks. This is supported by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009) which explain that audits related to PPE are completed regularly on outbreak units and are ongoing. An infection control executive reported:

> "The ICP on the outbreak floor and even post-outbreak, will monitor post outbreak personal protective equipment and adherence."

Piloting New Technologies

It was reported that the NHS administration has invested resources in piloting the use of new technology to promote hand hygiene. They have implemented the use of a voice recorder, which reminds patients, families, and staff to clean their hands every time they go through a doorway. A nurse executive stated:

> So, as you walk through certain corridors, a little voice will say, wash your hands, clean your hands, you know, as you walk through. Those are things that we're piloting here and actually it's working, we're seeing people, oh, you know, washing their hands.

Increased Education for Cleaning Staff

The NHS administration has increased education and standardization of infection control procedures for terminal cleaning of patient rooms. This is changing the complexity of the housekeeping role as they receive increased education and training on infection control procedures.

Patient Safety Walkabouts

The NHS promotes patient safety walkabouts by the senior administration, in which the vice presidents and infection control executives walk around on units, observe patient safety issues, and speak to staff about infection control. A nurse executive stated:

> "We do a focus walkabout and we gather the staff and we talk to them about patient safety and inevitably Infection Control comes up in some way, shape or form, inevitably."

The Gold Standard of Reporting: "Visual Management Boards"

The NHS has consulted with the Kaizen consulting group to increase the efficiency of services within the NHS. The consulting group helped the organization create a *white board* (visual management board) to organize the number of ARO patients on each hospital unit and to try to decrease the number of patient and beds being moved each day. The NHS administration has promoted the use of the visual management boards to increase communication among all disciplines. A nursing manager reported:

> '" Everybody has access to the board [visual management board] . . . [and] can see whose [who has] MRSA, whose [who has] VRE, whose [who has] C. diff, when's the next swab due, any re-assessment, its great."

The visual management boards, located at the nursing station in each hospital unit, provide all of the relevant recent patient information. A nurse manager reported:

> "[We] have a board [visual management board] and we update the board every day, swab issue today, isolation discontinued, or put the new -- so everything is available that they can see, so, its just that, a glance, they can see what's happening with their patients."

It has been reported that the use of visual management boards have decreased the number of errors in the reporting of AROs. The infection control executives reported:

> "There is a lot less error since we implemented the full board [visual management board], with more information on it. There always has been a board, but it wasn't as precise."

Physical Plant Changes to NHS Hospital Sites

The NHS administration has supported floor plan changes to the existing physical plant at the Niagara General Hospital Site. They have changed the room design by converting several four patient rooms and vacant units to private and semi-private rooms by closing beds. A nurse executive stated:

> "So, what we've done is, we've closed beds over the years, instead of closing units we've closed two beds out of this four bed room and two beds out of that room and, now, it's a private and this one's a semi-private."

Additionally, the NHS administration has implemented separate clean and dirty utility rooms and equipment supply rooms. Furthermore, there has been the creation of *flex units*, express units, and decanting areas for admitted patients in the ER, waiting for an available bed in the hospital. According to documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009), there has been an organizational-wide plan to separate "clean and dirty functions." The ICP team provides guidelines for hospital unit managers to follow. Physical plant changes on all hospital units are being tracked and will continue to be monitored until all of the changes have been made.

In addition, when the new hospital is built in St Catharines, in two and a half years, 80% of all beds in the hew hospital will be single rooms, with their own toileting facilities. There is an expectation that the infectious disease rate will drop in the new hospital. Also available in the new hospital, are negative pressure rooms with ante-rooms and a greater number of hospital floors which have either semi-private or private rooms. According to the *Construction/Renovations Policy* (2005), one of the tenents is to minimize the risk for nosocomial infections associated with construction and renovation. Thus, ICPs are currently directly involved in the process of approving the new hospital plans for infection control purposes. This is further supported by documentary sources (NHS Strategic Plan 2009-2011) that explain that all construction renovations and repair plan is to be reviewed by an ICP prior to the start of the project.

The Redistribution of Emergency Services

The NHS has redistributed emergency services in the region by converting hospital site emergency rooms into urgent care centres. The creation of urgent care centres at the Port Colborne Hospital Site, the Ontario Street Site, and the Douglas Memorial Hospital Site redistributes minor ambulatory cases from emergency departments at the larger sites. Therefore, the emergency rooms at the St. Catharines General Hospital Site and the Greater Niagara General Hospital Site will be utilized for emergency situations, only.

The NHS administration also increased the amount of public education when it closed down old emergency rooms at the hospital sites and converted them into urgent care centres. During this transition, there was increased education about where patients

should be accessing care to support the public in shifting from accessing ERs to accessing urgent care centres for minor ailments. Additionally, waiting times for patients to be evaluated at the St. Catharines General Hospital Site's ER have been made available online to assist patients in making better decisions about where they should seek care.

Evaluation of the Metrics of ER Wait Times

The NHS administration is initiating strategies to evaluate the current practices in the ER and the waiting times for patients to receive care. Their goal is to shorten the amount of time patients wait for care. The NHS is investing in strategies that support the movement of admitted patients from the ER to hospital inpatient units. The NHS administration is exploring evidence regarding the safe amount of time an admitted patient can be kept waiting in the ER, before anything untoward occurs. A nurse executive stated:

> So we're bringing the ethicist back, because, is it ethical to keep them [patients] in emerg with 28 admit no-beds [28 patients to admit with no available hospital beds] or to put six of them [patients] on a unit where they have a bed, where their nurse to patient ratio is better, you know.

Nursing Leadership Teams

The NHS has promoted a shared governance model with the establishment of hospital unit councils that encourage dialogue amongst nurses and the NHS management and administration. In the hospital unit councils, the point-of-care staff can introduce practice issues and solutions for the implementation of infection control policies.

MOHLTC Public Reporting

As result of the MOHLTC's mandated public reporting, there is greater accountability and responsibility by the NHS at all levels, from the point-of-care staff, to hospital management, and the NHS organization at all levels, to prevent the transmission of HAIs. While the MOHLTC has mandated that the public be informed about the increased activity of infectious diseases and infectious disease outbreaks, it does not want to alarm the public with these data. A nurse manager stated:

> "We now all have a part to play in this, from the person that is working in environmental services to the CEO."

The transparency of available infection control metrics among hospital sites encourages competiveness among hospital sites to decrease the number of HAIs at their site. Because of the MOHLTC's mandated public reporting, there has been an increase in the rigour of monitoring data from the NHS's senior management level.

"Daily Huddles": A Strategy to Manage Data Clinically

A strategy that was developed to manage data clinically was the *daily huddle*, for debriefing of point-of-care staff with respect to infection control issues, patient care issues, safety, environmental issues, and news of new developments. The daily huddle takes place every day at 2:00 pm for 15 to 20 minutes in one central location in the ER. It is organized by the nurse manager or charge nurse and it is expected that at least one person from each discipline attend the daily huddle. At the end of the week, the nurse manager updates the unit about all of the new infection control-related events that have taken place in the past week.

Education on Hand Hygiene

The HNS has promoted and increased education on hand hygiene. They have supported several strategies which include lunch learns; the use of intranet modules on *SharePoint*, in which staff are given certificates for completion of infection control education; the distribution of pamphlets; large posters posted around the hospital sites; and kiosks at the front door of each hospital site for the promotion of hand hygiene. All healthcare providers are advised and expected to perform hand hygiene in accordance with the *Just Clean Your Hands* program, supported by the MOHLTC. It is also expected that all healthcare providers complete the MOHLTC's *Hand Hygiene Module for Hand Hygiene Education* (2009). Additionally, educational reviews of hand hygiene are provided at orientation to all hospital staff and on a monthly basis throughout the year.

The Increased Number of Alcohol-Based Hand-Rub (ABHR) Dispensers

The NHS has increased the number of alcohol-based hand-rub dispensers throughout the hospital sites. According to documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009), new informative and educational signs have been posted in order to raise awareness organization-wide, as well as to increase the number of ABHR stands present at the front entrances of each of the hospital sites.

The Removal of Human Waste

The NHS has promoted the investment in infection control resources to remove human waste, such as macerators and *Hygie-bags*® (liners that are disposable). This is supported by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009) which report that Hygie-bags® are being used throughout the NHS. Spray wands to clean commodes and basins have been removed because the force of the spray causes the spreading of microorganisms into the air and onto health professionals' clothing. Additionally, three *Verna Care Units*, which are disposable systems for human waste management, have been installed at the Greater Niagara General Hospital Site, the Port Colborne Hospital Site, the Welland General Hospital Site), and on hospital units that have been on infectious disease outbreak. This is supported by documentary sources (NHS Strategic Plan, 2009 - 2011), which state that the organization is working towards reducing environmental factors contributing to the potential spread of infectious disease.

Infection Control Signage on Doors of Patients in Isolation

The NHS has supported the use of infection control directional signage on the outside of patient room doors to alert visitors and healthcare providers that the patient is in isolation, the type of isolation precautions required, and instructions about how to put on and remove PPE correctly. Nursing managers reported:

> "When I make rounds, we have the signs. We have something outside the door, that, so, if the patient is on droplets [precautions], so everything is outside the room, and the gown, and the setup."

This is further supported by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009) which explain that all hospital units have reviewed and ordered new signage as needed.

Antibiotic Stewardship Programs

The NHS administration has hired a pharmacist to monitor antibiotic utilization. According to documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009), the program is to audit prescribed antimicrobial therapy, with pharmacist intervention and feedback to the prescribers. A laboratory worker and infection control executive reported:

> "They have found that the antibiotics are used quite a bit and they're looking at that, for change."

According to documentary sources (NHS Strategic Plan, 2009 - 2011), the organization is publishing antibiotic sensitivity trends in a user-friendly format for use by prescribing healthcare professionals. A communication/decision tree for reporting significant changes in antibiotic susceptibility trends has been established and utilized by prescribing professionals in order for them to include predetermined thresholds and the time interval for reporting.

Consultation from the UHN (University Hospital Network)

When the NHS was in infectious disease outbreak two years ago, the NHS requested a review of infection control policies, procedures, and staffing by consultants from the *University Hospital Network Infection Control Resource Team* (ICRTs). Two

infectious disease physicians and two ICPs provided a "road map" of recommendations to assist the NHS with improved infection control processes and practices.

Hiring Infectious Disease Physicians

The NHS hired an infectious disease (ID) physician to chair the *Infection Control Committee* at the NHS. The ID physician reviews infection control policies and procedures to ensure they are reflective of best practices and to provide medical direction and support of infection control issues. This is corroborated by documentary sources (Public Health Agency Infection Control Resource Team Recommendations, 2009) which explain that a physician be hired to support and chair the Infection Control Committee and to provide direction and support to the infection control program, two days a month.

The Regional Infection Control Network (RICN)

The NHS participates in the *Regional Infection Control Network* (RICN), which is a funded program created by the MOHLTC, as recommended after SARS. The RICN is utilized as a resource for education and clinical consultation regarding managing infectious disease outbreaks, implementing programs, environmental issues, patient issues, and ongoing education for ICPs. There is a representative of each LHIN on the RICNs and they provide linkages to the community. The RICN is under the umbrella of the Ontario Agency of Public Policy and Health Promotion in Toronto.

CHAPTER 6: DISCUSSION

Analysis of the study findings revealed that, with the emergence of antibiotic-resistant hospital-acquired infections, the nature of healthcare professionals' work in community hospitals is changing and becoming more complex. Three major themes that emerged from the data that demonstrate the impact of infectious disease on healthcare professionals' daily work will be discussed. The data demonstrates that work has changed for healthcare professionals because of; (a) emerging infectious diseases and the proliferation of infection control protocols and practices; (b) increased responsiveness of healthcare professionals towards the emerging and continually increasing infection rates and increased data management and data-based decisions; and (c) increased communication and connectivity required across disciplines. Analyses of the three emerging themes reveal a new emerging *paradigm of infectious disease prevention, control, and treatment.*

Proliferation of Infection Control Protocols and Practices

Document analysis of the grey literature demonstrates a proliferation of infection control protocols and practices emerging in the last seven years, changing the nature of healthcare professionals' daily work. Review of the grey literature sources (see Appendix K) demonstrates a proliferation of provincial government documents that include 5 task reports, 13 general reports, 6 best practice guidelines, 13 infection control procedures, and 6 infection control policies since 2004. There has been intense provincial investment, both monetary and human, in the development of new government advisory committees,

agencies, and institutions that have provided increased provincial and regional infrastructure to manage infectious diseases.

The findings demonstrate that there has been an increase in physical and human infrastructure at the provincial, regional, and hospital level. Following SARS, the province evolved from the development of general guidelines on managing infectious disease, to chiefly focusing on the creation of more specific and larger committees to monitor infectious disease metrics and support the exponential growth of emerging policies. These newly created structures have led to more policies and procedures at the organization and point-of-care levels. Document analysis of the grey literature reveals that PIDAC has created 15 infection control best practice documents that support environmental cleaning, hand hygiene, routine practices, screening, testing, and surveillance for the prevention of transmission and management of HAIs (PIDAC, 2011) (see Appendix L). These infection control guidelines and algorithmic procedures and policies were disseminated to hospitals to standardize infection control protocols and practices across the province.

Analysis of the findings illustrates that these structural frameworks continue to change the management of infectious disease. In fact, they continue to develop, for example, the MOHLTC recently transferred responsibility of PIDAC and the RICNs to Public Health Ontario. The amalgamation of the regional and provincial bodies under PHO recognizes the alignment of these bodies with PHO's legislated mandate (PHO, 2011) and streamlines the existing and new policies for infection control. This partnership reduces duplication of effort and provides more comprehensive and effective

infectious disease management in the province (PHO, 2011). An important finding from the study is that a major challenge at both the organizational and the point-of-care levels is keeping current with the directives from PHO and implementing these new best practice infection control protocols and practices.

The NHS has responded to these directives and new infection control policies by investing in organizational resources and human infrastructure to manage infectious disease. These implemented strategies include frequent hand hygiene audits of all healthcare professionals, glow-germ® audits of housekeeping, and the terminal cleaning of patient rooms. There has been an increase in the education of all NHS healthcare professions in proper hand hygiene and infection control procedures. Furthermore, the NHS has implemented the use of isolation gowns, masks, and gloves as protective barriers at the point-of-care and increased the number of alcohol-based hand-rub dispensers in hospital units, patient rooms, and throughout the hospital sites.

The NHS has supported the use of new equipment and products such as Bath-in-a-Bag®, Hygie-bags® (disposable liners), macerators, and Verna Care Units. As well, there has been an increase in the number of semi-private and single rooms used for patient isolation, made available by renovating former four-bed rooms to semi-private rooms and former semi-private rooms to private rooms. In addition, the NHS instituted infectious disease outbreak strategies immediately, which included increased staffing, increased auditing of PPE, limited visiting hours, increased use of checklists to monitor infection control policy compliance, increased swabbing of patients, weekly meetings of health professionals with management, and weekly summary reports. Other instituted

organizational strategies include greater transparency of reported infectious disease data to the public and to the Niagara Region Public Health Department, the MOHLTC, and public reporting on the hospital website. The NHS has also invested in human infrastructure by hiring five new ICPs since 2003 and a senior infection control officer at the executive level. Seven ICPs are employed in the NHS and work across all sites. However, there has not been an increase in nursing human resource capacity to manage infectious disease at the point-of-care.

The Impact of New Infection Control Protocols and Practice on the Changing Nature of Work

The implications of the implementation of infection control strategies and new standardized infection control protocols and practices, has overwhelmed the NHS and changed the nature of the work of healthcare professionals. Analysis of the study findings demonstrate that there has been a shift in focus from the daily care of patients to an increased focus and time spent on infection control procedures. In general, healthcare providers are focusing largely on the management of the patient's infectious disease status, not on the patient's primary diagnosis. Care structures are changing as the focus has shifted away from the patient because healthcare professionals are preoccupied with following the increased number of infection control protocols and practices, making their work more mechanical and algorithmic.

At the individual practitioner level, work has changed for ICPs, laboratory staff, executives, and frontline nurses in different ways. The daily work of ICPs has changed with the increase in epidemiological trending of data, which includes monitoring,

categorizing, and reporting of infectious disease data to manage daily crises in the control of infectious disease (e.g., outbreaks). The profession has grown in numbers, and there is increased interprofessional education and communication with executives and frontline nurses.

Daily work has changed for laboratory staff because of the increased volume of HAI specimen samples that are received for surveillance. The institution of new technologies and the change from manual to electronic recording of data have increased the laboratory staff's productivity. Thus, they face the pressure to report faster results because quick turnover time is expected from hospital staff, but they are curtailed by (a) when they get the sample from the hospital and (b) the length of time it takes to report the test results (24 to 48 hours in most cases). Therefore, their work has changed because of the increase in the efficiency of technology and the demand for more surveillance of infectious disease specimens.

At the executive level, work has changed because of increased accountability to monitor and report data daily, weekly, and monthly, and to manage rising HAI rates and outbreaks. Executives have also invested in new organizational resources, strategies, and human infrastructure. It is a major challenge for executives to keep current with the directives from PHO and implement the numerous best practice infection control protocols and practices.

The continual rise in infectious diseases and outbreaks have had the greatest impact on nurses because of the *24/7* requirement of care. Thus, infection control protocols and practices have significant implications on their daily practices. For

example, when nurses care for patients in isolation, they spend more time putting on and removing PPE. Nurses reported that an additional three to six minutes is required per patient to put on and remove gowns and gloves every time the nurse goes into the patient's room, which may be as many as 20 times a day for one patient. The amount of time required for PPE varies based on the complexity of the patient. This was reported to be as high as 120 additional minutes per patient per shift. This has implications for daily work. This increase in time is a major change to nursing work because the procedure of putting on and removing isolation gowns is not unique to medical units, it is occurs on all acute care units.

It is interesting that the empirical literature does not support the combined use of isolation gowns and gloves as an added benefit in preventing the transmission of HAIs (Saunders et al., 2006; Vorex et al., 2008). Robert and Myers (2003) indicated that the use of gloves alone are just as effective as the use of gloves and isolation gowns together in preventing the transmission of C. difficile. Therefore, without evidence to support the use of isolation gowns when using gloves, their use is not warranted as a form of PPE for use with patients infected with C. difficile, especially when considering the workload and time required to don and doff gowns numerous times per shift.

Work has changed because of the constant procedure of moving patients and their beds in order to cohort patients or to put patients with the same infectious disease together in semi-private rooms. Patients with infectious diseases are also moved to single rooms. This has resulted in major changes to the nature of nurses' work at the point-of-care as they now participate in the daily phenomenon of *bed moving* of patients with infectious

disease. The consistent and frequent movement of patients with infectious disease often amount to between 15 and 17 patient moves in one shift in order to cohort patients who have tested positive for the same infectious disease in the same room (e.g., two MRSA positive patients). This practice has resulted in increased reports by frontline nurses of musculoskeletal strains and injuries, workers compensation usage, and disability-related time off work.

Consequently, there has been a change in nurses' workload, workflow, and patient load that may change several times a day as the patients in their assigned room's change, which presents a challenge to frontline nurses. The literature confirms that workloads for nurses caring for patients with infectious disease caused by multi-resistant organisms are increasing because of the increase of infection control procedures and therapeutic activities required (Edmunds et al., 2009; Haley, 2004; Williams et al., 2010).

Patient populations are changing and are more heterogeneous. The moving and cohorting of patients in isolation has changed the patient mix on medical, surgical, and emergency units. Patients are not clustered by diagnosed disease; they are now clustered by infectious disease. All nurses need to have expertise in managing patients with infectious diseases. For example, nurses who usually care for surgical patients are now caring for medical patients with HAIs, and ER nurses are now caring for medical patients in the ER as patients wait for two to three days for an inpatient bed. Consequently, the practice has increased the complexity of patient care and nurse's work in the ER and increased the number of roles played by frontline nurses at the point-of-care.

Evidence from the grey literature sources, such as PIDAC and PHO, support the use of isolation policies for infection control, although this is inconsistent with the findings in the published literature. Reviewed empirical studies (Brugman, 2008; Haley, 2003; Harbarth & Sudder, 2006; Kibley et al., 2005; Vicca et al., 2010) had major methodological weaknesses and lacked evidence of sufficient effect sizes associated with specific isolation measures, leading to the conclusion that certain infection control measures are not as effective as previously thought. It is interesting, in the age of evidence-based care, that hospitals are engaging in so many of these infection control practices and protocols, without conclusive evidence to support their utilization.

The Impact of New Infection Control Protocols and Practices on Patient Care

Frontline nurses have participated in an increasing number of algorithmic infection control protocols and practices and felt they were engaging in a new type of nursing care. The cumulative effect of the additional time spent on procedural work has implications for the quality of patient care. The care needs of patients are complex, and nurses are spending more time following infection control policies and procedures and trying to control infectious disease outbreaks, than on patient care. Nurses reported feeling the loss of close contact with patients when wearing gowns, gloves, and masks, which creates a barrier between the nurse and patient. The literature explains that, with increased workloads, patients in isolation receive less care from nurses (Monk et al., 2008). Nurse's work has become more insular as it is difficult to work in a team with so many patients in isolation rooms. Nurses are isolated from their colleagues and, to a

certain extent, their patients. Patients may have several different nurses caring for them in one day depending on the number of room changes the patient endures in one shift. Thus, there is disruption in the continuity of patient care, because nurses have to make *tradeoffs* to maintain infection control practices and procedures.

Implications and Limitations of Infection Control Protocols and Practices

Despite best efforts, infectious disease continues to proliferate in the NHS. The solution is not as simple as following best infection control practices and protocols. While grey literature sources, PIDAC, PHO, and RICNs, support the use of infection control protocols and practices, the empirical literature does not provide conclusive evidence for the use of isolation gowns and isolation precautions in managing infections. Further experimental research is needed to assess the effectiveness of infection control policies and practices. While infection control policies may limit the transmission of infection, there is *no perfect solution* to use to prevent the spread of HAIs.

Many uncontrollable and multi-factorial variables may contribute to the risk of acquiring C. difficile, MRSA, and VRE. Patients seeking care in hospitals have numerous co-morbidities and underlying chronic illnesses that weaken their defence mechanisms and make them more vulnerable to HAIs. Patients' lengths of stay in acute care facilities have increased because of limited homecare services and long-term care facilities available in Ontario. Therefore, the challenges of extended lengths of patients' hospital stays with an increased risk of acquiring HAIs and delays in the admission of patients with HAIs to the hospital while waiting for appropriate isolation facilities, are

challenges that contribute to ER overcrowding and increased opportunity for the transmission of HAIs between patients.

Limitations in the physical structure of older hospitals and longer lengths of hospital stays by patients increase the risk of iatrogenic infections. Additionally, the overcrowding of healthcare facilities for minor ambulatory issues has burdened hospital resources and created challenges in maintaining infection control policies and procedures. There is a growing body of evidence that reveals that overcrowding in hospitals directly influences transmission of HAIs and impedes infection control policies and practices (Demon et al., 2006; McPherson, 2008; Ryer et al., 2009). Likewise, there is an increased presence of CA-MRSA (community-acquired MRSA) and the virulent NAP1 C. difficile strains, whose spores remain endemic in the community, and have contributed to infectious disease outbreaks in hospitals globally. In addition, the high use of broad spectrum antibiotics destroys the effective bacteria in the gastrointestinal tract, allowing C. difficile to multiply. All these factors amount to a *perfect storm* of variables that place limitations on the effectiveness of infection control practices and protocols.

Data Management and Data-Driven Decisions

Work has changed because of the increased responsiveness of healthcare professionals towards the emerging and continually increasing infection rates and increased data management and data-based decisions. Significant change has occurred in the volume and availability of infection-related data that has impacted the daily decisions of healthcare professionals within organizations. The findings suggest the emergence of a new organizational culture that places a major emphasis on infection-related data. Since

the early 1990s, the management of HAI data with electronic decision support has become increasingly important for hospitals (Cox et al., 1992). Thus, the expansion of data needs and recording of HAI data has been growing within organizations with greater emphasis being given to the amount of data and data synthesis. Consequently, because of the availability of electronic decision support systems and the increasing need for information, infectious disease data are not only being disseminated in new ways but are being synthesized more quickly which impacts decision making at all levels of the organization.

Data-Driven Organizational Culture

The NHS has developed new infection control protocols and procedures to manage clinical data and has created an integrated, seamless system that promotes increased communication between disciplines. Data impacts decisions at all levels of the system from the point-of-entry to clinical management of data at the patient level. The findings suggest the creation of a data-driven organizational culture that focuses on managing data through tracking, collecting, monitoring, and reporting of infectious disease metrics on a daily basis. The increased availability of infectious disease and control data has promoted more communication and coordination between ICPs, nurses, managers, administration, and the laboratory staff. The findings suggest that healthcare professionals are inundated with increasing amounts of data and need to synthesize clinical findings and infectious disease data to plan care for their patients. Therefore, because of this emphasis on data and its impact on decision making, there is an increased level of accountability amongst healthcare professionals. The availability of infectious

disease data impacts decision making about workflow and patient care. For example, the cohorting of patients is based on patients testing positive for the same HAIs, which leads to the movement of patients and patient beds. There is an increased use of data to prevent nosocomial infections and to promote compliance with infection control policies, as can be seen with hand hygiene audits. The emergence of an infectious disease data-driven organizational culture is not reported in the literature. This study's findings demonstrate the evolution of a *new paradigm of infectious disease prevention, control, and treatment*. This paradigm can be described in nine steps, which illustrate the management of data and the impact infectious disease data have on decision making at all levels of the system, from the point-of-entry to the clinical level.

A New Paradigm of Infectious Disease Prevention, Control, and Treatment

In the following discussion, the *new paradigm of infectious disease prevention, control, and treatment* will be described through the nine steps that emerged from the study findings. The impact of the *new paradigm of infectious disease prevention, control, and treatment* on the work of frontline nurses, executives, ICPs, and laboratory staff will be discussed.

Step 1. Tracking Data (Screening of Patients upon Admission to Hospital)

The first step in managing infection control data involves the tracking of infectious disease data before hospital admission. This impacts the ER nurse's work because patients are initially screened for an ARO at triage in the ER, in order to determine if the patient acquired an infection before admission to the hospital. The patient's previous history is tracked through the NHS Health Record's electronic

database. This is the first step in making a decision about the patient's infectious disease status. A decision will be made as to whether the patient will be placed in isolation precautions or which infection control procedures should be followed upon patient admission to the hospital.

Step 2. Swabbing and Collecting Samples from Patients

Swabbing a patient for MRSA and VRE is routinely completed within 12 hours of the patient's admission to the hospital. Swabbing is also completed for colonized patients that have been in contact with patients with AROs, have a known history of AROs, or present with respiratory symptoms (i.e., a new onset of a cough or fever). A stool sample is collected from the patient that has been in contact with C. difficile or has symptoms of C. difficile (i.e., diarrhea, abdominal pain, and fever). Weekly swabbing of patients' noses, throats, and rectum, also referred to as *sweeps*, screens patients on inpatient units for the presence of AROs. This impacts both ER nurses and inpatient medical and surgical nurses' work because three swabs or stool samples need to be collected to confirm a positive MRSA, VRE, or C. difficile case, respectively.

Step 3. Surveillance of Infectious Disease Data (Laboratory)

The increased number of microbiology specimens received by the laboratory requires the use of new technologies and procedures for surveillance. New laboratory instruments used are more specific and efficient. The testing medium (e.g., agar plates) is more infectious disease-specific, increasing the accuracy of the results. The increase in efficiency of laboratory tests, impacts laboratory staff's work because the turnover time has decreased to report results to the hospital. Currently, it takes 24 hours to receive

results for MRSA and 48 hours for C. difficile and VRE results. The staff reports a constant pressure to provide results.

Step 4. Receiving Data from Electronic Health Records Database

Laboratory staff enters the patient's data into standardized electronic worksheets on a secure computer, which impacts their work. The microbiology plates (agar) have scannable barcodes that identify each patient so that the records for all specimens are stored electronically. The electronic worksheets, where results are entered, interface with the electronic health record database (i.e., Meditech). The patients' infection control surveillance results are made available to NHS healthcare professionals through these databases. Once received by staff, these data are entered into the daily census sheets. Census sheets are prepared for each unit in the hospital and updated throughout the day by ICPs and by people who monitor the available beds in the hospital (*Bed monitors*). ICPs' work is impacted by the timely receipt of census sheets, requiring them to make quick decisions and transmit information about new cases for surveillance and patient movement.

Step 5. Categorization of Data and Decision Making about Patient Flow

ICPs categorize data daily by confirmed cases of HAIs, new HAI cases, patient swabbing status, and patients that have been in contact with another patient with a HAI. Therefore, patients that are positive for HAIs are categorized and tracked on a daily and monthly basis. The regulation of daily patient flow, through newly created *bed management occupancy meetings*, has an impact on decisions for frontline staff, management, infection control staff, and the administration of the hospital. The

attendance at the bed occupancy management meetings includes senior hospital administration, charge nurses from the ER and inpatient units, ICPs, and a representative from the department of room bookings. The frequency of bed occupancy management meetings is twice a day, usually at 9:15 am and 1:30 pm, and the duration of the meetings are 30 minutes to 1 hour in length. The coordination of bed occupancy management meetings poses a daily major organizational challenge. In the bed occupancy management meetings, decisions are made about the movement of admitted patients waiting in the ER for a bed on an inpatient unit. The bed occupancy management team goes through every hospital unit to decide which patients will be discharged from the hospital and which patients are staying in the hospital. To make these decisions, the bed occupancy team needs to know the number of patients discharged and the number of patients colonized with HAIs, who are new admissions to the hospital and currently in the ER. From these data, decisions are made about how patients will be redistributed on to the hospital units (i.e., cohorting patients by infectious disease or placing patients in semi-private or single rooms). These bed occupancy management meetings have changed the nature of work for health professionals because they are superimposed on an already busy clinical day.

In addition to the bed occupancy meetings, the ICPs consistently communicate with the bed bookings department throughout the day when there are new confirmed cases of HAIs.

Step 6. Collecting Infectious Disease Data

There has been an increase in the amount of infectious disease data that are mandated to be collected at the clinical level. It includes internal checks and audits of infection control procedures and monitoring the transmission of nosocomial infections. For example, hand hygiene data on all healthcare professionals are collected using a *hand washing auditing observation tool* that was prepared by the MOHLTC's *Just Clean your Hands* program (2010). A weekly hand hygiene audit occurs on infectious disease outbreak units. Quarterly, auditing organization-wide is completed across sites, as well; directives from the NHS executives to audit two sites per month, per quarter, randomly are completed. Likewise, the collection of PPE audits is regularly completed, only on infectious disease outbreak units, by ICPs. These audits impact frontline nurses as they are monitored for hand hygiene compliance and PPE. Another form of data collection is randomized glow-germ® audits for housekeeping staff. These glow-germ® audits add a concentration of cleanser to the exposed areas in a patient room that have not been thoroughly cleaned, indicating where further cleaning is necessary. Data are also collected about patient's activity and the numbers of patient transfers and roommates a patient has had. Patient movement in the hospital to different rooms, in different units, with different roommates, up to discharge, is tracked, and entered into Meditech.

Step 7. Entering and Recording Data

The large quantity of infection control data increases the reporting requirements for ICPs who spend more time entering data and on epidemiological trending than working with frontline staff. The management and assimilation of reportable data

requires a stepwise process for both entering and recording data. To manage the volume of various sources of infectious disease data, a coordinated effort has to take place among frontline staff, charge nurses, ICPs, infection control managers, administrative staff, and decision support. The data are manually recorded and entered into computer databases daily (Microsoft Excel® worksheets), by ICPs, and takes from 10 minutes to 1 hour. An administrative assistant summarizes the monthly data and sends it to the ICP manager, who reports data to the MOHLTC on a monthly basis. Additionally, the ICPs keep their own manual log of any new cases and monitor any increases in nosocomial infection activity.

Step 8. Reporting Data

Since 2008 to 2009, the NHS, specifically the executive team, has been required to report the incidence of MRSA, VRE, and C. difficile publicly and to the MOHLTC, monthly. The transparency of available infectious disease metrics between hospital sites encourages competiveness among hospitals to decrease the number of HAIs at their site. Mandatory public reporting promotes an increased emphasis on rigour in the monitoring of data from the senior management level. The transparency of data encourages greater accountability and responsibility by the organization at all levels to prevent the transmission of HAIs. In addition, C. difficile cases are reportable to the Niagara Region Public Health Department. Therefore, consistent communication takes place between the ICPs and Niagara Region Public Health Department regarding the number of new cases of C. difficile during infectious disease outbreaks. In addition, the data collected from the hand hygiene audits are publically reported to the MOHLTC and to the hospital

administration. Updated data on hand hygiene compliance are given to senior administration daily and reports are sent monthly to and are published by the MOHLTC. A summary of hand hygiene data is also used as a benchmark to compare all the sites within the NHS.

Step 9. Managing Data Clinically: New Clinical Innovations

The daily review of clinical infectious disease data by healthcare professionals promotes immediate decisions at the clinical level; this directly impacts nurses' daily work. New clinical innovations to manage data include the institution of *visual management white boards* to promote clinical consistency of infectious disease data among healthcare professionals. The use of visual management white boards are considered the gold standard in reporting HAIs when used to increase timely communication between all disciplines in the management of patients with HAIs. The visual management white boards, located at every nursing station, visually depict the recent changes and new patient infectious disease data.

A second clinical innovation is the use of the *daily huddle*, which is used to rapidly transmit infectious disease data to point-of-care nursing staff. In order to manage the volume of data at the clinical level, the daily huddle is used to debrief point-of-care nursing staff with respect to infection control issues. This daily debriefing session supports healthcare professionals who are engaging in a new form of decision making. Patients are no longer cared for based on their diagnoses; rather, healthcare professionals are focusing on integrating and managing data about their patient's infectious disease status into their plan of care.

The final new clinical innovation is the implementation of daily, weekly, and monthly *communications networks* to report infectious disease metrics between staff, management, infection control practitioners, and senior hospital leadership. As healthcare professionals are inundated with infectious disease data, they have become efficient at developing an interwoven communication network that allows them to make decisions in managing new changes to infectious disease data, and to communicate these changes at a rapid speed.

Communications and Connectivity

The findings from this study demonstrate that work has changed for healthcare professionals because of the increase in interprofessional communication and connectivity among disciplines at the micro, meso, and macro levels. There have been increased support systems for frontline nurses from the ICPs and hospital executives, who provide increased education, awareness, and strategies for nursing staff about implementing infection control policies and practices. Thus, the overlay of infection control promotes increased interdependence among the frontline staff, infection control practitioners, and management. Additionally, there is consistent daily interprofessional communication and decision making among the disciplines. For example, daily communication takes place between ICPs, nurse managers, and the Chief Nursing Officer. Hospital and professional association leadership are consistently kept abreast daily about the units that are on infectious disease outbreak, the availability of inpatient beds, and the potential trends that are emerging for future outbreaks. The organization has also promoted a shared governance model with the establishment of unit councils that

encourage dialogue amongst nurses. According to the literature, positive leadership at the unit level is a necessary prerequisite for promoting increased resources and organizational support in the implementation of new infection control practices (Garen, 2011; Yukel, 2009).

Bronfenbrenner's Ecological Systems Theory: An Explanation of Increased Connectivity among Disciplines

The connectivity among frontline nurses, ICPs, laboratory staff, and executives in the management of emerging infectious disease can be explained using Bronfenbrenner's (1977) *Ecological Systems Theory*. This theory was initially developed to describe child development within the context of the systems of relationships that form a child's environment (Bronfenbrenner's 1977). However several researchers have applied the general principles of this family theory, within an organizational context (Gregson, 2011). This theory can be used to examine the multiple effects and interrelatedness of social elements in an environment (Gregson, 2001). The most noteworthy characteristics of this theory that were used in the analysis of the study findings are the relevance of four levels -- macro, exo, meso, and micro, which describe environmental influences of the intercultural, community, organizational, and individual levels.

Microsystems. Bronfenbrenner's (1977) theory recognizes that, not only does the environment directly affect the person, but that each level is interconnected and has an impact on the other (see Figure 1, Appendix M). The microsystems consist of individual or interpersonal features and those aspects of groups that comprise social identity (Gregson, 2001). At the micro level in the NHS, the frontline staff are experiencing the

direct impact of HAIs as they care for an increasingly complex population of patients with infectious disease. Their daily work has changed and consists of increased procedural work and implementation of numerous infection control protocols and practices. Additionally, frontline staff are managing data using new clinical innovations (i.e., the daily huddle, visual management white boards, and communication networks). In addition, at the micro level, laboratory staff are involved in increased surveillance of HAIs, and ICPs are working with the frontline staff and hospital management to prevent the transmission of HAIs in the NHS.

Mesosystems. According to Bronfenbrenner (1977), the mesosystems are the organizational or institutional factors that shape the environment within which the individual and interpersonal relations occur (Gregson, 2001). These can include rules, policies, and acceptable behaviours within an organization (Gregson, 2001). In the NHS, the mesosystem includes the infection control practices and protocols, which are mandated by NHS management and executives, and the MOHLTC. It is the senior leadership within the organization that provides the direction of the infection control policies and procedures that are implemented at the point-of-care. This includes the implementation of isolation policies, cohorting patients by infectious disease, and placing patients in single and semi-private rooms. Also included are the strategies that executives have implemented to control infections, such as environmental cleaning, the integration of new products, increased hand hygiene education, and alternative methods to remove waste. Moreover, the management of data and decisions also takes place at the meso level as healthcare professionals are required to track, monitor, collect, enter, categorize,

and report infectious disease data, which has promoted the development of a *paradigm of infectious disease prevention and control.*

Exosystems. The exosystems refer to the community level of influence, including fairly established norms, standards, and social networks (Gregson, 2001). In the NHS, an exosystem includes the overarching legislative bodies such as PHO, PIDACC, and the RCINs, which have developed best practice documents to standardize infection control in Ontario. These algorithmic practices and protocols have had direct and indirect impact on how HAIs are managed in the NHS.

Macrosystems. Finally, macrosystems consist of the contextual cultural environment (Bronfenbrenner, 1979). In the NHS, there has been an emerging culture of infectious disease prevention and control that has been influenced by focusing events, such as SARS, and increased media attention to the infectious disease outbreaks in noteworthy and small community hospitals in Ontario. The media play a significant role in shaping the organization's response to infectious disease at all levels. Media serve to communicate information and to assist in the development of expectations for all individuals in the culture (Gregson, 2001). Ultimately, the interconnectivity between each level of Bronfenbrenner's micro, meso, exo, and macro systems suggests a new interdependence among all levels of the hospital system that have not been reported in the literature. Each level is no longer functioning as an individual silo in a multi-silo system, because the overlay of infectious disease has influenced interprofessional interactions, connecting each level of the system.

Limitations of the Study

In qualitative descriptive studies, the researcher is the main instrument of data collection and analysis (Patton, 2002; Strauss & Corbin, 1998). The acknowledgment and disclosure of the researcher's perspective enhances the credibility and confirmability of the study (Patton, 2002; Sandelowski, 1986; Strauss & Corbin, 1998). This study focuses on one hospital system in Southern Ontario, which limits the ability to make assumptions about the findings beyond the context in which the study takes place. A limitation of the study design includes a small sample size, making it difficult for the findings to be generalized beyond the study population. A convenience sample of healthcare professionals was purposefully selected for qualitative interviews based on the recommendations of the NHS Interim CEO, formally known as the Vice President of Patient Services and the Chief Nurse Executive. The participants were selected because of their convenient accessibility and their willingness to participate; therefore, they may have been subject to volunteer bias, which decreases the reliability and validity of the research.

CHAPTER 7: CONCLUSION

The study findings demonstrate that work has changed for healthcare professionals in managing the rapid proliferation of infectious disease. Work has changed because of the establishment of new provincial, regional, and hospital infrastructures that are required to address the emerging infections. The province is continually engaged in the development of new committees, agencies, and institutions, monitoring metrics, and in the creation of standardized infection control protocols and practices to manage infectious disease. There are major challenges in keeping current with new infection control directives from PHO and implementing best practice infection control protocols. This has impacted work both the management level and at the point-of-care.

At the practitioner level, there are an increased number of decisions and interventions that focus on controlling infectious disease. Care structures are constantly changing as the focus has shifted away from the patient, because of healthcare professionals' preoccupation with infectious disease and infection control policies and procedures. This makes healthcare professionals' work more mechanical and algorithmic. Furthermore, work has changed for all healthcare professionals because the delivery of daily care has shifted from a clinically-driven culture to a culture that is data-driven. There has been an organizational shift towards infectious disease data collection, surveillance, monitoring, and treatment, which have changed the nature of work for all hospital healthcare professionals. The *new paradigm of infectious disease prevention, control, and treatment* illustrates how the availability and dissemination of data has

promoted increased connectivity and communication among disciplines on a daily, weekly, and monthly basis. This is a shift in organizational culture that is driven by data requirements and infection control procedures that has changed the nature of healthcare professionals' work. Consequently, because of all these changes, there are opportunity costs that occur in the delivery of patient care.

Implications and Recommendations

The findings illustrate that the NHS has invested both human and fiscal resources in promoting an organizational culture that supports infectious disease management and infection control. Yet, despite best efforts, the NHS has not been able to prevent infectious disease outbreaks. According to the PHAC field epidemiologist (CTV News, July 7, 2011), "There is a need to find out if there are particular problems with hospital infection prevention methods - or if the sudden upswing of cases simply is the result of more vigilant surveillance." The findings demonstrate that there are several challenges in controlling infectious disease, many of which have changed the nature of healthcare professionals' work. Many of these challenges are the result of maintaining the current infection control protocols and practices that are being utilized to manage HAIs. Suggested recommendations at the clinical, institutional, and healthcare system level follow:

Clinical Level

Decrease the Volume of Patient Bed Movements

Patients are constantly being moved to different rooms to cohort patients with similar infections in the same room. This bed and patient movement may increase the

risk of cross-contamination of C. difficile spores in the physical environment, on surfaces, and on equipment. A recommendation for the NHS is to create isolation units where patients with HAIs can be quarantined from other patients and to decrease the number of bed and patient movements.

Metrics to Evaluate Workload of Clinical Staff

Nurses' experience increased workloads from the constant bed and patient moving and the time spent putting on and removing isolation gowns, gloves, and masks. In order to manage the daily increase in procedural work and the data-based decisions at the point-of-care, it is recommended that there be further quantitative research that is targeted towards measuring the increase workloads of nurses caring for patients with infectious diseases.

Institutional Level

Assessment of Infection Control Protocols, Practices and Policies on Work

The emergence of standardized protocols and practices has changed the nature of health professional's work. It is recommended that experimental research is conducted on the effectiveness of these current infection control protocols and practices on health professional's work. It is also recommended that future studies evaluate the effectiveness of clinical innovations on nursing work. Moreover it is recommended that an evaluation of isolation criteria for cohorting patient is further assessed. Additionally, further research needs to evaluate if the current infection control government policies are appropriate in addressing the unique needs in managing infectious diseases in small community hospital

settings. Finally, further studies need to evaluate the impact of such variables: location, institutional practices, and regional infection control services on work, work practices and infectious disease processes.

Examine Current Infection Control Protocols and Practices in Targeted Areas

The findings demonstrate that there is a need to examine the issues of overcrowding of patients in the ER and the use of isolation barriers, specifically, the impact of "magic curtains" in increasing the risk of acquiring nosocomial infections. There is a lack of supporting evidence for these practices. It is recommended that there be an in-depth examination, and further studies in emergency departments to assess the effectiveness of these infection control practices.

Changes to the Physical Plant

The findings confirm the evidence that single rooms, with individual sinks and bathrooms may prevent the transmission of infectious diseases between patients and healthcare professionals. While the NHS has invested in several strategies to manage infections, more fiscal resources need to be dedicated to support the renovations of the existing physical plants at all hospital sites. It is recommended that the NHS increase the number of hand washing sinks and create more private and semi-private rooms.

Targeted Funding for Infection Control Policies and Procedures

Recognition of the impact and of the importance of emerging infectious diseases, at both the institutional and the clinical level, must take place. An evaluation of cost effectiveness of current infection control protocols and practices needs to be carried out.

It is recommended that the organization conduct an economic analysis to understand the costs of managing infectious disease within the NHS.

Healthcare System Level

Providing Funding for the Availability of Antibiotic Treatment of Patients in their Homes

Patients who have numerous comorbidities and underlying chronic illnesses need to receive their medication and antibiotic treatments at home or in long-term care facilities; which would decrease the transfer of patients to hospitals for medication and antibiotic treatments, decreasing their risk of acquiring C. difficile. It is recommended that having more people cared for in their homes would decrease the number of patients admitted to hospitals, and decrease the risk of the transmission and acquisition of infectious diseases.

Promoting the Utilization of Urgent Care Centres

It was reported that the use of acute care facilities for minor ambulatory services burdens the emergency department and increases the probability of infectious disease transmission. It is recommended that an increase in public education and media coverage be used to promote increased access and utilization of urgent care centres.

Early Notification of the Public of New C. difficile Cases

At risk patient populations could avoid accessing services at a particular hospital if timely data reporting of an increased number of C. difficile cases were made available to the public. It is recommended that *just-in-time* data reports be released to the public, informing them about accessing hospital websites to update information of HAIs as soon as a case has been identified, not at the end of the month, which is the current mandated

practice. It is recommended that provincial data be collected on the characteristics of confirmed case of patients that have C. difficile and that this data is compared across hospitals the province of Ontario.

Consistent Infectious Disease Outbreak Definitions

The findings demonstrate that there is variability in infectious disease outbreak definitions within the organization and that there is often confusion amongst healthcare professionals as to whether or when a unit is in outbreak. It is recommended that a consistent definition and terminology be used to describe the incidence of an infectious disease outbreak and that these are standardized across the province. Furthermore, it is recommended that a 3 year longitudinal study is completed to assess the characteristics of outbreak hospital sites, the location of the outbreaks, the patient characteristics and other essential variables.

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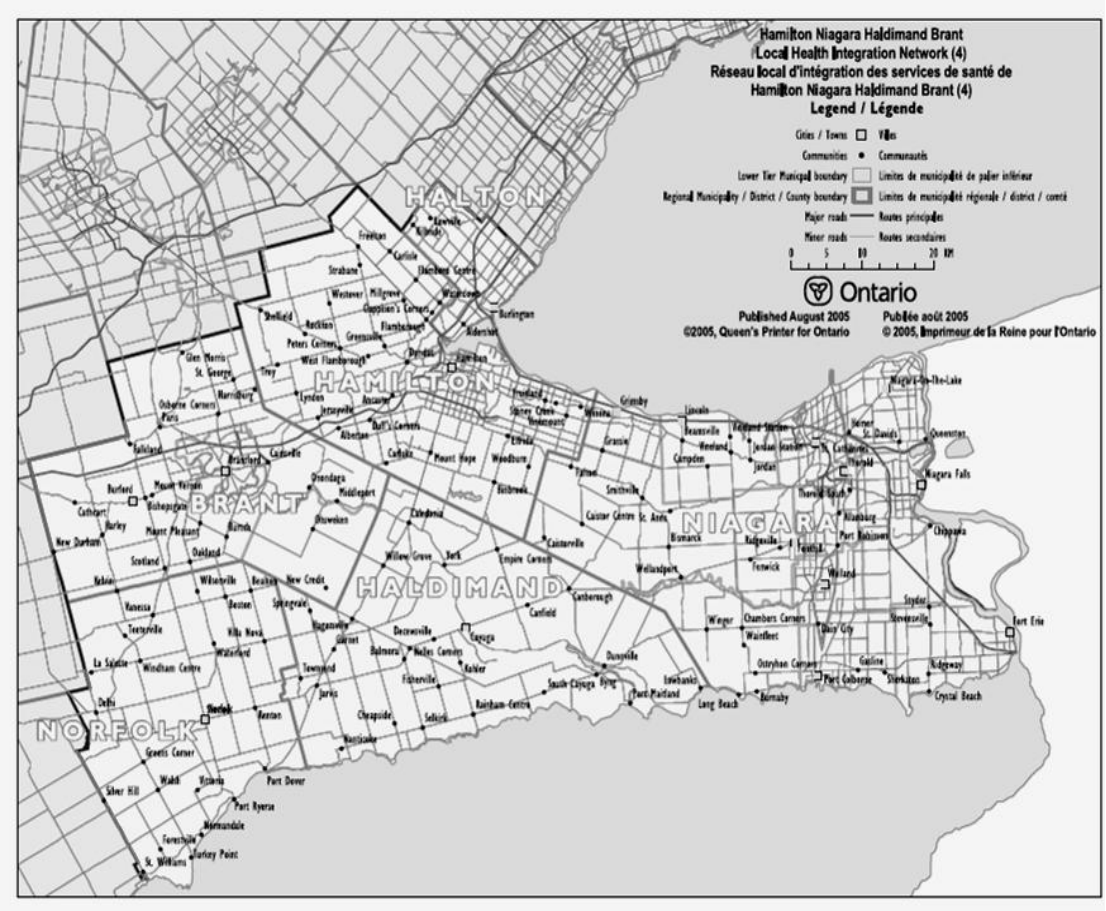
APPENDICES

Appendix A. Map of Hamilton Niagara Haldimand Brant Local Health Integration Network (LHIN 4)



Source: http://www.lhins.on.ca/FindYourLHIN.aspx

Appendix B. Map of the Study Hospitals Sites in the Niagara Health System

Source: http://www.niagarahealth.on.ca/services/

Appendix C. Participant Information and Consent Form

Participant Information and Consent Form

Research Team: Andrea Baumann, RN, PhD (PI), Alyshah Kaba, RN, BScN (MSc Student), Noori Akhtar-Danesh, PhD, Camille Kolotylo, RN, PhD

What is the purpose of the project?

You are being invited to participate in a research project exploring the impact of Hospital Acquired Infections (HAIs) on the changing nature of work for frontline nurses, nurse executives, laboratory staff, and infection control practitioners in community hospitals within the Hamilton Niagara Haldimand Brant Local Health Integration Network (LHIN 4). This study will provide baseline data for government policy-makers, hospital administrators, and other stakeholders in understanding the changing nature of health professionals' work. Findings will assist government decision-makers and other stakeholders in forecasting future policy implications for the management of infectious diseases, particularly in community hospitals.

What will be expected of me as a participant?

As a participant, you will be asked to take part in an interview lasting between 60 and 90 minutes. You will be asked questions about your everyday practices in the management of hospital acquired infections, your general experience of the nature of your work in this setting, and your perceptions of infection control policies and their impact on your role as a health professional in this setting.

How will I benefit from participating in this project?

Following your participation in the interview, we will send you a letter of appreciation that can be included in your Professional Portfolio. Additionally, the results of this study will be shared with the Ministry of Health and Long Term Care in an effort to aid decision-makers at the governmental and organizational level in planning for and maintaining a sustainable healthcare workforce in community hospitals in Ontario.

Are there any risks to participating in this project?

There are no known risks to you for participating in this study. Questions will focus on your experiences as a health professional working in a community hospital. Taking part in the study is completely voluntary. You are free to choose whether or not you will participate. At anytime throughout the research process you have the freedom to withdraw without any adverse consequences or questioning on the part of the researcher.

Confidentiality

Interviews will be tape-recorded and transcribed; however, all personal information will be kept confidential. Your name will not appear in any reports or publications. 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 when the project is complete. You have the right to listen to the tape for your session or read the transcript in which you participated.

Consent to participate

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 my work experiences as a health professional in a community hospital in Ontario. 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 will receive a signed copy of this form.

Name of Participant	Signature	Date
_____		
Research Team Member	Signature	Date
_____		
Person Obtaining Consent	Signature	Date
_____		

If I have any questions about this project, I understand my contact is Alyshah Kaba, Nursing Health Services Research Unit, McMaster University at (905)525-9140, Ext. 22507, kabaa@mcmaster.ca.

If I have any questions regarding my rights as a research participant, I understand that I may contact Niagara Health System Research Ethics Board, Welland Hospital Site, 65 Third Street, Welland, ON, L3B 4W6 at 905-378-4647, Ext. 32202 and/or the Office of the Chair of the Hamilton Health Sciences/Faculty of Health Sciences Research Ethics Board at 905-521-2100, Ext. 42013.

Appendix D. Information Letter

Information Letter

Research Team
Andrea Baumann, RN, PhD (PI), Alyshah Kaba, RN, BScN (MSc Student), Noori Akhtar-Danesh, PhD, Camille Kolotylo, RN, PhD

Background Information
As disease patterns change, healthcare facilities must adapt and create new strategies to ensure they have sufficient surge capacity to cope with changing work patterns. Little is known about the organizational context of disease management of HAIs or antibiotic-resistant HAIs and the delivery of care by nurses, nursing executives, infection control staff, and Infection Control Practitioners (ICPs) in community hospitals. New infection control policies, specifically isolation precautions and personal protective equipment (PPE), and public reporting systems have been implemented (MOHLTC, 2008), but research has not evaluated the perceptions of nurses, nurse executives, laboratory staff, and ICPs about the changing nature of their work following the implementation of these policies.

The purpose of this study is to explore the impact of HAIs on the changing nature of work for frontline nurses, nurse executives, laboratory staff, and infection control practitioners.

Objectives of this exploratory study are to:

1. Describe the incidence of HAIs and antibiotic-resistant HAIs in selected community hospital sites in the Niagara Health System, from 2008 to 2011.
2. Describe the workforce profiles and demographic characteristics of healthcare and nursing executives, frontline nurses, laboratory staff, and ICPs in selected community hospital sites in the Niagara Health System.
3. Describe infection control policies and practices, specifically isolation precautions and personal protective equipment (PPE), in selected community hospital sites in the Niagara Health System, from 2008 to 2011.
4. Explore and describe the perceptions of frontline nurses, nurse and healthcare executives, laboratory staff, and ICPs about the change in their work, in selected community hospital sites in the Niagara Health System.

Data Collection

This study will employ an exploratory, descriptive case study design whereby qualitative interviews will be conducted with frontline nurses (RNs and RPNs), nursing executives (managers, and clinical vice presidents), laboratory staff, and ICPs. Additionally, workforce and demographic questionnaires will be administered to frontline nurses, nursing and healthcare executives, laboratory staff, and ICPs. Document analysis of policy documents will involve an exploratory examination of isolation precautions and PPE infection control policies. Finally, available databases will be utilized to access incidence and prevalence data for HAIs, specifically MRSA, VRE, and C. difficile, from 2003 to 2011.

Expected Outcomes

In the short-term, this study will provide hospital administrators and other stakeholders with information in understanding the changing nature of health professionals' work. Additionally, it will have policy implications for the management of infectious diseases, particularly in community hospitals. Finally, by understanding the perception of health professionals the study will aid decision-makers at the governmental and organizational level to better plan for and address the organizational and environmental challenges in monitoring, reporting, and in the prevention of HAIs in community hospitals in Ontario.

If you would like to participate or if you have any questions about this project, please contact: Alyshah Kaba, Nursing Health Services Research Unit, McMaster University at (905)525-9140 ext. 22507, kabaa@mcmaster.ca

Appendix E. Demographic Questionnaire

Demographic Questionnaire

General Demographic Information for Health Professionals ID No. _____

1. Health Professional Occupation (please mark one of the following):
   - RN
   - RPN
   - Nursing Executive(s) (please identify your positions) _____
   - Laboratory staff (please identify your position) _____
   - Infection Control Staff (please identify your position)_____

2. Education: _____Certificate
   _____Diploma
   _____Baccalaureate Degree
   _____Master's
   _____ PhD
3. Additional certificates obtained (list type of certificates currently held):
_____
4. Current Employment Status: _____Full-time
   _____Shared position
   _____ Part-time
   _____Other (please list)
5. Average hours of work per week: _____
6. Schedule: _____ 8hr
   _____10hr
   _____ 12hr
   _____ Other
7. Number of years work experience in your current occupation _____

8. Number of years in current position _____
9. Number of years working in NHS_____
10. Number of years in this hospital: _____
11. Sex: Female _____ Male_____
12. What year you were born: _____

Adapted from Colleges of Nurses of Ontario (CNO) membership survey (2009).

Appendix F. Staff Nurses and Nurse Executive Interview Guide

Staff Nurses and Nurse Executives
Interview Guide

Research Team

Andrea Baumann, RN, PhD (PI), Alyshah Kaba, RN, BScN (MSc Student), Noori Akhtar-Danesh, PhD, Camille Kolotylo, RN, PhD

Preamble
I am very interested in learning about the changing nature of your work. I am specifically interested in how the rise in infectious disease in your organization has impacted your work practices. I have a few questions to ask that will take several minutes of your time to answer. Thank you again for agreeing to participate in this interview. If at any time you do not feel comfortable answering a question, you do not have to answer it, and we will proceed to the following question.

Nature of Work: The Impact of Infectious Disease (frontline nurses and nurse executives)

1. Tell me about a typical day when caring for patients with hospital acquired infections.
    - *Probe: Do you have support systems to help you cope when you are caring for numerous patients with HAIs?*
    - *Ask about detailed interactions with other staff, patients*
    - *Ask about # of pts they have in one shift, nurse-patient ratio, are there usually enough nurses on the unit, if there are increased numbers of patients with HAIs?*

2. How long have you been an employee with Niagara Health System? Have you seen a rise in infectious disease since you starting working in the Niagara Health System?
    - *Probe: what specific infections have you seen a rise in? (MRSA, VRE, C. difficile);*
    - *Are you seeing any newly emerging infectious diseases?*

3. Please identify how your work has changed in the past 5 years because of the rise in HAIs? Can you provide me with some examples?
    - *Probe: what types of challenges has this caused for you?*
    - *Has there been an increase in staffing ratios, workloads, more resources allocated to control infections?*

4. What is your perception on how the care of patients with hospital-acquired infectious diseases has changed in the past 5 years because of the rise of HAIs in your workplace? Please provide me 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 as complete care as you would like to?*
    - *Or are there things you are not able to complete in the course of a day?*

5. 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?*
    -
7. How have polices on Isolation Precautions (isolating patients with HAIs 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?*

8. 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 you find that other health professionals always adhere to these policies?*
    - *Do you find that families always adhere to these policies?*
    - *What are the challenges you face in educating families/relatives about PPE policies?*

9. 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)?*

10. How have the Infection Control Practitioners supported you in preventing, controlling, and managing HAIs?
    - *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 infectious control?*
    - *Have you had any in-services about HAIs?*
    - *What type of in-services have you received?*

Appendix G. Laboratory Staff and Infection Control Practitioners Interview Guide

Laboratory Staff & Infection Control Practitioners
Interview Guide

Research Team

Andrea Baumann, RN, PhD (PI), Alyshah Kaba, RN, BScN (MSc Student), Noori Akhtar-Danesh, PhD, Camille Kolotylo, RN, PhD

Preamble:
I am very interested in learning about the changing nature of your work. I am specifically interested in how the rise in infectious disease in your organization has impacted your work practices. I have a few questions to ask that will take several minutes of your time to answer. Thank you again for agreeing to participate in this interview. If at any time you do not feel comfortable answering a question, you do not have to answer it, and we will proceed to the following question.

Organizational structure:

1. Tell me about your role in this organization?
    - *Probe: where does your role fit in the organizational structure?*

2. Who do you directly report to in this organization?
    - *Probe: internally and externally*

Nature of Work: The Impact of Infe*ctious Disease*

1. Tell me about a typical work day and the nature or kind of work you engage in – what you do and whom you would interact with?

2. How do you perceive your work has changed, specifically related to the spike in incidence and prevalence of infectious disease in your organization? Please give me a few examples.
    - *Probe: what specific antibiotic resistant HAI has been steadily increasing each year?*

3. Please identify the impact on your work of the institution's infection control policies and practices aimed at controlling the transmission of HAIs

4. What do you perceive to be the organizational challenges in monitoring, reporting, and preventing the transmission of antibiotic-resistant HAIs?

5. What do you perceive to be the environmental challenges in monitoring, reporting, and preventing the transmission of antibiotic-resistant HAIs?

Laboratory Staff (specific questions)

1. What has been your role in recognizing and confirming that an outbreak has taken place on a specific hospital unit?

2. Explain how the demands of your work have changed over the past five years when it comes to infection control monitoring, reporting, and surveillance of infection rates and outbreaks of infectious disease. Please give me some examples.

3. What are the criteria the organization (NHS) uses to identify an outbreak? Is it unique for each hospital site?

4. What kind of technologies do you use to support and enhance the monitoring, reporting, and management of HAIs?
    - *Probe: Please describe how those technologies have changed since you started working in this organization? Has it been sudden or over time?*

5. Are you responsible for entering data for hospital acquired infections (HAIs)?
    - *Probe: If yes, where do you enter the data? To whom do you send the data i.e. wards? Decision support? MOHLTC, Infection control? Others?*
    - *Probe: Are these electronic or manual submissions?*

6. Explain the type of collaboration that takes place between infection control practitioners and laboratory staff in the monitoring, reporting, and prevention of HAIs?
    - *Probe: If there are no collaborations between these two departments, why do you think that is? Are there any other departments you collaborate with, concerning issues of monitoring, reporting, and management of infectious disease?*

Infection Control Practitioner (specific questions)

1. What is your primary role in preventing infections acquired by patients once hospitalized?
    - *Probe: what strategies do ICP's utilize to prevent secondary infections?*

2. Describe your role in monitoring and surveillance of new incidences of HAIs and 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 the process of developing approaches to reduce HAIs. Do you collaborate with other departments, such as the laboratory staff, in the development of approaches to reduce HAIs? Do you collaborate with anyone else? Please explain.

6. How do ICPs work with frontline nurses in preventing the transmission of HAIs on each unit?
    - *Probe: Are you responsible for providing in-services for frontline nurse? If yes, what kind of in services have you're provided? Have the nurses found this type of education useful in prevention hospital acquired infections?*

7. Is there anything else that you would like to discuss?

Appendix H. Incidence of MRSA, VRE, and C. difficile, 2008 to 2011

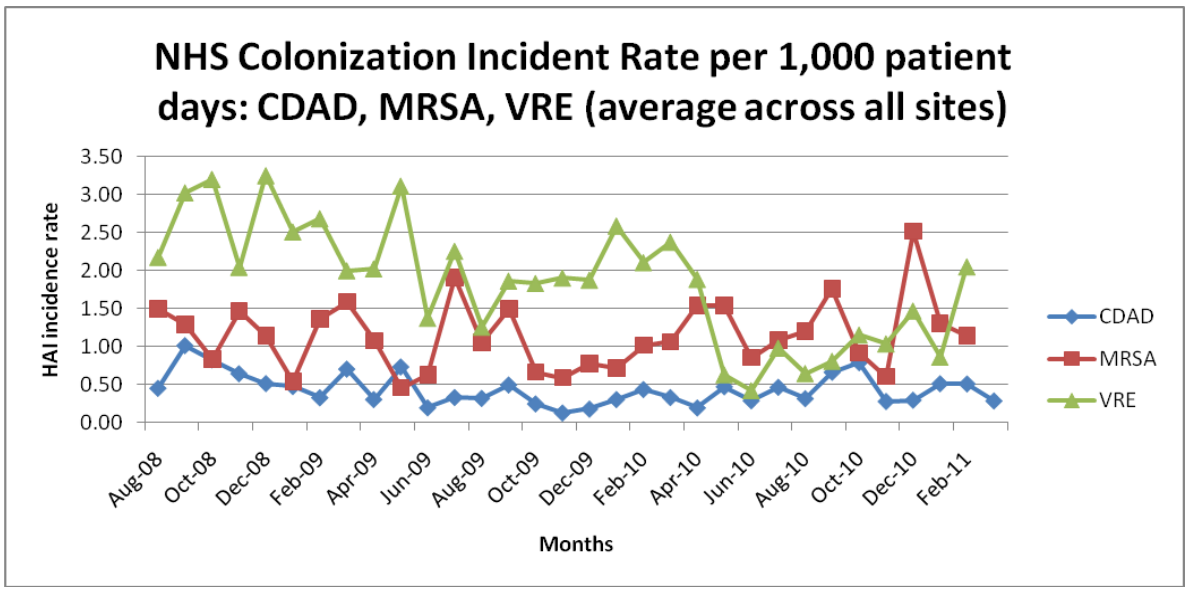


Figure1. NHS Colonization Incident Rate per 1,000 Patient Days for CDAD, MRSA, VRE

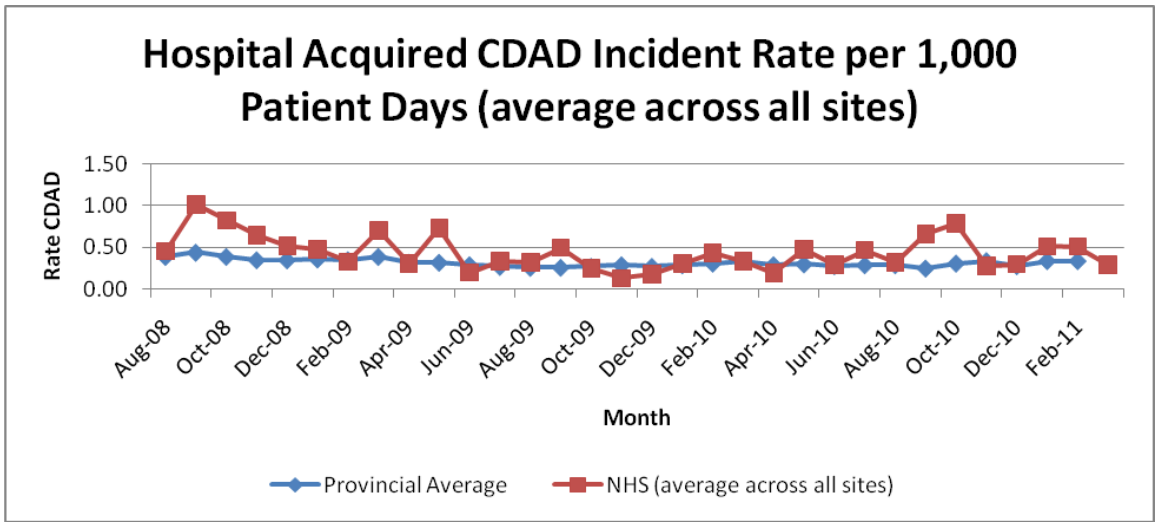


Figure 2. Hospital-Acquired CDAD Incident Rate per 1,000 Patient Days

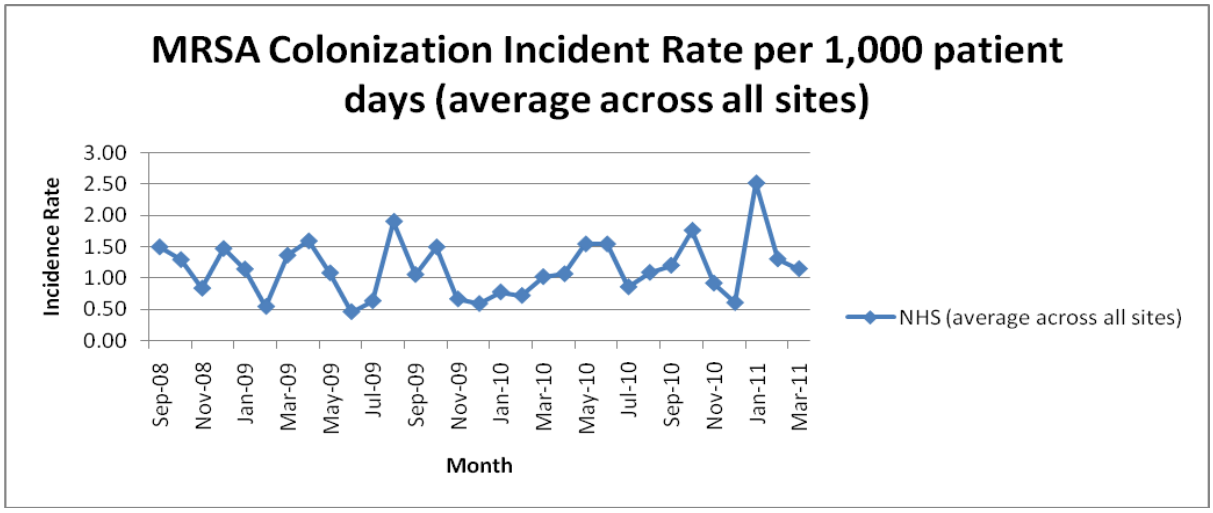


Figure 3. MRSA Colonization Incident Rate per 1,000 Patient Days (averaged across all sites)

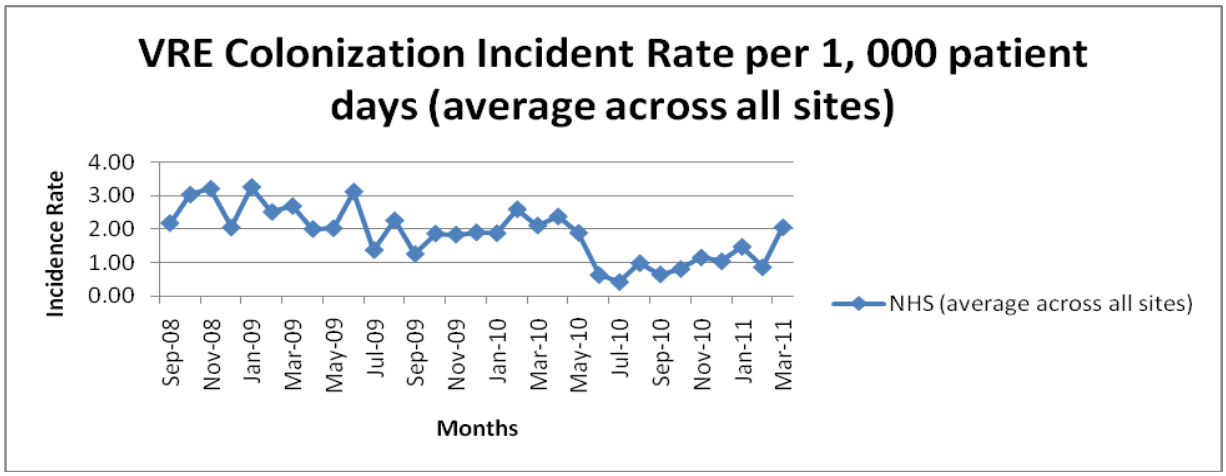


Figure 4. VRE Colonization Incident Rate per 1,000 Patient Days (averaged across all sites)

Appendix I. Workforce Demographic Data of Study Sample

Table 1

Healthcare Professionals: Occupation

Healthcare Professional	Frequency	Percent (%)
RN	10	33.3
RPN	5	16.7
Nursing Executives	4	13.3
Laboratory Staff	6	20.0
ICP	5	16.7
Total	30	100.0

Table 2

Healthcare Professionals: Highest Educational Level

Healthcare Professional	Certificate n (%)	Diploma n (%)	Undergrad Degree n (%)	Masters n (%)	PhD n (%)	Total N (%)
RN	0 (00.0)	7 (70.0)	3 (30.0)	0 (00.0)	0 (00.0)	10 (100)
RPN	2 (40.0)	2 (40.0)	1 (20.0)	0 (00.0)	0 (00.0)	5 (100)
Nursing Executives	0 (00.0)	0 (00.0)	2 (50.0)	1 (25.0)	1 (25.0)	4 (100)
Laboratory Staff	0 (00.0)	4 (66.7)	2 (33.3)	0 (00.0)	0 (00.0)	6 (100)
ICP	0 (00.0)	3 (60.0)	0 (00.0)	1 (20.0)	1 (20.0)	5 (100)
Total	2 (6.7)	16 (53.3)	8 (26.7)	2 (26.7)	2 (6.7)	30 (100)

Table 3

Healthcare Professionals: Current Employment Status

Healthcare Professional	Full-Time n (%)	Part-Time n (%)	Total n (%)
RN	9 (90.0)	1 (10.0)	10 (100.0)
RPN	5 (100.0)	0 (00.0)	5 (100.0)
Nursing Executives	4 (100.0)	0 (00.0)	4 (100.0)
Laboratory Staff	3 (50.0)	3 (50.0)	6 (100.0)
ICP	5 (100.0)	0 (00.0)	5 (100.0)
Total	26 (86.7)	4 (13.3)	30 (100.0)

Table 4

Healthcare Professionals: Average Hours per Week Worked

Healthcare Professional	Mean	Minimum	Maximum	Standard Deviation
RN	44.20	35.00	45.00	19.50
RPN	39.30	37.50	44.00	2.80
Nursing Executives	47.50	40.00	60.00	10.00
Laboratory Staff	32.90	25.00	37.50	5.30
ICP	38.00	37.50	40.00	1.80
Total	40.50	25.00	99.00	12.60

Table 5

Healthcare Professionals: Shift Schedules in Hours

Healthcare Professional	8hr n (%)	12hr n (%)	Other n (%)	Total n (%)
RN	4 (44.4)	3 (33.3)	2 (22.2)	9 (100.0)
RPN	0 (00.0)	3 (60.0)	2 (40.0)	5 (100.0)
Nursing Executives	3 (75.0)	0 (00.0)	1 (25.0)	4 (100.0)
Laboratory Staff	5 (83.3)	0 (00.0)	1 (16.7)	6 (100.0)
ICP	4 (80.0)	0 (00.0)	1 (20.0)	5 (100.0)
Total	16 (55.2)	6 (20.7)	7 (24.1)	29 (100.0)

Table 6

Healthcare Professionals: Number of Years at their Current Occupation

Healthcare Professional	Mean	Minimum	Maximum	Standard Deviation
RN	22.6	8.00	31.0	8.07
RPN	22.4	3.00	36.0	13.00
Nursing Executives	19.5	3.00	33.0	15.10
Laboratory Staff	15.4	0.50	25.0	10.90
ICP	11.5	2.00	31.0	1.06
Total	18.9	0.50	36.0	10.95

Table 7

Healthcare Professionals: Number of Years in their Current Positions

Healthcare Professional	Mean	Minimum	Maximum	Standard Deviation
RN	14.6	1.00	31.0	11.3
RPN	17.8	1.00	29.0	12.3
Nursing Executives	5.0	2.00	10.0	3.6
Laboratory Staff	15.4	.50	24.0	8.7
ICP	5.5	2.00	10.0	1.1
Total	12.5	.500	31.0	10.0

Table 8

Healthcare Professionals: Number of Years Worked in the NHS

Healthcare Professional	Mean	Minimum	Maximum	Standard Deviation
RN	16.7	3.0	29.8	10.90
RPN	18.2	3.0	29.0	11.60
Nursing Executives	13.3	2.0	26.0	10.80
Laboratory Staff	16.0	16.0	16.0	00.00
ICP	19.3	3.5	31.0	00.35
Total	16.9	2.0	31.0	11.00

Table 9

Healthcare Professionals: Gender

Healthcare Professional	Female n (%)	Male n (%)	Total n (%)
RN	10 (100.0)	0 00.0)	10 (100.0)
RPN	4 80.0)	1 (20.0)	5 (100.0)
Nursing Executives	3 (75.0)	0 (00.0)	4 (100.0)
Laboratory Staff	5 (83.3)	1 (16.7)	6 (100.0)
ICP	5 (100.0)	1 (25.0)	5 (100.0)
Total	27 (90.0)	3 (10.0)	30 (100.0)

Table 10

Healthcare Professionals: Age in Years

Healthcare Professional	Mean	Minimum	Maximum	Median	Standard Deviation
RN	52.1	46.0	58.0	53.0	4.5
RPN	46.0	30.0	57.0	44.0	11.4
Nursing Executives	52.0	48.0	56.0	55.0	4.4
Laboratory Staff	48.3	41.0	66.0	49.0	9.2
ICP	54.3	49.0	58.0	54.0	3.1
Total	50.4	30.0	66.0	50.0	7.3

Appendix J. Niagara Health System Infection Control Policies and Procedures

Title of Niagara Health System Policy/Procedure	Effective Date
Antibiotic Resistant Organisms (ARO) – MRSA and VRE Policy	June 25, 2008
Antibiotic Resistant Organisms (ARO) – MRSA and VRE Procedure	June 25, 2008
Antibiotic Resistant Organisms (ARO) – MRSA and VRE – Appendix A: Sample Protocol for Transporting Patients on Contact Precautions	June 25, 2008
Antibiotic Resistant Organisms (ARO) – MRSA and VRE – Appendix D1: Management of a Single New Case of MRSA	June 25, 2008
Antibiotic Resistant Organisms (ARO) – MRSA and VRE – Appendix D2: Management of Suspected Nosocomial MRSA	June 25, 2008
Antibiotic Resistant Organisms (ARO) – MRSA and VRE – Appendix D3: Management of a Single New Case of VRE	June 25, 2008
Antibiotic Resistant Organisms (ARO) – MRSA and VRE – Appendix D4: Management of Suspected Nosocomial VRE	June 25, 2008
Antibiotic Resistant Organisms (ARO) – MRSA and VRE – Appendix H: NHS Modes of Transmission	June 25, 2008
Antibiotic Resistant Organisms (ARO) – MRSA and VRE – Appendix L: NHS Terminal Clean Checklist	June 25, 2008
Clostridium Difficile Infection (CDI) Procedure	June 25, 2008
Construction / Renovation Guidelines Policy	February 22, 2005
Construction / Renovation Guidelines Procedure	February 22, 2005
Infection Prevention & Control Strategic Plan, 2009-2011 Strategic Priorities	March, 2011 (Updated May 18, 2011)
Hand Hygiene Policy	March 11, 2009
Hand Hygiene Procedure	March 11, 2009
Management of an Outbreak of ARO (MRSA or VRE) Policy	September 3, 2010
Management of an Outbreak of ARO (MRSA or VRE) Procedure	September 3, 2010
Management of an Outbreak of ARO (MRSA or VRE) Procedure – Appendix D: Outbreak Check List (Sample)	September 3, 2010
Management of an Outbreak of ARO (MRSA or VRE) Procedure – Appendix E: Hospitality Outbreak Metrics (Sample)	September 3, 2010
Outbreak Control Measures For Intersite Transfers/Admissions	May 13, 2011
Public Health Agency Infection Control Resource Team Recommendations	January 15, 2009
Preventing Febrile Respiratory Illness Policy	May 12, 2009
Preventing Febrile Respiratory Illness Procedure	May 12, 2009

Appendix K. Grey Literature Government Documents

Taskforce Reports

1. Naylor, D. *Learning from SARS: Renewal of public health in Canada: A report of the National Advisory Committee on SARS and public health*. Ottawa, Canada: Health Canada; 2003
2. Campbell, A. *Interim report: SARS and public health in Ontario*. Toronto, ON: MOHLTC; 2004.
3. Campbell, A. SARS Commission second interim report: SARS and public health legislation. Toronto, ON: MOHLTC; 2005.
4. Campbell A. *SARS Commission final report: Spring of Fear*. Toronto, ON: MOHLTC; 2007.
5. Walker D. *For the public's health: A plan for action*: Final report of the Ontario *Expert Panel on SARS and Infectious Disease Contro*l. Toronto, ON: MOHLTC; 2004.

General Reports

1. *Be Pandemic Prepared: Protecting Our Community and Healthcare Staff Report*, Toronto, ON: MOHLTC; 2004.
2. Ontario Burden of Infectious Disease Study (ONBOIDS) Report. Toronto, ON: PHO; 2010.
3. Connecting People, Connecting Practice Report. Toronto, ON: Regional Infection Control Networks; 2006-2007.
4. Building Regional Infection Control Networks (RICNs) Toronto, ON: Regional Infection Control Networks; 2007.
5. Syndromic Surveillance in Ontario: Current Initiatives and Future Directions Report. Toronto, ON: PHO; 2009.
6. Prevention and Control of Hospital-acquired Infections Report. Office of the Auditor General of Ontario. Toronto, ON: MOHLTC; 2007.
7. Additional Precautions for Preventing the Transmission of Infection in Healthcare, Communicable Disease Report. Toronto, ON: PHO; 2009.
8. Borders to Bridges Report. Toronto, ON: RICNs; 2006.
9. RICN Acute Care Sector Report. Toronto, ON: RICNs; 2007.
10. RICN Community Care Sector Report. Toronto, ON: RICNs; 2008.
11. RICN Provincial Qualitative Report. Toronto, ON: RICNs; 2009.
12. RICN Public Health Sector Report. Toronto, ON: RICNs; 2009.
13. Infection Prevention and Control Programs in Ontario. Toronto, ON: PIDAC ; 2009.

Best Practices Guidelines

1. Best Practices for Infection Prevention and Control Programs in Ontario in All Healthcare Settings, Toronto, ON: MOHLTC; 2008.
2. Practical Guidelines for Infection Control in Healthcare Facilities, Toronto, ON: MOHLTC; 2008.
3. Healthcare-associated Infections (HAIs) Guidelines. Toronto, ON: MOHLTC; 2009.
4. Infectious Diseases - Infection Control Guidelines, Toronto, ON: MOHLTC; 2009.
5. Disease Prevention and Control Guidelines, Toronto, ON: MOHLTC; 2010.
6. Protecting Healthcare Workers from Infectious Diseases, OPH, Toronto, ON, 2011.

Infection Control Procedures

1. Environmental Cleaning Toolkit, Toronto, ON: Regional Infection Control Networks (RICNs); 2010.
2. CHICA-Canada Standards and Guidelines Core Committee. Hand hygiene, Toronto, ON: CHICA; 2011.
3. Routine practices and additional precautions for preventing the transmission of infection in healthcare. Toronto, ON: MOHLTC; 2010.
4. Communicable Diseases Surveillance Protocols. Toronto, ON: Ontario Hospital Association; 2010.
5. Cleaning, Disinfection and Sterilization. Toronto, ON: Provincial Infectious Diseases Advisory Committee; 2008.
6. Environmental Cleaning for Prevention and Control of Infections , Toronto, ON: Provincial Infectious Diseases Advisory Committee; 2009.
7. Hand Hygiene. Toronto, ON: Provincial Infectious Diseases Advisory Committee, 2009.
8. Routine Practices and Additional Precautions in Ontario, Provincial Infectious Diseases Advisory Committee. Provincial Infectious Diseases Advisory nto, ON: PIDAC; 2009.
9. Prevention of Transmission of Acute Respiratory Infection. Toronto, ON: PIDAC; 2009.
10. Surveillance of Healthcare-Associated Infections. PIDAC. Toronto, ON: PIDAC; 2009.
11. Best Practice guideline, Clostridium difficile. Toronto, ON: PIDAC ; 2009.
12. Cleaning, Disinfection and Sterilization. PIDAC. Toronto, ON: PIDAC; 2009.
13. Best Practice Guidelines, MRSA/VRE PIDAC. Toronto, ON: PIDAC.

Legislative Policies

1. Just Clean Your Hands Program. Toronto, ON: MOHLTC; 2008.
2. Just Clean Your Hands for Long-Term Care Homes. Toronto, ON: MOHLTC; 2009.
3. Mandatory public reporting of patient safety indicators .Toronto, ON: MOHLTC; 2008.
4. C. difficile Public Health Outbreak Policy. Toronto, ON: MOHLTC; 2009.
5. Antibiotic Resistant Organisms Surveillance Protocol for Ontario Hospitals, Ontario Hospital Association and the Ontario Medical Association. Toronto, ON: Joint Communicable Diseases Surveillance Protocols Committee; 2008.
6. Infection control resource teams (ICRTs), Toronto, ON: OPH; 2010.

Appendix L. PIDAC Best Practice Documents

Policies and Best Practice Manuals

1. Cleaning, Disinfection, and Sterilization
2. Environmental Cleaning for Prevention and Control of Infections
3. Infection Prevention and Control Programs in Ontario
4. Hand Hygiene
5. Routine Practices and Additional Precautions in Ontario
6. Screening, Testing, and Surveillance for Antibiotic-Resistant Organisms
7. Prevention of Transmission of Acute Respiratory Infection
8. Testing, Surveillance and Management of Clostridium Difficile
9. Surveillance of Healthcare-Associated Infections

Fact Sheets

1. Hand Hygiene Fact Sheet for Healthcare Settings
2. Flash Sterilization in Healthcare Settings
3. Addition to PIDAC Guideline Documents
4. Methicillin-Resistant Staphylococcus

Presentations

1. Presentation: Surveillance of Healthcare Associated Infections (August 7, 2008).
2. Presentation: *C. Difficile* and Surveillance (June 26, 2008).

Appendix M. Bronfenbrenner's Ecological Systems Theory

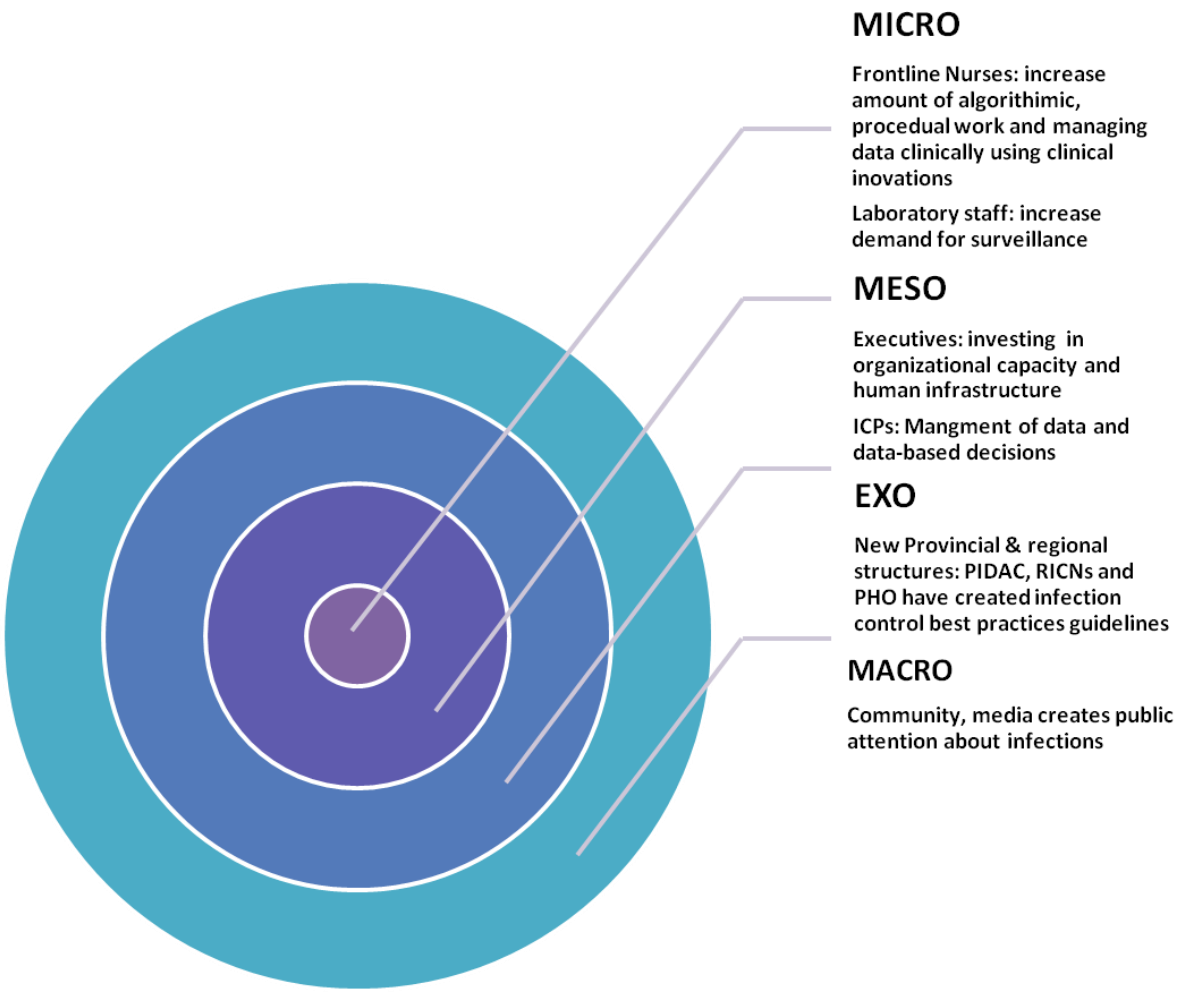


Figure 1. Impact of Emerging Infections on the Changing Nature of Health Professionals' Work: Increased Connectivity and Collaboration between Disciplines

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, 2010).

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, 2010).

Airborne Precautions: Airborne Precautions are used in addition to Routine Practices for patients known or suspected of having an illness transmitted by the airborne route (i.e., by small droplet nuclei that remain suspended in the air and may be inhaled by others; PIDAC, 2010).

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, 2010).

Benchmark: A validated figure that may be used for comparison provided data is 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, 2010).

CHICA: The Community and Hospital Infection Control Association of Canada, a professional organization of persons engaged in infection prevention and control activities in healthcare settings. CHICA offers a board certification for infection control practitioners (PIDAC, 2010).

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, 2010).

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, 2010).

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, 2010).

Cohorting of Staff: The practice of assigning specified healthcare providers to care only for patients known to be colonized or infected with the same microorganism. These healthcare providers would not participate in the care of patients who are not colonized or infected with that microorganism (PIDAC, 2010).

Colonization: The presence and growth of a microorganism in or on a body with growth and multiplication but without tissue invasion or cellular injury or symptoms (PIDAC, 2010).

Contact Precautions: Additional practices to reduce the risk of transmitting infectious agents via contact with an infectious person. Contact Precautions are used in addition to Routine Practices (PIDAC, 2010).

Contamination: 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, 2010).

Droplet Precautions: Droplet Precautions are used in addition to Routine Practices for patients known or suspected of having an infection that can be transmitted by infectious droplets (PIDAC, 2010).

Hand Hygiene: 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.

Hand Washing: The physical removal of microorganisms from the hands using soap (plain or antimicrobial) and running water (PIDAC, 2010).

Hospital Acquired Infection (HAI) or Healthcare-Associated Infection (HAI): A term relating to an infection that is acquired during the delivery of healthcare (also known as '*nosocomial infection'*) (PIDAC, 2010).

Health Professional: Any person delivering care to a client/patient/resident. This includes, but is not limited to, the following: emergency service workers, physicians, dentists, nurses, respiratory therapists and other health professionals, personal support workers, clinical instructors, students and home healthcare workers. In some non-acute settings, volunteers might provide care and would be included as a healthcare provider (PIDAC, 2010).

Healthcare Setting: Any location where healthcare is provided, including settings where emergency care is provided, 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, 2010).

Infection: The entry and multiplication of an infectious agent in the tissues of the host. 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 (disease; PIDAC, 2010).

Infection Prevention and Control Physician: Physician with specific training and expertise in the principles of epidemiology and infection prevention and control, and who incorporates infection prevention and control into his/her continuing professional development (PIDAC, 2010).

Infection Prevention and Control Program: A healthcare facility or organization (e.g., hospital, long-term care, continuing complex care, home care) program responsible for meeting the recommended mandate to decrease infections in the patient, healthcare

providers and visitors. The program is coordinated by healthcare providers with expertise in infection prevention and control and epidemiology (PIDAC, 2010).

Infection Control Practitioner(s) (ICPs): Trained individual(s) 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 a CHICA-Canada endorsed infection control program within six months of entering the role and must acquire and maintain Certification in Infection Control (CIC), when eligible (PIDAC, 2010).

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, 2010).

Long-Term Care (LTC): A broad range of personal care, support and health services provided to people who have limitations that prevent them from full participation in the activities of daily living. The people who use long-term care services are usually the elderly, people with disabilities, and people who have a chronic or prolonged illness (PIDAC, 2010).

Ministry of Health and Long Term Care (MOHLTC). The Ministry of Health and Long-Term Care is patient-focused, results-driven, integrated and sustainable publicly funded health system in Ontario. Ministry provides overall direction and leadership for the healthcare system, focusing on planning, and on guiding resources to bring value to the health system (PIDAC, 2010).

Methicillin-Resistant *Staphylococcus aureus* (MRSA): MRSA is an ARO which resistant to all of the beta-lactam classes of antibiotics, such as penicillins, penicillinase-resistant penicillins (e.g., cloxacillin) and cephalosporins (PIDAC, 2010).

Community-Acquired MRSA (CA-MRSA): MRSA bacteria which causes infection in people who have not been hospitalized nor had a medical procedure within the last year. These infections usually manifest as skin infections such as pimples and boils and can occur in otherwise healthy people. CA-MRSA is usually spread through direct physical contact or through contact with objects contaminated with infected bodily fluids. At any given time, between 20% and 30% of the general population carry Staphlococcus bacteria on their hands or in their noses but are not ill (PIDAC, 2010).

Outbreak: For the purposes of this document, an 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. Outbreak criteria for each HAI are also defined on the MOHLTC website (PIDAC, 2010).

Personal Protective Equipment (PPE): Clothing or equipment worn for protection against hazard (PIDAC, 2010).

Point-of-Care: The place where three elements occur together: patient, the healthcare provider and care or treatment involving patient contact. The concept usually refers to a hand hygiene product which is easily accessible to staff by being as close as possible, i.e., within arm's reach, to where patient contact is taking place. Point-of-care products should be accessible to the care provider without the provider leaving the zone of care, so they can be used at the required moment (PIDAC, 2010).

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, 2010).

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, 2010).

Public Health Ontario (PHO): Public Health Ontario, (PHO) formally known as the Ontario Agency for Health Protection and Promotion (OAHPP) is an arm's-length government agency dedicated to protecting and promoting the health of all Ontarians and reducing inequities in health. As a hub organization, PHO links public health practitioners, front-line health workers and researchers to the best scientific intelligence and knowledge from around the world (PIDAC, 2010).

Regional Infection Control Networks (RICN): The RICN of Ontario coordinate and integrate 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 utilization of best-practices within the region. There are 14 regional networks in Ontario (PIDAC, 2010).

Routine Practices: The system of infection prevention and control practices recommended by the Public Health Agency of Canada to be used with all patients during all care to prevent and control transmission of microorganisms in all healthcare settings. (PIDAC, 2010)

Staff: Anyone conducting activities in settings where healthcare is provided, including healthcare providers (PIDAC, 2010)

Surveillance: The systematic ongoing collection, collation and analysis of data with timely dissemination of information to those who require it in order to take action (PIDAC, 2010).

Terminal Cleaning: The cleaning of a patient/ room or bed space following discharge or transfer of the patient, in order to remove contaminating microorganisms that might be acquired by subsequent occupants. In some instances, terminal cleaning might be used once some types of Additional Precautions have been discontinued. Terminal cleaning methods vary, but usually include removing all detachable objects in the room, cleaning lighting and air duct surfaces in the ceiling, and cleaning everything downward to the floor. Items removed from the room are disinfected before being returned to the room (PIDAC, 2010).

Transmission: Transmission of infections can take place via many potential routes. Infectious organisms may be transmitted either by direct or indirect contact. Direct contact occurs when an individual comes into contact with the reservoir. Indirect contact occurs when the organism is able to withstand the harsh environment outside the host for long periods of time and still remain infective when specific opportunity arises (PIDAC, 2010).

Vancomycin-Resistant Enterococci (VRE): the bacterial strains of the genus *Enterococcus* that are resistant to the antibiotic vancomycin. VRE is an ARO which is most commonly spread from person to person by direct contact usually with the hands (PIDAC, 2010).