Nurses' Perception of Readiness for Mass Casualty Events Involving Children

by

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Abstract

After a mass casualty event, there is an expectation that hospitals will safely care for all patients—adults and children alike—who require medical and non-medical attention, regardless of any challenges they may face. In Canada, there are no national emergency preparedness standards for hospitals to follow, and coordination amongst hospital networks across the nation is fragmented at best. Within healthcare, there is an assumption that when resources are limited, patient care that is appropriate for adults is also suitable for children. However, children have unique physical and developmental care needs and they are not simply small versions of their adult counterparts. During mass casualty events where children are involved, hospitals must be ready to receive and provide patient care for both children and adults. However, many studies have shown that due to a lack of funding, resources, and time nurses consistently report feeling unprepared to care for children during mass casualty events.

This study focuses on understanding how prepared pediatric-trained nurses are to respond to mass casualty events involving children. Registered Nurse (RN) participants responded to a survey with questions that included four domains: professional demographics and employment history, experience working as an RN in a mass casualty event, knowledge questions related to current organizational mass casualty procedures, and perceptions on professional preparedness. Results of the study found that 74% of participants agree that a mass casualty event involving primarily children, requiring what is known as a Code Orange activation will occur at some point during their career. Nurse participants do not currently receive regular training related to a Code Orange activation and are overall dissatisfied with the little training provided. The study found that the nurses believe emergency preparedness is important to their professional development. The importance of regular training to improve hospital readiness throughout a nurse's career,

beginning in nursing school, is discussed. Other factors that can increase perceived preparedness include years of clinical nursing experience along with experience in specialty services such as emergency care and critical care.

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List of Acronyms

Acute Care of at-Risk Newborns (ACORN)

Association of Pediatric Hematology/Oncology Nurses (APHON)

Bachelor of Science in Nursing (BScN)

Canadian Nurses Association (CNA)

Centers for Disease Control and Prevention (CDC)

College of Nurses of Ontario (CNO)

Emergency Nurse Certified (C)anada (ENC(C))

Emergency Nursing Pediatric Course (ENPC)

Emergency Preparedness Team (EPT)

Emergency Room (ER)

Hospital Preparedness Program (HPP)

Incident Command System (ICS)

Incident Management System (IMS)

Intensive Care Unit (ICU)

International Council of Nurses (ICN)

London Health Sciences Centre (LHSC)

Metropolitan Medical Response System (MMRS)

National Disaster Medical System (NDMS)

National Incident Management System (NIMS)

Neonatal Intensive Care Unit (NICU)

Pediatric Advanced Life Support (PALS)

Preparedness and Emergency Response (PHEP)

Registered Nurse (RN)

Registered Practical Nurses (RPNs)

Research Ethics Board (REB)

Royal Roads University (RRU)

Trauma Nursing Core Course (TNCC)

United States (US)

U.S. Department of Health and Human Services (HHS)

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Chapter One-Introduction

The ability for hospitals to respond to mass casualty events reflects the nation's overall level of emergency preparedness (Ferrier, n.d.). Hospitals are regarded as leaders within the communities of which they are a part of, and there is an expectation that during an emergency, hospitals will fulfill their leadership role regardless of any challenges and barriers they may face (Ferrier, n.d.). However, limited time, resources, funding, and staff training mean that some hospitals have a general sense of complacency when it comes to emergency preparedness (Ferrier, n.d.).

In Canadian hospitals, there is little coordination of emergency preparedness and there are no national standards for hospital emergency training (Ferrier, n.d.). The National Framework for Health Emergency Management (2004) is a comprehensive document addressing emergency management in the healthcare field, providing an overview of emergency management and key topics to consider in the context of healthcare, but not hospitals. The Federal Policy for Emergency Management, published by Public Safety Canada (2009), focuses more on safety rather than health. There is little in either of these federal guidance documents to guide hospital preparedness. Neither the National Framework nor the Federal Policy provide the guidelines or assessment tools that are needed for hospitals to outline what a hospital prepared to respond to mass casualty events look like. Accreditation Canada currently mandates that accredited hospitals in Canada have an all-hazard disaster and emergency response plan, that staff receive regular training on their ability to support the plan, and that the plan is regularly tested with drills and exercises to evaluate the state of response preparedness (Accreditation Canada, 2017). However, while accreditation is highly regarded and strongly recommended, it is not compulsory for all Canadian hospitals to be accredited.

In the United States (U.S.), the Hospital Preparedness Program (HPP) is supported by the Office of the Assistant Secretary for Preparedness and Response and provides federal preparedness funding for hospitals and health care systems (U.S. Department of Health & Human Services (HHS), 2019). Through the HPP, federal preparedness and response capacity supports regional coalitions to ensure coordination and integration of medical preparedness and response (HHS, 2019). After September 11, 2001 and Hurricane Katrina in 2005, initiatives such as the National Incident Management System (NIMS) were developed, along with programs such as Basic Disaster Life Support to provide disaster responders with skills and consistency (Fox & Timm, 2008).

Gaps in the system persist as few programs address the unique circumstances that come with responding to a mass casualty event where children are involved (Fox & Timm, 2008). Little research and few standards and guidelines for hospitals specifically relate to mass casualty events, let alone mass casualty events that involve children. Hospitals across Canada do not have minimum standards for providing clarity or consistency in what hospital emergency preparedness entails in the context of children, meaning they are left to their own resources, including self-funding preparedness. This often pushes emergency preparedness to a low priority, delegated as an afterthought assignment to whomever is able in the organization.

At Children's Hospital at London Health Sciences Centre (LHSC), current emergency preparedness training is minimal. Registered Nurses (RN)s complete an online learning module related to all hospital emergency codes, including Code Orange on an annual basis. Within the hospital system, a Code Orange is defined as an event that results in a large number of casualties presenting to a hospital, and due to either the critical condition of patients or the sheer volume of patients, the event overwhelms the Emergency Room (ER) and the hospital. Additional training

specifically on Code Orange is sporadic. Some hospital staff have volunteered handful of staff have volunteered to be part of the hospital's Emergency Response Team, and therefore receive additional training in the decontamination process of any chemical, biological, radiological, nuclear, or explosive hazards. New staff working in the ER at Children's Hospital at LHSC receive a half-hour didactic classroom presentation regarding Code Orange response as part of their orientation program. In the last year, a small team of twelve staff from the ER, critical care, and Neonatal Intensive Care Unit (NICU) formed an Emergency Preparedness Team (EPT) to receive additional training on emergency preparedness. The team meets four times a year to learn the basic principles of Code Orange activation and response with the goal of providing guidance and 'just in time' training to their peers during a mass casualty event.

This proposed study focuses on improving understanding of preparedness in mass casualty events involving children in the hospital setting, using RNs at Children's Hospital at LHSC as a study population. While several previous studies focused on nurses working in one department such as the ER or in an Intensive Care Unit (ICU) where both children and adults are seen, this study is unique in that it examines the perception of readiness of pediatric-trained nurses in one organization across different in-patient and out-patient departments. Results will inform current training and practices for Code Orange type situations, including mass casualty events involving children in Canadian hospitals. Results will also spotlight the capacity and education gaps among nurses to meet the needs of children and their families impacted by a mass casualty event.

Research Problem, Purpose and Questions

Research Problem.

RNs are the largest group of health care professionals in Canada, with 270,000 working across the nation (Canadian Nurses Association (CNA), 2013). RNs have been recognized as making positive impacts on many aspects of both patient care and the health care system (CNA, 2013). However, little is known about nurses' preparedness for responding to mass casualty events involving children.

In Canadian hospitals, emergency preparedness initiatives generally lack coordination and there are no national standards for hospital emergency training (Ferrier, n.d.). Mass casualty events involving children will not only impact pediatric designated hospital organizations; all hospitals across the country must be prepared. Children will be brought to the nearest hospital for stabilization before being transferred to a more acute or pediatric specialized care centre, depending on their injuries and overall condition. Additionally, all departments within a hospital will be impacted in the event of a disaster, even if they do not provide direct care for patients from the disaster. Therefore, it is important to understand the nurses' perception across the entire hospital when studying hospital preparedness for mass casualty events.

Research purpose and questions.

The purpose of this research study is to assess pediatric RNs' perception of emergency preparedness at Children's Hospital at LHSC to gain a deeper understanding of the current level of the overall hospital preparedness for mass casualty events involving children using an online survey. This study involves nurses with an RN designation from all clinical units and departments at Children's Hospital at LHSC. During a mass casualty event all departments within a hospital organization will be impacted and will therefore need staff to respond in some

capacity. The following research questions guided this study: (1) What are the perceptions of readiness amongst RNs working at Children's Hospital at LHSC regarding mass casualty events involving children? Do these differ in comparison to mass casualty events involving primarily adults? and (2) What is the level of knowledge amongst RNs regarding preparedness for mass casualty events involving children? Are these levels of knowledge impacted by seniority, experience, and professional training?

The results of this research will provide baseline data on the current level of preparedness at a pediatric tertiary care centre and inform future education and training initiatives in mass casualty events for nurses working in a pediatric tertiary care centre.

Theoretical and Conceptual Framework

Kanter's theory of structural empowerment (1977) states that the therapeutic interactions and the care nurses provide have a direct impact on patient outcomes (Spence Laschinger, Gilbert, Smith & Leslie, 2010). Structural empowerment focuses on social structures in the workplace that enable staff to accomplish work and achieve organizational goals in meaningful ways (Wong & Laschinger, 2012).

While power in the context of a workplace organization is often associated with hierarchy and authoritative leadership (Kuokkanen & Leino-Kilpi, 2000), empowerment is a social construct associated with increasing influence in a minority group (Kuokkanen & Leino-Kilpi, 2000). It is important to note that organizations do not provide nor prohibit power, but Canadians hospitals has been noted by Daiski (2004) to be traditionally known where nurses often working in ranks and competitive relationships. Bardbury-Jones, Sambrook & Irvine (2007) argue that in a culture where the nursing profession continues to cope with negative

stereotypes, nurses cannot become empowered. And when nurses are not empowered, then these powerless nurses make ineffective nurses (Bradbury-Jones, Sambrook, & Irvine, 2007).

Empowerment is widely used in the nursing research field to describe nursing professional growth and development (Kuokkanen & Leino-Kilpi, 2000). Nurses, who play an integral role of the multidisciplinary health care team, can have a direct impact on patient outcomes due to the direct patient contact and engagement involved in their work (Spence Laschinger, Gilbert, Smith & Leslie, 2010). Because of this important relationship, when nurses are empowered, staff well-being, productivity, and effectiveness increase (Kuokkanen & Leino-Kilpi, 2000). Structural empowerment acknowledges that power can be gained from access to information, support, and resources in the workplace (Kuokkanen & Leino-Kilpi, 2000; Wong & Laschinger, 2012). Therefore, based on Kanter (1977)'s model, when nurses have the knowledge and skill and are well supported, they are more likely to demonstrate empowering behaviours when caring for their patients, bringing about improved patient outcomes (Spence Laschinger, et al., 2010).

This research study seeks to understand the nurses' perceptions of emergency preparedness regarding mass casualty events involving children and to understand how empowerment related to preparedness may be positively correlated with knowledge and skill (Kuokkkanen & Leino-Kilpi, 2000; Wong & Laschinger, 2012). Under structural empowerment theory, we will use nurses' perceptions of preparedness to inform us of the education and training initiatives required to prepare nurses for such events.

Chapter Two- Literature Review

Every year approximately 66.5 million children around the world are affected by disasters (Penrose & Takaki, 2006). According to the most recent National Census from 2016, 22% of the Canadian population is between the ages of 0 and 19 years old (Statistics Canada, 2017). One might assume that children will be impacted by disasters at least proportionally to their representation in the overall population. However, the reality is that because of their unique vulnerabilities and health requirements, children will experience higher morbidity and mortality rates as a result of disasters compared to the adult population (Burke, Iverson, Goodhue, Neches, & Upperman, 2010; Mason & Anderson, 2009).

As the global number of disasters and mass casualty events increase in frequency and severity, it is critical that healthcare providers are prepared to both respond to and recover from these events professionally and personally (Baack & Alfred, 2013). After a disaster, hospitals may become the most important healthcare resource, but during the time of the disaster, they are typically overburdened, underfunded, and understaffed (Toner et al., 2009). Hospitals are part of the greater community and, when a mass casualty event occurs, there is an expectation that hospitals will not only be capable of caring for the sudden increase in patients, but that they will also take a leadership role in the response: treating injuries, restoring health, and providing care to those impacted (Ferrier, n.d.). Some studies have found the expectation of hospitals during a disaster extends beyond caring for patients. Previous disasters have shown those impacted by disasters will arrive to hospitals seeking shelter, food, and other necessities, thus further compounding the demand on supplies that may already be limited (Grindlay & Breeze, 2016). Yet because of the role hospitals across the country play in a disaster response, hospital readiness reflects a nation's overall level of emergency preparedness (Ferrier, nd.).

Studies relating to hospital preparedness for mass casualty events, as well as how children experience disasters and mass casualty events differently than adults, were reviewed to characterize findings and identify gaps. A search of CINAHL Complete, Ovid LWW Total Access Collection, Sage Journals, and Wiley Online Library databases was conducted for articles published between 2005 and January 2019. Keywords used in the review include: children or pediatrics, nurse or hospital staff, hospitals, emergency department, disaster or mass casualty event, and emergency preparedness or emergency planning. Gaps remain in the current literature related to identifying factors such as how experience, knowledge, training, and perception are correlated with hospital readiness in mass casualty events involving children (Williams, Nocera, & Casteel, 2008).

Before 9/11

Historically, emergency management has military roots in civil protection and defense. Over time, there has been an evolution towards an all-hazard approach, including to public health emergencies (Quarantelli, 2000). In terms of meeting medical needs during disaster times, some focus was placed on disaster first aid and triage, but few disaster preparedness efforts were focused on hospitals. For example, little attention was given to activities

> "such as strengthening the ability of hospitals to effectively provide care when there is a large, sudden surge in patient volume; working with local hospitals and response agencies to optimize patient care during a disaster; and changing the delivery of patient care to ensure the best possible outcome for the greatest number of patients" (Toner et al., 2009, pp. 7).

Prior to 2001, several events reinforced the critical role hospitals play when responding to mass casualty events. The sarin nerve agent gas attack in Tokyo in 1995, followed by the

bombing of the Alfred P. Murrah Federal Building in Oklahoma City, OK the following year, led to the inception of the Metropolitan Medical Response System (MMRS) in 1996 by HHS (Homeland Security Digital Library, 2019). The MMRS had a mandate to enhance and coordinate local and comprehensive regional response capability during the first crucial hours of an incident, but few jurisdictions had the authority to designate this funding for hospital preparedness purposes (Toner et al., 2009; Homeland Security Digital Library, 2019). Similarly, the Centers for Disease Control and Prevention (CDC) developed programs focusing on public health surveillance, increasing funding for local and state health departments for public health threats, natural disasters and biological, chemical, nuclear, and radiological events but again these funds were focused on public health, not hospitals (CDC, 2019). Healthcare funding for disaster preparedness purposes were often meant for public health initiatives and hospital initiatives were often overlooked. In the 1990s, the National Disaster Medical System (NDMS) increased key resources to provide personnel, supplies and equipment, patient transport and definitive medical care to deploy and provide short-term medical care to those impacted by disasters (HHS, 2019). The Joint Commission, an accreditation body which certifies over 15,000 health care institutions and programs also issued emergency preparedness standards. However, these standards focused on physical hazards such as fires, floods, and utility loss impacting a hospital and did not address the needs of a hospitals in the event of a mass casualty situation during which hospital resources are overwhelmed due to a large influx of patients. Mass casualty event preparedness remained a responsibility for individual hospital organizations to fund and implement (Toner et al., 2009).

The terrorist attacks of 9/11 and subsequent anthrax letters in 2001 proved how unprepared hospitals were to adequately respond to and care for patients of mass casualty events.

Hospitals in New York City, NY and Washington, D.C. activated disaster plans, but staff struggled with challenges in communication, patient tracking, data management, staff support, personnel identification, supply chain management, and overcrowding (Toner et al., 2009). The federal government increased funding to states to assess and develop preparedness plans focusing on bioterrorism (Higgins, Wainright, Lu, & Carrico, 2004; Watson, Watson & Kirk Sell, 2017). It became clear that the existing programs for hospital preparedness were insufficient to support the necessary level of readiness to effectively respond to mass casualty events (Toner et al., 2009).

Hospital Preparedness Program (HPP)

A limited number of studies have demonstrated that education through a national hospital preparedness program increased nurses' knowledge, attitude, and performance in real incidents (Yousefi, Khankeh, Akbari, Dalvandi, & Bakshi, 2016). Not only can these programs facilitate education and training for hospital staff, increasing their ability to respond to events, but federal programs that provide funding models and set standards and guidelines for hospitals can also provide consistency for all hospitals across the country while bringing together public health care and hospitals for a coordinated response, improving a country's overall preparedness (Taschner, Nannini, Laccetti, & Greene, 2017; Watson et al., 2017). When national programs invest in frontline staff, positive outcomes impact not only patients but the healthcare system and the nation overall.

Looking to our American counterparts, the HPP is supported by the Office of the Assistant Secretary for Preparedness and Response. Created in 2002, the HPP is the only federal preparedness funding program focused on hospitals and health care systems (HHS, 2019). One of the purposes of the HPP is to improve hospital preparedness through grant funding to states,

territories and eligible municipalities, coordinated with funding for public health (Taschner, et al., 2017). Through the HPP, support is also provided to regional coalitions that ensure coordination and integration of medical preparedness and response (HHS, 2019, Watson et al., 2017).

Since the inception of the HPP program in 2002, there is evidence of hospital disaster preparedness improvement in individual hospitals across the U.S. (Toner et al., 2009; Watson et al., 2017). Because of the way funding was allocated, HPP gave hospitals incentives to come together to collaborate and discuss how to distribute and spend the grant money within the context of hospital preparedness (Taschner et al., 2017). These networks of funded hospitals, in conjunction with public health departments funded through the CDC's Public Health Emergency Preparedness (PHEP) Cooperative Agreement, began to integrate health systems into community-wide planning and drills (Taschner et al., 2017). With the funding provided from HPP, hospitals invested in personnel and stockpiled equipment to meet surge capacity needs, improve electronic and communication systems, and implement training initiatives (Toner et al., 2009).

Additional gaps between federal efforts and hospitals remain in the HPP program that have yet to be addressed (Kaji & Lewis, 2006). Modifications to the grant guidelines and reporting requirements, along with short terms of the funding cycles have created barriers for some hospitals, including rural hospitals, Department of Veterans Affairs hospitals, and Indian Health Service hospitals (Toner et al., 2009). Other hospitals declined to participate knowing despite the funding provided, they would not have the resources to fulfill the requirements (Toner et al., 2009). In the end, it must be noted that while these programs may be able to begin closing systemic hospital preparedness gaps, few programs address the unique circumstances of

responding to a mass casualty event where children are involved to address their needs (Fox & Timm, 2008).

The Current Canadian Hospital Landscape

In Canadian hospitals, emergency preparedness generally lacks coordination and there are no national standards for hospital emergency training (Ferrier, n.d.). Additionally, there are no validated tool to assess hospital preparedness (Kaji, Langford, & Lewis, 2008). Unfortunately, there is not a similar program to the HPP in Canada to provide funding to hospitals at a federal level for disaster and emergency preparedness initiatives. A National Assessment of Emergency Planning in Canada's General Hospitals was conducted between October 2000 and February 2001. Ferrier (n.d.) found that hospitals across the country reported a general lack of understanding in emergency management principles. The report concluded that despite having an emergency plan in place, hospitals were unable to make the connection between hazard and risk identification, with assumptions about evacuations, communication methods, and patient care made without exercising or testing processes. In addition, plans were written without consultation or collaboration from partners, leading to expectation assumptions from agencies that create logistical and operational gaps (Ferrier, n.d.).

An unpublished document, the National Framework for Health Emergency Management (2004) provides an overview of emergency management and key topics to consider in the context of healthcare in Canada. One of its key recommendations was the implementation of a National Health Incident Management System. However, while most health organizations and communities have now adopted and implemented the Incident Command System (ICS) that aligns them with other first responder agencies, most staff and leaders continue to report low levels of preparedness, and do not understand basic emergency management principles

(Christian, Kollek, & Schwartz, 2005). The Public Health Agency of Canada, which protects the health and safety of all Canadians through provincial and territorial health oversight, has three initiatives to support their constituents in disaster situations: The National Emergency Stockpile System; The National Office of Health Emergency Response Teams; and the Federal/Provincial/Territorial Memorandum of Understanding on the Provision of Mutual Aid in Relation to Health Resources During an Emergency Affecting the Health of the Public (Dauphinee, 2008). Each of the three initiatives provides resources such as medication, ventilators, and personnel to provinces and territories in large-scale emergencies, but none of the initiatives provide individual local hospitals capacity to improve hospital readiness, including training staff. There is little guidance in Canadian policy related to hospital preparedness. National documents focus on other aspects of emergency management and do not outline what a hospital that is prepared to respond to mass casualty events looks like.

Accreditation Canada is an accrediting body for hospitals and health care facilities across the country. While accreditation is highly regarded and strongly recommended, it is not compulsory for all Canadian hospitals to be accredited. Accreditation requirements currently mandate that hospitals in Canada have an all-hazard disaster and emergency response plan, that staff receive regular training on their ability to support the plan, and that the plan is regularly tested with drills and exercises to evaluate the state of response preparedness (Accreditation Canada, 2017). However, as noted in Ferrier (n.d.)'s report, although most hospitals report the existence of an emergency plan, few staff are familiar with the plan, know how to access the plan, or when to activate it. Hospital plans without regular revisions and training can create a false sense of security (Kaji & Lewis, 2006).

Hospital readiness for mass casualty events involving children is not an issue limited to pediatric tertiary care centres. During disasters, patients will be first transferred to the closest hospital for assessment and stabilization. Because of the rurality of our country and the low number of pediatric-specialized care centres, children involved in mass casualty events can be brought to small rural hospitals for life-stabilizing treatment before being transported by land or air ambulance to a pediatric tertiary care centre. As seen in previous events that occurred in 2018 in Wawa, Ontario and Armley, Saskatchewan, pediatric tertiary care centres will act as regional centres, supporting rural centres by receiving the most critically ill and those who require specialized care (Markenson & Krug, 2009).

With only sixteen pediatric tertiary care centres across Canada, pediatric resources will be in high demand and quickly become overwhelmed in the event of a mass casualty event involving children. In the event of a mass casualty event, hospitals must be prepared to safely accommodate up to a 300% increase in capacity, or up to 500 extra patients per million pediatric population (Burke et al., 2010; Goodhue, Lin, Burke, Berg & Upperman, 2013). With equipment in such short supply, only 6% of emergency departments report having appropriately sized equipment to treat and care for children and most lack key life-saving equipment such as ventilators (Gausche-Hill, 2009; Kaji & Lewis, 2006).

On a daily basis, hospitals in Canada operate over-capacity, with patients in stretchers in hallways becoming a norm, along with a chronic nursing staff shortage that is predicted to worsen in the next twenty years (Dauphinee, 2009; Gausche-Hill, 2009; Goodhue et al., 2013). Without extra staff to call in to respond to pediatric mass casualty events, hospitals will quickly become overwhelmed. Training for preparedness also becomes more difficult without extra staff

to cover patient care during exercises and drills when staff can barely cope with normal volumes of patients on a daily basis (Goodhue et al., 2013).

Few hospitals in Canada have experienced a mass casualty event requiring the activation of Code Orange; therefore, the truth is that most hospital and departmental emergency preparedness plans have never been operationalized (Kaji & Lewis, 2006). Emergency planners are currently without the tools and resources needed to develop training programs to ensure organizational preparedness. Without any national standards or tools for emergency preparedness evaluation, there is a general lack of understanding of emergency management principles within the hospital setting. Hospitals that take it upon themselves to increase preparedness have few resources to utilize and the implementation of procedures and training is sporadic and difficult to sustain (Ferrier, n.d.).

Children are Not Small Versions of Adults

The literature has demonstrated that during a mass casualty event, children need to be well-supported and cared for to ensure minimal negative impacts from disasters due to their unique physical and developmental health care needs (American Academy of Pediatrics, 2015). Currently, the assumption is that when resources are limited in a disaster, medical care appropriate for adults is also suitable for children (Burke, et al., 2010; Fox & Timm, 2008; Ginter et al., 2006;). This assumption is not only erroneous, but can result in severe negative outcomes for pediatric patients, as children are not simply "smaller versions" of their adult counterparts (American Academy of Pediatrics, 2015; Rassin et al., 2007).

Because of their small physical size, children have larger solid organs and larger total body surface area ratios proportionate to their bodies. Several studies highlight the higher risk for internal organ injuries from blunt trauma and a greater risk for circulatory compensation and

dehydration (American Academy of Pediatrics, 2015; Burke et al., 2010; Fox & Timm, 2008; Gausche-Hill, 2009; Rassin et al., 2007). Because of a shorter and narrower respiratory tract, children are at a significantly higher risk for respiratory failure should foreign particles enter their airway or swelling occur (Burke et al., 2010; Fox & Timm, 2008; Ginter et al., 2006).

Children also have unique developmental needs compared to their adult counterparts (Gaushe-Hill, 2009; Ginter et al., 2006). Infants and toddlers are, for the most part, non-communicative, and young children may have difficulties articulating their needs and emotions. They generally rely on their caregivers to provide and advocate for them (Gaushe-Hill, 2009; Ginter et al., 2006). During a mass casualty event, caregivers may be separated from their children and healthcare providers may need to provide care for children who are afraid and separated from those who know them best. Barthel et al. (2013) explain that children impacted by a disaster fare better the earlier they are reunited with their caregivers. Because of their immature coping and cognitive abilities, children may respond counter-intuitively to their safety out of fear during disasters. This includes hiding rather than seeking help from people unknown to them (Burke et al., 2010; Fox & Timm, 2008; Gausche-Hill, 2009; Ginter et al., 2006; Mason & Anderson, 2009; Rassin et al., 2007).

Ginter et al. (2006) discuss how children need support to understand their experience and to work through their emotions after a disaster, which is often overlooked in disaster preparedness planning. Several studies indicate that if children are not given the opportunity to work through the traumas of a disaster they experience, they are at a higher risk of developing symptoms of post-traumatic stress disorder and other psychological concerns later in life (Fox & Timm, 2008; Gausche-Hill, 2009; Peek, 2008).

Because the care management of a pediatric patient differs significantly from the care management of an adult patient, hospital preparedness research cannot focus solely on the adult population, and must begin to recognize the specialized developmental needs of children. Fox & Timm (2008) acknowledge that because of the overall lack of research and guidelines to follow, there is a lack of consistency and clarity in practice on how to best care for pediatric patients during mass casualty events persists. Recommendations from research must consider the unique vulnerabilities that will bring unique needs for a child impacted by a mass casualty event.

Nurses Role and Impact on Disaster Response

Nurses are the largest group of health care providers and have always played a significant role in a hospital's response to disasters (Labrague et al., 2017; Khalaileh, Bond, Beckstrand, Al-Talafha, 2009; O'Sullivan et al., 2008; Yousefi, et al., 2016). As disasters and mass casualty events increase in frequency and severity, nurses' preparedness to respond is of critical importance in reducing negative consequences to the health of the affected population (Labrague et al., 2017). Nurses are among the first responders during a mass casualty event and have the potential to be exposed to deadly hazards such as chemical, biological, radiological, nuclear, and explosive agents (Baack & Alfred, 2013; O'Sullivan et al., 2008). Nurses must therefore not only be able to provide complex lifesaving patient care, but also protect their own safety and well-being while responding to these events. Nurses can be found working on the frontlines as well as within various leadership capacities in a hospital system. As strong advocates for high quality patient-centred care, nurses can be empowered through training and education that improves preparedness and patient outcomes and develops and sustains change within the hospital system.

In a study by Kaji & Lewis (2006) on hospital preparedness, researchers surveyed a diverse group of hospital personnel and found that due to a lack of multi-agency collaboration to develop mutual aid agreements and limited surge capacity, hospital preparedness is perceived as minimal (Kaji, & Lewis, 2006). In another study by Rassin et al. (2007), Emergency Department physicians and nurses were surveyed to measure perceptions of the hospital's preparedness for mass casualty events involving children and mass casualty events involving only adults. Respondents reported lower levels of preparedness for mass casualty events involving children compared to mass casualty events with only adult patients. They also reported feeling unprepared to cope emotionally with children impacted by disasters, to such an extent that they may not respond to hospital's calls for help during a disaster (Rassin et al., 2007). However, a significant positive correlation was found between professional seniority and the ability to cope with pediatric mass casualty events in terms of knowledge and skill (Rassin et al, 2007). Yet no statistically significant association was found between years of professional experience and nurses' perception of their ability to cope with mass casualty events involving children (Rassin et al., 2007).

Due to the critical role nurses play in a disaster response, The International Council of Nurses (ICN) published Disaster Nursing, an International Classification for Nursing Practice catalogue to provide a unified language system that supports standardization of planning, managing, and documentation of nursing care in the disaster context (ICN, 2017). However, despite local, national, and international initiatives, nurses continue to report a lack of preparedness and uncertainty of their roles during a hospital response to mass casualty events (Baack & Alfred, 2013; O'Sullivan et al., 2008; Yousefi et al., 2017; Labrague et al., 2017).

Labrague et al. (2017) conducted a systematic review of peer-reviewed publications between 2006 and 2016 that measured nurses' preparedness for disaster response. Only one study in the review included Canadian nurses and only one study included pediatric nurses. O'Sullivan et al. (2008)'s work studied French-and English-speaking nurses across Canada using a Web-based survey. Less than half of respondents indicated their hospitals had an emergency plan, with almost 40% of respondents reporting they did not know or leaving the question unanswered (O'Sullivan et al., 2008). Overall, nurses reported low confidence toward the preparedness of Canadian healthcare institutions, with nurses from Ontario and Quebec reporting the highest levels of confidence (O'Sullivan et al., 2008).

Fox & Timm (2008) recognized that care for the pediatric patient extends beyond the triage and stabilization of the child in the emergency department. The Pediatric Issues in Disaster Preparedness program sought to educate pediatric care providers on the unique considerations and patient needs in the disaster context, focusing on inpatient pediatric nurses. Consistent with other reports studying the impacts of training and mock exercises, this study found that any training program must be implemented consistently and regularly over time for nurses to maintain high levels of hospital preparedness in mass casualty events involving children (Baack & Alfred, 2013, Fox & Timm, 2008, Yousefi et al., 2017).

Chapter Three-Research Methodology

RN participants in this study completed online surveys to report perceptions of hospital readiness for mass casualty events involving children. The survey collected information on each participant's professional demographics, their experience responding to mass casualty events involving children, their general understanding of the hospital emergency code for mass casualty events, and how prepared each nurse feels to respond to such an event. The purpose of the survey was to improve our understanding of how pediatric nurses feel about mass casualty events and their understanding/level of comfort to respond to care for children.

Methodology Framework

A survey was developed to assess the attitudes and opinions of pediatric nurses working at Children's Hospital at LHSC regarding readiness to respond to mass casualty events involving children and to test potential associations between reported attitudes, opinions, and perceptions of readiness. This methodology structure aligns closely with the postpositivist worldview, which seeks to understand the relationship between cause and effect and outcomes by identifying those factors that influence a certain outcome (Creswell & Creswell, 2018). The subjectivity of participatory approach opposes the neutrality, objectivity and value freedom of the postpositivist approach. Therefore, it considers the subjective meaning of the lived experience as valid and able to inform the results of the research (Creswell & Creswell, 2018; Parry, Gnich, & Platt, et al., 2001). By seeking nurses' perception, the study recognizes both the need to assess and understand current readiness levels as well as the integral role nurses have to empower change and improve patient outcomes in the context of emergency preparedness.

Survey Design and Data Sources

The survey was accessed by RNs currently employed at Children's Hospital at LHSC using the online platform REDCap. The full survey is available in Appendix D. The survey was developed based on the review of the literature and survey design considerations by Dillman et al. (2014) and Burns et al. (2008). The survey was piloted-tested and revised based on feedback. To ensure standardization with other research in the disaster and emergency management field related to perceived readiness, questions previously validated as part of prior published studies were used where possible. The survey included questions covering four domains, including professional demographics and employment history, experience working as an RN in a mass casualty event, knowledge questions related to current organizational mass casualty procedures, and perceptions on professional preparedness. Professional demographics included whether nurses hold a diploma in nursing or a nursing degree (Yes / No), the number of years of nursing practice (continuous), and whether the nurse has any critical care or emergency nursing experience (Yes / No). Nurse respondents are asked whether or not they have experience responding to mass casualty events (Yes/No), whether or not a Code Orange was activated during that mass casualty event (Yes/No), and the level of involvement the nurse had in previous mass casualty events (none, minimal, some, a lot, extensive). Data was also collected on any additional training and certifications the responding nurse may have received, such as trauma training courses and advanced life support certifications, using a list for the respondent to check off and to list any additional certifications not listed. Finally, the perception section of the survey utilized Likert Scales (1 = Strongly Disagree and 5 = Strongly Agree) to ask the respondent how confident they feel in coping with a mass casualty event and using the knowledge and skills they currently possess to respond to an event.

Prior to implementation, the survey was pilot tested among several groups representative of, but not included in, the target audience and revisions were made based on pilot tester's feedback. Those who participated in pre-testing included RNs who work as staff nurses at LHSC but not at Children's Hospital, hospital leaders at LHSC with an RN designation, staff physicians who work at Children's Hospital, and graduate students enrolled in the Master of Arts in Disaster and Emergency Management degree program at Royal Roads University. The opinion of other RNs and hospital leaders is important to ensure hospital terminology is consistent and appropriately used without jargon, while feedback from graduate students who have an understanding of the disaster and emergency management field ensures standardization with other emergency preparedness research.

Participant Recruitment Process

Participants for the study are RNs who work at Children's Hospital at LHSC in London, Ontario. There are approximately a total of 470 RNs and Registered Practical Nurses (RPNs) with valid license from the College of Nurses of Ontario (CNO) employed at Children's Hospital at LHSC with RNs forming the largest group of staff (N=270). This research study's eligibility requirement included an RN designation and working as a staff nurse.

The Coordinators of each clinical department at Children's Hospital received an email with information and rationale for the research study and a link to the online survey. Coordinators were asked to share the link for the online survey with all their RN staff who work as a staff nurse. Suggestions for encouraging participation in the study were also shared with the Coordinators since the survey provided an opportunity for staff to inform education and training initiatives in Code Orange situations at Children's Hospital (Dillman, Smyth, & Christian (2014). First contact was made with Coordinators through email on July 29, 2019. A follow-up

email was sent to Coordinators two weeks later on August 10, 2019. The researcher had face-to-face contact with each Coordinator when the survey was open and spoke with each Coordinator about the ongoing study, asking them to continue to speak with their staff about the study and the opportunity to influence staff education and training for mass casualty events involving training. The survey did not collect any identifying information of respondents, therefore neither Coordinators nor researcher knew which nurses participated in the study. The researcher did not have any direct communication or contact with potential study participants.

Data Collection

The survey was created and distributed online using REDCap, an online survey platform provided by the Lawson Health Research Institute to manage data. The survey followed Dillman, Smyth & Christian (2018) principles of reducing complexity and increasing accessibility, providing an open survey link but only inviting staff nurses to complete the survey via an email invitation to their work email. The researcher received email notification when surveys were completed, but all survey responses were anonymous, with only non-identifying professional demographics collected. There were no questions that were mandatory for respondents and the survey asked predominately closed-ended questions to reduce respondent burden and the complexity of data analysis. Perception questions were measured using a Likert scale. Open-ended questions were limited to listings of courses and certifications the respondent has received that were relevant to their career but that were not listed in the survey.

Data Analysis

Counts and frequencies were calculated for all variables, as well as the number of missing responses for each question. Responses were coded using 0, 1, and 2 for analysis purposes. When calculating measures of central tendency from the perception questions that

used Likert scales, it is noted that mean calculations can be challenging as there is no mean for 'strongly agree'; 'somewhat agree'; 'neutral'; 'somewhat disagree' and; 'strongly disagree'. However, with only five choices on the Likert scale, mode calculations do not represent the overall statement agreement well, and median calculations do not account or consider outlier responses. Therefore, mean calculations were used in order to summarize and represent each perception question along with standard deviation. Correlation coefficients were calculated between years of nursing and knowledge score compared to perception scores to determine the strength of any relationship. Chi square tests were conducted to determine relationships between RN education, years of experience, specialty experience, additional training, knowledge scores, experience responding to previous Code Orange, and perceptions.

Validity and Reliability

Validity is examined both externally and internally. The survey underwent a pre-test and piloting process with various groups of people including RNs working at LHSC who were not otherwise eligible to participate in this study because they do not work at Children's Hospital or due to their current role as leaders at Children's Hospital. Those who received the pilot survey were asked not only to complete the survey as a test, but to also evaluate the survey and provide feedback in order to ensure face validity and internal validity of the survey design (Frey, 2018; Nevo, 1985). This research gathers its content validity through its literature review, a representation of its relevant population and through experts in the field (Yaghmale, 2003). By clearly identifying that the objective of this study is to seek the perceptions of RNs in order to understand the needs to hospital readiness for mass casualty events, the research identifies its dimensions and limitations (Yaghmale, 2003).

Each pediatric tertiary care centre in Canada is unique and hospital preparedness for mass casualty events must be considered individually. However, population trends in nursing staff may be similar across the country and the challenges that Children's Hospital at LHSC faces in terms of hospital preparedness may be systemic in nature and therefore these other pediatric tertiary care centres may also deal with similar challenges. The validity of this study will enable other pediatric tertiary care centres to utilize the findings to better understand the needs of their organization.

Although the survey responses are anonymous, there is a risk to the subjects of disclosure of their identities due to the use of an intermediary to distribute the survey link. RN participants might also complete the survey in consultation with another respondent, thereby possibly increasing the potential of bias.

Researcher's Background and Role

The researcher has current experience as the Manager of Emergency Management at LHSC, allowing her to interpret data from the surveys to understand nurses' reports of readiness, which reflects the organization's overall readiness status. With previous experience working as an RN on several units at Children's Hospital at LHSC, the researcher also has the clinical understanding of the potential needs of different units required to care for children and their families with traumatic injuries. The researcher's professional experience provides an understanding of the complexities that can arise to ensure patient access and flow when the hospital is faced with pressures such as increased patient volumes and a shortage of beds. Throughout the study, the researcher maintained close communication with clinical Department Coordinators. Any communication to nurses about the research study was made through Department Coordinators and in any interactions the researcher had with nurses on other

professional matters, the research study was not discussed. Full disclosure regarding the researcher's dual role as the primary investigator and working as the hospital's Manager of Emergency Management was clearly articulated in email communications with staff.

Ethical Considerations

The survey and all other documents related to this research were reviewed and approved by the Royal Roads University (RRU) Research Ethics Board (REB), Lawson Health Research Institute (ReDA ID #7694), and the Western University Health Science Research Ethics Board (HSREB) (Project ID #114080). Since the researcher is employed at LHSC as the Manager of Emergency Management, this role includes ensuring preparedness at Children's Hospital for all types of emergencies impacting the hospital including mass casualty events involving children. Because participation in the study was voluntary and because of the researcher's professional role at the hospital, a disclosure statement in the Letter of Information approved by all Ethics Research Boards articulated clearly that the purpose of the study is conducted for a master's thesis in the Disaster and Emergency Management program at RRU and not for LHSC purposes, despite the dual role held by the researcher as a master's student at RRU and the Manager of Emergency Management at LHSC. The Letter of Information was included in the email sent through Department Coordinators and informed participants of the purpose, aims of the study, and that there are no known harms or immediate benefits associated with participating in the study. Participants were reminded that their participation, while appreciated, was voluntary, meaning they have the right to decide whether they wish to complete a survey and they have the right to refrain from answering any questions in the survey. Participants were free to withdraw from the study at any time prior to submitting their survey without negative consequences to their involvement with Children's Hospital or RRU. However, due to the anonymity of each

completed survey, once a survey is submitted, the RN participant can no longer withdraw from the study. Contact information of all researchers and committee members were provided so that any questions or concerns participants may have could be addressed. No contact information was collected from the respondents and all responses were kept on a password protected computer in a locked office at Children's Hospital or Royal Roads University.

Chapter Four-Results

Appendix E Table 1 provide the demographic characteristics of the RN participants in the study. All seven Coordinators at Children's Hospital sent out emails with the survey link to their RN staff, therefore a total of 270 surveys were sent out. 34 respondents completed the survey between July 30, 2019 and August 20, 2019. Seventy percent (24 of 34) of respondents have a Bachelor of Science in Nursing degree, with the remainder of respondents (10 of 34) having a College in Nursing diploma. In addition to their formal education, 21 of 34 (62%) of nurses report having either an expired or current Neonatal Resuscitation Program (NRP) certification while 24 of 34 (71%) nurses report having either an expired or current Pediatric Advanced Life Support (PALS) certification. Nearly half of all respondents (15 of 34; 44%) have at least 10 years of nursing experience.

Emergency and Critical Care Experience and Training

With regard to emergency and critical care experience, nearly all respondents have either current or previous emergency care (15 of 34; 44%) or critical care (18 of 34; 53%) experience with adults or pediatric patients. Eight respondents (8 of 34; 24%) have both emergency care and critical care experience and nine respondents (9 of 34; 26%) have neither emergency care nor critical care experience. However, few nurses have training specifically geared towards emergency response. Two nurses (6%) reported having an expired or current Emergency Nurse Certified (C)anada (ENC(C)) certification. Six (18%) report taking the Emergency Nursing Pediatric Course (ENPC) course while five (15%) took a Trauma Nursing Core Course (TNCC). Only one respondent (3%) reported taking a course in Incident Management System (IMS)/ICS and no nurses reported taking courses from the U.S. Federal Emergency Management Agency (FEMA). Four courses were reported by respondents who felt they were relevant, including

Association of Pediatric Hematology/Oncology Nurses (APHON) certification (N=1), Acute Care of at-Risk Newborns (ACORN) (N=1), Stop the Bleed (N=1), and Narcan community administration (N=1).

In terms of participation in an emergency or mass casualty event, only nine respondents (26%) reported experience responding to a multiple or mass casualty event in a hospital setting, while 25 (74%) reported no experience with a multiple or mass casualty event in a hospital setting. Of the 9 respondents with experience in a multiple or mass casualty event, only one (11%) reported that the hospital activated a Code Orange during the event. However, 7 of 9 (78%) of those who responded to a multiple or mass casualty event reported either substantial (N=3) or extensive (N=4) patient care. All nine reported they were working on shift in the hospital at the time they received first notification of the multiple or mass casualty event.

Knowledge of Emergency Events Impacting the Hospital

Based on their general knowledge, nurse respondents' definition of multiple or mass casualty events differed widely. While nearly all respondents (29 of 33; 88%) considered an incident activating a Code Orange would be this type of event, 17 of 33 (52%) considered a pandemic situation similar to SARS in 2003 would qualify. Eleven (33%) felt that a trauma incident involving two or more patients admitted to hospital constituted a multiple or mass casualty event, while 6 of 33 (18%) indicated that when the inpatient units are full and patients admitted to hospital spend over 24 hours in the Emergency Department was a multiple or mass casualty event. Nearly all respondents (33 of 34; 97%) were able to correctly define a Code Orange as an incident that occurs outside the hospital, resulting in a number of casualties that will overwhelm the hospital.

When asked about another emergency code colour used in the hospital, knowledge amongst the nurses varied. Twenty-eight nurses (82%) correctly identified a Code Purple as a hostage incident occurring in the hospital. No nurses (0%) identified a Code Purple as a robbery incident in the hospital, while three nurses (9%) identified a Code Purple as an active shooter incident occurring in the hospital, and no nurses (0%) identified a Code Purple as a violent behaviour incident occurring in the hospital. Two nurses (6%) reported they did not know the answer and one nurse (3%) did not answer the question.

In the case of a Code Orange activation, nearly half (14 of 34; 41%) could not identify the triage system used in the ER during a Code Orange. Forty-five percent (15 of 33) of respondents reported that their first action upon hearing a Code Orange would be paging their coordinator for instructions, while 11 of 33 (33%) reported that the first action would be to send the Charge Nurse to the ER for a debrief. About one-third of nurses (11 of 34; 32%) did not know which department leaders would be identified during a Code Orange while 11 (32%) correctly identified the departmental leadership during a Code Orange, which would include Physician Lead, Clinical Operations Lead, Logistics Lead, and Incident Commander.

Likert Scale Responses Related to Likelihood of Mass Casualty Event Involving Children and Adults

A series of questions asked nurse respondents to provide their opinions about the likelihood of mass casualty events. Twenty-five respondents (74%) either somewhat or strongly agree that a mass casualty event involving primarily children and requiring a Code Orange activation will occur at some point during their career as an RN at Children's Hospital at LHSC (mean=3.8; SD=1.1). Slightly more respondents (28 of 34; 82%) either somewhat or strongly agree that a mass casualty event involving event involving a mix of children and adults and

requiring a Code Orange activation will occur at some point during their career as an RN at Children's Hospital at LHSC (mean=4.0; SD=0.94). About the same (27 of 34; 79%) expected an event involving primarily adults during their career (mean=4.0; SD=0.97).

Likert Scale Responses Related to Perceptions of Professional and Facility Preparedness

Using the Likert Scale from 1=Strongly Disagree to 5=Strongly Agree, a series of questions asked nurse respondents to provide their opinions about their professional preparedness as well as the hospital's preparedness. Appendix E Table 2 provides mean values for the rating of perceptions of personal and facility preparedness as reported by the participants. Sixteen respondents (47%) somewhat or strongly agreed with the statement that as an RN, they have the skill and knowledge to response to a multiple/mass casualty event at Children's Hospital at LHSC (mean=3.3; SD=0.94). Twenty-five (74%) somewhat or strongly agreed with the statement that as an RN, they have the emotional and mental ability to cope and care for children who are impacted by a mass casualty event, presenting at Children's Hospital (mean=3.9; SD=1.0). Although the nurse respondents assess their skills, knowledge, and emotional and mental ability to respond positively, the majority of respondents (25 of 34; 74%) strongly or somewhat disagree that they receive regular training and education that help them care for patients during a multiple/mass casualty event at Children's Hospital at LHSC (mean=2.0; SD=1.0). Similarly, 26 of 34 (76%) report that they strongly or somewhat disagree with the statement that they are satisfied with the training they receive to prepare for a multiple/mass casualty event at Children's Hospital at LHSC (mean=1.9; SD=1.0).

Nurse respondents' assessment of hospital preparedness was different than their assessment of their personal preparedness. Half of all respondents (17 of 34; 50%) either strongly or somewhat disagree with the statement that Children's Hospital at LHSC has enough

equipment and supplies or the means to procure the required supplies and equipment to respond to a multiple/mass casualty event (mean=2.6; SD=1.1). Half the respondents (17 of 34; 50%) also strongly or somewhat disagreed with the statement that Children's Hospital at LHSC is prepared to respond to a mass casualty event involving children (mean=2.7; SD=0.91). One specific area where concerns about preparedness were seen was with the statement that Children's Hospital at LHSC has enough equipment and supplies or the means to procure the required supplies and equipment to respond to a multiple/mass casualty event. No nurses strongly agreed with this statement (5 strongly disagreed; 12 somewhat disagreed; 7 neutral; and 10 somewhat agreed). Overall, weighing against other priorities, 27 nurses (79%) either strongly or somewhat agreed that Code Orange preparedness is important to their professional development (mean=4.1; SD=0.90).

Factors Influencing Perceptions of Readiness

Two-by-two tables were constructed and chi square tests calculated for subsets of variables. There was no statistically significant difference found between diploma RNs and RNs with their Bachelor of Science in Nursing (BScN) degrees and perceptions of their skills and knowledge to care for children impacted during a mass casualty event ($p=0.13$) or perceptions of emotional ability to cope through a mass casualty event involving children ($p=0.58$). When comparing nurses with more than ten years of nursing experience and their perception of their skills and knowledge ($p=0.41$); and emotional ability ($p=0.33$) there were also no statistically significant differences.

Nurses with emergency care or critical care experience were more likely to report a higher likelihood of a mass casualty event involving primarily children occurring ($p<0.01$). Nurses with emergency care or critical care experience agreed an event would occur at some

point during their career and nurses without a specialty did not agree an event would occur. When comparing specialty experience with perceptions of regular training ($p=0.45$); and perceptions of satisfaction of training received ($p=0.94$), there were no statistically significant differences. When comparing knowledge scores and perceptions of knowledge and skill to respond to a mass casualty event involving children ($p=0.61$), perceptions of regular training ($p=0.084$), and perceptions of overall hospital readiness ($p=0.32$), there were no statistically significant differences. Lastly, when comparing nurses with past Code Orange experience and perceptions of skills and knowledge to respond to a mass casualty event involving children ($p=0.48$), emotional ability to cope during a mass casualty event involving children ($p=0.74$), perceptions of satisfaction with training ($p=0.26$), and perceptions of overall hospital readiness ($p=0.42$), there were no statistically significant differences. While p-values are calculated to identify statistical significance, it must be noted data with p-values greater than 0.05 still provide the researcher with information to analyze and understand.

Chapter Five-Discussion

This study is based on data collected from RNs who work at one pediatric tertiary care centre in Canada. Several themes were identified, including the perception of nurses of the likelihood of a mass casualty event involving children occurring, perceptions of professional and organizational readiness to respond to a mass casualty event involving children, other factors that influence perception of readiness and the importance training has to improve readiness.

Likelihood of an event

The majority of nurses agree that mass casualty events involving either a mix of adults and children or involving primarily children will occur at some point during their career; however, many nurses in this study do not feel prepared to respond. This finding aligns with the published research that finds that nurses are inadequately prepared (Labrague et al., 2017). This is increasingly important as over the last decade as the prevalence and severity of disasters have increased (Baack & Alfred, 2013). Within the Canadian context, there has been an increase in events, with 321 disasters reported in the Canadian Disaster Database from 2001-2019 compared to 608 disasters reported between 1951-2000 (Public Safety Canada, 2013). In addition to the increase in mass casualty events, nurses working in pediatric tertiary care centres must remember that due to their unique vulnerabilities and health requirements, along with the way children are socialized, children are often impacted by disasters in numbers larger than their proportional representation in the overall population (Mason & Anderson, 2009). Furthermore, nurses working in pediatric tertiary care centres will respond to events beyond their municipality borders with the most critical patients transported to their facility during a mass casualty event to receive specialized care they may not receive otherwise. Because of this, nurses working in

pediatric tertiary care centres have a greater need for education and training to ensure readiness to respond to mass casualty events involving children.

Perceptions of Readiness

Skills and knowledge.

In most previous studies, nurses report low to moderate levels of preparedness, with less than one quarter of study participants feeling prepared (Labrague et al., 2017). In this study, a mean score of 3.3/5 indicates that nursing staff feel moderately confident they have the skills and knowledge to respond to a mass casualty event involving children. This study included several basic questions about the current Code Orange plan and emergency code response at the hospital organization. No nurses were able to answer all six questions correctly, despite having an average of 13.3 years of nursing experience. This demonstrates a high level of unfamiliarity of the current emergency plan amongst nursing staff. This finding is similar to that of Baack & Alfred (2013), where nurses obtained a mean score of 90 out of the possible 205 on the EPIQ "suggesting a suboptimal competence in responding to disaster events" (Labrague et al., 2017). In five studies reviewed by Labrague et al. (2017), the majority of nurses reported their organizations had a disaster management protocol, but one quarter of the nurses in the Whetzel et al. (2013) study had never read the plan and 10% of nurses were unable to locate the plan. As Kaji & Lewis (2006) report, the presence of a disaster plan without staff who are familiar with it projects a false sense of security. Similarly, in Ferrier's (n.d) national assessment of Canadian hospitals, he found that most organizations had a disaster plan but few staff knew how to access it or how to implement the plan when needed.

Emotional readiness.

Research studies indicate that nurses report a low level of emotional capacity to cope with responding to a mass casualty event involving children (Rassin et al., 2007). Additionally, mass casualty events are circumstances known for chaos and uncertainty. Nurses in other studies report feeling personal helplessness but, regardless of these challenges, nurses are aware of the expectation that they must continue to provide quality patient care (Johnstone & Turale, 2014).

Studies have identified inexperience as a contributing factor to fear of disaster response (Chapman & Arbon, 2008). Part-time staff report higher levels of emotional stress compared to full-time staff, indicating that experience may lend to increased feelings of preparedness. However, the majority of the nurses in this study report moderate levels of emotional and mental ability to cope for children impacted by mass casualty events. Specific reasons for the difference in findings are unknown. However, one possible rationale could be that nurses in this study specialize in pediatric care, working with the sickest of patients in the region, and often cope with difficult and emotionally challenging outcomes involving children. Therefore the idea of caring for an influx of critically ill and injured children during a mass casualty event may not be seen as challenging compared to nurses who are not specialized and therefore do not provide care for children regularly.

Equipment and Supplies to Respond to an Event

Nurses in this study did not agree that Children's Hospital has enough equipment and supplies to surge a response to a mass casualty event involving children. Current guidelines for hospital readiness states that hospitals must be prepared to surge 300% in critical care capacity (Burke et al., 2010; Goodhue et al., 2013; Markovitz, 2009). Hospitals' surge capacity during a disaster situation is very different than daily surge when the facility is over-capacity (Kaji,

Koenig, & Bey, 2006). In a mass casualty event involving children, pediatric patients will present at the hospital at a rate that will overwhelm resources much more quickly than they will replenish and medical and ethical decisions will need to be made, while triage is shifted from caring for the most ill first to "doing the greatest good for the greatest number of patients" during a mass casualty event (Kaji et al., 2006; Markovitz, 2009). Resources that will be of greatest shortage during a disaster are known as the 3S: stuff, staff, and space (Corcoran, Niven, & Reese, 2012). Specifically, most hospitals cannot afford to stockpile ventilators as they are expensive to purchase and to maintain, and will therefore quickly see a shortage of ventilators early in a mass casualty response (Corcoran et al., 2012). Even calling on surrounding hospitals to lend ventilators will be a challenge due to the time it will take to transport. In this study, nurses with emergency medicine or critical care experience are much less confident in the hospital's ability to procure all necessary supplies and equipment (mean=2.36; SD=0.99), compared to nurses without emergency medicine or critical care experience (mean=3.4; SD=0.88).

Lack of space will be a challenge for most hospital organizations as critical care interventions and patient care can only be conducted in locations with access to electrical outlets, oxygen and monitoring equipment (Corcoran et al., 2012). Because of the challenges to convert administrative offices and areas designed for public use to accommodate patients with little notice during a mass casualty event, hospitals will be limited to use spaces already designed for inpatient and outpatient areas to meet their surge capacity needs. However, these designated areas for patient care will quickly become overcrowded with the number of staff and patients in the space. Staff may find these spaces unable to accommodate the same number of patients during a mass casualty event as during normal hospital operations.

Organizational Readiness

Historically, disaster events leading to Code Orange activations have been rare. Only one nurse in this study reported experience responding to a Code Orange in the past. Hospitals do not have exposure experience to Code Orange situations, which impacts overall organizational readiness. Most nurses do not agree that Children's Hospital is prepared to respond to a mass casualty event involving children. Hospital readiness encompasses not only the 3S of stuff, staff, space as mentioned earlier, but also coordination and communication with local and regional agencies and resources. For example, only 33.4% of Canadian hospitals have previously tested evacuation plans and only 8.6% have tested their organization's ability to accept patients from other sites (Ferrier, n.d.). Beyond the presence and familiarity of a disaster plan, a successful disaster response requires strategic navigation through the healthcare system, which is complex and highly integrated (Labrague et al., 2017). The majority of hospitals report there are no plans to share resources, and if plans exist, they have not been formalized (Ferrier, n.d.). With a lack of awareness and understanding of organizational plans, in addition to a lack of access to continuing education and training opportunities, nurses have little potential to empower themselves with the skills, knowledge and confidence to respond to mass casualty events involving children. This translates into an overall lower level of preparedness at the organizational level.

Other Factors that can Increase Preparedness

Other factors may improve perceptions of readiness in nurses responding to mass casualty events involving children. Due to the small sample size, this research was unable to observe differences in perception levels. However, several research studies suggest nursing years of experience, along with experience in Emergency Medicine and critical care increase

perceptions of preparedness. Hodge, Miller, & Skaggs (2015) found that when comparing nurses of the same age, nurses with each additional year of experience reported higher levels of emergency preparedness familiarity. The authors also observed that nurses working in the ER were more likely to be familiar with emergency preparedness than nurses working in other specialties. Nilsson et al. (2016) found similar results with nurses who worked in the ER, nurses with more years of experience and nurses who work night shifts, all reporting higher level of skill and capacity to respond to disaster events.

An increase in confidence in night shift workers could be related to the number of personnel resources available during night shifts. Staffing levels often decrease overnight, with minimal leaders on-site or available on-call to support frontline staff. Decisions that would normally be made by clinical leaders are made by frontline nursing staff overnight.

It is not surprising that nurses who work in the ER report higher levels of preparedness. Working in an environment that is constantly busy and overcrowded, ER nurses are the first to observe and determine the criticality of a patient. They are tasked with performing life-saving interventions to stabilize patients before initiating complex medication and treatment protocols.

Importance of Training to Improve Readiness

Researchers have long accepted training and education as critical components of organizational preparedness (Chapman & Arbon, 2008). Training and exercising provide nurses with experience responding to situations likened to mass casualty events, while creating a safe space for learning and questions. Based on studies reviewed, training has increased perceptions of preparedness in nurses, including improving confidence in disaster response and understanding of disaster plans and equipment (Chapman & Arbon, 2008; Grove, 2017; Labrague et al., 2008; Rassin et al., 2007). Baack & Alfred (2013) observed that nurses with

more confidence also scored higher on the EPIQ, which suggests a positive relationship with consistent training. Williams, et al. (2008) concluded that participation in disaster response improved nurses' perception of competence and therefore hands-on education opportunities can also help increase perceptions of readiness and skill.

Training allows nurses to focus on specific skills to address any unique considerations that may be involved with caring for children during mass casualty events to ensure care is developmentally appropriated for the pediatric patients. Mass casualty events require nurses to respond to high stress high risk situations, making quick and effective decisions while protecting resources (Chapman & Arbon, 2008). Frontline staff such as nurses must remain prepared to respond to disasters and mass casualty events involving children. Because of their integral role with direct patient contact and engagement, frontline nurses need to be empowered with knowledge and additional skills through training to ensure patient outcomes. Nurses need to have accurate risk perception of potential hazards they may face to understand and anticipate the types of injuries children may present with. Based on the findings of this research, nurses agree Code Orange readiness is a high priority and many are dissatisfied with the current training they receive, with many reporting they do not receive regular training. This dissatisfaction can lead to nurses feeling disempowered and disengaged; powerless-feeling nurses make ineffective caregivers at the bedside (Bradbury-Jones, et al., 2007). Similar to the findings of this research, many frontline staff do not feel comfortable responding to Code Orange, saying that they do not feel prepared (Grove, 2017; Kaji & Lewis, 2006; Rassin et al., 2007). As leaders in the community, there is an expectation that hospitals will be ready to respond to mass casualty events, caring for all who are injured. In turn, there is an expectation from hospitals that nurses working will be ready to receive and care for children for sustained periods of time during mass

casualty events regardless of challenges and barriers they may face, including a finite amount of resources.

In Canadian nursing schools, there are few education or training programs for caregivers related to coping with mass casualty events involving children. Nursing schools do not typically include disaster education in their curriculum, so new graduate nurses begin their career with no experience in disaster response. Once working with an RN license, little changes because hospitals that are already strapped for resources do not prioritize disaster preparedness efforts (Ferrier, n.d.). Barriers to training at the organizational level include the practicality of running mock disasters without interrupting the daily functions of a hospital department or compromising the quality of patient care. However, research has found that disaster drills typically have no impact on the timeliness of actual patients receiving care, despite the extra workload put on ER staff (Timm & Kennebeck, 2008). Another study conducted by Charney, Huskam, Armbrecht & Flood (2011) found that most caregivers of patients in an ER did not believe the presence of a mock exercise impacted the timeliness or quality of care that children received. In fact, most caregivers were satisfied with their visit to the ER despite the presence of a drill, and most understood the importance of these drills.

Study Limitations

This study has several important limitations. The sample size of this study was small and all participants came from one hospital. In addition, the study does not include participation from other allied health care professionals. Therefore, this study may be missing perspectives and opinions needed to generate a fully comprehensive and accurate description of staff preparedness to respond to a mass casualty event. The best patient outcomes during a mass causality event likely derives from a multidisciplinary approach, with all care providers working

collaboratively (Sierchio, 2003). Another limitation of this study is that it only includes RNs employed in one pediatric tertiary care centre of the sixteen across Canada. To address this, future research could survey a larger number of nurses in pediatric tertiary care centres across Canada.

With the study administered by Coordinators, there is a chance for the presence of social desirability bias from respondents. While the information letter outlined the anonymity of the survey, there remains a chance some respondents completed the survey with a desire to ensure the survey reflected positively on the participant or the department to which they work in.

In addition, the survey distributed to nursing staff was only available online using REDCap, meaning that nurses had to log onto their work email to access the survey link. This may have hindered the participation of some nurses with lower computer literacy. However, since most diagnostic and clinical documentation is online and all nurses are assigned to a dedicated computer during their shift, it is unlikely nurses felt uncomfortable completing an online survey. Despite these limitations, the study still highlights an area within nursing research that is seldom focused on. This research study increases the awareness of nurses as frontline resources during mass casualty events and of pediatric mass casualty events. Nurses' ability to effectively respond to these events and cope with the aftermath is directly linked to the overall success of a mass casualty event response.

Chapter Six-Recommendations and Conclusion

There is much to be done to improve the emergency preparedness of Canadian hospitals, where there is an overall lack of understanding of basic emergency management principles (Ferrier, n.d.).

Implications to Training

Nurses with previous experience in disaster response are, in general, better prepared (Labrague et al., 2017). Baack & Alfred (2013) observed a correlation between previous disaster response and higher EPIQ scores, indicating that practical and tactile training experiences increase nurses' perceptions of preparedness, which translates into increased skills and knowledge in preparedness. Due to the frequency of disasters and mass casualty events, training has long been accepted as the gold standard to expose nurses to disaster settings to increase experience opportunities to improve emergency preparedness (Baack & Alfred, 2013; Fox & Timm, 2008; Grove, 2017; Labrague et al., 2017; O'Sullivan et al., 2008; Skyabina, Reedy, Amlot, Jaye & Riley, 2017). Regular training not only increases nurses' experience with disaster-like situations, it also provides nurses with essential skills necessary to increase confidence in emotional preparedness and ability to cope during these high-stress events.

Currently, training opportunities are limited for nurses. A single mock exercise can bring awareness of the realism of mass casualty events and be used to highlight lessons learned and next steps. However, training for nurses must be regular and consistent to result in an overall increase in hospital readiness. As adult learners, nurses learn best when the subject matter is directly relevant to their lives (Ferrier, n.d.). Therefore, it is important for all training to be as realistic as possible, using a current risk hazard assessment to guide scenario development. Hospital readiness extends beyond the hospital, and therefore training scenarios should be guided

by community and regional hazards, including historical events, for nurses to understand and identify current risks their organizations may face. By understanding the potential disaster and mass casualty risks they face, nurses can then plan, educate and train accordingly.

Trainings should not be planned as stand-along events, but rather as elements of a larger curriculum using a diverse set of activities as well as engagement with other hospital staff. Due to the nature of hospital shift work, multiple training sessions will be required for all nurses in one department to participate.

Training Accessibility

There are barriers to nurses participation in exercises. Often if nurses are interested in an exercise planned and conducted by an agency external to the hospital they must attend on a day off, meaning they are providing their own transportation and are not paid for their time. Some hospitals may even create a disclaimer statement stating they are not liable for nurses who attend these events for insurance reasons. Hospitals should consider using training opportunities for nurses as an opportunity to invest in overall organizational readiness for mass casualty events, providing nurses with time off and paying for transportation and course fees. Governing bodies who regulate nursing licensure should invest in training for nurses that ensure access to high quality continuing education. By implementing a mandatory training credits program similar to medical residents and physicians, nurses can obtain a minimum number of mandatory and elective training credits to renew their nursing license and RN status. Mandatory training credits include courses such as Basic and Advanced Life Support courses and disaster preparedness courses, with elective credits left to the nurse's discretion depending on their area or nursing practice and interest. To ensure accessibility and compliance, governing nursing colleges can utilize a portion of license fees to provide education initiative dollars back to their constituents.

Nursing Education

An introduction to disaster preparedness and response within the nursing scope should begin in nursing school. Currently, by the time nurses graduate from nursing school and report to the bedside for their first shift as a RN, they will have had no education or training on disaster response. Studies have shown nursing school curricula has limited, if any, disaster preparedness and response education for students (Labrague et al., 2017). Foundational principles of emergency management such as the incident command system (ICS), concepts of decant and surge capacity, and basic skills of personal preparedness should be introduced early during nursing school (Chapman & Arbon, 2008).

Engage Nurses in Policy- and Decision-Making

The development and revision of disaster management protocols and plans allow for critical conversations regarding resource allocation and decision-making to occur. However, because best practice guidelines are not static, plans and policies should be living documents, undergoing regular revisions. The relationship between training and policies are symbiotic, meaning as exercises test protocols and identify practice gaps, and as research informs best practice, both should inform policy development and revisions. Furthermore, as frontline staff, nurses should be included in the policy development and revision processes. Currently, disaster policies are typically developed and maintained by hospital management staff. However, during mass casualty events, nurses are the first responders to activate and utilize the policies. If the policies are not written in a manner nurses can understand or follow easily under pressure, the policies are all but null and void in practice. Additionally, if policies are written such that decisions are made solely by hospital administrators, patient needs will not be met at the

frontline. By including nurses in policy development and maintenance, policies will be more likely to serve their function and successfully guide an organization through a disaster event.

Conclusion

Nurses will continue to play an integral role in mass casualty events involving children, providing direct patient care and ensuring the health and safety of children who present to the hospital injured or ill after a mass casualty event (O'Sullivan et al., 2008). Prior studies have consistently shown that Canadian hospitals are not prepared to respond to mass casualty evens involving children. In this study, although nurses perceive their preparedness as high, they simultaneously report the need for more training, and are unsatisfied with the current level of training they receive. In the same token, research also indicates that consistent training with regular exposure can increase levels of knowledge and skill as well as confidence in responding to mass casualty events. As disasters and mass casualty events continue to impact communities, hospitals, as leaders of the communities they serve, need to invest in their nursing staff to improve hospital readiness. As strong advocates for high quality patient-centered care, nurses can be empowered through training and education to improve preparedness and patient outcomes and to develop and sustain change within the hospital system. Future studies are needed to improve the understanding of nurses' ongoing perception of hospital readiness to evaluate any improvements that may be related to the implementation of consistent training for nursing staff.

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Appendix A

RESEARCH ETHICS BOARD APPROVAL LETTERS

May 17, 2019

Ethical Review – Rosemary Thuss

To Whom It May Concern:

This letter confirms that the Royal Roads University Research Ethics Board (RRU REB) has approved research for the project: **Nurses' Perception of Readiness for Mass Casualty Events Involving Children**, in accordance with TCPS 2 (2014) *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* and RRU Research Ethics Policy.

Approval was granted on **May 16, 2019**, pending any additional approvals required by the sponsoring organization or any other organization.

Should you require any additional information, please feel free to contact us.

Sincerely,

Gina Armellino
Research Ethics Coordinator

2005 Sooke Road, Victoria, BC, Canada, V9B 5Y2 Tel: (250) 391-2600 ext. 4425 Email: ethicalreview@royalroads.ca
www.royalroads.ca

Western Research

Date: 4 July 2019

To: Mrs Rosemary Thuss

Project ID: 114080

Study Title: Nurses' Perception of Readiness for Mass Casualty Events Involving Children

Application Type: HSREB Initial Application

Review Type: Delegated

Full Board Reporting Date: July 16, 2019

Date Approval Issued: 04/Jul/2019

REB Approval Expiry Date: 04/Jul/2020

Dear Mrs Rosemary Thuss

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above mentioned study as described in the WREM application form, as of the HSREB Initial Approval Date noted above. This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
Email to Children's Hospital Coordinators-July 2 2019 V1 (clean)	Email Script	02/Jul/2019	1
RThuss Research Proposal-2019	Protocol	20/Mar/2019	
RThuss-Letter of Information-July 2 2019 V2 (clean)	Written Consent/Assent	02/Jul/2019	
RThuss-Pilot Survey V1.0	Online Survey	27/Jun/2019	

No deviations from, or changes to, the protocol or WREM application should be initiated without prior written approval of an appropriate amendment from Western HSREB , except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

REB members involved in the research project do not participate in the review, discussion or decision.

The Western University HSREB operates in compliance with, and is constituted in accordance with, the requirements of the TriCouncil Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the International Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH GCP); Part C, Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Karen Gopaul, Ethics Officer on behalf of Dr. Philip Jones, HSREB Vice-Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

Appendix B

INVITATION TO PARTICIPATE [Email]

Dear Children's Hospital Coordinators,

I am currently conducting a research study for my Masters thesis in Disaster and Emergency Management program at Royal Roads University (RRU). My research, under the supervision of Dr. Jennifer Horney, studies nurses' perception of readiness for mass casualty events involving children. **Please open and read the attached letter of information with all the details related to the research study.**

Title of Study: Nurses' Perception of Readiness for Mass Casualty Events Involving Children

Disclosure Statement

As many of you know, my current role at LHSC is the Manager, Emergency Management, and I was previously a Registered Nurse at Children's Hospital. In accordance with RRU policy, Lawson Research Institute policy, LHSC policy and my ethical obligation as a research, I am disclosing my interest in the result of this study due to my previous and current roles LHSC, along with my role as the Principal Investigator of this research study. This research study is conducted for the purpose of master's thesis in Disaster and Emergency Management program at RRU, and not for LHSC purposes. This disclosure has been made fully to RRU, Lawson Research Institute, and LHSC, and I have in place an approved plan for managing any potential conflicts arising from the dual role I hold.

Purpose of the Study

The purpose of this study is to assess the level of preparedness of pediatric Registered Nurses (RN)s at Children's Hospital at LHSC for a mass casualty event involving children. The outcome of this study focuses on improving understanding of preparedness, and results will inform current practice and training for mass casualty events.

What I am asking of you

This research study seeks 270 Registered Nurses who are currently employed as staff nurses at Children's Hospital to complete a one-time survey that will take approximately 10 minutes to complete. It will ask questions related to the respondent's nursing career, his/her professional experience responding to mass casualty events, and his/her perceptions of preparedness at Children's Hospital at LHSC. The survey results will be kept anonymous and all responses are confidential.

I am asking that you forward this email and the attached letter of information to your staff, inviting them to participate in this study.

The link to the survey can be accessed here:
https://redcap.lawsonresearch.ca/surveys/?s=WAR4WHD4PE

If you have any questions concerning this email or your staffs' rights as possible participants in this research, please contact me at xxxxxxxx, or my Academic Supervisor, Dr. Jennifer Horney at xxxxxxxx.

I thank you for your support in this research study.

Yours sincerely,

Rosemary Thuss RN BScN
[Primary Investigator]

Appendix C

LETTER OF INFORMATION

Version Date: July 2, 2019

Nurses' perception of readiness for mass casualty events involving children

The link to the research survey titled 'Nurses' perception of readiness for mass casualty events involving children' is: https://xxxxxxxx

Principal Investigator: Rosemary Thuss RN BScN; Masters of Arts in Disaster and Emergency Management Program, School of Humanitarian Studies, Royal Roads University; Manager of Emergency Management, London Health Sciences Centre, xxxxxxxx

Academic Supervisor: Dr. Jennifer Horney PhD, MPH, CPH; Professor and Founding Director, Program in Epidemiology, Disaster Research Center, University of Delaware, xxxxxxxx

Faculty Member: Dr. Robin Cox PhD; Director, ResiliencebyDesign Research Lab; Professor, Disaster and Emergency Management, School of Humanitarian Studies, Royal Roads University, xxxxxxxx

Clinical Advisor: Dr. Naveen Poonai MSc MD FRCPC; Associate Professor Paediatrics & Internal Medicine, Schulich School of Medicine & Dentistry; Associate Scientist, Children's Health Research Institute; Research Director, Division of Paediatric Emergency Medicine, xxxxxxxx.

You are invited to participate in a survey conducted for a master's thesis in the Disaster and Emergency Management program at Royal Roads University, studying nurses' perception of readiness for mass casualty events involving children. This study is conducted under the supervision of Dr. Jennifer Horney.

Title of the study: Nurses' Perception of Readiness for Mass Casualty Events Involving Children

DISCLOSURE STATEMENT

In accordance with Royal Roads University (RRU) policy, Lawson Research Institute policy, London Health Sciences Centre (LHSC) policy, and ethical obligation as a researcher, the Principal Investigator (PI) has interest in the result of this study due to her previous role as a Registered Nurse at Children's Hospital, and current role as the manager, Emergency Management at LHSC. While this study is conducted for the purpose of a master's thesis in the Disaster and Emergency Management program at RRU and not for LHSC purposes, despite the PI holds a dual role as a master's student at RRU and the manager, Emergency Management at LHSC.

This disclosure has been made fully to RRU, Lawson Research Institute, and LHSC, and the PI has in place an approved plan for managing any potential conflicts arising from the dual role the PI holds.

BACKGROUND

Hospitals are regarded as leaders within the communities they are a part of, and there exists an expectation that during an emergency, hospitals will fulfill their leadership role, providing quality patient care to all those who require medical attention. It has been identified that there exist gaps in both the literature and in practice, regarding care for children during mass casualty events. Most studies either focus on the impact of mass casualty events in children in the community context, or when hospital preparedness is studied, research extends only to the Emergency Department.

The purpose of this study is to assess the level of preparedness of pediatric Registered Nurses (RN)s at Children's Hospital at London Health Sciences Centre (LHSC) for a mass casualty event involving children. The outcome of this study focuses on improving understanding of preparedness, and results will inform current practice and training for mass casualty events.

WHAT WILL BE ASKED OF YOU?

This research study seeks 270 Registered Nurses who are currently employed at Children's Hospital. You are invited to participate in this research study by completing a one-time survey following the link attached (link attached). The survey will take approximately 10 minutes to complete. It will ask questions related to your nursing career, your professional experience responding to mass casualty events, and your perceptions of preparedness at Children's Hospital at LHSC. The survey results will be kept anonymous and all responses are confidential. Your consent to participation to the research study will be obtained after opening the link to the survey attached, and by submitting a partially completed or completed survey.

RISKS AND BENEFITS

There are no risks associated with participating in this study. All surveys are submitted anonymously. There are no negative consequences associated with participation in the study, and there are no negative consequences associated with refusal of participation in the study. Because of the anonymity of each survey submitted, there are no immediate benefits associated with participating in this study. However, participation in this study will contribute to the overall assessment of the level of preparedness of pediatric Registered Nurses (RN)s at Children's Hospital at London Health Sciences Centre (LHSC) for a mass casualty event involving children. The information received from this study may help inform the capacities and education gaps amongst RNs who will care for children impacted by mass casualty events.

VOLUNTARY PARTICIPATION

Participation in this study is completely voluntary, and therefore you will have the right to refrain from opening the survey without negative consequences. Should you decide to participate in the study, you have the right to skip any questions in the survey. You will be able to submit the survey partially completed. You are free to withdraw from the study at any time prior to submitting your survey by closing the survey window, should you decide you would not like to participate in the study at any point prior to submitting the survey. However, once the survey is submitted, due to the anonymity of each completed survey, you will no longer be able to withdraw from the study.

There will be no negative consequences to your involvement with Children's Hospital, London Health Sciences Centre, or Royal Roads University should you decide not to participate in the study, withdraw from the study prior to submitting the survey, or refrain from answering any questions in the survey.

Only after you submit your survey will you agree to participate in the study.

WILL I BE PAID FOR PARTICIPATING, OR DO I HAVE TO PAY FOR ANYTHING?

Your participation in this study is voluntary. There are no costs you will incur as a participant of the study, nor will there be any compensation for the time spent completing the survey. Your time and participation in the study is appreciated.

WHAT WILL BE DONE WITH THE INFORMATION?

Your survey and responses to survey questions are anonymous and will be kept confidential using REDCap. REDCap is a Research Electronic Data Capture web-based tool for creating and managing online database applications and surveys. Hosted at the hospitals' data center, Lawson Research Informatics administrates this secure platform to meet diverse research needs of the Lawson community. The data collected through this study will be kept in accordance to Lawson Research Institute and LHSC SOPs. The archived data is usually kept for 15 or 25 years based on the retention period and applicable regulations and then destroyed.

Authorized representatives from the Royal Roads University, Western University Research Ethics Board and the Lawson Health Research Institute may look at the anonymous survey responses and relevant data for quality assurance purposes.

Data collected from your participation in this research study will be used for descriptive analyses to study associations and any statistically significant trends. Results from the analyses will be used in the PI's final master's thesis. Any future use of this research data is required to undergo review by a Research Ethics Board.

AGREEMENT TO PARTICIPATE

Your decision to complete and return this survey will be interpreted as an indication of your agreement to participate. In no way does this waive your legal rights nor release the

investigators, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time.

If you have further questions concerning matters related to this research, please contact:

Rosemary Thuss: xxxxxxxx

or

Dr. Jennifer Horney: xxxxxxxx

If you have any questions concerning your rights as a possible participant in this research, please contact the Royal Roads University Research Ethics Board:
xxxxxxxx.

Royal Roads University Research Board, Lawson Health Research Institute, Western University Research Ethics Board have approved of this research.

Thank you in advance for your interest in this project.

The link to the research survey titled 'Nurses' perception of readiness for mass casualty events involving children' is: https://xxxxxxxx

Yours sincerely,

Rosemary Thuss [Primary Investigator]

This letter is yours to keep for future reference.

Appendix D

SURVEY TO PARTICIPANTS

Nurses' Perception on Readiness for Mass Casualty Events Involving Children

Dear Participant,

Thank you for deciding to participate and providing consent to this research study which focuses on nurses' perception on hospital preparedness in mass casualty events involving children. Your participation in this research study will help the researcher understand nurses' perception of hospital preparedness, and the results will inform current practice and training for mass casualty events.

The following survey will take you approximately 10 minutes to complete and has four components asking questions on the following topics:

(1) professional demographics and employment history
(2) experience working as a Registered Nurse (RN) in a mass casualty event
(3) knowledge questions related to current mass casualty procedures at Children's Hospital at London Health Sciences Centre (LHSC)
(4) perceptions on professional preparedness.

Please note that responses to the survey are anonymous, confidential, and will be used solely for the purposes of this research study. You may wish to refrain from answering any questions in the survey, without any consequence. You may wish to withdraw from this survey at any time by closing the survey, however your responses will not be saved. By submitting the survey, you will be providing consent to participate in the survey. After submitting the survey, you will no longer be able to withdraw due to the anonymity of each survey.

Thank you again for your participation to this research study!

The following questions ask about your education and experience as a Registered Nurse.

1) Please select the option which is most applicable:
I am a Registered Nurse (RN) with a

- o College Nursing Diploma.
- o Bachelors of Science in Nursing Degree (BScN).
- o Post Diploma-Bachelors of Science in Nursing Degree (BScN).

2) Please select any education in addition to your education you may have:

- ☐ College Diploma
- ☐ Graduate College Certificate
- ☐ Bachelors Degree
- ☐ Masters Degree
- ☐ Postdoctorate Degree
- ☐ None of the Above

3) I have been a Registered Nurse (RN) for __ years.

_____

4) Please check the following clinical areas you have experience working as a Registered Nurse (RN), currently or previously; including with adults or paediatrics.

- ☐ Emergency Care
- ☐ Critical Care
- ☐ None of the Above

5) Please check the following courses or certifications you have completed (current or expired):

- ☐ Advanced Cardiovascular Life Support (ACLS)
- ☐ Certified Nurse in Critical Care (C)anada (CNCC(C))
- ☐ Emergency Nurse Certified (C)anada (ENC(C))
- ☐ Emergency Nursing Pediatric Course (ENPC)
- ☐ Federal Emergency Management Agency (FEMA) Independent Study (IS) courses
- ☐ Incident Management System (IMS)/Incident Command System (ICS) courses
- ☐ Neonatal Resuscitation Program (NRP)

- ☐ Pediatric Advanced Life Support (PALS)
- ☐ Trauma Nursing Core Course (TNCC)
- ☐ Other None of the Above

5i) If applicable, please list any Federal Emergency Management Agency (FEMA) Independent Study (IS) courses you have completed.

_____

5ii) Please list all IMS/ICS courses you have completed.

_____

5iii) Please list any courses or certifications relevant to your nursing career that you have completed and are not listed in the above list.

_____

The following questions ask about your experience working as a Registered Nurse (RN) during a multiple or mass casualty event.

6) Have you responded to a multiple or mass casualty event in a hospital setting?

- o Yes If 'yes', please answer Question 7, 8, 9.
- o No If 'no', please skip to Question 10.

7) Did the hospital activate a 'Code Orange'?

- o Yes
- o No

8) How would you report your level of involvement as a Registered Nurse (RN) in the multiple or mass casualty event that you responded to?

- o Minimal patient care, with mostly non-patient care tasks carried out
- o Some patient care, with some non-patient care tasks carried out
- o Substantial patient care, with some non-patient care tasks carried out
- o Extensive patient care, with minimal non-patient care tasks carried out

9) Where were you when you first received notification of the multiple or mass casualty event?

- o I was off-shift, away from the hospital at the time
- o I was off-shift but at the hospital at the time

- I was on-shift, working at the hospital at the time
- I was on-shift but away from the hospital at the time

The following questions ask about your knowledge related to current mass casualty procedures at Children's Hospital at London Health Sciences Centre (LHSC).

10) Based on your experience, what events do you consider a multiple or mass casualty event in a hospital? (check all that apply)

- ☐ A trauma incident involving 2 or more patients admitted to hospital
- ☐ When the inpatient units are full and patients admitted to hospital spend over 24 hours in the Emergency Department
- ☐ An incident activating a 'Code Orange' at the hospital
- ☐ A pandemic situation, similar to SARS in 2003
- ☐ I do not know

11) Select the best answer describing the following statement.
A 'Code Orange' at Children's Hospital at London Health Sciences Centre (LHSC) is:

- An incident that occurs in the Emergency Department resulting in its closure, and patients are now diverted to an Emergency Department at a different hospital.
- An incident that occurs outside the hospital, resulting in a number of casualties that will overwhelm the hospital.
- A severe weather incident occurs, and the hospital is on standby in case casualties present to the Emergency Department.
- An incoming Ornge helicopter is awaiting landing on the hospital helipad.
- I do not know

12) Select the best answer describing the following statement.
A 'Code Purple' incident is:

- A robbery incident occurring in the hospital
- An active shooter incident occurring in the hospital
- A hostage incident occurring in the hospital
- A violent behavior incident occurring in the hospital
- I do not know

13) Select the single best answer describing the following statement.
The triage system used in the Emergency Department during a 'Code Orange' at LHSC is called:

- CTAS
- SALT
- JumpSTART

- Military Triage
- I do not know

14) Select the single best answer describing the following statement.
After hearing a 'Code Orange' overhead activation, what should be the first actions from your department?

- Call all your staff in to work
- Page your Coordinator for instructions
- Vertically evacuate all patients and family in your department two floors down
- Send the Charge Nurse/In-Charge Person (ICP) down to the Emergency Department for a debrief meeting
- I do not know

15) Select the best answer describing the following statement.
Departmental Leaders will be identified throughout Children's Hospital during a 'Code Orange'. They are:

- Incident Commander, Planning Lead, Finance Lead, Clinical Operations Lead
- Physician Lead, Clinical Operations Lead, Logistics Lead, Incident Commander
- Charge Nurse, Coordinator, Educator, Physician, Support Services
- Clinical Operations Lead, Educator Lead, Equipment and Supply Lead, Physician Lead
- I do not know

The following questions ask about your perceptions on professional preparedness regarding a mass casualty event at Children's Hospital at London Health Sciences Centre (LHSC).

16) A mass casualty event involving PRIMARILY CHILDREN and requiring a 'Code Orange' activation will occur at some point during my career as a Registered Nurse (RN) at Children's Hospital at London Health Sciences Centre (LHSC).

- Strongly Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

17) A mass casualty event involving a MIX OF CHILDREN AND ADULTS, and requiring a 'Code Orange' activation will occur at some point during my career as a Registered Nurse (RN) at Children's Hospital at London Health Sciences Centre (LHSC).

- Strongly Disagree

- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

18) A mass casualty event involving PRIMARILY ADULTS, and requiring a 'Code Orange' activation will occur at some point during my career as a Registered Nurse (RN) working at Children's Hospital at London Health Sciences Centre (LHSC).

- Strongly Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

19) As a Registered Nurse (RN), I have the skill and knowledge to respond to a multiple/mass casualty event at Children's Hospital at London Health Sciences Centre (LHSC).

- Strongly Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

20) As a Registered Nurse, I have the emotional and mental ability to cope, and care for children who are impacted by a mass casualty event, presenting at Children's Hospital.

- Strongly Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

21) Children's Hospital at London Health Sciences Centre (LHSC) has enough equipment and supplies, or means to procure the required supplies and equipment, to respond to a multiple/mass casualty event.

- Strongly Disagree
- Somewhat Disagree
- Neutral

- Somewhat Agree
- Strongly Agree

22) As a Registered Nurse (RN), I receive regular training and education that help me care for patients during a multiple/mass casualty event at Children's Hospital at London Health Sciences Centre (LHSC).

- Strongly Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

23) I am satisfied with the training I receive to prepare me for a multiple/mass casualty event at Children's Hospital at London Health Sciences Centre (LHSC).

- Strongly Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

24) Children's Hospital is prepared to respond to a mass casualty event involving children.

- Strongly Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

25) Weighing against other priorities, how important is 'Code Orange' preparedness to your professional development?

- Strongly Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Strongly Agree

Appendix E

RESULTS TABLE

Table 1

Demographic characteristics of RN participants

	College Diploma RN (n=10)		BScN RN (n=24)		Total (n=34)	
Characteristics	n	%	n	%	n	%
Additional education to nursing						
College diploma	3	30%	2	8.3%	5	15%
Graduate college certificate	1	10%	1	4.2%	2	6%
Bachelors degree	0	0%	7	29.2%	7	21%
Masters degree	0	0%	3	12.5%	3	9%
Post-doctorate degree	0	0%	0	0%	0	0%
No additional education to nursing	4	40%	11	45.8%	15	44%
Nursing experience						
0-5 years	0	0%	11	45.8%	11	32%
6-10 years	0	0%	8	33.3%	8	24%
11-15 years	0	0%	4	16.7%	4	12%
16-20 years	2	20%	0	0%	2	6%
21 and more years	8	80%	1	4.2%	9	27%
Clinical specialty experience						
Emergency care only	1	10%	6	25%	7	21%
Critical care only	6	60%	4	16.7%	10	29%
Both emergency care and critical care	3	30%	5	20.8%	8	24%
Neither	0	0%	9	37.5%	9	27%
Additional Courses or Certificates						
Advanced Cardiovascular Life Support (ACLS)	3	30%	6	25%	9	27%
Certified Nurse in Critical Care (C)anada (CNCC(C))	3	30%	1	4.2%	4	12%
Emergency Nurse Certified (C)anada (ENC (C))	1	10%	1	4.2%	2	6%
Emergency Nursing Pediatric Course (ENPC)	2	20%	4	16.7%	6	18%
Federal Emergency Management Agency (FEMA) Independent Study (IS) courses	0	0%	0	0%	0	0%
Incident Management System (IMS)/Incident Command System (ICS) courses	0	0%	1	4.2%	1	3%
Neonatal Resuscitation Program (NRP)	8	80%	13	54.2%	21	62%

Pediatric Advanced Life Support (PALS)	8	80%	16	66.7%	24	71%
Trauma Nursing Core Course (TNCC)	3	30%	2	8.3%	5	15%
Other	1	10%	2	8.3%	3	9%
No additional courses or certificates	0	0%	4	16.7%	4	12%
Experience responding to multiple or mass casualty event						
Yes	2	20%	7	29.2%	9	27%
No	8	80%	17	70.8%	25	74%

Table 2

Perception Mean Scores

1=Strongly Disagree; 2=Somewhat Disagree; 3=Neutral; 4=Somewhat Agree; 5=Strongly Agree

Perception Question	Mean Score	Standard Deviation
A mass casualty event involving PRIMARILY CHILDREN and requiring a 'Code Orange' activation will occur at some point during my career as a Registered Nurse (RN) at Children's Hospital at London Health Sciences Centre (LHSC).	3.8	1.1
A mass casualty event involving a MIX OF CHILDREN AND ADULTS, and requiring a 'Code Orange' activation will occur at some point during my career as a Registered Nurse (RN) at Children's Hospital at London Health Sciences Centre (LHSC).	4.0	0.93
A mass casualty event involving PRIMARILY ADULTS, and requiring a 'Code Orange' activation will occur at some point during my career as a Registered Nurse (RN) working at Children's Hospital at London Health Sciences Centre (LHSC).	4.0	0.97
As a Registered Nurse (RN), I have the skill and knowledge to respond to a multiple/mass casualty event at Children's Hospital at London Health Sciences Centre (LHSC).	3.3	0.94
As a Registered Nurse, I have the emotional and mental ability to cope, and care for children who are impacted by a mass casualty event, presenting at Children's Hospital.	3.9	1.0
Children's Hospital at London Health Sciences Centre (LHSC) has enough equipment and supplies, or means to procure the required supplies and equipment, to respond to a multiple/mass casualty event.	2.6	1.1
As a Registered Nurse (RN), I receive regular training and education that help me care for patients	2	1.1

during a multiple/mass casualty event at Children's Hospital at London Health Sciences Centre (LHSC).		
I am satisfied with the training I receive to prepare me for a multiple/mass casualty event at Children's Hospital at London Health Sciences Centre (LHSC).	1.9	1.0
Children's Hospital is prepared to respond to a mass casualty event involving children.	2.6	0.91
Weighing against other priorities, how important is 'Code Orange' preparedness to your professional development?	4.1	0.89

Table 3

P-value characteristics versus perception

	Perception Skills and knowledge to respond to MCE	Perception Emotional and mental ability to cope	Perception RN receive regular training	Satisfaction with training	Perception hospital is ready
RN education Diploma BScN	p=0.13	p=0.5	p=0.84	p=0.4	p=0.75
Years of nursing experience 10 years or less More than 10 years	p=0.41	p=0.34	p=0.35	p=0.35	p=0.54
Specialty Experience Emergency or critical care experience No experience	p=0.28	p=0.59	p=0.45	p=0.94	p=0.42
Knowledge test score Received over 50% on knowledge test questions Did not receive 50% on knowledge test questions	p=0.61	p=0.17	p=0.08	p=0.23	p=0.32
'Code Orange' experience Had 'Code Orange' experience No 'Code Orange' experience	p=0.48	p=0.74	p=0.26	p=0.26	p=0.42