Factors Influencing Quality of Emergency Department Nurse Shift Handover

by

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Abstract

Nurse-to-nurse shift handover communication is an essential exchange of information that occurs at shift change with the purpose of ensuring that incoming nurses have necessary information to take responsibility for their patients and to provide high quality, safe care. Poor quality shift handover has been associated with adverse outcomes such as incorrect treatment, delays in diagnosis, increased length of stay, and both nurse and patient dissatisfaction. Despite an increase in the amount of handover related literature, little is known about factors that influence quality of nurse-to-nurse shift handover.

The Emergency Department (ED) environment presents unique challenges for high quality handover communication as a result of unpredictability, increased volumes and rapid patient turnover. The purpose of this study was to test and refine a conceptual model of 18 factors hypothesized to influence quality of nurse-to-nurse shift handover communication in the ED. This study was conducted using a cross-sectional survey design. A total of 650 ED nurses across the Province of Ontario were invited to participate in this study. The survey included questions about demographic information as well as items and instruments to measure concepts such as staffing, triage, relationships, safety climate, interruptions, job stress, fatigue and handover
format. The hypothesized conceptual model was tested using backwards stepwise multiple regression with data from a final sample of 227 participants.

Following multiple regression analysis, four statistically significant predictors were retained in the final model. Together, triage flow, intrusions, safety climate and relationships explained 34% of the variance in handover quality (p < 0.0001). Handover quality was increased when patients flowed smoothly through triage, when nurses experienced positive intrusions, in the presence of a positive safety climate and positive relationships between incoming and outgoing nurses. By developing interventions targeted towards improving triage flow, encouraging appropriate intrusions, and fostering a positive safety climate and positive relationships among nurses, ED nurse-to-nurse shift handover quality can be improved.
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Chapter 1: Introduction

Effective communication among healthcare providers is integral to the provision of safe patient care (Manser & Foster, 2011). Yet literature suggests that communication between healthcare providers is often subject to failure, resulting in negative consequences for patients, staff and healthcare organizations. In 2013, the US Joint Commission listed communication failures as a major cause of over 63% of documented adverse events (The Joint Commission, 2013). For example, communication failures among hospital staff have been linked with death and disability (The Joint Commission, 2013). Zinn (1995) reported that 25,000 to 30,000 individuals experienced a preventable adverse event leading to permanent disability in Australian hospitals. Eleven percent of these adverse events were the result of communication problems (Zinn, 1995). The effectiveness of communication among healthcare providers has become such a prevalent issue that the World Health Organization (WHO) had declared communication and coordination to be the top research priority for developed countries (WHO, 2009).

Nurse-to-Nurse Handover Communication

Hospital nurses provide 24-hour care for hospitalized patients. As a result, nurses must ensure continuity of patient care by sharing information with incoming colleagues (Lardner, 1996). Nurse-to-nurse handover communication is defined as bidirectional communication that results in the transfer of information and responsibility for a patient (Friesen, White & Byers, 2008; McFetridge, Gillespie, Goode & Melby, 2007; Tregunno, 2009). Nurses depend on information provided during handover to inform decision making, to establish priorities, and to plan and provide patient care (Strople & Ottani, 2006). The transfer of responsibility for a patient distinguishes handover communication from other forms of communication (Cohen & Hilligoss, 2010).

Shift handover is communication that occurs during shift change and rest/breaks. Other types of handover communication, such as intrahospital and interhospital handover, occur during transfer of patients to other departments, transfer of patients to other units, and transfers to other facilities (Ong, Biomed & Coiera, 2011). The primary purpose of shift handover communication is to ensure continuity of patient care where the incoming nurse receives necessary information to effectively care for assigned patients, including assessment data, health and safety issues, care delivered, and outstanding care that is required (Carroll, Williams & Gallivan, 2012; Lelean, 1976; Manias & Street, 2000; Manser, Foster, Gisin, Jaeckel &
Ummenhofer, 2010; Walker, 1967). The information obtained during handover is then used to increase the effectiveness of actions taken by the receiving nurse (Cohen & Hilligoss, 2010). According to several sources, the secondary purpose of handover communication is to reinforce the group’s social cohesion through interaction with peers by providing opportunities to discuss social matters and updates (Lally, 1999; Lelean, 1976; Payne et al., 2000; Randell, Wilson & Woodward, 2011; Walker, 1967). Other functions include social support for nurses and training for less experienced nurses (Kerr, 2002; Lally, 1999). As interest in the topic of handover continues to expand, the lexicon used to describe the process continues to increase. Shift handover is also known as shift report, sign out, sign off, transfer of accountability, shift change, change over, and handoff (Tregunno, 2009). In this thesis, the terms handover and report are used interchangeably.

Nurse-to-nurse shift handover is a regular occurrence. Handover communication occurs on every patient care unit, within every healthcare organization, all over the world (Staggers, Clark, Blaz & Kapsandoy, 2011). Handover communication is estimated to comprise approximately 8-16% of nurse activities (Duffield et al., 2005; Pelletier et al., 2005). Handover communication tends to take the form of a verbal exchange, however, handover can also be provided via tape/digital recording or in written format, proximal (bedside) or distant to the patient (Benson, Rippin-Sisler, Jabusch & Keast, 2007; Sexton, Chan, Elliott, Stuart, Jayasuriya & Crookes, 2004). More recently, handover has been facilitated by the use of mnemonic devices (Clark, Squire, Heyme, Mickle & Petrie, 2009; Haig, Sutton & Whittington, 2006; Porteous, Stewart-Wynne, Connolly & Crommelin, 2009; Riesenber, Leitzsch & Little, 2009; Sandlin, 2007; Street et al., 2011; Thomas & Donohue-Porter, 2012) or through the use of written or computer generated handover information sheets containing patient information such as vital signs and allergies (Athwal, Fields & Wagnell, 2009; Barnes, Campbell, Stockman & Wunderlink, 2011; Nelson & Massey, 2010; Staggers et al., 2011). Although handover communication can take a variety of different formats, to date there is limited evidence supporting superiority of any one type of handover communication method (Riesenber, Leitzsch & Cunningham, 2010).

**Ineffective Handovers and Associated Consequences**

Despite nurses’ experience in providing handover communication, current literature suggests that handovers are not done well (Athwal et al., 2009; Benson, Rippin-Sisler, Jabusch &
Keas, 2007; McFetridge et al., 2007; Meissner et al., 2007; Ong et al., 2011; Sexton et al., 2004). When examining hospital safety climate, handovers often received the worst ratings from nurses and physicians compared to other safety related activities (Campbell et al., 2010). This may be because information provided during handover communication has often been noted as incomplete, inaccurate or subjective (Kerr, Lu, McKinlay & Fuller, 2011; Meissner et al., 2007; McCloughen, O’Brien, Gillies, & McSherry, 2008; Ong et al., 2011).

The provision of incomplete or inaccurate information, omissions, or misinformation during handover communication can result in uncertainty and false assumptions by clinicians (Arora et al., 2005; Estryn-Behar et al., 2014; Sharit et al., 2008). Findings from a study examining medical resident handover indicated that 58.3% of medical residents reported minor patient harm as a result of problems with handover (Kitch et al., 2008). Kitch et al. (2008) also found that 12.3% of residents reported that a patient experienced major harm as a result of handover problems. In a qualitative study of physician handovers between the Emergency Department (ED) and inpatient units, Apker et al. (2007) stated that physicians identified poor handover as contributing to fragmented care and increased risks for patients with extended ED lengths of stay. Clair and Trusell (1969) and Richard (1988) found that nurse-to-nurse handover often does not reflect the patient’s actual condition. Richard (1988) defined this mismatch as information incongruence, which can lead to improper patient monitoring. For example, a nurse may not frequently monitor an unstable patient who was previously reported to be stable.

Handover exchanges are regularly conducted in locations where nurses are interrupted by patients, families, and other staff members. This can lead to information gaps and exchange of incorrect information (Meissner et al., 2007; McCloughen et al., 2008; Sharit et al., 2008; Staggers & Jennings, 2009). The length of time for handover varies greatly, often resulting in patients being left unattended for extended periods of time (Benson et al., 2007; Meissner et al., 2007, Staggers & Jennings, 2009; Street et al., 2011). This situation leaves patients at risk for adverse events such as falls, unexpected cardiac arrest, delayed treatment, and failure-to-rescue (Athwal et al., 2009; Rabol et al., 2011). Many hospitals do not have policies or guidelines outlining the length of time allotted for shift handover (Benson et al., 2007; Street et al., 2011). As such, the length of handover communication varies from nurse to nurse (Athwal et al., 2009; Lamond, 2000). When clinicians take excess time to provide handover communication, the result is increased costs related to overtime and less time for patient care delivery (Athwal et al., 2009;
Nelson & Massey, 2010). Nurse-to-nurse handover communication can result in nurse dissatisfaction with factors such as the length of shift handover, interruptions, and amount of information provided during shift handover (Meissner et al., 2007).

According to the Australian Council for Safety and Quality in Health Care (2005), poor quality handover communication can result in “(1) wrong treatment, (2) delays in medical diagnosis, (3) life threatening adverse events, (4) patient complaints, [and] (5) increased hospital length of stay” (p.1). In addition to these consequences, it is hypothesized that other negative outcomes may occur as a result of poorly executed handover communication. For example, incomplete nurse-to-nurse handover can result in missed medications or double dosing of medications, as nurses may either believe that a medication was administered when it was not, or believe that a medication was not given and administer it. Misinformation or omissions during nurse-to-nurse handover communication can result in adverse consequences such as disease outbreaks if nurses enter isolation rooms without realizing that they should be wearing protective equipment. Finally, handover communication failures may lead to frustration and anger from both patients and their families when nurses are unable to provide information about diagnostic tests and care plans.

**Nurse-to-Nurse Communication in the Emergency Department**

According to Laxmisan et al. (2007), “all clinicians, including physicians, residents and nurses identified shift changes as a source of the communication gap in the ED” (p.808). Yet, the majority of the literature related to healthcare provider communication and nurse-to-nurse handover communication is focused on hospital medical inpatient units, where nurses have the opportunity to get to know patients over the course of their admission (McFetridge et al., 2007). Interestingly, there are few studies focused exclusively on nurse-to-nurse shift handover communication in the ED (Klim et al., 2013). This is surprising because of the increased number of patient transfers that occur into, within, and out of the department. The ED is a unique environment that presents many challenges to effective nurse-to-nurse shift handover (Klim et al., 2013).

One of the distinctive characteristics of the ED that has implications for nurse handover communication is the chaotic and erratic nature of the environment (Ong et al., 2011). Patient volumes are unpredictable, as there is usually no limit on the number of patients registered in the department at any given time (Klim et al., 2013; Lawrence, Tomolo, Garlisi & Aron, 2008). The
flow of individuals who are not patients is also high, as visitors, consultants, paramedics, and police come and go throughout the ED. Patients in the ED are often acutely ill with unpredictable trajectories, requiring intense nursing intervention (Baker, 2010; Klim et al., 2013; Lawrence et al., 2008). In this situation, nurses may become focused on one particular patient and forget details about other patients. This presents opportunities for information omissions as well as mix-ups during handover, as nurses’ memory lapses may hinder information recall.

In the ED, there are frequently multiple caregivers for one patient, along with numerous transfers within the department (Baker, 2010; Klim et al., 2013; Lawrence et al., 2008). Frequent patient movement leads to an increased number of handover reports conducted under time pressure, as patients are usually transferred when they begin to deteriorate (Lawrence et al., 2008). Frequent movement also results in nurses having less time to get to know their patients, making it more difficult to provide accurate information to the next nurse. According to Mahajan (2011), 50% of hospital admissions begin in the ED. As the ED is often the first point of care for hospital inpatients, it is important to ensure that nurse-to-nurse handover communication is effective.

Quality Handover Communication

Effective or high quality shift handover communication has not been well defined in the literature. Some studies have used the term handover quality in the absence of a definition (McCloughen et al., 2008). Several published papers suggest that a standard definition of quality or effectiveness remains elusive, as it is contingent upon researcher perceptions of the primary function of handover (Carroll et al., 2012; Lardner, 1996; Manser & Foster, 2011; Patterson & Wears, 2010; Riesenberg, Leitzsch & Cunningham, 2010). Lack of clarity related to the definition of handover quality renders it difficult to measure and compare the concept across studies, as well as to design interventions aimed at improving overall handover quality.

Patterson and Wears (2010) and Cheung et al. (2010) suggest that indicators of handover quality can include measures of content, processes or outcomes of handover. Content measures assess quality by determining whether or not handover followed protocols or contained or omitted predetermined content such as history, medical issues, resuscitation status, assessment findings, pending laboratory results and outstanding consultations (Arora, Johnson, Lovinger, Humphrey & Meltzer, 2005; Carroll et al., 2012; Catchpole et al., 2007; Cheung et al., 2010; Currie, 2002; Manser et al., 2010; Patterson et al., 1995; Patterson & Wears, 2010; Siddiqui et
al., 2012; Ye, Taylor, Knott, Dent & MacBean, 2007). Process measures of quality or effectiveness examine processes involved in the provision of handover communication such as retention of information, recall abilities of incoming clinicians and ability to manage competing demands such as needs of patients and colleagues during handover (Bhabra, Mackeith, Monteiro & Pothier, 2007; Pickering, Hurley & Marsh, 2009; Talbot & Bleetman, 2007). Outcomes associated with quality or effectiveness of handover include ability to answer questions while on call, death, disability, medication errors, falls, patient satisfaction, nurse satisfaction, and nurse overtime (Athwal et al., 2009; Borowitz et al., 2008; Meissner et al., 2007; Rabol et al., 2011).

In addition to the single definitions of handover quality, several authors propose multifaceted definitions, including both content and process. Slagle and colleagues (2007) characterize effective handover between operating room teams and PACU clinicians through content (information transfer) and processes (use of evidence-based handover strategies, interpersonal skills and team behaviours). Jeffcott et al. (2009) state that quality handover communication is comprised of providing information, taking responsibility for the patient, as well as contextual factors such as teamwork and work environment. In a recent mixed methods study conducted by Klim and colleagues (2013), ED nurses identified handover that was structured, tailored to their specific patients, conducted at the bedside and containing information such as problem, treatment, plan and patient information as reflective of effective handover. Manser et al. (2010) propose that quality or effective handover communication entails adequate information transfer (e.g., relevant information organized logically), creating a shared understanding with the incoming clinician (e.g., providing opportunities for questions and clarification), and creating a working atmosphere with colleagues and patients (e.g., establishing good contact with colleagues, respecting patients). More recently, Manser and colleagues (2013) examined team communication in the operating room using an instrument developed by Manser et al. (2010). Based on survey results, Manser et al. (2013) concluded that quality handovers are comprised of a discussion of patient care (e.g., assessment information), organized information (e.g., relevant information organized logically), and creating a shared understanding (e.g., providing opportunities for questions and clarification).

Only one study examined handover content, processes and outcomes. Anwari (2002) defined handover quality between the operating room and the postanesthesia care unit (PACU) as quality of verbal information, condition of the patient upon transfer, professional behavior of
the anesthesiologist, and nurse satisfaction with handover. Although this study included content, processes and outcomes, it was focused on PACU related activities and transfers between disciplines.

For the purposes of this thesis, Manser et al.’s (2013) definition of quality will be used. This definition has been selected as it is multifaceted and is congruent with theoretical perspectives identified in Chapter 2. The definition of handover quality includes a discussion of patient care, organized information, and creation of a shared understanding (Manser et al., 2013).

Problem

From the evidence presented in this chapter, ineffective or poor quality nurse-to-nurse handover communication in the ED can have negative implications for patients, staff, and healthcare organizations. Adverse consequences range from serious issues such as death, disability, medication errors, and falls, to less serious outcomes such as decreased patient satisfaction, decreased nurse satisfaction, and increased nurse overtime. Although nurse-to-nurse communication issues have been widely reported in the literature, there are few quantitative studies documenting factors that influence nurse-to-nurse handover communication in the ED. A number of recent papers highlight a lack of empirical evidence that explains what factors result in an effective or quality handover (Cohen & Hilligoss, 2010; Raduma-Tomas, Flin, Yule & Williams, 2011; Riesenber et al. 2010). Ilan et al. (2012) state there is a need to identify those factors that contribute to high quality handover communication. Understanding factors that influence quality of ED nurse-to-nurse shift handover is integral to developing interventions to promote handover quality and ultimately lead to improved patient safety, continuity of care, and staff and organizational outcomes. Therefore, this study aims to identify factors that influence the quality of nurse-to-nurse shift handover communication in the ED.
Chapter 2: Review of the Literature and Conceptual Framework

In this chapter, theoretical and empirical literature related to the following is discussed: patient safety, communication theory (derived from psychology and sociology), and handover communication literature including both nurse-to-nurse and physician-to-physician. Safety literature is used to demonstrate the relationship between ED nurse-to-nurse shift handover communication and patient safety. Communication and handover related literature form the foundation for identifying factors that contribute to handover quality. The overall purpose of this chapter is to review relevant literature, identify gaps in existing literature, and to propose a conceptual model of factors that influence quality of ED nurse-to-nurse shift handover communication. The proposed model was tested in this study. This chapter ends with the study purpose, research question, conceptual model, and hypotheses.

Literature Review Methods

The search strategy utilized in this literature review began in August 2011 and was updated in the latter half of 2014. The literature review included an electronic search of Medline and Cumulative Index to Nursing and Allied Health Literature (CINAHL) with keywords including handover, handoff, transfer of accountability, shift report, sign out, sign off, change of shift, shift change, and change over. In April 2015, an additional search using the same keywords was carried out using PsychINFO. Proquest’s Dissertation Abstracts International was also reviewed to assist with the identification of additional published literature. Results were limited to those papers that were published in English and that were available through the University of Toronto library.

Through this search strategy, a total of 728 published titles (including duplicates) were identified. The titles of papers were reviewed and if relevant to this study, the abstracts were evaluated. A total of 159 published papers with relevant abstracts were reviewed. Manuscripts were included if they presented empirical data (qualitative or quantitative) or if they included a theoretical perspective of factors that influence shift handover communication. Exclusion criteria included those papers that were opinion based such as editorials, those that were not available in English and those that were not accessible through the University of Toronto library. From the 159 manuscripts that were reviewed, 103 were retained in this literature review, plus eight additional published manuscripts, which were identified through reference lists. Therefore, a
total of 111 published manuscripts pertaining to handover communication were included in this literature review, including eight handover related systematic literature reviews.

Published papers and texts pertaining to communication and safety related conceptual models and theories were identified by reading seminal literature in these fields. A total of seven communication theory textbooks and one published communication paper were included, in addition to ten safety science related textbooks and 18 safety science published manuscripts.

Patient Safety Conceptual Literature

Theoretical Approaches to Understanding Errors in Healthcare

Errors in healthcare are considered to be any planned sequence of events that do not unfold as intended (Reason, 1990). These events may or may not lead to an undesired outcome or adverse consequence, depending on the presence of other hazards. As discussed in Chapter 1, handover communication can contribute to adverse events and other unfavorable consequences for patients, families, clinicians, and organizations. When providing handover communication, nurses are responsible for providing sufficient, clear, and organized information to allow their incoming colleagues to take over accountability and care for patients. Quality or effective handover communication is defined as an exchange of information that contains a discussion of patient care information, provides organized information, and creates a shared understanding between participants (Manser et al., 2013). Handover communication that is incomplete, unclear, contains omissions or misinformation is considered to be an error as it has not unfolded as intended (Reason, 1990). The following section contains an exploration of a taxonomy of errors related to skill, rule, and knowledge-based performance.

Skill, Rule and Knowledge-Based Performance

In 1974, Rasmussen and Jensen proposed a framework of human information processing in electronics repairmen. Since then, this framework has been adopted by other industries such as aviation and healthcare. Within this framework, individual performance is divided into three distinct categories: skill-based, rule-based, and knowledge-based (Rasmussen, 1983; Rasmussen & Jensen, 1974). Skill-based performance occurs when individuals apply “…pre-packed, structured thought patterns” (Armitage, 2009, p.195) to carry out tasks (Rasmussen, 1983). Once skills are learned and ingrained within an individual, actions are automatic and completed without a great deal of thought or conscious attention (Embrey, 2005). An example of skill-based
performance is a nurse taking a patient’s blood pressure. This is an activity that can be carried out with very little mental effort from the nurse.

Rule-based performance is similar to skill-based performance, where tasks are carried out without much thought. However, the completion of tasks is based on memorization of steps or rules, similar to a recipe, rather than a deeply ingrained thought pattern (Rasmussen, 1983). Cognitive processing requirements in rule-based performance are higher than skill-based performance but lower than requirements for knowledge-based performance (Embrey, 2005). For example, when deciding to administer antipyretic medication for a fever, the nurse ensures that the patient has a temperature greater than 38.5°C.

Knowledge-based performance occurs when there is no pre-determined solution and the individual must use conscious thought processing to make a decision and carry out corresponding actions (Leape, 1994; Rasmussen, 1983; Rasmussen & Jensen, 1974). Knowledge-based performance relies on experience, level of training and subjective preferences (Rasmussen, 1983). Handover communication is an example of knowledge-based performance. Nurses must process and apply knowledge to make judgments and organize relevant information that needs to be communicated to incoming colleagues at shift change.

**Skill, rule, and knowledge-based errors.** Reason (1990) posited that there are several types of errors, also known as latent and active failures. Active failures can be divided into slips, lapses, and mistakes and are generally related to human information processing and performance (Rasmussen, 1983; Reason, 1990; Reason, Manstead, Stradling, Baxter & Campbell, 2011). Slips occur when there are failures in the execution of a plan, regardless of whether or not the plan was adequate; these are known as skill-based errors (Armitage, 2009; Reason, 1990). Slips are often observable but unintended. For example, when a nurse does not notice that a patient is allergic to a medication, yet administers the medication anyway. Lapses are also skill-based errors that occur when there is a failure in memory. However, lapses are generally not observable (Armitage, 2009; Hughes, 2008; Reason, 1990). An example of a lapse is when a nurse intends to check a medication dose but forgets to do so prior to administration. Related to handover, an example of a lapse occurs when a nurse intends to convey a patient’s unstable vital signs but forgets.

Mistakes occur when a plan is executed as intended, but the desired outcome is not achieved (Reason, 1990). Mistakes are also errors in thinking and judgment but are more
complex than slips and lapses (Armitage, 2009; Hughes, 2008; Reason, 1990). Some of this complexity arises from the mental processes of cognition, objective setting, and decision-making that are used by individuals leading up to mistakes (Reason, 1990). Mistakes are especially relevant in healthcare settings where nurses must use clinical decision making and reasoning to prioritize and make decisions about patient care (Potter et al., 2005). There are two classifications of mistakes, rule-based or knowledge-based errors (Reason, 1990). In a rule-based mistake, actions are carried out as planned but the plan (rule) was incorrect to begin with. For example, a rule-based mistake would occur if a nurse provided handover using a computer generated information sheet that contained incorrect patient information.

A knowledge-based mistake occurs when an incorrect solution is applied to a novel problem (Reason, 1990). Knowledge-based mistakes can also occur when one possesses insufficient knowledge, or misinterprets a situation (Leape, 1994). Knowledge-based mistakes can contribute to poor quality handover in many situations, as decisions about handover communication require cognitive processing, conscious thought, and decision making (Rasmussen, 1983; Reason, 1990; Reason et al., 2011). Knowledge-based mistakes occur when an outgoing nurse does not make appropriate decisions about the type and amount of information provided to the incoming nurse during shift handover. An example of this situation is if the outgoing nurse did not think it was necessary to tell their incoming colleague about a patient’s Methicillin-Resistant Staphylococcus Aureus (MRSA) positive status because it was assumed that their incoming colleague would read it in the chart. If the incoming nurse did not read it in the chart, he/she may inadvertently spread MRSA throughout the department.

Violations. Building upon Rasmussen and Jensen’s (1974) taxonomy, Reason (2000) suggests another type of error: rule violations. Rule violations occur when there are intentional deviations from standards and policies (Amalberti, Vincent, Auroy, & de Saint Maurice, 2006; Armitage, 2009; Reason, 2000). Although violations are intentional, the consequences that result are usually unintentional (Reason, 2000). Unlike errors which are related to individual information processing, violations are often related to social and motivational factors (Reason et al., 2011). Cook and Rasmussen (2005) describe the notion of “going solid” that can occur when the ED is at full capacity. In the state of “going solid”, there is little slack between operations (e.g., no time between patients), causing staff to feel pressured to perform at increased levels. In instances such as these, clinicians are more likely to engage in violations as they balance
competing priorities to accomplish their work. A common violation is a workaround, where a nurse finds a faster way to complete a task by circumventing existing unit or organizational policies (Palmieri, DeLucia, Peterson, Ott & Green, 2008). Violations often become accepted and encouraged by colleagues in situations of increased workload and time pressure (Amalberti et al., 2006). This notion will be explored in further detail in the next section. The following scenario depicts a handover communication related workaround. An outgoing ED nurse is aware that there are several ambulances on the way to the ED. Instead of using a printed handover checklist to provide handover, as mandated by the unit’s practice guidelines, the nurse engages in both a violation and a knowledge-based error by simply providing patient highlights in an unorganized manner, leaving out essential pieces of patient information. Since the incoming nurse is aware of this increased workload, the incoming nurse may encourage this intentional deviation (violation) from practice standards. Although both nurses may believe that the outgoing nurse is providing faster and more efficient handover, this situation has created conditions under which adverse events could occur.

This section has outlined different types of human performance including skill, rule, and knowledge-based work (Rasmussen, 1983). Based on this taxonomy, errors were defined as being a product of human performance and information processing (Reason et al., 2011). Conversely, violations were explained as being related to social and motivational factors (Reason et al., 2011).

The following section explores two different theoretical perspectives that explain the causes of error and adverse events. The individual approach puts blame for errors on individuals, and the system approach considers other contextual factors as contributing to errors and adverse outcomes.

**Individual and System Approaches to Error**

Errors and adverse outcomes in healthcare can be approached through two differing perspectives: the individual approach and the system approach (Reason, 2000). The individual approach is centered on individual actions that lead to errors, suggesting that the individual may have been deficient or lacking attentiveness (Henriksen, Dayton, Keyes, Carayon & Hughes, 2008; Reason, 2000). When the individual approach is the dominant paradigm, individuals involved in errors are singled out and blamed with no consideration of contributing factors such as organizational culture and workload. This approach often results in punishment, litigation, and
even criminal prosecution (Palmieri et al., 2008). A nurse who is blamed for providing misinformation about patient vital signs resulting in undetected patient deterioration is an example of the individual approach. The limitation of this approach is that although individuals may contribute to error, there are usually a number of other factors that could have made the error possible.

In contrast to the individual approach, the system approach considers errors to be consequences arising from multifaceted causes including “…upstream systemic factors” (Reason, 2000, p.768). This approach assumes that human error is inevitable; therefore, other factors that contribute to error beyond the individual are considered (van Beuzekom, Boer, Akerboom & Hudson, 2010). When investigating errors using the system approach, contextual conditions are explored in addition to individual factors. A recent healthcare example of the system approach is using a root cause analysis to understand causes of a medication error (Dekker, 2011). Using this approach, healthcare organizations investigate errors by examining other contributing factors rather than simply blaming the individual who administered the incorrect medication. These other contributing factors are known as latent conditions.

Reason (1990) defines an unsafe act as an “…error or violation committed in the presence of a potential hazard” (p.206). Hazards are latent conditions that have the potential to contribute to error. Latent conditions often occur as a result of decisions made by individuals removed from the frontline such as executives, builders, and designers (Reason, 1990; Reason, 2000). Latent conditions are rarely obvious, and include organizational and contextual factors such as staffing, communication, and training (Armitage, 2009; Henriksen et al., 2008; van Beuzekom et al., 2010). Latent conditions generally do not result in immediate error, but rather they create conditions under which errors can occur (Ebright, Patterson, Chalko & Render, 2003; Reason, 2000). The more latent conditions that exist, the more likely adverse consequences will result (Reason, 1993). For example, insufficient nurse staffing is not necessarily the cause of medication error. However, insufficient nurse staffing may result in a nurse being too busy to double check a medication, which can contribute to a medication error. A criticism of the system approach is the hindsight bias (Reason, 1993). After an error has occurred, it is easier to identify a number of contributing factors. However, prior to the error those contributing factors may not have been recognized.
**International Classification for Patient Safety.** In 2009, the World Health Organization (WHO) developed an International Classification for Patient Safety (ICPS). This conceptual model reflects a system approach to understanding patient safety incidents. To develop the model, the WHO convened a Drafting Group for the purpose of “defining, harmonizing and grouping patient safety concepts into an internationally agreed classification in a way that is conducive to learning and improving patient safety across systems” (Sherman et al., 2009, p. 3). Drafting Group members included experts in the fields of patient safety, law, informatics and medicine. The group developed a conceptual framework consisting of ten high-level classes as well as “[approximately] 600 concepts that group incidents into clinically meaningful categories, provide descriptive information, represent system resilience, and inform learning and analytical processes” (Sherman et al., 2009, p.4). This framework was refined using a two-stage modified Delphi survey, as well as through expert input (Thomson et al., 2009). The final model is displayed in Figure 1 below.

![Conceptual Framework for the International Classification of Patient Safety](image)

The ICPS can be grouped into three overarching categories. The triangles in Figure 1 represent the patient safety incident or adverse event (this also includes near-misses, reportable circumstances, harmful and no harm incidents), as well as patient outcomes resulting from the incident (Sherman et al., 2009). In the context of handover communication, poor quality handover can be considered as the incident, which may lead to adverse patient outcomes.

As previously stated, this model uses a system approach to explore contextual factors that may have contributed to the patient safety incident. These factors are represented by ellipses in Figure 1. Contextual factors include contributing factors/hazards, patient characteristics, incident characteristics and organizational outcomes (Runciman et al., 2009; Sherman et al., 2009). Contributing factors/hazards are “circumstances, actions or influences which are thought to have played a part in the origin or development of an incident or to increase the risk of an incident” (Sherman et al., 2009, p. 5). Contributing factors/hazards can be further grouped into categories that include staff factors, external factors, organizational factors or patient related factors (Runciman et al., 2009). Contributing factors/hazards themselves are not necessarily the cause of incidents or adverse events (WHO, 2009). However, when a patient safety incident occurs, one or more contributing factors/hazards can often be identified.

The third category, represented by rectangles, is system resilience or “the degree to which a system continuously prevents, detects, mitigates or ameliorates hazards or incidents” (Runciman et al., 2009, p.22). Using information from patient safety incidents, organizations can apply lessons learned to effectively react to safety issues. Organizations can also use this information to be proactive and prevent incidents from occurring in the first place.

One drawback of this conceptual model is that many of the concepts listed below the classes do not have associated definitions (Schulz et al., 2009), therefore, it is up to the reader to interpret these concepts. Moreover, relationships among classes and concepts are not always clearly delineated, leaving the nature of the relationships open to reader interpretation. Despite its limitations, in order to contribute to the further development of this model, as well as a standardized taxonomy at an international level, factors influencing quality of nurse-to-nurse shift handover will be situated within the high-level class of contributing factors/hazards.

To further build upon the system approach to error and adverse outcomes, the next section identifies two different theoretical perspectives that contribute to greater understanding of the way in which contextual factors may result in adverse outcomes.
Safety Perspectives and Nurse-to-Nurse Shift Handover

To frame understanding of contextual factors that can affect nurse-to-nurse shift handover, two safety related conceptual models are presented: the Swiss Cheese Model (Reason, 1990) and the System Migration Model (Amalberti, 2001; Amalberti, Vincent, Auroy & de Saint Maurice 2006). The Swiss Cheese Model explains contextual factors from a human factors perspective (Reason, 1997), and aligns with the previous discussion of errors. This model is well known and used widely across a variety of industries such as aviation and healthcare. The System Migration Model provides a perspective beyond individual limitations and accounts for the interplay between social, economic, workload, and technological factors that may create situations leading to adverse events. Together, these two conceptual models will be used to inform the proposed model of factors influencing quality of ED nurse-to-nurse shift handover. The Swiss Cheese Model provides a theoretical foundation for understanding the role of individuals such as nurses, leaders, and decision makers in handover quality. The System Migration Model explains the role of social, technological and workload factors and how poor quality handover communication becomes acceptable in ED practice environments. Both the Swiss Cheese Model and the System Migration Model can be situated within the International Classification for Patient Safety developed through the WHO (2009).

Swiss Cheese Model.

![Swiss Cheese Model](image_url)

In 1990, psychologist Dr. James Reason proposed the Swiss Cheese Model (SCM) to conceptualize the dynamics of accident causation (Reason, 1990). The SCM (See Figure 2) is a system approach to error from a human factors perspective (Reason, 1997) that demonstrates how minor errors, such as misinformation during handover can proliferate into more significant adverse events. The SCM is comprised of multiple layers resembling Swiss cheese. At one end are hazards that when undetected, can move through holes in the layers ultimately resulting in adverse events at the other end. The Swiss cheese slices themselves represent defenses that have the ability to protect users (e.g. patients, staff) from error and subsequent adverse consequences. This model can apply to handover communication in two ways. First, handover itself can serve as a defensive layer to prevent adverse events. However, if poor quality handover is considered to be an adverse event, then components of the handover process can be considered both defensive layers (e.g., the use of a checklist) and holes (e.g., interruptions).

In healthcare, one example of a defensive layer includes patient allergy bracelets to alert clinicians of medication allergies. When a clinician experiences a slip (Reason, 1990) and forgets to check the bracelet prior to administering medications, they may unintentionally give the patient a medication to which they are allergic. Another example of a defensive layer for handover communication is the use of checklists and mnemonic devices such as SBAR (situation, background, assessment, recommendations) (Leonard et al., 2004) to remind clinicians to include required information and to prevent omissions. When these policies are circumvented, the effects of skill or knowledge-based errors (Reason, 1990) may lead to adverse outcomes. For example, the outgoing ED nurse may forget to alert the incoming nurse (lapse) that a patient has a history of suicidal ideation. As such, the incoming nurse may not take appropriate monitoring precautions, potentially resulting in adverse outcomes for the patient. Had the outgoing nurse used the acronym SBAR, they would have included background information such as suicidal ideation. Although defensive layers prevent error, they are not impermeable (Reason, 1990). The use of SBAR to guide handover in the previous example may have prevented an adverse outcome. However, if other holes were present such as a bottle of medication at the bedside, an adverse outcome may still have been the result.

Holes in the Swiss cheese slices represent latent conditions or “upstream systemic factors” (Reason, 1990 p.768) such as fallible decisions made by leaders, line management deficiencies, and psychological precursors to unsafe acts such as fatigue and stress (Reason,
1990). Holes in the Swiss cheese slices may also represent active failures, which are breaches or unsafe acts such as slips, lapses, and mistakes (Reason, 2000). Unlike latent conditions, consequences of active failures result in errors that can often be felt immediately (Reason, 1990). An example of an active failure is when a nurse forgets to check morphine (lapse) prior to administration and accidentally provides a patient with a triple dose, causing the patient to lose consciousness. Under certain conditions, holes will line up, allowing a clinician error to pass from one end to the other resulting in an adverse event (Reason, 2000). Reason’s (1990) model is based on the assumption that for serious errors to occur, there will likely be several simultaneous or sequential failures (van Beuzekom et al., 2010).

Fallible decisions are those decisions made by executives, designers, and builders, which ultimately create conditions for error (Reason, 1990; Reason, 2000). A poorly designed hospital unit that does not allow staff to easily visualize patients is an example of a fallible decision. Line management deficiencies include competence and decision making abilities of frontline managers (Reason, 1990). If a manager is incompetent or makes poor decisions, the manager may create conditions for error. For example, a unit manager may decide not to replace two nurse sick calls, leaving the unit short staffed. This decision may increase other nurses’ workloads to the point that they do not have the time to answer patient call bells, thereby not responding to a deteriorating patient. Closely related to this are psychological precursors to unsafe acts. These occur when human conditions such as stress, motivation, and failure to perceive hazards lead to errors (Reason, 1990). For example, a nurse may be lacking sleep because of young children at home. This lack of sleep may impair performance, leading the outgoing ED nurse to subsequently forget to relay critical patient information to the incoming nurse.

Reason’s (1990) theoretical approach provides the foundation for understanding that there are a multitude of factors that may impact handover communication. These factors include defensive layers such as handover structures as well as holes such as psychological precursors and decisions made by management. Reason’s approach is reflected in the ICPS, where both active and latent failures can be classified as contributing factors/hazards. Defensive layers can also be situated within the system resilience grouping of the ICPS. Defensive layers such as handover tools and checklists can be used to reduce risks associated with poor quality handover.
One criticism of Reason’s (1990) Swiss Cheese Model is that the model assumes errors result from a linear combination of latent conditions and active failures and that simply strengthening defensive layers can prevent errors. In the following section, another perspective offered through Amalberti (2001) and Amalberti et al.’s (2006) System Migration Model (Amalberti, 2001; Amalberti et al., 2006) is examined. This model provides alternative views on the way in which interplay between contextual factors can contribute to adverse outcomes.

System Migration Model. Reason’s SCM model (1990) illustrates that adverse events in healthcare generally have more than one contributing factor related to individual performance. Conversely, Amalberti (2001) contends that accidents and adverse events “…are the consequences of the systematic migration of socio-technical systems towards augmented complexity, performance, and individual advantages” (p.117). In other words, adverse events result from a variety of factors and pressures such as economic conditions, technology, and social forces that require a clinician to balance a number of complex competing demands. These factors proposed by Amalberti (2001) are aligned with the contributing factors/hazards represented in the ICPS (WHO, 2009). The integration of Amalberti’s System Migration Model (2001) (See Figure 3 below) provides an understanding of how handover practices are shaped through a social context and how poor quality handover can become accepted as a normal practice in the ED.

The System Migration Model is originally based on Rasmussen’s work (1997) and was further developed by Amalberti (2001) and Amalberti and colleagues (2006). This model explains how clinicians have to adapt routines when faced with pressures for increased performance such as workload (Amalberti et al., 2006). This adaptation of performance can blur the boundaries of safety. According to Cook and Rasmussen (2005), the boundaries of acceptable performance are dynamic and move based on context and social norms. For example, in periods of adequate staffing and low patient acuity, clinicians are more likely to adhere to unit policies and managers expect this to be the case. Conversely, in conditions of short staffing and increased workload, the boundaries of acceptable performance shift. In this space, managers and other staff may tolerate deviations from policies to manage heavy workloads. Amalberti et al.’s (2006) System Migration Model consists of three phases in the process of moving towards the boundaries of safety: initial safe space of action, borderline tolerated conditions of use, and normalization of deviance and reckless individuals (p. 68).

The initial safe space of action is the area where processes are designed to operate within organizational rules and policies (Amalberti et al., 2006). These organizational rules and policies are synonymous with the defensive layers that exist in the SCM (Reason, 1990). These rules and procedures are based on ideal working conditions, and, therefore, do not take into account the complexities of the work environment. An example of this safe space of action is when hospital leadership creates unit-mandated policies for handover communication such as the use of lengthy handover mnemonics or pre-printed patient information sheets, without considering the chaotic nature of the work environment.

The practice environment is where the creation of borderline tolerated conditions of use are created. The practice environment is dramatically different from the ideal situation upon which rules and policies are based. Instead, employees must balance the pressure for performance with individual advantages (Amalberti et al., 2006). Pressures include increased workload with fewer available resources (Amalberti et al., 2006). Individual advantages include being able to take allotted breaks and leave work on time. For example, an ED nurse who is eager to leave work on time engages in a violation (Reason, 2000) by ignoring handover policy and providing a brief handover consisting of “the patient is fine, everything is done”. In this situation, there is potential for omission of critical information such as do not resuscitate status, which could ultimately lead to adverse outcomes for the patient. The incoming nurse may
tolerate or even encourage this violation if they want to help their colleague get home to their children. If the patient is stable, this may not result in adverse outcomes. However, if something goes wrong immediately after the outgoing nurse has left, the incoming nurse will have insufficient information to manage the situation.

In the state of “going solid”, such as when the unit is at full capacity, “Clinical decision making becomes pressurized as practitioners struggle to identify the patients most likely to do well with lower levels of care in order to create openings for new patients” (Cook & Rasmussen, 2005, p.132). In other words, when the ED is at full capacity (or above) with many patients waiting to be seen, a nurse may not conduct mandatory hourly rounds on admitted patients in order to care for the mass of new incoming patients. During this period of heavy workload, a patient needing assistance with ambulation may be overlooked, possibly resulting in a fall. In this borderline tolerated conditions of use space, pressure to perform and accomplish work may lead to violation of rules and policies (also known as workarounds), as nurses make trade-offs between safety and performance. In the aforementioned example, the nurse may disregard the policy on hourly rounds in order to keep up with incoming patient demands. Since leaders and managers are often under the same pressure, minor violations such as these become tolerated. Once employees realize that minor violations are tolerated by leadership, they may push the boundaries further (Amalberti et al., 2006), thus leading to the creation of borderline tolerated conditions of use.

The last state of the System Migration Model is the normalization of deviance and reckless individuals. For this phase, Amalberti and colleagues (2006) drew upon Vaughan’s (1996) theoretical work related to the 1986 explosion of the Challenger Space Shuttle. The normalization of deviance and reckless individuals phase begins after initial deviations from policies and procedures have been accepted for some time. These minor deviations become routine and, therefore, invisible to employees and leaders (Amalberti et al., 2006). Within this phase, if workers deviate any further than what has already been accepted (reckless behaviour), patient harm may result (Amalberti et al., 2006). This model provides an understanding of how clinicians must manage competing priorities and balance trade-offs. The System Migration Model also provides the foundation for the inclusion of contextual factors such as relationships, technology and safety climate, as well as interactions between staffing and time pressure in the hypothesized model presented at the end of this chapter.
In summary, Reason’s (1990) Swiss Cheese Model illustrates the notion that poor quality handover may have a multitude of contributing factors, including both latent and active failures. While defensive layers can prevent adverse outcomes, holes created by failures can allow an error to result in unintended consequences. Related to handover, defenses include having adequate staffing to manage workload and the use of structured handover tools such as mnemonics to guide the provision of handover. If clinicians make rule-based mistakes (Reason, 1990) by providing information for the wrong patient, a hole in this defensive layer is created. However, if the incoming nurse takes the opportunity to clarify information (defensive layer), the error may be caught prior to reaching the patient. According to the definition of quality proposed by Manser et al. (2013), a quality handover should include defensive layers by ensuring a discussion of patient care, provision of organized information and providing clinicians the opportunity to create a shared understanding during handover through questions and clarification of information.

Amalberti (2001) and Amalberti et al.’s (2006) System Migration Model provides another lens through which to understand adverse events and accidents. This model explores contextual factors beyond those related to individual performance, such as workload, technology and social factors, and the interplay between them. This model highlights the notion that clinicians must balance competing demands and often have to make trade-offs to accomplish their work. These trade-offs can become accepted by peers and leaders, embedding them into practice. Related to handover, this model helps to explain why clinicians may choose to violate handover policies to leave work on time or to tend to a critically ill patient. The model also explains how violations become acceptable. As violations are tolerated, the clinician may be pushed into operating in an unsafe zone where patient harm can occur. Perspectives from this theory are reflected in the conceptual model through the inclusion of safety climate, staffing, relationships between incoming and outgoing nurses and interactions between staffing and time pressure.

**Review of Handover Communication Related Literature**

Since the release of *To Err is Human: Building a Safer Health System* (Kohn et al., 2000) and the *Canadian Adverse Events Study* (Baker et al., 2004), there has been an increase in the amount of handover communication literature. Despite an increase in the number of handover related studies, there is significant variation in methods and findings (Manser & Foster, 2011).
Related studies tend to examine handover content (e.g., information that should be shared), processes (e.g., behaviour and environment), or outcomes (e.g. nurse or patient satisfaction) (Manser & Foster, 2011). Literature focused on the processes of handover is most relevant to this study. It is through gaining an understanding of these processes that will enable identification of those factors that influence quality of ED nurse-to-nurse shift handover communication. Once factors influencing quality of handover are identified and explained, quality of handover can be improved by modifying these influencing factors.

In the following section, a conceptual definition of handover quality is presented, as well as three existing conceptual models that include handover influencing factors. In addition to factors identified in conceptual models, a number of factors influencing handover communication were identified in the literature. In this chapter, concepts are explained first using perspectives from communication and safety literature (where applicable) followed by healthcare conceptual and empirical literature. At the end of this chapter, relationships between concepts are hypothesized in a conceptual model.

**The Concept of Quality Handover Communication**

Nurse-to-nurse handover communication is defined as bidirectional communication that results in the transfer of information and responsibility for a patient (Friesen, White & Byers, 2008; McFetridge, Gillespie, Goode & Melby, 2007; Tregunno, 2009). The concept of quality handover communication as defined in the literature includes both actions that comprise quality (e.g., providing relevant and accurate information in an organized manner) and outcomes (e.g., nurse satisfaction, medication errors) that occur in the presence of quality. Several studies defining these actions and outcomes of handover quality are discussed below.

Anwari (2002) defined handover quality between the operating room and post anesthesia care unit (PACU) as quality of verbal information, condition of the patient upon transfer, professional behavior of the anesthesiologist, and nurse satisfaction with handover. Anwari’s (2002) study included 276 patient handover exchanges between anesthesiologists and PACU nurses. Following handover, a written survey was administered to receiving nurses to assess handover quality. Findings indicated that the overall quality of handover was “good” in 42% of cases, “satisfactory” in 38% of cases and “bad” in 20% of cases (Anwari, 2002, p.490).

In a quasi-experimental quality improvement project testing a handover training program, Slagle et al. (2007) defined effective handover between anesthesia providers and PACU nurses
as information transfer, use of evidence-based handover strategies, interpersonal skills, and team behaviours. Quality of handovers was measured by observers and self-reported by participants before and after implementation of a handover training program. Outcomes of this study were not published.

Manser et al. (2010) developed a rating tool to assess overall handover quality and to understand factors that contribute to a safe and effective handover. This rating tool for handoff quality was developed through literature reviews as well as interviews with three healthcare providers (roles were not specified). The instrument was tested with a sample of 126 handovers involving paramedics to ED staff (nurses and physicians), anesthesia providers to PACU nurses, and PACU nurses to inpatient nurses. Manser et al. (2010) identified three factors that reflect handover quality: information transfer ($\beta = 0.59, p < .001$), shared understanding ($\beta = 0.28, p < .001$), and working atmosphere ($\beta = 0.16, p < .01$). Information transfer was associated with handover quality and included provision of relevant information, presented clearly and logically (Manser et al., 2010). Shared understanding included ensuring that communication was complete and that opportunities to clarify information were available (Manser et al., 2010). Working atmosphere included contact with colleagues and consideration of the patient’s experience (Manser et al., 2010).

In a more recent study, Manser et al. (2013) observed handovers among clinicians between operating and recovery rooms, from recovery room nurses to unit nurses, and among clinicians between the operating room and the cardiac intensive care unit. Following observations of handovers, clinicians were asked to complete a survey assessing handover quality. Using data from clinician surveys, Manser et al. (2013) concluded that high quality handovers included a discussion of patient care, provision of organized information, and creation of a shared understanding between participants. Discussions of patient care included clinical information and patient assessment findings, as well as risks and care priorities (Manser et al., 2013). Discussions of patient care were associated with higher ratings of handover quality ($\beta = 0.46, p < .001$). Providing organized information included presenting information logically, in a sufficient amount of time, and having completed necessary documentation. Providing organized information was correlated with handover quality ($\beta = 0.33, p < .001$). Creating a shared understanding consisted of providing opportunities for clarification and ensuring that handover
was comprehensive. Shared understanding was also correlated with handover quality ($\beta = 0.28$, $p < .001$).

There are a number of similarities among these studies, indicating some consensus on the concept of quality handover communication. Most researchers acknowledge the importance of information sharing through organized, synthesized, and complete communication (Anwari, 2002; Manser et al., 2010; Manser et al., 2013; Slagle et al., 2007). Clinicians must not only possess knowledge, but must know how to organize and synthesize knowledge so that it can be applied (Dekker, 2011; Strople & Ottani, 2006). Organization refers to the way in which information is delivered to the incoming clinician. Communication theory suggests that a sender must present information in a clear and coherent format, otherwise the message can become distorted and be misinterpreted by the receiver (Ellis, Gates & Kenworthy, 1995; Parry, 1967). Findings from physician interviews suggest that “well crafted” stories are required for effective handover in addition to simply stating facts such as lab results (Sharit et al., 2008, p.978).

Synthesis involves providing a “snapshot” of patient information by integrating assessment findings, lab results, history and risks such as allergies and falls (Strople & Ottani, 2006). To effectively synthesize information, clinicians must make decisions related to salience versus completeness (Cheung et al., 2010; Kerr et al., 2011; Siemsen et al., 2012). Salience versus completeness is the term used to describe how clinicians must discern between providing information that is important versus providing excess information that is not necessarily relevant. Throughout any given shift, clinicians process a large amount of information that must be refined and synthesized so that only pertinent pieces of information are provided to the incoming clinician. This synthesis of information takes place through information processing and as previously described, often contributes to active failures such as slips, lapses and mistakes (Rasmussen, 1983; Reason, 1990; Reason, Manstead, Stradling, Baxter & Campbell, 2011). Quality handover occurs when an outgoing clinician provides a snapshot of patients containing enough detail to provide a complete picture but also not so much detail that the message gets lost. To do this effectively, clinicians must use critical thinking and judgment as illustrated by the following quote. “Because it is never possible to transfer a complete picture of a patient’s condition from the mind of one caregiver to another and because the handover time is necessarily limited, clinicians must make judgments about the relevance and importance of what goes into the co-construction of the picture” (Behara et al., 2005, p.317). As previously stated, when
making judgments about handover information, clinicians need to assess available information, as well as the situation to make decisions about what is relevant and needs to be conveyed to the next nurse (Birmingham et al., 2014).

Manser et al. (2010) and Manser et al. (2013) identified the need for both incoming and outgoing clinicians to have a shared understanding of the patient situation. Similarly, in a study of handover between medical-surgical nurses, Birmingham and colleagues (2014) defined handover effectiveness as “painting a full picture” of the patient between incoming and outgoing nurses (p.6). Leonard et al. (2004) also cited a common mental model as one of the aims of effective communication. All clinicians have a mental model of the patient that they are trying to handover including “the rationale for treatment decision, uncertainties and anticipations of problems” (Manser & Foster, 2011). Creating a shared understanding or shared mental model allows outgoing clinicians to transfer this mental picture to incoming clinicians. This is related to the previous discussion of synthesis. Clinicians must “thin slice” (Jeffs, personal communication, 2013) information in such a way that it will create a shared understanding between the incoming and outgoing clinicians. Shared understanding also includes “closing the communication loop” (Manser et al., 2010, p.3) between participants and ensuring that there are opportunities for questions and clarification of information (Manser et al., 2013).

The provision of quality handover communication requires both a sender to convey information (outgoing nurse), as well as a receiver (incoming nurse) to accept and use information to guide patient care (Eggins & Slade, 2012). In the following literature review, the majority of handover related studies do not specify whether or not they are assessing handover communication through the perspectives of the sender or the receiver. Rather, most studies tend to provide a global assessment of handover. Lack of differentiation between the incoming and outgoing nurse renders it difficult to discern whether or not there is a difference in factors that influence handover communication between these two roles. In this literature review, studies that differentiate between incoming and outgoing nurses will be highlighted. This study is focused on handover quality as it is perceived by the incoming nurse. Rationale for this decision is presented at the end of Chapter 2.
Handover Communication Models

Existing conceptual models. The following section provides an overview and discussion of three handover communication conceptual models identified in the literature that include handover influencing factors.

Cheung and colleagues (2010) developed a conceptual model of barriers that hinder ED physician-to-physician handovers (See Figure 4). Barriers proposed in the model are based on literature findings. Cheung et al.’s (2010) model reflects ED physician workflow, which is characterized by a patient presenting to the ED who is subsequently interviewed by a physician about their complaint. At shift change, the outgoing physician provides handover to the incoming physician. Throughout this process, there are a variety of factors identified that contribute to ineffective handover: the patient, physicians, ED team, tasks, technology, and the environment (Cheung et al., 2010).

![Conceptual Model for Barriers in Handoffs](image)

Patient factors impact the amount of information that is provided to the physician during the initial interview. These factors include patient level of alertness, pain, education, knowledge, diagnosis, and language barriers (Cheung et al., 2010). Physician factors include fatigue, stress, attention span, memory, experience, knowledge, bias, and personal agendas (e.g., needing to be...
somewhere after a shift) (Cheung et al., 2010). Team factors include shift schedules, compensation methods, relationships, power balance, failing to understand the importance of handover, and ambiguity (e.g., when the outgoing physician remains in the department after shift completion) (Cheung et al., 2010).

Task factors include signal-to-noise ratio, salience versus completeness, and red flags (Cheung et al., 2010). Signal-to-noise ratio characterizes the difficulty of transmitting a message in the presence of noise or other types of interference. Salience versus completeness (Cheung et al., 2010) explains how the outgoing clinician must balance relevant information with the overall amount of information that is shared. Emergency physicians are accustomed to being attuned to “red flags” to alert them of high-risk situations (Cheung et al., 2010). An example of a red flag is a subtle indication that something might be wrong, such as sundowning eyes in children indicating a brain injury or illness. Often these “red flags” are not conveyed during handover. Task factors also include the number of patients in the department, patient complexity, geographic location, and the use of a standardized approach while providing handover communication (Cheung et al., 2010). Environmental factors include handover location, distractions, competing demands for attention, and ED length of stay (Cheung et al., 2010). Technological factors include the list of patients in the ED and documentation method (e.g., paper or computer based) (Cheung et al., 2010).

Lawrence and colleagues (2008) proposed a conceptual model of handover communication in the ED (See Figure 5) based on a qualitative grounded theory study. Researchers conducted observations of ED physician shift handover as well as surveys and interviews with physicians, physicians’ assistants, Registered Nurses (RNs), and Licensed Practical Nurses (LPNs). Based on their findings, Lawrence et al. (2008) suggest that the degree of smoothness and patient safety in handover is contingent upon six overarching themes: functions/business of the ED, operations, resources, professionalism, communication, and clinical decision processes.

Functions/business of the ED refers to clinical patient challenges (e.g., acuity), patient volume, patient flow (e.g., movement of patients within, in and out of the department), time pressures, and non-clinical patient challenges (Lawrence et al., 2008). Operations encompass shift overlap (e.g., how much time incoming and outgoing clinicians spend together in the ED), non-clinical demands, physical structure/setting of the board (e.g., staff crowding around the whiteboard at shift change), and triage arrangements (e.g., number of triage locations) (Lawrence et al., 2008). Resources include physical space, staffing and staff ratio, and personal limitations (e.g., fatigue, stress) (Lawrence et al., 2008). Professionalism refers to ownership (e.g., clinician accountability for patients), consideration (e.g., willingness to accept handover), and punctuality (Lawrence et al., 2008). The broadest theme, communication, encompasses interruptions/distractions, formal mechanisms for exchange (e.g., method of handover), completeness of knowledge available, adequacy of information exchanged, status of tasks (e.g., items that are outstanding), and external factors (e.g., status of transfers outside of the ED) (Lawrence et al., 2008). The final theme in Lawrence et al.’s (2008) model is clinical decision processes. This theme includes degree of closure/case completeness (e.g., whether or not the patient has been stabilized, diagnosed and is receiving treatment), focus of attention (e.g., attention is directed to new patients as opposed to those that have been in the department for an extended period of time), degree of testing and workups (e.g., amount of testing required), and timing and speed (e.g., number of competing requests) (Lawrence et al., 2008).
Sharit et al.’s (2008) Influence Diagram of Factors Contributing to False Assumptions (See Figure 6 above) is derived from a qualitative study using interviews and observations in the paediatric intensive care unit (PICU) and the paediatric PACU. Handover observations were conducted with a total of 12 nurses and eight residents. Interviews were conducted with four nurse managers, four attending physicians, four residents, and four nurses. Findings from observations and interviews revealed several factors that lead to gaps in handover communication, which could lead to false assumptions by the incoming clinician. Included in this model are factors such as the personalities of both incoming and outgoing clinicians (e.g., passive versus aggressive), attention spans of clinicians, distractions, workload, and experience and skill of both clinicians (Sharit et al., 2008). Through the development of this model, the authors suggest a number of interventions that can be implemented to mitigate some of these risks. Some examples of interventions include creation of organizational policies, training, and simultaneous assessments of the patient (Sharit et al., 2008).

**Summary of conceptual models.** The five factors that were identified in Sharit et al.’s (2008) model are similar to those proposed by Cheung et al. (2010) and Lawrence et al. (2008). Four of these factors (attention span, interruptions, workload and experience) are discussed in the following sections and included in the proposed model where appropriate. Attention span and

![Influence Diagram of Factors Contributing to False Assumptions](image-url)
distractions were identified in three conceptual models as influencing handover communication (Cheung et al., 2010; Lawrence et al., 2008; Sharit et al., 2008). Sharit et al. (2008) identified workload as a handover influencing factor. Although this factor is not explicit in Cheung et al. (2010) or Lawrence et al.’s work (2008), it is likely that workload is captured through factors such as patient volumes, patient complexity, inpatient boarding, status of tasks, status of external factors, degree of patient testing, and time pressures. Experience is reflected in Cheung et al.’s (2010) model; however, it is not included by Lawrence et al. (2008). While other authors (Cheung et al., 2010; Lawrence et al., 2008) are in agreement with Sharit et al.’s (2008) proposed model, Sharit et al. (2008) do not incorporate a primary theme located in the safety literature: organizational context. Both Cheung et al. (2010) and Lawrence et al.’s (2008) models of ED shift handover include organizational issues such as staffing as influencing handover communication. As explained by the Swiss Cheese Model (Reason, 1990), the System Migration Model (Amalberti, 2001; Amalberti et al., 2006) and the International Classification for Patient Safety (WHO, 2009), contextual factors such as leadership and social influences may also play a role in quality handover communication.

Lawrence et al.’s (2008) model included additional variables that may be relevant when explaining quality shift handover. The completeness of knowledge available to the outgoing clinician influences the amount of information that can be provided to the incoming clinician during handover (Kerr et al., 2011; Lawrence et al., 2008; Siemsen et al., 2012; Street et al., 2011). If outgoing clinicians do not have knowledge about their patients, they cannot relay it to their incoming colleagues. Linking back to the definition of quality handover, without sufficient knowledge, it is difficult to have a discussion of patient care (Manser et al., 2013). Triage is another variable unique to Lawrence et al.’s (2008) model. Triage arrangements refer to the number of triage locations and the triage process. It is likely that triage arrangements contribute to workload. When the triage process is smooth and well organized, the flow of patients should be steady. If triage is not well organized, bottlenecks may result and clinicians may face lulls in patients waiting to be seen followed by extremely busy periods. Professionalism refers to characteristics of the incoming clinician such as punctuality, willingness to accept handover and take on accountability for patients. Another variable included in Lawrence et al.’s (2008) model that is less applicable to nurse-to-nurse communication is location of the board. Location of the board refers to the whiteboard that is used to list patients present in the ED. When physicians are
dividing patients among themselves, they often crowd in front of the whiteboard, creating a chaotic environment. Location of the board is not relevant to nurse shift handover as based on the researcher’s experience, nurses tend to have pre-existing assignments made by the previous shift, unlike physicians who may divide work up among themselves.

Cheung et al.’s (2010) model also contained several unique variables that were not included Lawrence et al. (2008) or Sharit et al.’s (2008) models. These include salience versus completeness, technology, peer relationships, and shift overlap. Salience versus completeness refers to a clinicians’ ability to make appropriate decisions about handover content (Cheung et al., 2010). Clinicians need to decide how to provide relevant information balanced with the provision of excess information (Cheung et al., 2010). Salience versus completeness is an influencing factor identified by a number of other handover studies (Behara et al., 2005; Kerr et al., 2011; Siemsen et al., 2012; Street et al., 2011) and is discussed in further detail under handover concepts. Technology is another factor cited by Cheung et al. (2010) that is not included in other handover related models but is also reflected in the System Migration Model (Amalberti, 2001; Amalberti et al., 2006). Technology in Cheung et al.’s (2010) model refers to electronic lists of patients in the ED and electronic documentation. Electronic health records and documentation can influence handover communication by producing pre-printed patient handover sheets that maintain handover information in one location. Several studies have found that pre-printed handover sheets have contributed to improved handover outcomes (Bhabra et al., 2007; Pickering et al., 2009). Peer relationships are also important to providing shift handover, as communication requires interaction with colleagues. A number of other studies support this through identifying clinician relationships as influencing shift handover communication (Anthony & Preuss, 2002; Carroll et al., 2012; Meissner et al., 2007). Shift overlap is the period of time where both the incoming and outgoing clinicians continue to work in the ED. Shift overlap may influence handover by creating ambiguity for patients and other staff members who may be uncertain about which clinician is most responsible for care. This may have implications for nurses when they are moved to different assignments in a shift or are working in fast track areas where patients are not assigned primary nurses.

Two variables identified by Cheung et al. (2010) that are not hypothesized to influence nurse-to-nurse ED shift handover are physician compensation and red-flags. In some ED settings, physician productivity drives compensation. Therefore, some physicians may be
reluctant to transfer patients to other physicians if it will impact their income (Cheung et al., 2010). This does not apply to Ontario nurses as they are not compensated based on patient volumes. Red flags are subtle cues that physicians rely on to diagnose patients. Since nurses do not diagnose patients, this factor is not likely to have a great amount of influence on nurse-to-nurse handover communication.

The conceptual models discussed include a variety of factors that are hypothesized to influence quality of ED nurse-to-nurse handover communication. Those variables identified in the above models that are congruent with information found in handover literature will be discussed in the following section. While each model conceptualizes factors that influence handover, based on the following literature review, none of them alone are comprehensive representations of factors that influence quality of ED nurse-to-nurse shift handover. Theoretical literature by Reason (1990), Amalberti (2001), and Amalberti et al. (2006) suggest that human performance is influenced by a variety of factors external to the individual, such as leadership and social influences. Although Cheung et al.’s (2010) model includes relationships as influencing factors, it does not include consideration of leadership or safety climate. Furthermore, leadership, safety climate, and relationships are gaps in both Lawrence et al. (2008) and Sharit et al.’s (2008) models.

**Empirical Evidence Related to Concepts Influencing ED Nurse-to-Nurse Handover**

The following section highlights concepts identified in studies related to handover involving nurses, physicians, and ambulance crews. These concepts are hypothesized to influence quality of ED nurse-to-nurse shift handover communication. Concepts are organized into the following headings to facilitate discussion: workload, cognitive work, interruptions, psychological precursors, ED safety climate, technology, teamwork, handover format and experience.

**Workload.** Workload is a complex, multifaceted concept that may have a negative impact on quality of handover communication. A number of studies have reported relationships between nursing workload and patient safety, mortality and failure to rescue (Aiken et al., 2002; Pearson et al., 2006; Needleman et al., 2011). When clinicians are overwhelmed with high workloads, handover communication can be compromised. According to Clarke (2010), jobs with high demands and role overload “are likely to have a negative impact on patient safety” (p.555). Clarke and Aiken (2003) discussed a Canadian case study where an inexperienced nurse
was so overwhelmed with demands that she did not have time to report the deteriorating status of her patient to the charge nurse. Amalberti (2001) and Amalberti et al.’s (2006) System Migration Model demonstrates how increased demands placed on clinicians can result in trade-offs that compromise safe practice. According to Jeffs and colleagues (2009), being overwhelmed with workload can cause clinicians to “err in clinical judgment” (p.76). The nurse described in the paper by Clarke and Aiken (2003) did err in judgment, leading her to make inappropriate trade-offs between completing her work and taking the time to report findings to the charge nurse. This trade-off ultimately led to an adverse outcome (death) for the patient. Findings from a number of studies suggest that increased workload negatively influenced handover communication (Olsen et al., 2013; Sharit et al., 2008; Siemsen et al., 2012). Furthermore, according to Siemsen et al. (2012), unmanageable workload is a barrier to high quality, safe work.

Increased workload was hypothesized to negatively influence the quality of handover communication. However, the incoming nurse may not have a sense of the exact nature of workload when coming in for a shift, as the incoming nurse may not be aware of what occurred prior to arrival. It was therefore hypothesized that incoming nurses will have clues about workload as indicated by staffing levels as well as triage flow, both of which were included in the conceptual model proposed by Lawrence et al. (2008).

In an observational study, Richards (1988) reported short staffing led nurses to feel overwhelmed with workload. According to Birmingham and colleagues (2014), short staffing made it more difficult for outgoing nurses to assess patients and recognize changes in patient status, thus hindering their provision of handover communication. As such, it was hypothesized that inadequate staffing will negatively influence handover communication. It was also hypothesized that staffing will moderate the relationship between time pressure and handover quality.

No studies linking triage flow to workload were identified. However, as there is a finite number of staff working in the ED at a given time and the number of patients presenting at triage is unpredictable and may exceed staffing capacity, it is posited that triage flow will also contribute to workload. Therefore, it was hypothesized that poor triage flow will negatively influence handover communication as it reflects on the incoming nurse’s increased workload (See Figure 7 below).
Figure 5. Relationship between triage flow, staffing, time pressure and handover quality.

Cognitive work. Cognitive work is defined as the amount of mental processing required by an individual, which allows them to accept and understand information as well as carry out actions (Lamond, 2000; Neill, 2011). Cognitive work and cognitive processing capabilities impact an individual’s ability to analyze information and make decisions. Cognitive work is required when engaging in knowledge-based performance as discussed by Rasmussen (1983). As handover communication requires cognitive processing including decision-making, critical thinking, and judgment about salience versus completeness (Potter et al., 2005), the influence of cognitive workload on handover quality should be considered. Namely, cognitive work will have implications for organization of information and the discussion of pertinent patient information, both of which comprise quality handover (Manser et al., 2013). Cognitive work is complex and non-linear and includes two related factors, cognitive capacity and focus of attention (Neill, 2011; Potter et al., 2005; Woods et al., 2010).

Cognitive capacity. The amount of cognitive space or capacity that an individual possesses at any given time impacts cognitive processing abilities (Kreps & Thorton, 1984; Parry, 1967; Schramm, 1955). Since cognitive work is required for communication, cognitive space will ultimately affect one’s ability to communicate clear and correct information, as well as to receive and store this information (Kreps & Thorton, 1984; Parry, 1967; Schramm, 1955). Cognitive space is limited, approximately five to nine pieces of information can be stored in the short-term memory for 20 seconds at any given time (Dayton & Henriksen, 2007; Lamond, 2000). Following 20 seconds of storage, the information is lost unless there are active efforts to store it in the long-term memory (Dayton & Henriksen, 2007). When the amount of available information exceeds cognitive capacity, the result is confusion and disorientation (Kreps & Thorton, 1984).
In a setting such as the ED, where there are multiple demands competing for attention, there are often instances where clinicians are required to store information beyond cognitive capacity. In a theoretical piece of literature, Weick (1987) explained that when an air-traffic controller had to deal with complex tasks in addition to regular tasks, there was greater risk of error because the individual did not have sufficient cognitive capacity to process all of the incoming information. In other words, increased cognitive workload and decreased storage space rendered it difficult to deal with competing demands, increasing the risk of knowledge-based errors (Amalberti, 2001; Rasmussen, 1983). Limited cognitive capacity was cited by Lardner (1996) as a barrier to handover communication for nurses, as well as being a barrier to communication in other industries such as oil and gas. Limited cognitive capacity affects handover quality in two ways. First, it inhibits cognitive work and information processing, making it increasingly difficult for clinicians to make correct judgments about salience versus completeness, potentially resulting in slips, lapses or mistakes. Second, it may hinder the outgoing nurse’s ability to access to information, rendering it difficult to convey pertinent details. This also affects quality from the perspective of the incoming nurse, as cognitive capacity is required to process and store information received during handover.

**Focus of attention.** Focus of attention refers to the way that clinicians direct or focus their attention based on their understanding and knowledge of a situation, and surrounding activity (Dekker, 2011). Directing attention requires cognitive resources (Dekker, 2011). When making decisions about where to direct attention, clinicians make trade-offs, choosing to direct attention to one task over another. In the ED setting, there are almost always multiple goals and shifting priorities that compete for a clinician’s attention. For example, while providing shift handover within a limited time frame, a nurse may have to choose between dealing with an interruption (such as an IV alarm) and providing extra information to the incoming clinician. Amalberti (2001) and Amalberti et al., (2006) acknowledge this concept in the System Migration Model. As clinicians make trade-offs by omitting information to make gains in productivity, they move towards the boundaries of unsafe practice.

In addition to having to choose where to direct attention, ED clinicians often have to direct their attention to a number of different activities. This is known as multitasking or cognitive shifting, where clinicians shift their attention back and forth between tasks (Dekker, 2011; Potter et al., 2005). In their mixed methods study, Potter and colleagues (2005) observed
that nurses had to shift their focus from one patient to another approximately every 6 to 7 minutes. They calculated a cognitive stacking measure to identify the number of tasks and priorities that nurses had to focus on at any given time during their shifts. Using this measure, Potter and colleagues (2005) concluded that the average cognitive load was 11 activities at a time. Increased frequency of cognitive shifting between tasks and priorities creates demands on attention and increases the risk for loss of focus and subsequent error (Dekker, 2011; Potter et al., 2005). A critically ill patient brought in by an ambulance while the nurse is getting a patient ready for intubation is an example of cognitive shifting. The nurse will likely be focused on the patient needing intubation while receiving handover from the ambulance crew. The nurse may not fully receive the message as his/her focus of attention shifts back and forth between tasks. Not receiving the entire message may cause the nurse to miss critical information, such as the presence of ST-elevation, potentially resulting in the patient’s cardiac arrest. This is supported by Leonard and colleagues (2004), who state that clinicians have a limited ability to manage competing demands, which can inevitably lead to errors.

Both Lawrence et al. (2008) and Cheung et al. (2010) hypothesized that the management of competing demands directly influences handover communication in their conceptual models. Slagle et al. (2007) identified management of competing priorities as essential for effective handover. Most recently, Nagpal et al. (2011) reported findings from a study of PACU clinicians suggesting that management of competing demands can lead to incomplete handover communication. In their ethnographic study of ED clinicians (nurses, physicians and medical residents), Laxmisan et al. (2007) reported that multitasking or management of competing demands is a required skill when working in the ED. Laxmisan et al. (2007) also noted that clinicians constantly had to reprioritize tasks to accommodate those that were more critical.

Cognitive work requires a clinician’s attention. In handover literature, attention related mental activities such as concentration (Talbot & Bleetman, 2007), attention span (Sharit et al., 2008; Talbot & Bleetman, 2007), and inattention (Cheung et al., 2010) have been hypothesized to influence handover communication. Interruptions during handover may break a nurse’s concentration and divert attention, causing him/her to omit key pieces of information, ultimately leading to adverse consequences. Currie (2002) surveyed 28 nurses in a UK emergency admission assessment unit and reported that decreased attention span was a barrier to effective
communication. Cheung et al. (2010) also included attention span in their model as a factor influencing handover exchanges.

As handover communication requires sufficient cognitive capacity to process information, as well as sufficient focus of attention to be able to receive the message, it was hypothesized that insufficient cognitive capacity and insufficient focus of attention will negatively influence quality of ED nurse-to-nurse shift handover from the perspective of the incoming nurse (See figure 8 below).

**Interruptions.** Another concept identified in communication and handover related literature is interruptions. Interruptions disrupt cognitive focus (focus of attention), concentration and ability to store information (Berg et al., 2013; Jett & George, 2003) and can interfere with the ability to carry out the task at hand (Potter et al., 2005). According to Jett and George (2003), interruptions can be further divided into intrusions, breaks and distractions, all of which can have positive or negative outcomes. Intrusions are defined as unexpected encounters initiated by another individual that disrupt the flow of activity and cause activity to halt temporarily (Jett & George, 2003; McGillis Hall et al., 2010a). Breaks are similar to intrusions, however, they are self-initiated (Jett & George, 2003) and therefore are not likely to occur during handover. Distractions are breaks in concentration triggered by competing activities or environmental stimuli that are not related to the task at hand (Jett & George, 2003). Although there is difference between intrusions, breaks and distractions, this distinction is generally not made explicit in handover communication related literature. Rather, handover related literature tends to use the terms distractions and interruptions interchangeably.

Distractions and interruptions were one of the most commonly identified handover communication influencing factors found in the literature. In healthcare settings, distractions and interruptions were often reported to occur as a result of noise from patients, family members, other staff as well as call bells, telephones, and alarms (Lawrence et al., 2008; Laxmisan et al., 2007; McGillis Hall et al. 2010a,b; Staggers & Jennings, 2009). According to Hughes (2008), distractions can jeopardize patient safety as they can lead to skill-based errors, such as slips or lapses (Armitage, 2009; Reason, 1990). It is posited that interruptions can also lead to knowledge-based errors as Potter et al. (2005) and Jett and George (2003) suggest that interruptions can disrupt a nurse’s ability to think critically, synthesize and store information. Birmingham and colleagues (2014) reported that disruptions during handover interfered with
nurses’ abilities jointly “paint a picture” (p.6) of the patient during handover. Therefore, interruptions likely influence handover from the perspective of the incoming nurse, as handover communication requires critical thinking and judgment. Factors that pull attentional resources away from the task at hand will jeopardize an outgoing nurse’s ability to provide quality handover.

In a study by Berg et al. (2013), the majority of clinician interruptions occurred during the exchange of information (20%) with the nursing station being the area where most interruptions occurred (49%). In their evaluation of a postoperative handover tool, Nagpal et al. (2011) found that distractions were present in 35% of handovers (clinician role was not specified). Kitch et al. (2008) indicated that 36.6% of medical resident handovers were interrupted either “most of the time” or “always”. Berg et al. (2013) identified interruptions as occurring 5.1 times per hour in the ED. Laxmisan et al. (2007) reported that physicians were interrupted an average of every 9 minutes, while residents were interrupted every 14 minutes. Woloshynowych et al. (2007) observed ED charge nurses and reported that they engaged in a new communication activity every 36 seconds, leaving them at risk for interruptions. Surveys and observations of nurses, residents, and physicians revealed that distractions were frequently reported as barriers to the delivery of handover (Benson et al., 2007; Kerr et al., 2011; Lawrence et al., 2008; Nagpal et al., 2011; Staggers & Jennings, 2009; Street et al., 2011). Theoretical handover literature also suggests that noise, interruptions, and distractions are barriers to handover communication (Cheung et al., 2010; Lardner, 1996).

Distractions and interruptions increased the length of time required for nurses to provide handover (Currie, 2002), resulted in nurse dissatisfaction (Meissner et al., 2007), information loss (Dayton & Henriksen, 2007; Laxmisan et al., 2007), and unclear handover presentation (McCloughen et al., 2008). It was further reported by some authors that distractions and interruptions influence clinician cognitive processing ability (Jett & George, 2003; Laxmisan et al., 2007; Staggers & Jennings, 2009; Woloshynowych et al., 2007), attention span (Currie, 2002; Sharit et al., 2008), and ability to manage competing priorities (Laxmisan et al., 2007).

It is important to note that not all interruptions are negative (Berg et al., 2013; Jett & George, 2003; McGillis Hall et al., 2010a,b,c). For example, a nurse giving handover may be interrupted by a phone call with urgent lab results that can quickly be conveyed to the incoming nurse for immediate action. Although positive interruptions exist, the interruption itself will
inevitably result in a cognitive shift (Dekker, 2011; Potter et al., 2005). Given that interruptions impact cognitive workload and subsequent information synthesis and decision-making (Potter et al., 2005), they are likely to have a negative impact on handover quality by interfering with handover organization and discussion of patient care. Therefore, it was hypothesized that the presence of negatively perceived interruptions (further defined as intrusions and distractions) will negatively influence the quality of handover communication (See Figure 8 below). As a result of their influence on cognitive work, namely focus of attention, it is also hypothesized that intrusions will moderate the relationship between focus of attention and handover quality. According to Jett and George (2003), intrusions may lead to increased feelings of time pressure, as such, it was further hypothesized that negatively perceived intrusions will also moderate the relationship between time pressure and quality of handover communication.

Figure 6. Relationship between cognitive capacity, focus of attention, intrusions, distractions, time pressure and handover quality.

Psychological precursors. The next category of concepts hypothesized to influence handover quality are those considered to be psychological precursors. Psychological precursors as defined by Leape (1994) and Reason (1990) are stresses of daily life such as fatigue and time pressure. According to Leape (1994) and Reason (1990), psychological precursors can hinder human performance, leading to unsafe situations. Findings from theoretical literature on communication suggest that psychological precursors including fatigue and stress can interfere with communication (Barnlund, 1968). Psychological precursors may confound the way a message is sent by decreasing one’s ability to synthesize and organize information, as well as by
limiting one’s ability to make effective clinical judgments (Jeffs et al., 2009). Psychological precursors may also obstruct the incoming clinicians’ interpretation of the situation because of a hindered ability to accept and process information. The following section will provide an overview of theoretical and empirical perspectives related to psychological precursors including job stress, divided into anxiety and time stress, time pressure, acute fatigue, and chronic fatigue, as well as a discussion of their role in handover related literature.

**Job stress.** Parker and Decotiis (1983) describe job stress as “the feeling of a person who is required to deviate from normal or self-desired functioning in the work place as the result of opportunities, constraints, or demands relating to potentially important work-related outcomes” (p. 165). Based on study findings using data gathered from restaurant managers, Parker and Decotiis (1983) identified anxiety and time stress as dimensions of job stress.

“Anxiety is an unpleasant emotional state that has adaptive or maladaptive consequences” (Addae & Wang, 2006, p.477). Anxiety is often accompanied by physical manifestations such as sweating and increased heart rate (Sadock & Sadock, 2005). In this particular context, anxiety “relates to tensions or pressures experienced by employees brought on by their job requirements”(Addae & Wang, 2006, p.477). Study findings by Stathopoulou and colleagues (2011) suggest a weak, yet statistically significant correlation between working in the ED and anxiety levels (Kendall’s τ = 0.18, p = 0.01).

Time stress is the second component of job stress (Parker & Decotiis, 1983). “Time [stress] relates to employees’ perception of insufficient time to accomplish the demands of their job” (Addae & Wang, 2006, p.477). Parker and Decotiis (1983) reported that factors such as number of hours worked per week and negative perceptions of management contribute feelings of time stress.

**Time pressure.** Time pressure is a feeling that is transient in nature and occurs when an individual perceives that there is insufficient time to complete required tasks (Teng, Hsiao & Chou, 2010). It is posited that the concept of time pressure is different from time stress. Time pressure pertains to handover specific instances of feeling rushed, unlike time stress that occurs over time and is related to factors such as number of hours worked per week (Parker & Decotiis, 1983).

**Fatigue.** Fatigue related research has identified two different types of fatigue, acute and chronic fatigue (Winwood et al., 2005). Acute fatigue is a temporary state that can be overcome
with rest, often known as intershift recovery (Barker & Nussbaum, 2011; Winwood et al., 2005). Conversely, chronic fatigue is persistent and affects both physical and mental functioning (Winwood et al., 2005). Fang et al. (2008) reported that acute fatigue was a major predictor of chronic fatigue.

Psychological precursors such as fatigue can lead to adverse consequences including hindered information processing, decreased vigilance, impaired short term memory, and decreased mental acuity (Caldwell, 2001; Geiger-Brown et al., 2012; IOM, 2004; Kunert, King & Kolkhorst, 2007; Lee et al., 2004; Lockely, Barger, Ayas, Rothschild, Czeisler & Landrigan, 2007; Sexton, Thomas & Helmreich, 2000; Swaen, van Amelsvoort, Bultmann, & Kant, 2003). Impaired information processing and limited short-term memory, as well as decreased mental acuity can result in knowledge-based errors, while decreased vigilance may result in slips and lapses.

In both conceptual and empirical handover literature, a number of researchers noted that psychological precursors such as time pressure and fatigue negatively influenced handover communication (Birmingham et al., 2014; Cheung et al., 2010; Lawrence et al., 2008; Olsen et al., 2013; Slagle et al., 2007; Street et al., 2011; Sutcliffe, Lewton & Rosenthal, 2004; Talbot & Bleetman, 2007). Other research suggests that psychological precursors negatively impact performance (Ebright, Patterson, Chalko & Render, 2003) and can ultimately lead to mistakes (Leonard et al., 2004).

Aforementioned literature considers the impact of psychological precursors primarily from the perspective of outgoing nurses. However, it is postulated that psychological precursors can also affect handover communication from the incoming nurse’s perspective. To process and apply knowledge effectively to make clinical judgments, nurses must be able to receive and understand a message (Berlo, 1960; Fritz et al., 1984). In the presence of fatigue, time pressure and job stress, incoming nurses may not be able to accept messages as a result of decreased vigilance, decreased mental acuity, and cognitive impairment. It was therefore hypothesized that psychological precursors including anxiety, time stress, time pressure, acute fatigue, and chronic fatigue experienced by the incoming nurse will negatively influence quality of handover communication (See Figure 9). Given that there is a relationship between chronic fatigue and mental functioning (Winwood et al., 2005), it was further hypothesized that chronic fatigue will moderate the relationship between cognitive capacity and handover quality.
Relationships. Findings from communication related theoretical literature suggest that relationships between the incoming and outgoing nurse may influence handover communication. Communication often contains a relational aspect involving feelings that the sender and receiver have for one another (Ellis et al., 1995; Kreps & Thorton, 1984). These feelings may be conveyed consciously or unconsciously and can impact the meaning of a message and delivery of handover (Ellis et al., 1995; Fritz et al., 1984). For example, if a nurse providing handover does not like the receiving nurse, although not conveyed in words, these feelings may be inadvertently transmitted through terse message delivery. If the incoming nurse senses the outgoing nurse’s negative feelings, they may avoid asking questions and end handover as quickly as possible, thus decreasing the chance of creating a shared understanding.

In handover related literature, relationships with peers were identified as influencing handover communication (Anthony & Preuss, 2002; Cheung et al., 2010; Meissner et al., 2007). During handover between ambulance crews and ED staff, it was noted that working relationships between individuals facilitated handover (Bost, Crilly, Patterson & Chaboyer, 2012). Similarly, when nurses rated handover as being effective, there was often a positive relationship between the incoming and outgoing nurse (Carroll et al., 2012).
When relationships are positive, they can serve as a defensive layer in the Swiss Cheese Model proposed by Reason (1990). Positive relationships can serve to prevent errors by creating an atmosphere that is conducive to speaking up when something is wrong. In the case of handover, positive relationships will facilitate nurses alerting their counterparts when important information is missed. It was hypothesized that positive relationships between the incoming and outgoing nurse will have a positive influence on the quality of handover communication (See Figure 10).

![Diagram](image)

**Figure 8. Relationship between relationships and handover quality.**

**ED safety climate.** Emergency Department safety culture / climate may contribute to the quality of handover communication. Sutcliffe et al. (2004) suggested that communication behaviour in healthcare organizations is influenced by cultural norms. In their qualitative study of clinician handover, Siemsen et al. (2012) reported that organizational culture did not support increased safety during handover communication, as clinicians did not consider handover to be a high-risk activity. Organizational culture includes values shared by employees that impact attitudes and behaviours within an organization (Cooper, 2000). It is also known as “the way we do things around here”. A safety culture is characterized by a work environment in which there are shared behaviors, values, expectations, and priorities of patient safety (Cooper, 2002; Mearns & Flin, 1999). Employee empowerment, learning from errors, teamwork, free flow of information, and management and leadership committed to safety further characterize safety cultures (Dekker, 2011; Pronovost et al., 2003). When safety is the dominating characteristic of a corporate culture, the organization is said to have a safety culture (Cooper, 2000). When safety is not the dominating feature, safety then becomes a sub-culture (Cooper, 2000).

An organizational climate is the attitudes expressed by members of the organization reflecting organizational culture (Guldenmund, 2000). Similarly, a safety climate is defined as employee perceptions of safety related policies and practices, as well as perceptions of management priorities of safety within the workplace (Clarke, 2010; Neal & Griffin, 2006; Zohar et al., 2007).
Although the relationship between safety culture and climate has not been clearly established (Guldenmund, 2000), it is hypothesized that safety culture is reflected through safety climate (Guldenmund, 2000; Schein, 1992). Safety climate captures safety related attitudes and values of safety as opposed to safety culture, which is focused on safety related behaviours (Cooper, 2000; Flin, Mearns, O'Connor & Bryden, 2000; Guldenmund, 2000; Mearns & Flin, 1999; Neal, Griffin & Hart, 2000; Steyrer et al., 2012). In a recent review of safety culture measures, Halligan and Zecevic (2011) reported that out of 139 studies reviewed, climate and culture were used interchangeably and 82 of the studies did not provide a definition for these concepts. Safety climate is often used as a proxy measure of safety culture in quantitative studies, as measuring culture is suited towards qualitative methods such as ethnography (Cooper, 2000; Guldenmund, 2000; Sexton et al., 2006).

There is a relationship between safety climate and decreased rates of accidents in industries outside of healthcare such as nuclear, construction, and manufacturing (Vincent, 2010). Organizations with higher safety culture scores have lower rates of documented patient adverse events and complications when controlling for teaching status, number of beds, and hospital ownership (Mardon, Khanna, Sorra, Dyer & Famolaro, 2010). More positive safety climate scores have been linked to lower rates of pressure ulcers, fewer nurse injuries, as well as increased safety behaviours (Clarke, 2010; Agnew, Flin & Mearns, 2013; Taylor et al., 2012). The rationale may be that when safety is part of one’s value system, vigilance is increased while performing high-risk activities. Safety climate is reflected in the System Migration Model (Amalberti, 2001; Amalberti et al., 2006) when employees are faced with balancing competing demands. If the organization has a positive safety climate, peers and managers will be less likely to accept deviations from safety standards in order to increase productivity. Zohar and colleagues (2007) and Clarke (2010) support this by suggesting that safety climate reflects employee perceptions of the priority of safety when there are trade-offs that must be made between productivity and safety. In other words, in the presence of a safety climate, nurses may be more likely to choose safety over production, keeping them in the safe space of action (Amalberti et al., 2006).

Management commitment and supervisory practices are linked to employee perceptions of safety climate (Agnew et al., 2013; Zohar, 2010). Leaders and managers are key components of both the Swiss Cheese Model (Reason, 1990) and the System Migration Model (Amalberti,
Frontline managers contribute to defensive layers in the Swiss Cheese Model as they are responsible for implementing policies that facilitate delivery of safe patient care (Palmieri et al., 2008). Managers make decisions related to latent contextual factors such as staffing, communication, and training, all of which impact the performance of frontline staff (Henriksen et al., 2008; van Beuzekom et al., 2010). In the System Migration Model (Amalberti, 2001; Amalberti et al., 2006), leaders may contribute to unsafe practice by allowing violations of rules and policies to become acceptable or borderline tolerated conditions of use. For example, if frontline managers allow staff to circumvent handover policies by not using handover mnemonics, they create conditions that can lead to misinformation or omissions. As this deviation becomes further embedded into practice, handover communication may become less and less thorough, creating conditions that may lead to an adverse event.

Although there is limited evidence supporting the link between safety climate and handover communication in handover related literature, the existence of a link between patient safety and safety climate and culture is supported in safety literature (Mardon et al., 2010). As handover communication contributes to patient safety, it was hypothesized that a positive safety climate (where employees have positive perceptions of safety related policies, practices and management priorities [Clarke, 2010; Neal & Griffin, 2006; Zohar et al., 2007]) will positively influence handover communication. (See Figure 11).

![Figure 9. Relationship between safety climate and handover quality.](image)

**Technology.** Contributions from safety science literature suggest that there are organizational factors that influence employee performance. Amalberti (2001) and Amalberti et al.’s (2006) System Migration Model suggests that there is an interplay of contextual factors that influence a nurse’s decision making process. Contextual factors in the System Migration Model include workload (previously discussed) and technology. Complexity of technology may push the boundaries of practice towards the unsafe or borderline zone (Amalberti, 2001; Amalberti et
al., 2006). Conversely, technology that facilitates nursing work by decreasing workload may move performance boundaries away from the unsafe zone.

Cheung et al.'s (2010) model of ED handover barriers includes lack of technology as a hindrance to handover communication. Conversely, in a literature review, Strople and Ottani (2006) concluded that the use of technology such as electronic documentation, bedside documentation devices, and other point of care technology had the potential to improve handover quality by organizing and streamlining the presentation of patient information. For example, technology such as online documentation can be used to support handover communication through pre-population of handover information sheets (Athwal et al., 2007; Barnes et al., 2011; Birmingham et al., 2014; Bhabra et al., 2007; Nelson & Massey, 2010; Pickering et al., 2009). In a 2011 pilot study of surgical handover, Ryan and colleagues reported that the implementation of an electronic handover format resulted in a significant decrease in patient length of stay (p = 0.05). According to findings from an observational study, Randall and colleagues (2011) noted that handover related technology can play a key role in facilitating handover. However, since technology cannot provide detailed explanations and clarification that is often required during handover, technology cannot replace the need for two-way information exchange (Randell et al., 2011).

As technology continues to evolve in hospitals, it is likely to influence the way in which handover is carried out. It was hypothesized that availability of handover related technology (e.g., electronic documentation) in EDs will positively influence quality of handover communication (See Figure 12).

![Figure 10. Relationship between technology and handover quality.](image)

**Handover format.** The last group of factors proposed to influence quality of handover communication are related to handover format. The majority of handover communication related publications focus on the format of handover communication or the way in which handover is carried out. Handover format includes mode of communication, handover tools such as checklists and mnemonics, and individuals who are included as handover participants. Handover
may be provided in groups (tape/digitally recorded or presented by the charge nurse) (Hardey et al., 2000; Kerr, 2002; Lally, 1999; Lamond, 2000; Richard, 1988), verbally and face-to-face between two individuals (Clark et al., 2009; Haig et al., 2006; Kerr, 2002; Nelson & Massey, 2010), or verbally and face-to-face while including the patient at the bedside (Anderson & Mangino, 2006; Athwal et al., 2009; Cahill, 1998; Chaboyer et al., 2009; Chaboyer et al., 2010; Manias & Street, 2000; Street et al., 2011; Thomas & Donohue-Porter, 2012; Timonen & Sihvonen, 2000; Webster, 1999; Wilson, 2011). Different tools used for handover communication include structured pre-printed handover information sheets (Athwal et al., 2009; Nelson & Massey, 2010), as well as checklists and mnemonics used to trigger clinicians’ thought processes and structure handover delivery (Clark et al., 2009; Haig et al., 2006; Porteous, Stewart-Wynne, Connolly & Crommelin, 2009; Riesenberg et al., 2009; Sandlin, 2007; Street et al., 2011; Talbot & Bleetman, 2007). These factors are explored in further detail below.

**Face-to-Face Communication.** Face-to-face verbal communication is often the method of handover used in the ED. Face-to-face verbal handover provides nurses with the opportunity to clarify information and ask questions (Friesen et al., 2008). Face-to-face communication facilitates reciprocity and clarification of information. This type of communication serves as a defensive layer in the Swiss Cheese Model by preventing information gaps (Reason, 1990). Face-to-face communication provides the opportunity for both incoming and outgoing nurses to ensure that all relevant information is communicated, and is more likely to result in a shared understanding as opposed to tape/digitally recorded report (Randell et al., 2011). Tape/digitally recorded shift handover offers the benefit of allowing nurses to listen to information later in their shift if necessary (Friesen et al., 2008). Richard (1988) found that taped report was more likely to be congruent with patients’ conditions than verbal report. However, findings suggest that information was more likely to be omitted during taped report compared to verbal report (Richard, 1988).

Since face-to-face handover communication provides opportunities for clarification of information and improves the likelihood of a shared understanding, it was hypothesized that face-to-face handover communication will positively influence the quality of handover communication (See Figure 13).
Use of structured handover tools. Following the release of To Err is Human: Building a Safer Health System (Kohn et al., 2000), a number of researchers tested the use of a structured handover tools such as mnemonic devices or pre-printed handover information sheets to guide handover content. Examples of mnemonics include iSoBAR [identify, situation, observations, background, agreed plan, read back] (Porteous et al., 2009), I PASS the BATON [introduction, patient assessment, situation, safety, background, actions, timing, ownership, next] (Sandlin, 2007), and SHARED [situation, history, assessment, risk, expectations, documentation] (Riesenberg et al., 2009). These are based on one of the original, more commonly used mnemonics, SBAR [situation, background, assessment, recommendations] (Leonard et al., 2004). Pre-printed handover information sheets are other examples of handover tools and are completed by the outgoing nurse or by electronic health record programs. Pre-printed information sheets generally present information in a structured format similar to SBAR.

In their qualitative study of nurse handover, Staggers and Jennings (2009) found that there was no clear structure for giving or receiving handover. Staggers and Jennings (2009) observed that handovers relied heavily upon nurses’ memories and would be improved if structures were in place to ensure that information transfer was complete and accurate. McCloughen et al. (2008) reported that when handover was unstructured (e.g., without guidelines for information that must be delivered) content varied greatly from nurse to nurse. Nurses often omitted key pieces of information such as the patient’s admitting diagnosis, history, and nursing interventions (McCloughen et al., 2008).

Studies testing handover tools reported improved consistency, organization and amount of information shared between nurses (Benson et al., 2007; Currie, 2002; McFetridge et al., 2007; Millar & Sands, 2013; Nelson & Massey, 2010; Siemsen et al., 2012). A 2012 literature review by Foster and Manser found that seven out of twelve studies using standardized handover sheets reported significant improvements in outcomes such as information retention and adverse events. Johnson and Cowin (2013) reported that the use of structured handover tools may contribute to increased continuity of care. Moseley and colleagues (2012) examined handover
among neurology residents. They reported that the implementation of a standardized SBAR format for handover led to increased completeness and accuracy of information transferred (Moseley et al., 2012). Similarly, in a study of pediatric residents, Weiss and colleagues (2013) found that a written cognitive aid resulted in improved transfer of information. Other studies have suggested that the use of handover tools contributes to effective handover communication (Cheung et al., 2010; Lawrence et al., 2008; Street et al., 2011). In a study of information retention, Bhabra et al. (2007) reported that structured pre-printed handover sheets resulted in improved clinician retention of information. Pickering et al. (2009) reported similar findings after implementing electronic, pre-printed handover information sheets. Conversely, when a mnemonic was used between ambulance crews and ED clinicians, recall was less when compared to ad-hoc handover delivery (Talbot & Bleetman, 2007). Dowding (2001) also found that the type of handover communication (e.g., task oriented and retrospective versus patient focused and prospective) had little effect on clinician recall. However, type of handover did impact the ability to plan care, with task oriented, retrospective handover resulting in higher scores compared to patient focused, prospective handover (Dowding, 2001).

Existing literature suggests that the use of tools and checklists increases the likelihood of mutual understanding (Birmingham et al., 2014; Leonard et al., 2004). They do so by creating shared expectations between clinicians about the information that needs to be exchanged during handover (Lardner, 1996; Leonard et al., 2004). Tools such as mnemonics and checklists make it easier for clinicians to discern between salience and completeness, by providing cues about information that needs to be conveyed. They do not however, replace the need for clinical judgment. Handover tools can serve as defensive layers in the Swiss Cheese Model (Reason, 1990) by preventing information omissions. The use of a tool such as SBAR includes assessment information, which is congruent with the definition of handover quality (Manser et al., 2013). Tools will also facilitate the presentation of organized information, also congruent with the definition of handover quality (patient assessment, organization, shared mental model) being used in this research.

As the use of handover tools facilitate the organization of information, enable focus on relevant information and create a shared understanding, it was hypothesized that the use of structured handover tools will positively influence quality of handover communication (See Figure 14).
Figure 12. Relationship between use of structured handover tools and handover quality.

Patient/family participation in handover. Increasingly, patient centered care is being identified as a feature of excellent nursing care (Jeffs et al., 2013). Including the patient as a participant in bedside handover communication is one way in which this is being achieved. In a mixed methods study, Timonen and Sihvonen (2000) reported that including the patient in handover communication made it easier for incoming nurses to begin their shifts as they were prepared with necessary information. Jeffs and colleagues (2013) support these findings, suggesting that bedside handovers allow nurses to plan care and set priorities for the shift. A number of researchers also found that including the patient in handover communication made it easier for the incoming nurse to assume accountability as they were given the opportunity to visualize patients (Anderson & Mangino, 2006; Birmingham et al., 2014; Ekman & Segesten, 1995; Jeffs et al., 2013). Other studies reported perceptions of increased continuity of care and opportunities for clarification when the patient was included (Cahill, 1998; Jeffs et al., 2013; Maxson et al., 2012). In an ethnographic study of intensive care nurses, Philpin (2006) observed that bedside handover allowed nurses to convey “care and concern for patients” (p.88). Two studies examining patient perspectives reported that patients perceived bedside handover positively (Jeffs et al., 2014; Lu, Kerr & McKinlay, 2014). Bedside handover provided opportunities for patients to connect with incoming nurses, get updates on the plan of care and contribute information to address potential errors (Jeffs et al., 2014; Lu et al., 2014). In a survey of ED nurses, Klim and colleagues (2013) found that 62.7% of nurses who participated preferred handover conducted at the bedside.

Concerns regarding the inclusion of patients during handover relate to patients not feeling comfortable participating in handover as a result of their illness, fatigue, lack of technical knowledge, or inability to understand medical jargon (Cahill, 1998; Jeffs et al., 2014; Johnson & Cowin, 2013; Lu et al., 2014; Timonen & Sihvonen, 2000). In a recent qualitative study of bedside handover, Lu and colleagues (2014) reported that patients were not overly concerned about confidentiality provided that sensitive topics were not discussed. Additional drawbacks to
bedside handover include nurses criticizing one another in front of the patient (Cahill, 1998; Manias & Street, 2000), nurse anxiety related to providing handover in front of the patient (Philpin, 2006) and concerns about maintaining patient confidentiality and privacy (Birmingham et al., 2014; Cahill, 1998; Currie, 2002; Jeffs et al., 2014; Johnson & Cowin, 2013; Webster, 1999). This may be more of a pertinent challenge in the context of the ED, as often patients are separated by curtains as opposed to enclosed rooms.

Including the patient (or family if the patient is unable to participate) in handover communication may serve as a defensive layer (Reason, 1990), as patients and/or family members may be able to identify and fill information gaps (Jeffs et al., 2013). Visualizing the patient may also serve as memory trigger, assisting the nurse to recall pertinent information and focus on patient assessment information, aligning with Manser et al.’s (2013) definition of handover quality. It is therefore hypothesized that handover communication that includes the patient/family will positively influence the quality of handover communication (See Figure 15 below).

Figure 13. Relationship between patient/family participation and handover quality.

**Nurse Experience.** Clinician level of experience has been identified by a number of studies as influencing handover communication both positively and negatively (Carroll et al., 2012; Cheung et al., 2010; McFetridge et al., 2007; Sharit et al., 2008). McFetridge et al. (2007) and Sharit et al. (2008) explained that increased experience led to improved handover communication, as clinicians were able to better prioritize, as well as clarify information. Several published papers suggest that clinicians require socialized knowledge to interpret handover (Kerr, 2002; Hardey et al., 2000). Through experience, nurses learn how to provide and receive handover, which eventually leads to fewer knowledge-based mistakes. Findings from safety literature indicate that beginner practitioners are more likely to make knowledge-based errors than their experienced counterparts (Amalberti, 2001). Conversely, routine-based errors increase as level of experience increases (Amalberti, 2001). In their mixed-methods study, Carroll and colleagues (2012) found that increased nurse experience was a barrier to handover...
communication. Carroll et al. (2012) reported that experienced outgoing nurses provided less adequate handover when the incoming nurse knew the patient, compared to less experienced colleagues. However, when the incoming nurse did not know the patient, experienced nurses provided more adequate handovers than their less experienced colleagues (Carroll et al., 2012).

The majority of literature suggests that increased experience results in improved handover communication. Carroll and colleagues (2012), are an exception to this, suggesting that handover is only improved when experienced nurses do not know the patient. Since ED nurses often do not have the opportunity get to know patients since the are in the department for a short period of time, it was hypothesized that increased levels of nurse experience will positively impact quality of handover communication.

**Figure 14. Relationship between nurse experience and handover quality.**

**Summary of the Literature Review**

Poor quality or ineffective handover communication can result in adverse outcomes. The provision of handover communication involves knowledge-based performance (Armitage, 2009; Leape, 1994; Rasmussen, 1983), where nurses must use critical thinking, decision-making, and priority setting to provide sufficient information that is organized in a way that facilitates understanding for their incoming colleagues. Handover communication related errors can be classified as lapses (e.g., forgetting to include information, passing along misinformation), mistakes (e.g., insufficient knowledge, misinterpretations leading to incorrect information, or poor decision-making), or violations (e.g., intentionally deviating from policies and procedures) (Armitage, 2009; Leape, 1994; Reason, 1990, 2000).

Safety literature provides two different approaches with which to understand healthcare errors. The individual approach places blame on the individual closest to the error, while the system approach considers both human factors and other contextual factors that may have contributed to the occurrence (Reason, 1993, 2000). The system approach provides insight into the way in which contextual factors such as decision making by leadership, organizational
characteristics, safety climate, and individual factors can contribute to errors in ED nurse-to-nurse shift handover.

A theoretical model that illustrates the system approach is Reason’s Swiss Cheese Model (Reason, 1990). Reason’s (1990) theoretical approach provides the understanding that poor handover quality as an outcome may have a number of contributing factors including both active and latent failures (Reason, 1990). Moreover, although handover errors such as omitted information may not cause adverse events, when combined with other hazards such as poorly designed work environments and short staffing, poor quality handover leading to patient harm may result. This model supports the hypothesis that psychological precursors, safety climate and management decisions (e.g., staffing) contribute to quality handover communication.

Another theoretical perspective that informs the development of the hypothesized ED nurse-to-nurse shift handover communication model is the System Migration Model (Amalberti, 2001; Amalberti et al., 2006). This model highlights the notion that clinicians must make trade-offs between the pressures of performance and individual rewards (Amalberti et al., 2006). As these trade-offs are made, clinicians begin to deviate from established policies and procedures, moving into a zone that is less safe. The System Migration Model (Amalberti, 2001; Amalberti et al., 2006) demonstrates the importance of safety climate, workload, technology, and social influences such as relationships in shaping safe practice, including the provision of quality handover. Workload, technology and the interaction between staffing and time pressure may influence boundaries in the zone of tolerated conditions, either towards or further away from safe practice. As clinicians begin to operate within this zone of borderline tolerated conditions, they may shift further towards unsafe practice if their actions are accepted by their peers and organizational leadership. This shift into recklessness may lead to patient harm (Amalberti et al., 2006).

The World Health Organization’s International Classification for Patient Safety [ICPS] (2009) supports the system approach to understanding errors. Using the ICPS as a lens through which to understand factors that contribute to handover quality, almost every handover influencing factor can be categorized as a contributing factor/hazard including at the staff, work environment, organizational and external levels. Interestingly, nurse experience was one factor that was not identified as part of the ICPS. Situating factors that influence handover quality
within the ICPS conceptual framework will contribute to the promotion of learning and patient safety at an international level (Sherman et al., 2009).

The conceptual definition of handover quality used in this research is that proposed by Manser and colleagues (2013). Quality nurse-to-nurse shift handover communication includes a discussion of patient care information, organized information, and the creation of a shared understanding. Discussion of patient care is defined as the provision of relevant information including assessment data and priorities (Manser et al., 2013). Handover organization is defined as ensuring sufficient time for communication as well as synthesized and organized presentation of information (Manser et al., 2013). Shared understanding includes ensuring that information is complete and that there are opportunities for clarification and discussion (Manser et al., 2013).

There are a number of published research papers that explain or make inferences about factors that contribute to quality of handover communication. Three existing conceptual models of handover communication suggest a number of factors that influence handover communication including attention span, interruptions and workload (Cheung et al., 2010; Lawrence et al., 2008; Sharit et al., 2008). However, Sharit et al. (2008) and Lawrence et al.’s (2008) models fail to consider organizational context or social influences identified in the Swiss Cheese Model, the System Migration Model and the International Classification for Patient Safety. Cheung et al.’s (2010) model demonstrates strengths in that it highlights the importance of relationships. However, Cheung et al.’s (2010) model does not include organizational factors such as safety climate. The greatest shortcoming of these three existing conceptual models is that none of them have been tested quantitatively to confirm whether or not proposed concepts influence quality of handover communication. This is an important consideration. To develop strategies to strengthen handover communication, it is necessary to determine evidence of which factors actually impact quality of handover communication.

According to Riesenber et al. (2010), handover literature is characterized by low quality studies. Beyond existing instruments and conceptual models, the majority of handover literature reviewed was comprised of qualitative studies and quality improvement projects testing handover interventions. Although qualitative studies are important to facilitate understanding, findings from these studies are often context specific. Since findings may not be generalizable, factors that influence handover communication in one hospital may not be the same for other hospitals or other countries.
Recent evidence suggests that there may be differences in perceptions of handover quality between incoming and outgoing nurses (Carroll et al., 2012; Manser et al., 2013). For example, Carroll and colleagues (2012) reported that incoming nurses preferred handovers that included eye contact, whereas outgoing nurses rated handover as less effective when there was eye contact and questions by the incoming nurse. Manser and colleagues (2013) found higher ratings of handover quality from the incoming nurse were associated with the provision of assessment information. Conversely, this relationship was not found with the outgoing nurse. Despite these differences, among studies reviewed, few researchers differentiated between these roles. Exceptions to these included studies examining the effects of a handover intervention, where outcomes were measured using perceptions of the receiving or incoming nurse (Behara et al., 2007; Dowding, 2001; Kerr et al., 2011; Talbot & Bleetman, 2007). Exceptions also included several studies investigating handover quality that focused on perceptions of the incoming or receiving nurse (Anwari, 2002; Carroll et al., 2012; Kerr et al., 2011; Manser et al., 2010; Manser et al., 2013).

For the purposes of this current research, perspectives of incoming nurses are examined. The rationale to support this decision is that incoming nurses will be better able to evaluate the overall quality in terms of a discussion of patient care, organization of information and shared understanding, as it has implications for their ability to provide patient care. Although investigating outgoing nurses’ perceptions related to handover quality is of interest, it is not the focus of this study. Outgoing nurses asked to assess the quality of handover communication that they provide may be subject to bias, as outgoing nurses may be more likely to rate their own delivery of handover highly. This is supported by Chang and colleagues (2010) who stated “pediatric interns overestimated the effectiveness of their handoff communication” (p.491). Therefore, investigations of this nature are better suited to observational studies where quality is assessed by a neutral observer. It is recognized that there may be biases such as the leniency bias that influence quality ratings provided by the incoming nurse. These biases and steps taken to minimize them are discussed in Chapter 5.

In summary, handover literature suggests that handover communication may be influenced by nurse cognitive work (cognitive capacity, focus of attention) (Currie, 2002; Dayton & Henriksen, 2007; Kerr et al., 2011; Lamond, 2000; Lawrence et al., 2008; Laxmisan et al., 2007; Nagpal et al., 2011; Sharit et al., 2008; Siemsen et al., 2012; Slagle et al., 2007; Staggers et
al., 2011; Street et al., 2011; Talbot & Bleetman, 2007; Williams et al., 2007), psychological precursors (job stress, time pressure, fatigue) (Cheung et al., 2010; Ebright et al., 2003; Lawrence et al., 2008; Sagle et al., 2008; Street et al., 2011; Sutcliffe et al., 2004; Talbot & Bleetman, 2007), interruptions [intrusions, distractions] (Benson et al., 2007; Kerr et al., 2011; Lawrence et al., 2008; Laxmisan et al., 2007; Nagpal et al., 2011; Staggers & Jennings, 2009; Street et al., 2011), relationships (Anthony & Preuss, 2002; Carroll et al., 2012; Cheung et al., 2010; Siemsen et al., 2012), technology (Cheung et al., 2010; Strople & Ottani, 2006), face-to-face communication, use of a handover tool, patient participation in handover (Cheung et al., 2010; Lawrence et al., 2008; Street et al., 2011) and nurse experience (Carroll et al., 2012; Cheung et al., 2010; McFetridge et al., 2007; Sharit et al., 2008).

Seventeen out of the eighteen influencing factors identified within handover literature are supported in the class of contributing factors included in the ICPS (WHO, 2009). Theoretical safety literature further emphasizes the importance of cognitive workload, psychological precursors, technology, workload, relationships and interactions between staffing and time pressure as factors that influence handover communication (Amalberti, 2001; Amalberti et al., 2006; Leape, 1994; Reason, 1990; Weick, 1987). Drawing upon safety literature, it was further hypothesized that ED nurse-to-nurse handover communication will be influenced by safety climate (Amalberti, 2001; Amalberti et al., 2006; Palmieri et al., 2008; Reason, 1990, 2000).

To date, few nursing related quantitative studies examining factors that influence quality of ED nurse-to-nurse shift handover have been published. Having knowledge of factors influencing ED nurse-to-nurse handover communication makes it possible to develop evidence based handover delivery strategies. In this study, a conceptual model of factors that influence quality of ED nurse-to-nurse shift handover communication will be tested.

**Research Question**

The following research question will be addressed in this study:

1) What are the factors that influence quality of nurse-to-nurse shift handover in Ontario’s Emergency Departments from the perspective of incoming nurses?

**Study Objective**

The objective of this study is:

1) To test and refine the proposed conceptual model explaining factors influencing quality of nurse-to-nurse shift handover communication in the Emergency Department.
Proposed Conceptual Model

Based on the above literature review, the following conceptual model is hypothesized to explain factors that influence quality of ED nurse-to-nurse handover communication. The model includes 18 factors hypothesized to have a direct impact on the quality of handover communication, as well as four interaction effects (See Figure 1 below). This model was developed using one of Walker and Avant’s (2005) three approaches to theory development, theory synthesis. This approach is aimed at representing factors that influence an event, in this case, quality of handover communication. Theory is synthesized by combining evidence from a variety of literature sources in order to develop a model that can be tested empirically (Walker & Avant, 2005). There are three steps involved in the process of theory synthesis: 1) specifying the concept of interest, 2) reviewing the literature and 3) organizing findings into a representation (Walker & Avant, 2005). This chapter focused on the specification of concepts, a literature review, as well as the organization of findings into a conceptual model. In the next chapter, methods used to empirically test the conceptual model are described.
Figure 15. Hypothesized model of factors that contribute to quality handover communication from the perspective of the incoming nurse.
Hypotheses
The following relationships are hypothesized in the ED nurse-to-nurse shift handover model:

H1) Inadequate staffing will negatively influence the quality of handover communication.

H2) Backlogs in patient flow through triage will negatively influence the quality of handover communication.

H3) Negative intrusions experienced by the incoming nurse will negatively influence the quality of handover communication.

H4) Negative distractions experienced by the incoming nurse will negatively influence the quality of handover communication.

H5) Decreased cognitive capacity experienced by the incoming nurse will negatively influence the quality of handover communication.

H6) Decreased focus of attention experienced by the incoming nurse will negatively influence the quality of handover communication.

H7) High anxiety experienced by the incoming nurse will negatively influence the quality of handover communication.

H8) High time stress experienced by the incoming nurse will negatively influence the quality of handover communication.

H9) High time pressure experienced by the incoming nurse will negatively influence the quality of handover communication.

H10) High levels of acute fatigue experienced by the incoming nurse will negatively influence the quality of handover communication.

H11) High levels of chronic fatigue experienced by the incoming nurse will negatively influence the quality of handover communication.

H12) Positive relationships between the incoming and outgoing nurse will positively influence the quality of handover communication.

H13) Higher ratings of safety climate will positively influence the quality of handover communication.

H14) Availability of handover related technology will positively influence quality of handover communication.

H15) Face-to-face communication will positively influence the quality of handover communication.
H16) Use of structured handover tools will positively influence the quality of handover communication.

H17) Patient/family participation in handover will positively influence the quality of handover communication.

H18) Increased level of incoming nurse experience will positively influence the quality of handover communication.

H19) Intrusions will moderate the relationship between time pressure and handover quality.

H20) Intrusions will moderate the relationship between focus of attention and handover quality.

H21) Chronic fatigue will moderate the relationship between cognitive capacity and handover quality.

H22) Staffing levels will moderate the relationship between time pressure and handover quality.
Addendum to Chapter 2

This addendum describes a conceptual model of handover communication, a handover performance tool, as well as several manuscripts identifying features of an effective handover, all of which were identified or published after the design and execution of this study. As such, factors in these publications were not all included in the final hypothesized model.

In a qualitative study of healthcare providers in a Danish hospital, Siemsen and colleagues (2012) identified eight factors that impacted the safety of handover communication within hospitals, between hospitals and from ambulances to hospitals. These eight factors included communication, information, organization, infrastructure, professionalism, responsibility, team awareness and culture (Siemsen et al., 2012). Communication was defined as the exchange of information, both written and verbal, from one person to another, as well as the completeness of information provided. Although communication was not explicitly included in the hypothesized conceptual model, it was included in the definition of handover quality. According to Manser and colleagues (2013), quality handover includes a discussion of patient care, which includes the exchange of information as well as the complete patient story. The next factor, information, included “important existing knowledge concerning a particular fact or circumstance” (Siemsen et al., 2012, p.441). Again, this concept is reflected in Manser et al.’s (2013) definition of handover quality through the discussion of patient care, as well as the provision of organized information. Organization refers to the individuals who work together in a given structure such as a hospital. Lack of handover structure, workload and pressures to complete work were identified as challenges for organization. These factors were identified in handover related literature (e.g., McCloughen et al., 2008; Olsen et al., 2013) as well in the theoretical perspective offered by the System Migration Model [SMM] (Amalberti, 2001; Amalberti et al., 2006). As such, these factors were included in the hypothesized conceptual model. Infrastructure includes elements that support the function of an organization such as information technology. Technology was identified as a factor that may influence handover communication in handover related literature (Cheung et al., 2010; Strople & Ottani, 2006), as well as in the SMM (Amalberti, 2001; Amalberti et al., 2006). This factor was also included in the hypothesized conceptual model. Team awareness was defined as having concern for colleagues rather than oneself exclusively. The nature of this concept is reflected in the hypothesized conceptual model through the inclusion of relationships between the incoming and
outgoing nurse. Since relationships are generally reciprocal in nature, if the relationship is positive, then both the incoming and outgoing nurse are likely concerned with meeting the needs of the other. Culture referred to “a set of shared attitudes, values, goals, and practices that characterizes an organization, department, or profession” (Siemens et al., 2012, p.445). Safety culture, measured by safety climate was included in the hypothesized conceptual model, it was not readily identified in handover literature. Rather, safety climate was reflected in the theoretical perspectives offered by Reason (1990) through the Swiss Cheese Model, as well as through Amalberti’s (2001) SMM. Siemens and colleagues (2012) defined professionalism as “the conduct, aims, or qualities that characterize or mark a profession or a professional person” (p. 445). Professional behaviour of the clinician was used as a measure by Anwari (2002) and professionalism was identified in the conceptual model proposed by Lawrence et al. (2008). This model also included responsibility, similarly identified by Siemens and colleagues (2012). Professionalism and responsibility were not included in the hypothesized conceptual model, as they were not widely identified during the literature review, except as noted by Anwari (2002) and Lawrence et al. (2008).

Using a mixed methods approach, Klim and colleagues (2013) conducted group interviews (n = 41) as well as surveys of incoming nurses (n = 63) once they had received handover in the ED. Data obtained from nurse surveys were primarily descriptive including information about nurses’ preferred location for handover and adequacy of information received. Findings from focus group interviews defined five features of effective handover as well as necessary content. The five characteristics of a good handover included a systematic approach, treatment, appropriate environment, reference to documentation and efficient communication (Klim et al., 2013). A systematic approach meant that handover was presented in an organized, relevant and concise manner. This finding is congruent with definitions proposed by Manser et al. (2010) and Manser et al. (2013). Treatment referred to the treatment that was received by the patient while in the ED, as well as outstanding required care. This is also similar to Manser et al. (2013), who proposed that effective handover is characterized by a discussion of patient care. In terms of appropriate environment, nurses expressed a desire to conduct handover at the bedside or in a similar environment free from noise and other distractions. Although not previously identified as a feature of effective handover, this finding is aligned with other literature suggesting that handovers are often characterized by interruptions and distractions (Kitch et al.,
2008; Nagpal et al., 2011) and that such interruptions and distractions may serve as barriers to effective handover (Benson et al., 2007; Kerr et al., 2011; Lawrence et al., 2008; Nagpal et al., 2011; Staggers & Jennings, 2009; Street et al., 2011). This is also aligned with recent literature suggesting that bedside handover provides a number of benefits for patients as well as nurses (Anderson & Mangino, 2006; Jeffs et al., 2013; Jeffs et al., 2014; Maxson et al., 2012; Timonen & Sihvonen, 2000). Klim and colleagues (2013) reported that nurses preferred to use documentation to guide handover. Although the use of electronic documentation and structured format were identified as facilitators of handover communication (Bhbra et al., 2007; Pickering et al., 2009; Strople & Ottani, 2006), documentation was not specifically identified in the previously reviewed literature. Finally, nurses reported that the way in which communication was delivered was important, meaning that communication should be “professional and respectful” (Klim et al., 2013, p.2238). This is aligned with research conducted by Siemsen et al. (2012), Lawrence et al. (2008) and Anwari (2002), where the professional behaviour of the clinician was considered when assessing the quality of handover. The concept of respectful communication is also aligned with positive relationships between staff, which were identified by Carroll and colleagues (2012) as contributing to effective handover.

Pezzolesi and colleagues (2013) conducted a mixed methods study with the aim of developing and testing a handover performance tool for physicians in paediatrics, obstetrics and gynaecology. Items used to assess handover were developed using literature, as well as a Delphi process. A single item was used to assess handover quality, in addition to 25 other items reflecting the domains of communication, teamwork, leadership, situation awareness, task management, accountability/responsibility and circumstances of handover. Using factor analysis (principal axis components), Pezzolesi et al. (2013) extracted three factors that accounted for 66% of the total variance. These factors were communication, teamwork and situation awareness. The researchers also carried out multiple regression analyses and found that these three scales accounted for 39.6-55.5% of the variance in handover quality (Pezzolesi et al., 2013). Communication, which included closing the communication loop and a discussion of clinical information, was the most significant predictor of handover quality ($\beta$: 0.53-0.58, $p \leq 0.0001$). This finding is congruent with the definition of quality being used to guide this research. According to Manser et al. (2013), handover quality includes both a discussion of patient care, as well as the creation of a shared understanding. Teamwork included cooperation and coordination
among team members as well as the absence of conflict (Pezzolesi et al., 2013). Relationships, similar to teamwork, are included in the hypothesized model as the concept is consistent with other handover related literature suggesting that positive relationships between clinicians will positively influence quality of handover communication (Bost et al., 2012; Carroll et al., 2012; Cheung et al., 2010; Meissner et al., 2007; Siemsen et al., 2012). Situation awareness included the development of a shared understanding between staff, as well as awareness of potential complications (Pezzolesi et al., 2013). Although not included in the hypothesized conceptual model, this finding is also aligned with Manser and colleagues’ (2013) definition of handover quality which includes the development of a shared understanding between clinicians.

In a large-scale study using results from the Hospital Survey on Patient Safety Culture (HSOPS), Richter, Scheck McAlearney and Pennell (2014) examined predictors of successful handover. Data from 515,637 respondents including clinical staff and management from 1,052 hospitals were used to conduct multiple regression analyses. The researchers defined successful handover as how well information was relayed between clinicians. Successful handover was measured using a scale comprised of four items contained within the HSOPS. Independent variables in the study were also gathered using the HSOPS and included supervisor and management support for safety, organizational learning, teamwork within and across units, communication openness and staffing (Richter et al., 2014). Richter and colleagues (2014) reported significant differences in results between clinical staff and management. Since results from clinical staff are most relevant to this study, only these findings are reported below. Using data from clinical staff, the model resulted in an adjusted $R^2$ of .76. Staffing ($\beta = .18$, $p < .01$), management support for safety ($\beta = .11$, $p < .01$), and communication openness ($\beta = .13$, $p < .001$) positively impacted the success of handovers. The association between staffing and handover success is supported by handover related literature (Birmingham et al., 2014; Lawrence et al., 2008) and is included in the hypothesized conceptual model. Management support for safety having an impact on handover is aligned with safety literature suggesting that positive safety climates are associated with fewer adverse events and increased safety behaviours (Clarke, 2010; Agnew et al., 2013; Taylor et al., 2012). Safety climate is included in the hypothesized conceptual model. Organizational learning ($\beta = -.08$, $p < .05$) was negatively associated with handover success. This is a unique finding, as safety literature suggests that learning from adverse events should result in organizational implementation of defensive layers (Reason, 1990).
or actions to reduce risk (WHO, 2009) in order to prevent adverse events in the future. This factor was not included in the hypothesized conceptual model. According to Richter and colleagues (2014), perceived teamwork within units ($\beta = -.11$, $p < .01$) had a negative impact on handover success, whereas teamwork across units ($\beta = .68$, $p < .001$) had a positive impact. Findings related to teamwork within units is most applicable to this research as shift handover communication takes place between clinicians on the same unit. The finding that teamwork within units had a negative impact on handover success is contrary to handover related literature suggesting that teamwork and relationships should have a positive influence on handover (Bost et al., 2012; Carroll et al., 2012; Cheung et al., 2010; Meissner et al., 2007; Pezzolesi et al., 2013; Siemsen et al., 2012). Similar to the concept of teamwork, relationships between ED nurses are included as a factor that influences handover quality in the hypothesized conceptual model.
Chapter 3: Methods

In this chapter, methods employed to conduct this research study are described. The chapter begins with an overview of the study design, sampling strategy, procedures for conducting the study, concepts and their measurement and ethical considerations.

Research Design

This study was carried out using a cross-sectional survey design to test the hypothesized conceptual model of factors influencing the quality of ED nurse-to-nurse shift handover communication from the perspective of the incoming nurse. Chapter 2 focused on a review of existing theoretical and empirical literature for theory development and synthesis through identification of influencing concepts. A conceptual model was developed to represent relationships among the phenomena of interest (Walker & Avant, 2005). In this chapter, procedures for data collection using survey methods are explained. Additionally, analysis procedures used to test the strength of relationships and explore the hypothesized model are described (Newsted, Huff & Munro, 1998).

A self-administered survey was used to collect data from ED nurses. A survey was selected as surveys are useful for collecting quantitative data on attitudes and opinions of large samples, allowing the researcher to draw conclusions about broader populations (Creswell, 2009; Groves et al., 2009; Shi, 2008). Quantitative data derived from surveys can be used for explanatory purposes and to examine relationships among variables (Punch, 2003; Shi, 2008) such as those hypothesized in this study. Surveys are a convenient and cost effective method of gathering large amounts of data in a relatively short period of time (Dillman et al., 2009; Shi, 2008). Conversely, as surveys are primarily limited to quantitative data, they are generally not amenable to information that cannot be quantified (Groves et al., 2009). As a consequence, surveys may fail to generate “a rich understanding of the intricate mechanisms that affect human thought and behaviour” (Groves et al., 2009, p.406). Survey designs are also vulnerable to a number of measurement errors that are further discussed in Chapter 5.

Setting and Sample

This study took place in Ontario, Canada using individual nurses as the unit of analysis. A random sample of Registered Nurses (RN) employed in Ontario EDs was invited to complete a mailed survey. The ED was chosen as the setting because of lack of nurse related handover communication studies in this area, the large number of handovers carried out in the ED, and
writer experience in this area. Ontario was selected as the location for feasibility reasons. In 2012, there were 6,717 RNs in Ontario, Canada, who identified the ED as their primary area of practice (College of Nurses of Ontario, 2012). A random sample of those 6,717 RNs who agreed to participate in research was acquired from the College of Nurses of Ontario (CNO) database. The CNO database contains registration information such as employment status, area of practice, and mailing information for all nurses registered to practice in the Province of Ontario.

**Sample size considerations.** Sample size calculations for studies using multiple regression analysis can be carried out using several different approaches. One method for calculating sample size suggested by Tabachnick and Fidell (2013) is a formula of \( N \geq 50 + 8 \times (\text{number of predictors}) \). This formula is calculated using the assumptions of \( \beta = 0.20 \) and \( \alpha = 0.05 \) to ensure that there is sufficient power to detect a medium sized effect (Tabachnick & Fidell, 2013). Using this calculation (\( N \geq 50+8\times22 \)), a sample size of at least 226 participants was required for this study.

Dillman et al. (2009) suggest that response rates for mailed surveys range from 50 - 70%. Patrick et al. (2011) recently conducted a study of clinical leadership practices among acute care nurses in Ontario. Surveys were mailed to a random sample of acute care nurses using Dillman et al.’s (2009) Tailored Design Method, consisting of multiple mailings and reminders (described in further detail below). The researchers reported a response rate of 46% (Patrick et al., 2011). Wilson (2012) surveyed Ontario ED nurses in a study of managerial trust using a similar sampling approach. Using this method, Wilson (2012) received a response rate of 40%. Assuming that the present study would achieve a 35% response rate as a result of stricter inclusion criteria, 650 Ontario ED nurses were surveyed to achieve a minimum sample size of 226 participants.

**Inclusion criteria.** To participate in this study, nurses had to meet the following inclusion criteria:

1) Be a Registered Nurse providing direct patient care in an Ontario ED.

2) Must have worked in the ED for at least six months.

3) Must have worked at least one shift in the ED in an area where they received handover (e.g., not triage, or float) within the last ten days.


**Concepts and Their Measurement**

The following section provides an overview of concepts included in the hypothesized conceptual model presented in Chapter 2. Concepts are separated into dependent and independent variables, which are then defined by their conceptual definition, followed by their operational definition. Psychometric properties of measures are described where available.

There are three types of validity that can be considered when assessing appropriateness of proposed study measures, including construct, content, and criterion related validity (Nunnally & Bernstein, 1994). Construct validity assesses whether or not an instrument is measuring the hypothetical construct it is intended to measure and is most frequently reported for the measures selected below (Creswell, 2009; Kline, 2011; Nunnally & Bernstein, 1994). Construct validity can be established using convergent validity or discriminant validity (Campbell & Fiske, 1959). Convergent validity is established when two measures of the same concept result in the same outcome (Campbell & Fiske, 1959). Discriminant validity is established when measures of different constructs result in dissimilar outcomes (Campbell & Fiske, 1959). Construct validity can also be assessed using factor analysis to determine whether or not items are related (Cronbach & Meehl, 1955). Content validity refers to whether there are enough items present to cover the domain of the construct, often assessed using expert input (Nunnally & Bernstein, 1994). Criterion or predictive validity indicates how well an instrument is able to predict current or future events (Creswell, 2009; Nunnally & Bernstein, 1994). Criterion validity can be evaluated by correlating instrument outcomes with another instrument measuring the same or a similar concept.

Reliability is the repeatability of a measure and the notion that “any random influence which causes different measurements of the same variable to vary is a source of measurement error” (Nunnally & Bernstein, 1994, p.267). There are three types of reliability: internal consistency, equivalence, and stability (Nunnally & Bernstein, 1994). The most commonly reported measure of reliability in study instruments is internal consistency. Internal consistency is established by determining that proposed variables are all measuring the same concept, achieved through assessing correlations (coefficient alpha) among variables (Nunnally & Bernstein, 1994). Equivalence refers to agreement across observers using the same instrument, this can be assessed using inter-rater reliability (Nunnally & Bernstein, 1994). Stability refers to achieving the same results when tests are administered over time. Stability can be assessed using
test-retest (Nunnally & Bernstein, 1994). As previously stated, evidence of validity and reliability in proposed instruments will be reported where possible. Furthermore, during data analysis, psychometric properties of all instruments were tested and are reported in Chapter 4.

**Dependent Variable**

**Handover quality.** Handover quality was the outcome variable of interest in this study. The conceptual definition of handover quality used in this study is that proposed by Manser et al. (2013). Quality of handover is the degree to which communication results in a discussion of patient care, presents information in an organized manner, and creates a shared understanding. Discussion of patient care includes information about assessments and the transmission of relevant information. Providing organized information includes presenting information logically, in a sufficient amount of time, and having completed necessary documentation. Creating a shared understanding consists of providing opportunities for clarification and ensuring that handover is comprehensive.

Handover quality was assessed using one variable measured by a single item modified from Manser et al.’s (2013) study. The item, “Overall, the quality of this handover was” uses a five choice response scale (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent). As the term quality may be interpreted differently among participants, Manser et al.’s (2013) definition was included in the question lead in. Since this is a single item, psychometric properties were not appropriate. Psychometric properties such as construct validity pertain to the way in which multiple items fit together (Nunnally & Bernstein, 1994) and therefore are not applicable to single items.

**Independent Variables**

**Staffing.** Inadequate staffing was hypothesized to negatively influence quality of handover communication. Staffing was defined as having a sufficient number of nurses to care for patients and manage workload. Staffing was operationalized using a single variable, measured by a single researcher created item, as no suitable instrument was identified. This measure of staffing was created based on literature findings suggesting that increased workload is a barrier to handover communication (Sharit et al., 2008; Siemsen et al., 2012). The item was “Considering the workload at the beginning of the last shift where you received handover, how would you describe the level of nurse staffing?” Response options included three choices (1 = inadequate, unable to manage workload demands, 2 = marginal, difficult but possible to manage...
workload demands, \(3 = \) adequate, able to fulfill workload demands). As this was a single item, psychometric properties were not available.

**Triage flow.** According to Lawrence and colleagues (2008), the flow of triage impacts the quality of handover communication. Triage flow refers to the smoothness of the triage process where patients are seen and assigned a triage score by the triage nurse. Triage flow was measured using a single variable, measured by a single researcher created item, as no suitable instrument was located. The item was “Overall, how would you rate the flow of patients through triage in your Emergency Department?” Response options included three choices (1 = poor, there are frequent patient backlogs, 2 = marginal, there were occasional patient backlogs, 3 = good, patients flowed smoothly into the department).

**Interruptions.** Interruptions were conceptually defined as any noise or communication event during handover not initiated by a handover participant, requiring a participant to shift their focus off handover communication (Dekker, 2011; Woloshynowycz et al., 2007). According to Jett and George (2003), interruptions can be further divided into intrusions and distractions, both of which can have positive or negative outcomes. Negative intrusions and distractions are hypothesized to negatively influence quality of handover communication. Intrusion and distraction measures created below are based on literature findings suggesting that interruptions occur frequently (Kitch et al., 2008; Laxmisan et al., 2007; Nagpal et al., 2011) and may be a barrier to handover communication (Benson et al., 2007; Kerr et al., 2011; Lawrence et al., 2008; Nagpal et al., 2011; Staggers & Jennings, 2009; Street et al., 2011).

**Intrusions.** Intrusions were defined as unexpected encounters initiated by another individual that disrupt the flow of activity and cause activity to halt temporarily (Jett & George, 2003; McGillis Hall et al., 2010). Intrusions were operationalized using one variable, measured by a single researcher created item, as no instrument was available. The item was “How would you rate the overall impact of intrusions on your ability to receive handover communication?” Response options included five choices (ranging from 1 = very negative impact to 5 = very positive impact). For the purpose of delineating the distinction between intrusions and distractions, a definition of intrusions was provided in the survey prior to the item. To enhance descriptive information related to intrusions, a second item not included in the hypothesized model was included in the survey. The item was “If intrusions were experienced, please identify
Distractions. Distractions are breaks in concentration triggered by competing activities or environmental stimuli that are not related to the task at hand (Jett & George, 2003). Distractions were operationalized using one variable, measured by a single researcher created item, as no instrument was available. The item was “How would you rate the overall impact of distractions on your ability to receive handover communication?” Response options included five choices (ranging from 1 = very negative impact to 5 = very positive impact). For the purpose of clarifying the differences between intrusions and distractions, a definition of distractions was provided in the survey prior to the item. To enhance descriptive information related to distractions, a second item not included in the hypothesized model was also included in the survey. The item was “If distractions were experienced, please identify the source(s)”. Response options included: call bells, alarms from IV pumps and monitors, background noise or chatter and other. This additional information will be used to interpret and contextualize distraction related findings.

Cognitive capacity. Diminished cognitive capacity experienced by the incoming nurse is hypothesized to negatively influence quality of handover communication. Cognitive capacity was defined as having sufficient mental space to be able to carry out cognitive work such as information processing and decision making (Kreps & Thorton, 1984; Parry, 1967; Schramm, 1955). Limited cognitive capacity was identified as a barrier to handover communication in theoretical literature (Lardner, 1996; Weick, 1987). Cognitive capacity was measured using one variable derived from one researcher created item, as no suitable instruments were located. The item was “The last time that I received handover I felt I had enough cognitive capacity to receive and process information.” This item used a seven choice response scale (ranging from 1 = strongly disagree to 7 = strongly agree). To increase clarity of this item, a definition of cognitive capacity was provided in the survey, prior to the question.

Focus of attention. Literature pertaining to nurse handover suggests that attention related mental activities such as concentration (Talbot & Bleetman, 2007), attention span (Sharit et al., 2008; Talbot & Bleetman, 2007), and inattention (Cheung et al., 2010) influence handover communication. Focus of attention refers to the provider’s ability to direct attention to a situation (such as handover) based on their understanding and knowledge of the situation, and surrounding
activity (Dekker, 2011). Poor focus of attention was hypothesized to negatively influence quality of handover communication. Focus of attention was measured with one variable derived from one researcher created item, as no suitable instruments were located. The item was “The last time that I received handover, I was able to focus my attention on the information that I was receiving.” This item used a seven choice response scale (ranging from 1 = strongly disagree to 7 = strongly agree).

**Psychological precursors.** Psychological precursors are a group of concepts identified in both safety and handover related literature as having the potential to influence handover quality. Conceptually, psychological precursors are defined as stresses of daily life (Barnlund, 1968; Leape, 1995; Reason, 1990). Anxiety, time stress, time pressure, acute fatigue and chronic fatigue were psychological precursors included in this study.

**Anxiety.** Parker and Decotiis (1983) described job stress in terms of two concepts, anxiety and time stress. Work related anxiety is defined as “an unpleasant emotional state that has adaptive or maladaptive consequences” (Addae & Wang, 2006, p.477). Anxiety was operationalized with one variable, the anxiety subscale of the Job Stress Scale developed by Parker and Decotiis (1983). McCaughey and colleagues (2013) have recently used the Job Stress Scale to examine the relationship between work related injuries and safety climate perceptions in hospital nurses and allied health professionals. The Job Stress Scale contains a total of 13 items, including five items, which comprise the anxiety subscale (e.g., I have felt fidgety or nervous as a result of my job). See Appendix A for a complete list of items. Response options in the original scale included five choices (ranging from 1 = strongly disagree to 5 = strongly agree) but were revised post pilot test to include seven choices (ranging from 1 = strongly disagree to 7 = strongly agree). Responses to each item were summed to create a total score for the subscale. The theoretical range of scores for this instrument was 5-35. Scores of 25 or greater were used to indicate high levels of anxiety, as this indicates that on average, participants somewhat agree with each item in the scale.

Coefficient alpha of the Job Stress Scale was measured by several researchers and was reported as ranging from 0.71-0.91 (Jamal, 1990; McCaughey et al., 2013; Xie & Johns, 1995). Coefficient alpha values greater than 0.70 are considered to be acceptable in early stages of construct validation and indicate that scale items are measuring the same construct (Nunnally, 1978; Nunnally & Bernstein, 1994). Jamal and Baba (1992) reported that construct validity was
confirmed through factor analysis demonstrating that anxiety and time stress are distinct dimensions. Further evidence of validity was reported through negative correlations between the overall Job Stress Scale and organizational commitment and satisfaction. Positive correlations were reported between the Job Stress Scale and role ambiguity and overload (Jamal & Baba, 1992).

**Time stress.** Time stress is the second component of job stress (Parker & Decotiis, 1983). Time stress was measured using one variable derived from the time stress subscale of Parker and Decotiis’ (1983) Job Stress Scale. This subscale contains eight items (e.g., ‘working here makes it hard to spend enough time with my family’). Response options in the original scale included five choices (ranging from 1 = strongly disagree to 5 = strongly agree) but were revised post pilot test to include seven choices (ranging from 1 = strongly disagree to 7 = strongly agree). Responses to each item were summed to create a total score for the subscale. The theoretical range of scores for this instrument was 8-56. Scores equal to 40 or greater were used to indicate high levels of time stress, as this indicates that on average, participants somewhat agree with each item in the scale. Coefficient alpha values for the time stress subscale range from 0.71-0.91 (Jamal, 1990; McCaughey et al., 2013), indicating instrument reliability (Nunnally, 1978). Validity of this instrument is reported above by Jamal and Baba (1992).

**Time pressure.** Time pressure is a feeling that is transient in nature and occurs when an individual perceives that there is insufficient time to complete required tasks (Teng, Hsiao & Chou, 2010). The concept of time pressure is different from time stress. Time pressure pertains to specific instances of feeling that there is insufficient time, unlike time stress that occurs over a longer period of time. Time pressure was measured using one variable derived from an adapted time pressure scale created by Putrevu and Ratchford (1997). The time pressure scale was originally developed for consumer marketing purposes. Teng and colleagues (2010) translated the scale into Chinese for use with acute care nurses. The time pressure scale contains five items (e.g., ‘when working, I often have limited time’). Response options in the original scale included five choices, but were revised to include seven choices (ranging from 1 = strongly disagree to 7 = strongly agree) following the pilot test. Responses to each item were summed to create a total score for the scale. The theoretical range of scores for this instrument was 5-35. Scores equal to 30 or greater were used to indicate high levels of time pressure, as this indicates that on average, participants agree with each item in the scale. Coefficient alpha values for this scale range from
0.90 - 0.95 (Putrevu & Ratchford, 1997; Teng et al., 2010), indicating instrument reliability (Nunnally, 1978). Evidence of convergent, discriminant, and content validity for this subscale was reported by Putrevu and Ratchford (1997).

**Acute & Chronic Fatigue.** Acute fatigue is a temporary state that can be overcome with rest (Barker & Nussbaum, 2011; Winwood et al., 2005). Chronic fatigue is persistent and affects both physical and mental functioning (Winwood et al., 2005). Both acute and chronic fatigue were hypothesized to negatively influence handover communication. Acute fatigue and chronic fatigue were measured using two variables derived from the acute and chronic fatigue subscales of the Operational Fatigue Exhaustion Recovery Scale (OFER-15) (Winwood et al., 2006). Acute and chronic fatigue were each measured using five items. The OFER-15 used a seven choice response scale (ranging from 0 = strongly disagree to 6 = strongly agree). For acute fatigue, two items were reverse coded; all items were then summed, divided by 30 and multiplied by 100 to obtain a total score for acute fatigue. For chronic fatigue, all items were summed, divided by 30 and multiplied by 100 to obtain a total score for chronic fatigue. The theoretical range of scores for these scales was 0-100. Scores of 51 or greater were used to indicate higher levels of acute and chronic fatigue respectively.

The OFER-15 instrument has been primarily used to measure fatigue among nurses and other hospital employees (Barker & Nussbaum, 2011; Geiger-Brown et al., 2012; Pasupathy & Barker, 2012; Winwood et al., 2005; Winwood et al., 2006). There is evidence of face validity, construct validity, and discriminant validity for the OFER-15 (Winwood et al., 2005; Winwood et al., 2006). Test-retest reliabilities range from 0.62 to 0.84 (Geiger-Brown et al., 2012). Test-retest reliability levels greater than 0.80 are considered high (Shi, 2008). However, since fatigue is a phenomenon that changes over time, one would not necessarily expect high test-retest reliability scores (Streiner & Norman, 2008). A reliability score for the acute fatigue subscale was reported as $\alpha = 0.84$ (Winwood et al., 2006).

**Relationships.** A positive relationship between the incoming and outgoing nurse was hypothesized to positively influence quality of handover communication. Relationships between coworkers were defined as feelings that the incoming and outgoing nurse have towards one another (Ellis et al., 1995; Kreps & Thorton, 1984). Relationships were measured using one variable derived from the Positive Relationships subscale used in a nurse-to-nurse handover related study by Carroll and colleagues (2012). The subscale originally contained three items,
however, one item was removed, as it was very similar to the outcome variable. The revised Positive Relationships scale included seven response choices (ranging from 1 = strongly disagree to 7 = strongly agree). Scores from the two items were summed to provide a total score. The theoretical range of scores was 2-14. A score of 12 or higher was used to indicate the presence of a positive relationship between the incoming and outgoing nurse, as this indicates that on average, participants agree with each item in the scale. The Positive Relationships subscale has not been used in other studies. Coefficient alpha for the positive relationships subscale from the perspective of the incoming nurse was reported by Carroll et al. (2012) as $\alpha = 0.84$. Evidence of validity was not reported. Psychometric properties of this instrument are further assessed and reported in Chapter 4.

**ED safety climate.** The presence of a safety climate was hypothesized to have a positive influence on handover quality. Safety climate was defined as employee perceptions of safety related policies and practices, as well as perceptions of management priorities of safety (Clarke, 2010; Neal & Griffin, 2006; Zohar et al., 2007). Safety climate was operationalized using one variable, comprised of seven items derived from the safety climate subscale of the Safety Attitudes Questionnaire (Sexton et al., 2006). The safety climate subscale measured “perceptions of a strong and proactive organizational commitment to safety” (Sexton et al., 2006, p.3). The Safety Attitudes Questionnaire (SAQ) originally used a five choice response scale but was modified to include seven response options (ranging from 1 = disagree strongly to 7 = agree strongly). Questions included ‘In this clinical area, it is difficult to discuss errors’. The instrument was scored out of 100 by using the mean of the scale (negatively worded items are reverse scored) minus one multiplied by 25. The theoretical range of scores was 0-100. According to Sexton and colleagues (2006), scores of 75 or higher are considered to have a positive safety climate.

Items contained in this instrument were developed by subject matter experts and healthcare providers based on the Flight Management Attitudes Questionnaire (Helmreich et al., 1993; Helmreich & Merritt, 1998; Sexton et al., 2006). Factor analysis of the overall SAQ resulted in six distinct factors (teamwork climate, safety climate, perceptions of management, job satisfaction, working conditions and stress recognition), confirmed using multilevel confirmatory factor analysis (Sexton et al., 2006). Coefficient alpha for the safety climate subscale has been reported between 0.75- 0.84 (Etchegaray & Thomas, 2012; Taylor et al., 2012). The SAQ
demonstrates good reliability and predictive validity (Etchegaray & Thomas, 2012; Sexton et al., 2006). Predictive validity of the safety climate scale was established through correlations with reporting of adverse events \( r = 0.44, p < 0.05 \), general perceptions of patient safety \( r = 0.63, p < 0.05 \), and overall patient safety scores expressed as letter grades \( r = 0.65, p < 0.05 \) (Etchegaray & Thomas, 2012).

**Technology.** The presence of technology was hypothesized to positively influence quality of handover communication. Technology was defined as the use of electronic documentation and bedside documentation devices that organize and present patient information (Strople & Ottani, 2006). Technology was operationalized with one variable measured using a single researcher created item, as no suitable instruments were located in the literature. To measure technology, a single item was created based on literature findings suggesting that technology can be used to facilitate the delivery of handover communication (Athwal et al., 2009; Barnes et al., 2011; Bhabra et al., 2007; Cheung et al., 2010; Nelson & Massey, 2010; Pickering et al., 2009; Strople & Ottani, 2006). A definition of technology was included in the survey prior to the item. The single item was “Please indicate your level of agreement with the following statement: Technology is available in my Emergency Department to make it easier for me to receive handover communication.” This item used a seven choice response scale (ranging from 1 = strongly disagree to 7 = strongly agree). Although not included in the hypothesized model, one additional item was included to enable sample description and context related discussion. The item was “Please indicate the types of technology that you used when receiving handover”. Response options included electronic medical record, bedside documentation technology, handheld applications or other (please specify).

**Face-to-face communication.** Face-to-face communication between nurses was hypothesized to positively influence quality of handover communication. Face-to-face communication was defined as nurse-to-nurse handover communication conducted verbally between two or more nurses in close physical proximity to one another. Face-to-face communication was assessed with one variable, measured using a single researcher created item. No existing instruments were identified to quantify this concept. Therefore, face-to-face communication was measured with the item “Was the last shift handover communication that you received face-to-face?” Response options included yes (1) or no (0). This item was based on literature findings suggesting that face-to-face communication results in fewer information
omissions and offers increased opportunities for reciprocity and clarification of information (Friesen et al., 2008; Richard, 1988). To enhance descriptive information related to mode of communication, a second item not included in the hypothesized model was included in the survey. The item was “If handover communication was not face-to-face, how was it delivered?” Categorical response options included the following: tape recorded, written, or other (please specify).

**Use of a structured handover tool.** The use of handover tools was hypothesized to positively influence handover communication. Handover tools were defined as checklists or mnemonic devices used by nurses to guide handover communication. Checklists may be created using the electronic medical record, or they may be available for manual completion. Mnemonics may include acronyms such as SBAR, iSoBAR, SHARED, IPASSTHEBATON (Leonard et al., 2004; Porteous et al., 2009; Riesenber et al., 2009; Sandlin, 2007) or other proprietary versions. Use of handover tools was assessed with one variable, measured using one researcher created item. No existing instruments were identified to measure this concept. Therefore, use of a structured handover tool was assessed with “Was the last shift handover that you received guided by a handover tool?” Response options included yes (1) or no (0). This single item was created based on literature findings suggesting that checklists and mnemonic devices facilitate organization of handover communication and contribute to handover quality (Benson et al., 2007; Currie, 2002; Lawrence et al., 2008; McFetridge et al., 2007; Siemsen et al., 2012; Street et al., 2011). A definition of structured handover tools was included in the survey prior to the item. To enhance descriptive information related to handover tools, a second item not included in the hypothesized model was included in the survey. The item was “If handover was guided by a tool, what type of tool was used?” Categorical response options included the following: checklist, mnemonic device (e.g., SBAR, iSoBAR, SHARED, IPASSTHEBATON), other (please specify).

**Patient / family participation in handover.** Patient / family participation in handover communication was hypothesized to positively influence quality of handover communication. Patient / family participation was defined as including the patient (or family if the patient was unable to participate) in handover communication. Patient participation was assessed with one variable, measured using a single researcher created item. No existing instruments were identified to measure this concept. Therefore, patient participation was measured with the item
“During the last shift handover that you received, was the patient and/or family included in a face-to-face discussion?” Response options included yes (1) or no (0). This item was created based on literature findings indicating that patient involvement in handover may contribute to handover quality through increased information and opportunities for clarification (Anderson & Mangino, 2006; Cahill, 1998; Ekman & Segesten, 1995; Maxson et al., 2012; Nelson & Massey, 2010; Timonen & Sihvonen, 2000). A definition of patient/family participation was included in the survey to enhance clarity.

**Nurse experience.** Nurse experience was hypothesized to positively influence the quality of handover communication. This is based on several published papers that suggest clinicians require socialized knowledge and experience to interpret handover (Kerr, 2002; Hardey et al., 2000). Nurse experience was defined as the number of years of practice in the ED setting. Nurse experience was assessed with one variable, measured using a single researcher created item, as no suitable instruments were located. The item was “How many years have you worked as an Emergency Department nurse?”. Nurses were asked to indicate the number in years.

**Demographic and other information.** Although not included in the hypothesized model of factors influencing handover quality, participant demographic information was gathered to describe the overall study sample. Participant demographic information was collected using single items. Questions included level of education completed, year of birth, and sex. Other information concerning hospital type, patient assignment, and time since last handover was collected. See Appendix A for complete list of demographic and other questions.

**Procedure for Conducting Study**

**Pilot test.** Prior to data collection, the survey was pilot tested for item clarity and ease of completion (Shi, 2008). The pilot test was used to identify poorly worded or confusing questions, to assess the general survey flow and whether or not participants had the information necessary to respond to questions (Burns et al., 2008; Groves et al., 2009). Pilot testing of the survey minimized threats to validity by reducing the chance that participants would misinterpret questions (Burns et al., 2008).

The survey was pilot tested using a cognitive interviewing technique (Groves et al., 2009; Knafl et al., 2007). Using this technique, participants were asked to think out loud as they worked through the survey (Groves et al., 2009). In addition to verbalizing thoughts while responding to questions, participants were asked to verbalize their interpretation of items and
comment on wording (Knafl et al., 2007). Pilot testing was completed using a convenience sample of six ED nurses recruited by the researcher from a local ED.

Following institutional ethics approval from a local teaching hospital, the unit manager sent an email to all ED nurses on behalf of the researcher asking for volunteers (See Appendix B). Recruitment posters were also placed in the nurses’ lounge (See Appendix C). A total of six ED RNs who met survey inclusion criteria volunteered to participate in the pilot test. After signing the consent form (See Appendix D), survey pilot tests were conducted one on one with nurses using a cognitive interviewing technique in a quiet room located on the unit (Groves et al., 2009; Knafl et al., 2007). Nurses were asked to complete the proposed survey while talking out loud about any questions or difficulties that they encountered while answering survey questions. Upon pilot test completion, participants were provided with a $20 gift card as a token of appreciation for participating.

During cognitive interviewing, participant interpretation of questions and other feedback was noted and later entered into an Access database (Knafl et al., 2009). Upon completion of the pilot tests, results were reviewed to identify questions that needed to be amended and/or reworded. Pilot test results are included in Chapter 4. Feedback and suggestions received from pilot test participants were used to amend the survey prior to University of Toronto Research Ethics review and commencement of data collection. There were no pilot test participants included in the College of Nurses of Ontario (CNO) database list used to mail the nurse survey.

Data collection. Data were collected from nurses identified in the CNO random sample using pencil and paper surveys mailed to participants’ homes. ED nurses sampled from the CNO database were surveyed using a modified version of Dillman’s Tailored Design Method (Dillman et al., 2009). Dillman’s Tailored Design Method is designed to reduce error related to coverage, sampling, non-response, and measurement (Dillman et al., 2009). The modified version of this approach consisted of four mailings: a complete survey package, a reminder card, a complete survey package for non-responders, followed by a reminder card for non-responders (Dillman et al., 2009). Complete survey packages included an information letter (See Appendix E), a survey (See Appendix F), and a postage paid return envelope. The information letter explained study purposes, time required for completion, return procedures, information related to anonymity and confidentiality, and information about implied consent. Researcher contact information was provided with survey packages in case participants had questions about the study or eligibility.
Surveys were marked with a survey number to facilitate the delivery of reminders (See Appendix G) to those that did not respond. The use of study numbers was explained in the information letter.

Based on Dillman’s Tailored Design method (Dillman et al., 2009), the timeline for survey mailing was as follows:

- Week 1: Survey package mail out
- Week 2: Reminder card mail out
- Week 4: Survey package mail out
- Week 8: Reminder card mail out

According to Dillman et al. (2009), including incentives with mailed surveys increases response rates. Direct compensation for participation was not provided because of limited researcher resources. However, as a token of appreciation for considering participation, a $2 donation was made to one of three charities on behalf of participants (to a maximum of $500.00). Participants were given a choice of three charities at the end of the survey (United Way, Ronald McDonald House and the Heart and Stroke Foundation). Those who did not wish to participate were also able to select a charity. Upon completion of data collection, $242.50 was donated to Ronald McDonald House®, $214.60 was donated to the Heart and Stroke Foundation® and $42.90 was donated to the United Way®.

A total of 650 surveys were mailed to ED nurses’ homes using a modified version of Dillman’s Tailored Design (Dillman et al., 2009). The first mailing consisted of an information letter, a survey and a postage paid return envelope that were mailed during week one (January 2nd, 2014). One week later a reminder/thank you card was sent to all participants. Three weeks following the first survey package mailing, a second survey package was sent to all non-responders. Seven weeks after the first mailing a reminder/thank you card was mailed to all non-responders.

Data management and analysis. Data were coded and entered into SPSS 22.0. All entered data were double-checked prior to analysis. Missing data were assessed by examining the frequencies of missing codes. If less than 5% (Kline, 2011; Tabachnick & Fidell, 2013) of data were missing, data were imputed using mean substitution. According to Tabachnick and Fidell (2013), when there is less than 5% of data missing, most strategies for dealing with missing data yield the same results.
Descriptive statistics including frequencies, maximums, and minimums were used to assess the presence of outliers, as well as the overall sample distribution. Descriptive statistics including means, standard deviations, and proportions were calculated for study variables such as age, education, years of employment, and organization type to describe sample characteristics. Psychometric properties of instruments included in the survey were assessed using confirmatory factor analysis (Streiner & Norman, 2008). Confirmatory factor analysis is an appropriate approach when the researcher has knowledge about the “underlying structure of the construct under investigation” (Pett, Lackey & Sullivan, 2003, p.4). Using item reduction in SPSS, items from each scale were loaded onto a single factor. When factor loadings were greater than 0.30, items were retained (Pett et al., 2003). In situations where factor loadings were less than 0.30, items were not retained for analysis. Additionally, Cronbach’s alpha was calculated for all scales as a measure of reliability [internal consistency] (Streiner & Norman, 2008). Cronbach’s alpha greater than 0.70 indicates an adequate level of similarity among items (Nunnally & Bernstein, 1996).

The hypothesized conceptual model was analyzed using multiple linear regression. Multiple linear regression is a multivariable technique that is used to examine relationships among variables where independent variables are measured at nominal, interval, or ratio levels (Tabachnick & Fidell, 2013). As this was one of few studies that quantitatively tested the effects of multiple independent variables on the outcome of quality handover, an exploratory approach such as multiple regression was suitable for analysis (Gefen et al., 2000).

Prior to multiple regression analysis, there were several assumptions that had to be met. The first was the assumption of multivariate normality (Munro, 2001; Tabachnick & Fidell, 2013). Multivariate normality is the assumption that all independent and dependent variables are normally distributed. Normality was assessed using frequency distributions, residual plots and normal p-plots (Tabachnick & Fidell, 2013). Linearity assumes that the relationships between the independent and dependent variables are linear, as indicated by scatterplots and residual plots (Munro, 2001; Tabachnick & Fidell, 2013). Homoscedasticity is the assumption that variability in scores for one variable is similar in other variables, assessed through residual plots and scatterplots (Munro, 2001; Tabachnick & Fidell, 2013). Scatterplots were also used to evaluate the presence of outliers (Heeringa et al., 2010; Polit, 2010). Multicollinearity may exist where independent variables are too highly correlated (Tabachnick & Fidell, 2013). Presence of this
problem was assessed through bivariate correlations. Where two variables had a correlation greater than 0.90, only one variable was used in the multiple regression equation (Tabachnick & Fidell, 2013).

To begin regression analysis, all independent variables and interactions were entered into a model simultaneously, as all independent variables were hypothesized to impact the dependent variable of handover quality equally (Tabachnick & Fidell, 2013). The regression equation and total variance explained (adjusted $R^2$) derived from simultaneous regression were assessed.

There were four steps involved in multiple linear regression, specification, estimation of model parameters, model evaluation, and inferences (Heeringa et al., 2010). Model specification involved the development of a hypothesized model based on findings from the literature and other “subject matter knowledge” (Heeringa et al., 2010, p.186). This step was carried out in Chapter 2 and is illustrated in Figure 16. Estimation of model parameters involved using SPSS to calculate estimates of regression parameters (Heeringa et al., 2010). This included calculation of the F-test which identified whether or not any regression coefficients were statistically significant and not equal to zero (Tabachnick & Fidell, 2013). When the F statistic was larger than the critical value (Polit, 2010), it was accepted that at least one coefficient among predictors was not equal to zero. To further evaluate which coefficients were different from zero, $t$ statistics were used (Polit, 2010). Significant $t$ values reflected those coefficients that were significantly different from zero (Polit, 2010).

To understand which predictors had the greatest impact on handover quality and to identify a more parsimonious model, all hypothesized independent variables were entered into a backward deletion stepwise multiple regression model. Unlike sequential regression, stepwise regression methods use statistical criteria rather than theoretical underpinnings to measure relationships (Tabachnick & Fidell, 2013). Backward deletion stepwise regression began with all variables entered into the model. Variables were then removed individually according to statistical criteria until a suitable model was achieved (Streiner, 2013; Tabachnick & Fidell, 2013). This technique is best suited to this type of research that is exploratory in nature (Tabachnick & Fidell, 2013). Upon completion of backward deletion stepwise regression, the regression equations and total variance explained (adjusted $R^2$) by the simultaneous and stepwise models were compared. The most parsimonious model with the greatest amount of variance explained is reported in the following chapter.
Model evaluation uses measures to explore goodness-of-fit (Heeringa et al., 2010). A standard measure of fit is the $R^2$ statistic which indicates the proportion of variance in the dependent variable accounted for by the independent variables (Heeringa et al., 2010; Polit, 2010). For this study, the adjusted $R^2$ statistic was used as it accounts for sample size and number of independent variables, which if not considered, could falsely inflate $R^2$ estimates (Tabachnick & Fidell, 2013). The larger the value of $R^2$, the more variance is explained by the predictors. Inference, the final step, involved using “estimated parameters and their standard errors to characterize or infer about the conditional distribution of [the dependent variable] given the predictor variables” (Heeringa et al., 2010, p.199).

Moderators are independent variables that impact the relationship between another independent variable and the dependent variable (Baron & Kenny, 1986). Moderators specify when relationships hold true, unlike mediators that specify how and why relationships occur (Baron & Kenny, 1986). To test several hypothesized moderating relationships, interaction effects were included in each of the models. The first step in testing interaction effects began with multiplying scores between the two independent variables (Frazier, Barron & Tix, 2004; Heeringa et al., 2010). The product of these two variables was then entered into the regression equation and evaluated for significance using the steps described above (Heeringa et al., 2010). A significant regression coefficient for the interaction term indicates the presence of a moderating relationship between the independent variables (Polit, 2010). The following interactions were hypothesized in the proposed conceptual model:

1) Intrusions will moderate the relationship between time pressure and handover quality.  
2) Intrusions moderate the relationship between focus of attention and handover quality.  
3) Chronic fatigue will moderate the relationship between cognitive capacity and handover quality.  
4) Staffing levels will moderate the relationship between time pressure and handover quality. 

Assessing the presence of interaction effects required multiple occurrences of statistical testing, which increased the risk of a Type 1 error (Tabachnick & Fidell, 2013) where the null hypothesis is falsely accepted. To minimize this risk, a Bonferroni adjustment was applied to the study p-value. A Bonferroni adjustment was calculated by dividing the desired p-value by the number of
estimated predictors (Tabachnick & Fidell, 2013). For this study, to achieve statistical significance, the adjusted p-value had to be less than 0.0023.

**Ethical Considerations**

Hospital ethics approval was sought for the survey pilot-testing phase of this study. Pilot test participants were asked to complete a consent form indicating their consent to participate. A second copy of the consent form was provided to pilot study participants for their records.

Following pilot testing, once the survey had been finalized, ethics approval was sought from the University of Toronto Health Science Research Ethics Board. The information letter included with the survey package provided participants with information about consent to participate, confidentiality, and participation risks and benefits. Return of a completed survey implied a participant’s informed consent.

**Confidentiality.** Participant names were collected during the pilot test to ensure that pilot test participants were not included in the survey mail out. The list of pilot test participant names was maintained in locked cupboard in the Health Sciences Building at the University of Toronto. Once this list was cross checked with the CNO mailing list, the list containing pilot test participant names was shredded.

To maintain survey participant confidentiality, identifying information such as names and birthdates was not collected. Access to completed surveys was limited to members of the research team and PhD supervisory committee. Upon study completion, only group level data were reported. To facilitate mailing of surveys and reminder cards to non-responders, all participants were assigned a study number. The electronic list of participants and study numbers was password protected and maintained in a locked cupboard at the University of Toronto.

**Data storage.** Pilot test survey feedback and comments were stored on a password protected computer separate from the list of pilot test participants. Following amendment of the survey, the database of participant feedback was deleted.

Completed surveys were maintained in a locked cupboard at the University of Toronto. Surveys will be physically destroyed two years following data collection. Electronic files will also be deleted from computers and portable drives two years after study completion. All electronic files were maintained on a password-protected computer. When files needed to be moved to a portable drive such as a USB key, they were encrypted.
Risks and benefits. There were minimal risks associated with participation in this study. Risks included stress or emotional discomfort for participants elicited by survey questions. Participants were free to omit answers or stop survey completion at any time, with no repercussions. There were no direct benefits associated with participation in this study. However, nurses may have benefited from increased awareness of shift handover communication practices.
Chapter 4: Results

Study findings are presented in this chapter. These include a description of survey pilot test results, descriptive statistics, multiple regression analyses and results related to model and hypothesis testing.

Survey Pilot Test

The ED nurse survey (See Appendix F) was pilot tested with a group of six RNs from an urban teaching hospital. As a result of feedback received from participants, a number of survey amendments were made to increase ease of completion and survey clarity for phase two of the study. The amendments included: 1) addition of criteria to exclude participants working in the roles of float nurse as well as triage, as they generally do not receive full shift handover; 2) additional information was added to seven questions to improve clarity (See Table 1); 3) extraneous information was also removed from one question to improve clarity; 4) response option changes were made to two questions to improve participants’ ability to provide accurate responses; 5) Likert-type scales were changed to include seven response choice options as opposed to a mix of five and seven response choices, this improved overall consistency and facilitated analysis.

Table 1. Pilot Test Survey Amendments

<table>
<thead>
<tr>
<th>Item</th>
<th>Original Question/Statement</th>
<th>Revised Question/Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3</td>
<td>How long has it been since you last received shift handover? (Please indicate the number of days)</td>
<td>How long has it been since you last received shift handover? (Please indicate the number of days, today would be 0)</td>
</tr>
<tr>
<td>B3</td>
<td>Handover followed a logical structure.</td>
<td>Handover followed a logical / sensible structure.</td>
</tr>
<tr>
<td>B8</td>
<td>The person handing off the patient clearly communicated her / his assessment of the patient.</td>
<td>The person handing off the patient clearly communicated her / his assessment of the patient at shift handover.</td>
</tr>
<tr>
<td>B21</td>
<td>Was the last shift handover that you received guided by a handover tool?</td>
<td>Was the last shift handover that you received guided by a structured handover tool?</td>
</tr>
<tr>
<td>C2</td>
<td>If intrusions were experienced, please identify the source(s).</td>
<td>If intrusions were experienced during the last handover that you received, please identify the source(s).</td>
</tr>
<tr>
<td>C4</td>
<td>If distractions were experienced, please identify the source(s).</td>
<td>If distractions were experienced during the last handover that you received, please identify the source(s).</td>
</tr>
<tr>
<td>H4</td>
<td>Personnel frequently disregard rules or</td>
<td>Health team members frequently</td>
</tr>
<tr>
<td>Item</td>
<td>Original Question/Statement</td>
<td>Revised Question/Statement</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td>guidelines (e.g., hand-washing, sterile field etc.) that are established for this clinical area.</td>
<td>disregard rules or guidelines (e.g., hand-washing, sterile field etc.) that are established for this ED.</td>
</tr>
<tr>
<td>B12</td>
<td>Questions and ambiguities were resolved (active enquiry by the person taking on responsibility for the patient).</td>
<td>Questions and ambiguities were resolved about patients during shift handover.</td>
</tr>
<tr>
<td>B20</td>
<td>During the last shift handover that you received, was the patient and / or family included in a face-to-face discussion? Yes or no</td>
<td>During the last shift handover that you received, was the patient and / or family included in a face-to-face discussion? Yes or no/not applicable</td>
</tr>
<tr>
<td>I5</td>
<td>Do you hold an Emergency Nursing specialty certificate? Yes or No</td>
<td>Do you hold any of the following Emergency Nursing specialty certificates? Trauma Nursing Care Course (TNCC), Emergency Nursing Pediatric Certification Course (ENPC), CNA Emergency Certification, Other / please specify.</td>
</tr>
</tbody>
</table>

Survey Response Rate

Out of 650 surveys originally mailed out, a total of 316 surveys were returned (See Table 2). Seventy-four reported that they did not meet study inclusion criteria, including 26 who did not work in an ED in Ontario and 48 who had not received handover in the last ten days. Eleven surveys were either blank or indicated that they did not wish to participate in the study. The final eligible sample was 231 out of 576 for an overall response rate of 40.1%.

Table 2. Summary of Surveys Returned

<table>
<thead>
<tr>
<th>Mailing</th>
<th>Eligible</th>
<th>Ineligible</th>
<th>Does Not Wish To Participate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey mail out 1</td>
<td>182</td>
<td>61</td>
<td>10</td>
<td>253</td>
</tr>
<tr>
<td>Survey mail out 2</td>
<td>49</td>
<td>13</td>
<td>1</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>231</td>
<td>74</td>
<td>11</td>
<td>316</td>
</tr>
</tbody>
</table>

Data Preparation and Screening

Data were entered into SPSS 22.0. To ensure data accuracy, data were double entered and then the two data sets were compared. After correcting data entry discrepancies, missing data patterns were inspected.
Missing data for each variable ranged from 0 to 3.5%. The item with the largest number of missing values was the number of days since last handover, this variable was missing for eight (3.5%) participants. This variable is not a hypothesized predictor of handover quality, rather, it was intended to determine eligibility. Therefore, missing data for this variable were not imputed.

There were 27 cases missing at least one value. The amount of data missing from each case ranged from 0% to 20.4%. Of those 27 cases containing missing data, all had less than 2.7% with the exception of two cases missing 12.4% of data and two cases missing 20.4% of data. Upon inspection of these four surveys, it was noted that entire pages were skipped, suggesting that they may have been stuck together. As such, these four cases were removed from the data set for analysis.

The patterns of data missingness were examined, as these are more important than the amount of missing data itself (Tabachnick & Fidell, 2013). The pattern of missingness in this sample was assessed using Little’s Missing Completely at Random (MCAR) test (Little, 1988). Little’s MCAR test is a chi-square test that if significant indicates that data are not MCAR. MCAR results for this sample were $\chi^2 = 744.31$, df = 2145, $p = 1.00$. These results indicate that there is no pattern of missingness and suggest that data are missing at random.

Data were missing for the following concepts: handover quality (scale), positive relationships (scale), anxiety subscale of the Job Stress Scale (scale), OFER acute (scale), SAQ (scale), triage flow (single item) and experience (single item). Two participants with missing responses for the positive relationships scale and triage flow provided relevant survey comments. These comments were used to impute missing data, as they pertained directly to the concepts being measured. Where participants responded to at least one item in a scale, a scale score was imputed by adding items with responses and dividing by the total number of items with responses ($n = 7$). For single items, as well as scales missing all answers, data were imputed using the sample mean substitution ($n = 3$). One participant was missing a response for the experience item. To ensure accurate imputation, three cases with similar years of experience and age were identified. All three cases provided the same response, therefore, this response was used to replace the missing experience value.

Pre and post imputation scale means were calculated and compared using t-tests. All t-test values were non-significant ($p > 0.05$), indicating that missing data imputation did not significantly alter the aggregated data.
Analysis Assumptions

Normality & Linearity. Variables were assessed for normality through the examination of frequency distributions, residual plots and normal p-plots, as well as skewness and kurtosis values (Tabachnick & Fidell, 2013). All variables with the exception of the dependent variable, handover quality, were not normally distributed. Scatterplots and residuals displaying the relationship between the dependent variable and independent variables were assessed for linearity. The Positive Relationships Scale was the only variable that had a somewhat linear relationship with handover quality (dependent variable). None of the remaining variables had a linear relationship with the dependent variable. As a result of the non-normal and non-linear nature of the independent variables, a decision was made to recode all independent variables into dichotomous categories. This decision was made after unsuccessfully attempting data transformations, as well as to increase the ease of interpretation of results. A summary of variable recoding is presented in Table 3 below. In the following study variables section, where applicable, both continuous and categorical results are presented.

Table 3. Variable Recoding

<table>
<thead>
<tr>
<th>Variables (number of items)</th>
<th>Original Response Options and Values</th>
<th>New Values (original values or scale scores)</th>
</tr>
</thead>
</table>
| Access to Technology (1 item) | 1 = strongly disagree  
2 = disagree  
3 = somewhat disagree  
4 = neutral  
5 = somewhat agree  
6 = agree  
7 = strongly agree | 0 (1-5) = no access to technology  
1 (6-7) = access to technology |
| Intrusions (1 item) | 1 = very negative impact  
2 = negative impact  
3 = neutral / no impact  
4 = positive impact  
5 = very positive impact | 0 (1-3) = intrusions with negative impact  
1 (4-5) = intrusions with positive impact |
| Distractions (1 item) | 1 = very negative impact  
2 = negative impact  
3 = neutral / no impact  
4 = positive impact  
5 = very positive impact | 0 (1-3) = distractions with negative impact  
1 (4-5) = distractions with positive impact |
| Triage Flow (1 item) | 1 = poor, there are frequent patient backlogs  
2 = occasional patient backlogs  
3 = good, patients flowed | 0 (1-2) = frequent or occasional triage backlogs  
1 (3) = smooth triage flow |
<table>
<thead>
<tr>
<th>Variables</th>
<th>Original Response Options and Values</th>
<th>New Values (original values or scale scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse Staffing</td>
<td>Smoothly into the department 1 = inadequate and unable to manage workload 2 = marginal, able to manage workload 3 = adequate, able to fulfill workload</td>
<td>0 (1-2) = inadequate staffing 1 (3) = adequate staffing</td>
</tr>
<tr>
<td>Cognitive Capacity</td>
<td>1 = strongly disagree 2 = disagree 3 = somewhat disagree 4 = neutral 5 = somewhat agree 6 = agree 7 = strongly agree</td>
<td>0 (1-5) = decreased cognitive capacity 1 (6-7) = sufficient cognitive capacity</td>
</tr>
<tr>
<td>Focus of Attention</td>
<td>1 = strongly disagree 2 = disagree 3 = somewhat disagree 4 = neutral 5 = somewhat agree 6 = agree 7 = strongly agree</td>
<td>0 (1-5) = decreased focus of attention 1 (6-7) = sufficient focus of attention</td>
</tr>
<tr>
<td>Positive Relationships</td>
<td>1 = strongly disagree 2 = disagree 3 = somewhat disagree 4 = neutral 5 = somewhat agree 6 = agree 7 = strongly agree</td>
<td>0 (2-11) = negative relationship 1 (12-14) = positive relationship</td>
</tr>
<tr>
<td>Time Pressure</td>
<td>1 = strongly disagree 2 = disagree 3 = somewhat disagree 4 = neutral 5 = somewhat agree 6 = agree 7 = strongly agree</td>
<td>0 (5-29) = low time pressure 1 (30-35) = high time pressure</td>
</tr>
<tr>
<td>Anxiety</td>
<td>1 = strongly disagree 2 = disagree 3 = somewhat disagree 4 = neutral</td>
<td>0 (5-24) = low anxiety 1 (25-35) = high anxiety</td>
</tr>
<tr>
<td>Variables</td>
<td>Original Response Options and Values</td>
<td>New Values (original values or scale scores)</td>
</tr>
<tr>
<td>----------------------</td>
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<td>---------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>5 = somewhat agree 6 = agree 7 = strongly agree</td>
<td>0 (8-39) = low time stress 1 (40-56) = high time stress</td>
</tr>
<tr>
<td></td>
<td>Scale score is calculated out of 35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 = strongly disagree 2 = disagree 3 = somewhat disagree 4 = neutral 5 = somewhat agree 6 = agree 7 = strongly agree</td>
<td>0 (0-50) = low / moderate acute fatigue 1 (51-100) = moderate/high acute fatigue</td>
</tr>
<tr>
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<td>Scale score is calculated out of 100</td>
<td></td>
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<tr>
<td></td>
<td>0 = strongly disagree 1 = disagree 2 = somewhat disagree 3 = neutral 4 = somewhat agree 5 = agree 6 = strongly agree</td>
<td>0 (0-50) = low / moderate chronic fatigue 1 (51-100) = moderate / high chronic fatigue</td>
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<tr>
<td></td>
<td>Scale score is calculated out of 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 = strongly disagree 2 = disagree 3 = somewhat disagree 4 = neutral 5 = somewhat agree 6 = agree 7 = strongly agree</td>
<td>0 (0-74) = negative safety climate 1 (75-100) = positive safety climate</td>
</tr>
<tr>
<td></td>
<td>Scale score is calculated out of 100</td>
<td></td>
</tr>
</tbody>
</table>
**Multicollinearity.** Bivariate correlations of dichotomous variables were computed using Pearson’s $r$ correlation coefficients. These were examined to ensure that there were no correlations greater than 0.90, as correlations greater than 0.90 indicate multicollinearity (Tabachnick & Fidell, 2013). Bivariate correlations are displayed below in Table 4. The highest bivariate correlation was 0.65 between cognitive capacity and focus of attention. As all correlations were less than 0.90, all variables were retained for subsequent analysis.

Multicollinearity was further assessed during the regression analysis using tolerance tests. Tolerance values close to zero indicate multicollinearity, as one minus the proportion of shared variance with other independent variables is equal to the tolerance value (Munro, 2001; O’Brien, 2007). Therefore, if variables were perfectly correlated (1-1), tolerance values would be equal to zero (Munro, 2001; Tabachnick & Fidell, 2013). When all hypothesized predictor variables were entered into the regression model, they produced tolerance values greater than 0.20 indicating that multicollinearity was not a significant problem (O’Brien, 2007; Tabachnick & Fidell, 2013). Further, in the final stepwise regression model, all tolerance values were greater than 0.94, indicating that multicollinearity was not present and likely did not impact the interpretation of the regression model.
Table 1. Bivariate correlations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Handover Quality</th>
<th>Technology</th>
<th>Patient and/or Family Participation</th>
<th>Use of Structured Handover Tool</th>
<th>Intrusions</th>
<th>Distractions</th>
<th>Triage Flow</th>
<th>Nurse Staffing</th>
<th>Cognitive Capacity</th>
<th>Focus of Attention</th>
<th>Relationships</th>
<th>Time Pressure</th>
<th>Anxiety</th>
<th>Time Stress</th>
<th>Acute Fatigue</th>
<th>Chronic Fatigue</th>
<th>Safety Climate</th>
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<td>Use of Structured Handover Tool</td>
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<td>Variables</td>
<td>Handover Quality</td>
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<td>Use of Structured Handover Tool</td>
<td>Distractions</td>
<td>Triage flow</td>
<td>Nurse Staffing</td>
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<td>Focus of Attention</td>
<td>Relationships</td>
<td>Time Pressure</td>
<td>Anxiety</td>
<td>Time Stress</td>
<td>Acute Fatigue</td>
<td>Chronic Fatigue</td>
<td>Safety Climate</td>
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<td>Age</td>
<td>Sex</td>
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<tr>
<td>Variables</td>
<td>Handover Quality</td>
<td>Technology</td>
<td>Patient and/or Family Participation</td>
<td>Use of Structured Handover Tool</td>
<td>Intrusions</td>
<td>Distractions</td>
<td>Triage Flow</td>
<td>Nurse Staffing</td>
<td>Cognitive Capacity</td>
<td>Focus of Attention</td>
<td>Relationships</td>
<td>Time Pressure</td>
<td>Anxiety</td>
<td>Time Stress</td>
<td>Acute Fatigue</td>
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<td>Safety Climate</td>
<td>Years of Experience</td>
<td>Age</td>
<td>Sex</td>
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<td>.187**</td>
<td>.082</td>
<td>.085</td>
<td>-.076</td>
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</tbody>
</table>

*Correlation is significant at the 0.05 level

**Correlation is significant at the 0.01 level
**Homoscedasticity.** Homoscedasticity is the assumption that variability in the dependent variable is approximately the same as variability in the independent variables (Munro, 2001; Tabachnick & Fidell, 2013). As dichotomous variables were used, homoscedasticity was not assessed as there would only be two points on the scatter plot.

**Outliers.** Box plots and interquartile ranges were assessed to detect univariate outliers. There were a number of cases with extreme outlier values. Extreme outlier values are cases three interquartile ranges above the first quartile or below the third quartile (Munro, 2001). To ensure that these cases were not skewing the outcome, the regression model was run both with and without outliers. The final model resulted in the same outcome both with and without outliers, therefore it is appropriate to ignore these cases (Munro, 2001). Rumel (1970), as cited in Tabachnick and Fidell (2013) suggests that variables containing splits of 90-10 or greater should also be deleted. Patient / family participation and distractions were the only two variables that met this criteria. To ensure that these variables were not skewing the outcome, the regression model was run both with and without these two variables. The final model resulted in the same outcome both with and without outlying variables, therefore, these were retained. SPSS casewise diagnostics were used to assess for the presence of multivariable outliers. No multivariable outliers were detected.

**Sample Demographics**

Demographic data included age, sex, years of experience as an ED nurse and highest level of education. Other information related to hospital type and patient assignment was also collected to further describe the study sample. Demographic variables are presented in Table 5 below.
Table 1. Summary of descriptive statistics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean (SD) or Sample Frequency</th>
<th>Range or Sample Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>51.4 (7.4)</td>
<td>34-76 years</td>
</tr>
<tr>
<td>ED Experience</td>
<td>17.1 (8.4)</td>
<td>1- 47 years</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex - female</td>
<td>219</td>
<td>96.5%</td>
</tr>
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<td>Sex – male</td>
<td>8</td>
<td>3.5%</td>
</tr>
<tr>
<td>Education</td>
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</tr>
<tr>
<td>Nursing diploma as highest level of education</td>
<td>184</td>
<td>81.1%</td>
</tr>
<tr>
<td>Baccalaureate in nursing as highest level of education</td>
<td>39</td>
<td>17.2%</td>
</tr>
<tr>
<td>Masters in nursing as highest level of education</td>
<td>4</td>
<td>1.8%</td>
</tr>
<tr>
<td>Non-nursing diploma</td>
<td>17</td>
<td>7.5%</td>
</tr>
<tr>
<td>Non-nursing Baccalaureate</td>
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<td>7.0%</td>
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<tr>
<td>Trauma Nursing Care Course (TNCC)</td>
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<td>Emergency Nursing Pediatric Certification Course (ENPC)</td>
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<tr>
<td>CNA Emergency Certification</td>
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<td>17.6%</td>
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<td>Advanced Trauma</td>
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<td>3.5%</td>
</tr>
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<td>Critical Care Certificate</td>
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</tr>
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<td>Triage Course/Certification</td>
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<td>2.6%</td>
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<td>Emergency Certificate</td>
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</tr>
<tr>
<td>Other (e.g., violence prevention, perinatal, geriatric emergency management, forensics etc.)</td>
<td>11</td>
<td>4.8%</td>
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<tr>
<td>Hospital Type</td>
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<tr>
<td>Urban teaching hospital</td>
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</tr>
<tr>
<td>Community hospital (more than 100 beds)</td>
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<td>43.6%</td>
</tr>
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<td>Small hospital (less than 100 beds)</td>
<td>75</td>
<td>33.0%</td>
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<td>Patient Assignment</td>
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<tr>
<td>Patients on stretchers</td>
<td>177</td>
<td>78.0%</td>
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<tr>
<td>Patients on stretchers in an ambulatory area</td>
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<td>7.5%</td>
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<tr>
<td>Patients in a fast track, rapid assessment or ambulatory area</td>
<td>32</td>
<td>14.1%</td>
</tr>
</tbody>
</table>

Note. Sample percent does not always add up to 100% as a result of missing data. Missing data that were not part of the conceptual model were not imputed. Sample percent also does not add up to 100% for education outside of nursing and specialty certificates, as nurses were asked to select all that apply and some selected more than one, while others selected none.

Study Variables

This section provides descriptive univariate information about variables hypothesized in the conceptual model explaining factors that influence handover quality of ED nurse shift handover. Table 6 displays the amount of missing data for each variable, theoretical ranges of
scores, sample means pre and post imputation, dichotomous coding values and sample modes. Where scales were used, coefficient alpha values are presented as a measure of reliability. All reliability values were greater than 0.70, indicating adequate internal consistency (Nunnally & Bernstein, 1996). Confirmatory factor analysis was carried out on all scales. All scales resulted in single factor solutions with factor loadings greater than 0.30 (Pett et al., 2003).
<table>
<thead>
<tr>
<th>Variables (Survey item)</th>
<th>Number of Missing Data Points</th>
<th>Theoretical Range of Scores</th>
<th>Pre-imputation Mean (SD)</th>
<th>Post Imputation Mean (SD)</th>
<th>Dichotomous Coding</th>
<th>Proportion</th>
<th>Cronbach’s Alpha</th>
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<td>3.42 (0.92)</td>
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<td>N/A</td>
<td>N/A</td>
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<td>Technology (B16)</td>
<td>0</td>
<td>1 - 7</td>
<td>3.62 (2.14)</td>
<td>3.62 (2.14)</td>
<td>0 = no access to technology 1 = access to technology</td>
<td>72.7%</td>
<td>N/A</td>
</tr>
<tr>
<td>Patient and / or Family Participation (B20)</td>
<td>0</td>
<td>0 - 1</td>
<td>N/A</td>
<td>N/A</td>
<td>0 = did not include patient or family in handover 1 = included patient or family in handover</td>
<td>91.6%</td>
<td>N/A</td>
</tr>
<tr>
<td>Use of Structured Handover Tool (B21)</td>
<td>0</td>
<td>0 - 1</td>
<td>N/A</td>
<td>N/A</td>
<td>0 = did not use structured handover tool 1 = used structured handover tool</td>
<td>89.0%</td>
<td>N/A</td>
</tr>
<tr>
<td>Intrusions (C1)</td>
<td>0</td>
<td>1-5</td>
<td>2.50 (0.85)</td>
<td>2.50 (0.85)</td>
<td>0 = intrusions with negative impact 1 = intrusions with positive impact</td>
<td>89.4%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Distractions (C3)</td>
<td>0</td>
<td>1-5</td>
<td>2.37 (0.70)</td>
<td>2.37 (0.70)</td>
<td>0 = distractions with negative impact 1 = distractions with positive impact</td>
<td>96.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Triage Flow (C5)</td>
<td>2</td>
<td>1-3</td>
<td>1.90 (0.79)</td>
<td>1.89 (0.79)</td>
<td>0 = frequent or occasional triage backlogs 1 = smooth triage flow</td>
<td>74.0%</td>
<td>N/A</td>
</tr>
<tr>
<td>Variables (Survey item)</td>
<td>Number of Missing Data Points</td>
<td>Theoretical Range of Scores</td>
<td>Pre-imputation Mean (SD)</td>
<td>Post Imputation Mean (SD)</td>
<td>Dichotomous Coding</td>
<td>Proportion</td>
<td>Cronbach’s Alpha</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
<td>---------------------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Nurse Staffing (C6)</td>
<td>0</td>
<td>1-3</td>
<td>2.10 (0.80)</td>
<td>2.10 (0.80)</td>
<td>0 = inadequate staffing 1 = adequate staffing</td>
<td>63.0%</td>
<td>N/A</td>
</tr>
<tr>
<td>Cognitive Capacity (D1)</td>
<td>0</td>
<td>1-7</td>
<td>5.71 (1.18)</td>
<td>5.71 (1.18)</td>
<td>0 = decreased cognitive capacity 1 = sufficient cognitive capacity</td>
<td>28.2%</td>
<td>N/A</td>
</tr>
<tr>
<td>Focus of Attention (D2)</td>
<td>0</td>
<td>1-7</td>
<td>5.59 (1.16)</td>
<td>5.59 (1.16)</td>
<td>0 = decreased focus of attention 1 = sufficient focus of attention</td>
<td>36.1%</td>
<td>N/A</td>
</tr>
<tr>
<td>Relationships (E2-3)</td>
<td>3</td>
<td>1-7</td>
<td>5.82 (1.00)</td>
<td>5.83 (1.00)</td>
<td>0 = negative relationship 1 = positive relationship</td>
<td>23.3%</td>
<td>0.84</td>
</tr>
<tr>
<td>Time Pressure (F1-5)</td>
<td>0</td>
<td>1-7</td>
<td>4.29 (1.65)</td>
<td>4.29 (1.65)</td>
<td>0 = low time pressure 1 = high time pressure</td>
<td>79.7%</td>
<td>0.93</td>
</tr>
<tr>
<td>Anxiety (G1-5)</td>
<td>3</td>
<td>1-7</td>
<td>3.58 (1.50)</td>
<td>3.58 (1.49)</td>
<td>0 = low anxiety 1 = high anxiety</td>
<td>76.2%</td>
<td>0.83</td>
</tr>
<tr>
<td>Time Stress (G6-13)</td>
<td>0</td>
<td>1-7</td>
<td>3.81 (1.42)</td>
<td>3.81 (1.42)</td>
<td>0 = low time stress 1 = high time stress</td>
<td>75.8%</td>
<td>0.91</td>
</tr>
<tr>
<td>Acute Fatigue (G14-18)</td>
<td>1</td>
<td>0 - 100</td>
<td>68.81 (21.28)</td>
<td>68.69 (21.30)</td>
<td>0 = low/ moderate acute fatigue 1 = moderate/ high acute fatigue</td>
<td>17.2%</td>
<td>0.90</td>
</tr>
<tr>
<td>Chronic Fatigue</td>
<td>0</td>
<td>0 - 100</td>
<td>49.79 (26.63)</td>
<td>49.79 (26.63)</td>
<td>0 = low/ moderate chronic fatigue</td>
<td>51.1%</td>
<td>0.91</td>
</tr>
<tr>
<td>Variables (Survey item)</td>
<td>Number of Missing Data Points</td>
<td>Theoretical Range of Scores</td>
<td>Pre-imputation Mean (SD)</td>
<td>Post Imputation Mean (SD)</td>
<td>Dichotomous Coding</td>
<td>Proportion</td>
<td>Cronbach’s Alpha</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>--------------------------</td>
<td>---------------------</td>
<td>------------</td>
<td>------------------</td>
</tr>
<tr>
<td>(G19-23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = moderate/ high chronic fatigue</td>
<td>48.9%</td>
<td></td>
</tr>
<tr>
<td>Safety Climate (H2, 3, H5-9)</td>
<td>2</td>
<td>0 - 100</td>
<td>59.21 (16.19)</td>
<td>59.21 (16.12)</td>
<td>0 = negative safety climate 1 = positive safety climate</td>
<td>73.6% 26.4%</td>
<td>0.75</td>
</tr>
<tr>
<td>Years of Experience (I6)</td>
<td>4</td>
<td>1 - 47</td>
<td>17.09 (8.35)</td>
<td>17.18 (8.34)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Age (I2)</td>
<td>1</td>
<td>20 - 80</td>
<td>51.42 (7.40)</td>
<td>51.42 (7.40)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Sex (I1)</td>
<td>3</td>
<td>0 - 1</td>
<td>N/A</td>
<td>N/A</td>
<td>0 = Male 1 = Female</td>
<td>3.5% 96.5%</td>
<td>N/A</td>
</tr>
</tbody>
</table>
**Other Descriptive Variables.** In addition to variables included in the hypothesized conceptual model, detailed information pertaining to types of intrusions, distractions and technology use is presented in Table 7. This information was collected to enhance sample description.

Table 7. Other variables

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>Types of Intrusions</th>
<th>Number (Percentage of respondents who selected item)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Patients</td>
<td>96 (42.3%)</td>
</tr>
<tr>
<td></td>
<td>Families</td>
<td>121 (53.3%)</td>
</tr>
<tr>
<td></td>
<td>Colleagues</td>
<td>140 (61.7%)</td>
</tr>
<tr>
<td></td>
<td>Other - telephone calls</td>
<td>24 (10.6%)</td>
</tr>
<tr>
<td></td>
<td>Other - lab</td>
<td>5 (2.2%)</td>
</tr>
<tr>
<td></td>
<td>Other - requests for information</td>
<td>4 (1.8%)</td>
</tr>
<tr>
<td></td>
<td>Other - EMS</td>
<td>3 (1.3%)</td>
</tr>
<tr>
<td></td>
<td>Other - visitors (not family)</td>
<td>3 (1.3%)</td>
</tr>
<tr>
<td></td>
<td>Other - diagnostic imaging</td>
<td>2 (0.9%)</td>
</tr>
<tr>
<td></td>
<td>Other - admission demands</td>
<td>1 (0.4%)</td>
</tr>
<tr>
<td></td>
<td>Other - code blue</td>
<td>1 (0.4%)</td>
</tr>
<tr>
<td>C4</td>
<td>Types of Distractions</td>
<td>Number (Proportion)</td>
</tr>
<tr>
<td></td>
<td>Call bells</td>
<td>89 (39.2%)</td>
</tr>
<tr>
<td></td>
<td>Alarms from IV pumps</td>
<td>97 (42.7%)</td>
</tr>
<tr>
<td></td>
<td>Alarms from monitors</td>
<td>123 (54.2%)</td>
</tr>
<tr>
<td></td>
<td>Background noise or chatter</td>
<td>150 (66.1%)</td>
</tr>
<tr>
<td></td>
<td>Other - telephone ringing</td>
<td>27 (11.9%)</td>
</tr>
<tr>
<td></td>
<td>Other - overhead paging</td>
<td>4 (1.8%)</td>
</tr>
<tr>
<td></td>
<td>Other - colleagues</td>
<td>3 (1.3%)</td>
</tr>
<tr>
<td></td>
<td>Other - EMS</td>
<td>3 (1.3%)</td>
</tr>
<tr>
<td></td>
<td>Other - triage bell</td>
<td>2 (0.9%)</td>
</tr>
<tr>
<td></td>
<td>Other - new orders</td>
<td>2 (0.9%)</td>
</tr>
<tr>
<td>B17</td>
<td>Types of Technology</td>
<td>Number (Proportion)</td>
</tr>
<tr>
<td></td>
<td>Electronic medical record</td>
<td>93 (41.0%)</td>
</tr>
<tr>
<td></td>
<td>Bedside documentation technology</td>
<td>30 (13.2%)</td>
</tr>
<tr>
<td></td>
<td>Handheld applications</td>
<td>9 (4.0%)</td>
</tr>
<tr>
<td></td>
<td>Other - electronic tracking system / e-whiteboard</td>
<td>14 (6.2%)</td>
</tr>
<tr>
<td></td>
<td>Other - electronic lab results</td>
<td>5 (2.2%)</td>
</tr>
<tr>
<td></td>
<td>Other - monitors</td>
<td>2 (0.9%)</td>
</tr>
</tbody>
</table>

Note. Sample percent does not add up to 100% for each variable, as nurses were asked to select all that apply and some selected more than one, while others selected none.

**Excluded Variables.** Although 18 variables were included in the hypothesized conceptual model of factors influencing handover quality, one variable, face-to-face
communication was subsequently excluded from model analysis. Out of 227 included cases, there were only two participants that indicated that they did not use face-to-face communication. As such, no effect would be detected, as there would be no variability in responses.

**Main Findings: Regression Analysis**

**Simultaneous Multiple Regression Analysis.** Using simultaneous multiple regression, all 17 hypothesized predictor variables and four interactions (intrusions and time pressure, intrusions and focus of attention, chronic fatigue and cognitive capacity, staffing and time pressure) were entered into a linear regression model. Simultaneous multiple regression resulted in a statistically significant regression model: adjusted $R^2 = 0.33$, $F (20, 206) = 6.50$, $p < .0001$. This indicates that when adjusted for the number of variables included, this model predicted 33% of variance in the dependent variable, handover quality. Model statistics are presented in Table 8. Using simultaneous multiple regression, there were three variables identified as significant predictors of handover quality at the $p \leq 0.05$ level, these included triage flow, safety climate and relationships.

**Table 8. Simultaneous multiple regression analysis**

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>$\beta$</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>-.058</td>
<td>.122</td>
<td>-.028</td>
<td>.636</td>
<td>(-.297, .182)</td>
</tr>
<tr>
<td>Patient/family participation</td>
<td>.253</td>
<td>.188</td>
<td>.076</td>
<td>.180</td>
<td>(-.118, .624)</td>
</tr>
<tr>
<td>Handover tools</td>
<td>-.015</td>
<td>.173</td>
<td>-.005</td>
<td>.932</td>
<td>(-.357, .327)</td>
</tr>
<tr>
<td>Intrusions</td>
<td>.109</td>
<td>.346</td>
<td>.037</td>
<td>.753</td>
<td>(-.573, .791)</td>
</tr>
<tr>
<td>Distractions</td>
<td>.040</td>
<td>.284</td>
<td>.009</td>
<td>.141</td>
<td>(-.520, .600)</td>
</tr>
<tr>
<td>Triage flow</td>
<td>.338</td>
<td>.126</td>
<td>.162</td>
<td><strong>.008</strong></td>
<td>(.090, .586)</td>
</tr>
<tr>
<td>Staffing</td>
<td>-.057</td>
<td>.128</td>
<td>-.030</td>
<td>.658</td>
<td>(-.310, .196)</td>
</tr>
<tr>
<td>Cognitive capacity</td>
<td>-.082</td>
<td>.220</td>
<td>-.040</td>
<td>.709</td>
<td>(-.517, .352)</td>
</tr>
<tr>
<td>Focus of attention</td>
<td>.157</td>
<td>.156</td>
<td>.082</td>
<td>.315</td>
<td>(-.150, .463)</td>
</tr>
<tr>
<td>Relationships</td>
<td>.981</td>
<td>.130</td>
<td>.453</td>
<td><strong>.000</strong></td>
<td>(.725, 1.238)</td>
</tr>
<tr>
<td>Time pressure</td>
<td>-.288</td>
<td>.154</td>
<td>-.126</td>
<td>.063</td>
<td>(-.592, .016)</td>
</tr>
<tr>
<td>Acute fatigue</td>
<td>.135</td>
<td>.160</td>
<td>.056</td>
<td>.397</td>
<td>(-.179, .450)</td>
</tr>
<tr>
<td>Chronic fatigue</td>
<td>-.062</td>
<td>.229</td>
<td>-.034</td>
<td>.786</td>
<td>(-.508, .385)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.047</td>
<td>.155</td>
<td>.022</td>
<td>.762</td>
<td>(-.259, .353)</td>
</tr>
<tr>
<td>Time stress</td>
<td>.125</td>
<td>.143</td>
<td>.059</td>
<td>.381</td>
<td>(-.156, .407)</td>
</tr>
<tr>
<td>Safety climate</td>
<td>.367</td>
<td>.128</td>
<td>.177</td>
<td><strong>.005</strong></td>
<td>(.115, .620)</td>
</tr>
<tr>
<td>Experience</td>
<td>-.003</td>
<td>.006</td>
<td>-.028</td>
<td>.623</td>
<td>(-.015, .009)</td>
</tr>
<tr>
<td>Intrusions * Time pressure</td>
<td>.247</td>
<td>.458</td>
<td>.035</td>
<td>.589</td>
<td>(-.655, .1150)</td>
</tr>
<tr>
<td>Intrusions * Focus of attention</td>
<td>.294</td>
<td>.376</td>
<td>.084</td>
<td>.435</td>
<td>(-.447, 1.036)</td>
</tr>
<tr>
<td>Chronic fatigue * Cognitive capacity</td>
<td>.132</td>
<td>.250</td>
<td>.065</td>
<td>.600</td>
<td>(-.362, .625)</td>
</tr>
<tr>
<td>Staffing * Time pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not included in model as the product is equal to zero</td>
</tr>
</tbody>
</table>
n = 227, B = unstandardized regression coefficient, SE = standard error, β = standardized regression coefficient, CI = confidence interval.

**Backward Deletion Stepwise Multiple Regression Analysis.** To achieve the most parsimonious model, all 17 hypothesized predictor variables and four interactions were entered into a regression model. Interactions were entered into the model by multiplying the two hypothesized variables and using the product as the predictor variable. Variables that were the least significant in the model were removed one by one according to the highest p-value (Streiner, 2013). Amounts of variance explained by each model were compared using the F change test. Variables were no longer removed from the model once the F change test was statistically significant (p = 0.023), indicating that the removal of the final variable would have produced a significantly different model that would have explained less variance. Interaction terms were removed beginning with staffing and time pressure, followed by chronic fatigue and cognitive capacity, intrusions and focus of attention and intrusions and time pressure. Interactions were removed first as, in addition to being non-significant, they use power and make it more difficult to create a parsimonious model. Remaining variables were removed in the following order: structured handover tools, cognitive capacity, experience, anxiety, distractions, technology, staffing, chronic fatigue, acute fatigue, focus of attention, patient / family participation, time stress and time pressure. The final statistically significant model was as follows: adjusted $R^2 = 0.34$, $F (4, 222) = 29.85$, $p < 0.0001$. Four of 17 predictors included in the hypothesized model explained 34% of variance in handover quality: triage flow, relationships, intrusions and safety climate. Table 9 displays model results.

**Table 9. Backward deletion stepwise multiple regression analysis**

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triage flow</td>
<td>.353</td>
<td>.115</td>
<td>.169</td>
<td>.002</td>
<td>(.126, .579)</td>
</tr>
<tr>
<td>Relationships</td>
<td>.995</td>
<td>.121</td>
<td>.459</td>
<td>.000</td>
<td>(.757, 1.232)</td>
</tr>
<tr>
<td>Intrusions</td>
<td>.374</td>
<td>.164</td>
<td>.125</td>
<td>.023</td>
<td>(.051, .698)</td>
</tr>
<tr>
<td>Safety climate</td>
<td>.315</td>
<td>.116</td>
<td>.151</td>
<td>.007</td>
<td>(.086, .543)</td>
</tr>
</tbody>
</table>

The regression equation for the hypothesized conceptual model is handover quality = .169(triage flow) + .459(relationships) + .125(intrusions) + .151(safety climate). Handover quality is increased when triage flow is smooth, the relationship between the incoming and
outgoing nurse is positive, when intrusions are perceived as positive and in the presence of a positive safety climate.

**Confounding Variables.** The hypothesized conceptual model was further tested using age and sex as potential confounders. Backwards stepwise regression described above was carried out, including age and sex as additional variables. This method did not result in changes to regression coefficients, suggesting that participant age and sex did not have an impact in the model and are not associated with handover quality. To ensure the most parsimonious model, these variables were excluded as they did not enhance model prediction.

**Summary**

In this chapter, results from the ED nurse handover study are presented. Prior to full survey implementation, the survey was pilot tested with six ED nurses from a local urban teaching hospital. After mailing surveys to 650 randomly selected registered nurses working in Ontario Emergency Departments, 231 eligible surveys were returned for a total response rate of 40.1%. The majority of study participants were female (96.0%), with a mean age of 51.4 years (SD 7.4). Participants had an average of 17.1 years (SD 8.4) of ED experience, with the majority working in community hospitals (43.6%), caring for stretcher patients (78.0%). The majority of nurses included in the sample held RN diplomas as their highest level of education (81.0%).

Two hundred and twenty seven cases were included in the final analyses. The backwards stepwise multiple regression analysis tested the direct impact of 17 independent variables on the dependent variable, handover quality, in addition to four hypothesized interactions (See Table 9). The final statistically significant stepwise regression model included four predictors (triage flow, relationships, intrusions and safety climate) that explain 34% of the variance in handover quality (p <0.0001). This indicates that handover quality from the perspective of the incoming nurse is increased when triage flow is smooth, the relationship between the incoming and outgoing nurse is positive and when safety climate and intrusions are perceived to be positive. Figure 18 illustrates the Revised Model of Factors Influencing Quality of Handover Communication.
Figure 16. Final model of factors that influence ED nurse shift handover quality

Based on the above findings, the majority of hypothesized predictor variables were not found to be statistically significant. Table 10 displays revised hypothesized relationships based on dichotomization of independent variables and whether or not hypotheses were supported by analysis findings (for a comparison of pre and post dichotomization hypotheses, see Appendix H). The next and final chapter includes a discussion of the implications of these findings and how they can be used to influence practice.

Table 10. Hypothesis testing results

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Supported by findings (Yes / No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1) Adequate staffing will positively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H2) Smooth patient flow through triage will positively influence the quality of handover communication.</td>
<td>Yes</td>
</tr>
<tr>
<td>H3) Positively perceived intrusions experienced by the incoming nurse will positively influence the quality of handover communication.</td>
<td>Yes</td>
</tr>
<tr>
<td>H4) Positively perceived distractions experienced by the incoming nurse will positively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H5) Sufficient cognitive capacity experienced by the incoming nurse will positively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H6) Adequate focus of attention experienced by the incoming nurse will positively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H7) High anxiety experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H8) High time stress experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H9) High time pressure experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>Supported by findings (Yes / No)</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>H10) High levels of acute fatigue experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H11) High levels of chronic fatigue experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H12) Positive relationships between the incoming and outgoing nurse will positively influence the quality of handover communication.</td>
<td>Yes</td>
</tr>
<tr>
<td>H13) Higher ratings of safety climate will positively influence the quality of handover communication.</td>
<td>Yes</td>
</tr>
<tr>
<td>H14) Availability of handover related technology will positively influence quality of handover communication.</td>
<td>No</td>
</tr>
<tr>
<td>H15) Face-to-face communication will positively influence the quality of handover communication.</td>
<td>No</td>
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<tr>
<td>H16) Use of structured handover tools will positively influence the quality of handover communication.</td>
<td>No</td>
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<td>H17) Patient/family participation in handover will positively influence the quality of handover communication.</td>
<td>No</td>
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<td>H18) Increased level of incoming nurse experience will positively influence the quality of handover communication.</td>
<td>No</td>
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<tr>
<td>H19) Positive intrusions will moderate the relationship between time pressure and handover quality.</td>
<td>No</td>
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<td>H20) Positive intrusions will moderate the relationship between focus of attention and handover quality.</td>
<td>No</td>
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<td>H21) Chronic fatigue will moderate the relationship between cognitive capacity and handover quality.</td>
<td>No</td>
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<td>H22) Adequate staffing levels will moderate the relationship between time pressure and handover quality.</td>
<td>No</td>
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Chapter 5: Discussion

This study aimed to develop and test a model of factors that influence quality of nurse-to-nurse shift handover communication in the Emergency Department (ED), from the perspective of the incoming nurse. Nurse-to-nurse shift handover is defined as bidirectional communication that results in the transfer of information and responsibility for a patient (Friesen et al., 2008; McFetridge et al., 2007; Tregunno, 2009). Nurses depend on this information to inform care that they will provide to patients over the duration of their tours of duty (Strople & Ottani, 2006). As nurses rely heavily on this information to guide their work, it is important that handover communication be carried out in an effective manner. To date, there has been a lack of consensus related to the definition of quality or effective handover communication. In this study, quality handover communication was defined using findings identified by Manser and colleagues (2013). Quality handover communication includes a discussion of patient care, provision of organized information and the creation of a shared understanding between nurses (Manser et al., 2013).

Although there is no consensus on the definition of handover quality, literature has demonstrated that ineffective or poor quality handover communication can result in negative consequences such as “…wrong treatment, delays in medical diagnosis, life threatening adverse events, patient complaints [and] increased hospital length of stay” (Australian Council for Safety & Quality, 2005). Nurse-to-nurse shift handover research has increased over the last several years; however, the majority of this literature is focused on inpatient units. The ED is an important area of focus for this research as it presents unique challenges stemming from the chaotic and unpredictable nature of the environment (Ong et al., 2011). Although handover communication is a widely practiced and vital nursing function, little is known about factors that influence the quality of nurse-to-nurse handover communication in the ED.

Based on communication, safety and handover literature, a conceptual model of factors influencing quality of handover communication from the perspective of incoming ED nurses was developed. This model contained 18 hypothesized influencing factors as well as four interaction effects. Using survey data collected from ED nurses across Ontario, the model was tested using multiple linear regression. The final model included only four of the 18 hypothesized factors that were found to have a significant impact on quality of handover communication. These factors included flow of patients through triage, the relationship between the incoming and outgoing
nurse, intrusions and safety climate, which together explained 34% (p < 0.0001) of the variance in quality of handover communication. In this study, the mean score for handover quality was 3.42 on a five-point scale, suggesting that on average, nurses perceived handover quality as slightly better than good. This is congruent with findings reported by Manser and colleagues (2013). In their study of postoperative handover, quality ratings were positive, with means between 3.1 and 3.9 on a five-point scale. Carroll et al. (2012) measured handover effectiveness from the perspectives of incoming and outgoing nurses. Handovers were generally perceived as positive with mean scores of 6.49 out of 7 and 6.72 out of 7. In a survey of ED physicians, Ye and colleagues (2007) reported that handovers received a median score of three out of five, indicating that handovers were generally reported as adequate or better. A study of handovers among medical and surgical residents conducted by Kitch and colleagues (2008) reported that 31% of participants rated handover as poor or fair.

**Significant Variables**

**Triage.** As hypothesized, flow of patients through triage was a significant predictor of handover quality (p = 0.002). Handover quality is increased when the flow of patients through triage is smooth. Triage flow was included in the conceptual model proposed by Lawrence and colleagues (2008) and was used as a proxy for workload which was identified as having an influence on handover. In the present study, nurses were asked to rate the flow of patients through triage at the beginning of their shift. Overall, 74% of nurses rated triage flow as having frequent or occasional backlogs. Although this study was measuring the perceptions of incoming nurses, triage flow is likely reflective of workload that the incoming nurse is about to assume as well as workload that the outgoing nurse has been experiencing. It is suggested that when the flow of patients through triage is backlogged, nurse workload becomes unpredictable and less manageable as a result of patient volumes. This makes the provision of high quality handover difficult, as a result of the outgoing nurse having less time to get to know patients and increased cognitive demands when trying to juggle competing priorities. Moreover, in anticipation of increased workload, the incoming nurse may rush through handover in attempt to begin work in a timely manner. This finding aligns with the System Migration Model [SMM] (Amalberti, 2001; Amalberti et al., 2006), where factors such as increased workload can result in work adaptations in order to keep up with performance expectations. Triage flow as a contributor to handover quality may be explained using the Swiss Cheese Model [SCM] (Reason, 1990), as
backlogs and increased workload may create holes in defensive layers intended to improve handover. Finally, triage flow is also aligned with the concept of contributing factors / hazards in the World Health Organization’s (2009) International Classification for Patient Safety (ICPS).

Triage can be mapped to the ICPS subcategories of organizational / service factors and resources / workload.

It should be noted that in addition to being reflective of workload, flow of patients through triage might also reflect the skill of the triage nurse. More experienced triage nurses may be more efficient at triaging as they have had more exposure to a wide variety of patients. Faster triage may lead to fewer patient backlogs. Flow through triage may also reflect the severity of patients presenting at triage as those that are critically ill may receive increased attention from the triage nurse, leading to backlogs.

**Relationships.** The relationship between the incoming and outgoing nurse was found to be a significant predictor of handover quality (p < 0.0001). Positive relationships between incoming and outgoing nurses led to improved ratings of handover quality. This is not a surprising finding, given that a significant portion of communication involves feelings that the sender and receiver have for one another (Ellis et al., 1995; Kreps & Thorton, 1984).

Relationships with peers and teamwork were identified as influencing handover communication in a number of studies and conceptual models (Anthony & Preuss, 2002; Bost et al., 2012; Carroll et al., 2012; Cheung et al., 2010; Meissner et al., 2007; Pezzolesi et al., 2013). In this study, nurses generally rated relationships with their outgoing colleagues as being positive (76.7%). In the definition of handover quality proposed by Manser and colleagues (2013), the creation of a shared understanding was included as part of a high quality handover. Through the development of positive relationships with colleagues, incoming nurses are more likely to feel comfortable asking questions and clarifying information with their outgoing colleagues.

Moreover, when relationships between nurses are positive, the nurse providing handover is less likely to feel intimidated and rush through the information. This finding is congruent with perspectives offered by the SCM (Reason, 1990), ICPS (WHO, 2009) and SMM (Amalberti, 2001; Amalberti et al., 2006). Positive relationships may serve as defensive layers and actions taken to reduce risk by encouraging reciprocity and opportunities for clarification of information. This may prevent information omissions and misunderstandings during information exchange. Further, positive relationships with colleagues may prevent a shift towards unsafe practice as
nurses may feel as though they are in a safe environment where they can take time to share necessary information.

**Intrusions.** Positively perceived intrusions were found to have a positive impact on handover quality ratings ($p = 0.023$). In the present study, the majority of nurses reported having intrusions with a negative impact (89.4%), as opposed to those intrusions that were perceived as positive in nature (10.6%). The impact on handover quality was not contingent on whether or not nurses experienced intrusions, but rather, whether or not the intrusions were perceived as being positive or negative in nature. This builds on findings by Jett and George (2003) and McGillis-Hall and colleagues (2010a,b,c) suggesting that there are different types of intrusions, both positive and negative. Presence of positive intrusions aligns with theoretical perspectives offered by the SCM (Reason, 1990) and the ICPS (WHO, 2009), as positive intrusions are those that offer additional information to the handover. This additional information serves as a defensive layer and as an action taken to reduce risk by preventing omissions that may have otherwise had a negative impact on the quality and safety of handover. These findings are contrary to other literature findings suggesting that interruptions in general can result in information loss and unclear presentation of handover information (Dayton & Henriksen, 2007; Laxmisan et al., 2007; McCloughen et al., 2008). Additional research on intrusions is required to identify whether or not positive intrusions can overcome negative consequences that have been associated with intrusions in general. Consequences include decreased attention span, concentration and ability to store information (Berg et al., 2013; Jett & George, 2003).

**ED safety climate.** Results of this study suggest that a positive ED safety climate positively influences handover quality. Yet, overall, 73.6% of study participants perceived the safety climate in their EDs as being negative. A safety culture is a culture that includes behaviours, values and expectations of safety (Cooper, 2002; Mears & Flin, 1999). Safety climate is a reflection of the observable aspects of safety culture (Weaver et al., 2013) and includes employee perceptions of safety related policies and practices, as well as perceptions of management priorities of safety within the organization (Agnew et al., 2013; Clarke, 2010; Neal & Griffin, 2006; Zohar et al., 2007). Research in support of study findings has identified an association between positive safety climate and increased clinician safety behavior (Agnew et al., 2013; Clarke, 2010; Steyrer et al., 2012), in addition to a relationship between positive safety climate and fewer adverse events (Mardon et al., 2010; Taylor et al., 2012). Referring to
organizational culture in general, based on a qualitative study of multidisciplinary handovers, Siemsen and colleagues (2012) reported that the existing culture did not support handover and that many clinicians did not perceive handover to be a safety related behaviour. The authors suggested that creating a culture of safety could have a positive impact on patient safety as it relates to handover (Siemsen et al., 2012). Most recently, in support of study findings, Richter and colleagues (2014) carried out a large study using data from the Hospital Survey on Patient Safety Culture. Richter et al. (2014) reported that management support for safety was positively associated with perceived handover success.

Theoretical perspectives offered by the SMM (Amalberti, 2001; Amalberti et al., 2006), SCM (Reason, 1990) and ICPS (WHO, 2009) further align with study findings. In the presence of a positive safety climate, nurses are less likely to make trade-offs and accept incomplete handover in order to increase productivity, thus remaining in the safe space of action (Amalberti et al., 2006). Moreover, a positive safety climate is likely to be reflective of management’s commitment to safety, meaning that leaders and managers are less likely to tolerate unsafe handover practices. Similarly, safe management practices can contribute to defensive layers in the SCM (Reason, 1990), as well as actions taken to reduce risk (WHO, 2009), as leaders and managers are responsible for implementing policies that facilitate delivery of safe handover (Palmieri et al., 2008). Managers also make decisions related to latent contextual factors such as staffing, communication, and training, all of which can increase both patient safety and safety of handover communication (Henriksen et al., 2008; van Beuzekom et al., 2010).

Non-Significant Variables

**Cognitive capacity and focus of attention.** Neither cognitive capacity nor focus of attention was a significant predictor of handover quality. Although these were predicted as influencing factors by a number of researchers (e.g. Lardner, 1996; Lawrence et al., 2008; Sharit et al., 2008), it is possible that these two variables do not have an impact from the incoming nurses’ perspective, as they typically aren’t dealing with the same competing demands as outgoing nurses. Outgoing nurses are frequently rushing to complete work prior to shift change, so these two factors may in fact influence quality of handover from their perspective. Another reason that these variables may not have been significantly related to handover quality could be the result of the way in which they were measured. A review of studies examining cognitive workload revealed that this variable is most accurately measured through observational studies or
simulations conducted in laboratory settings (Galy, Cariou & Melan, 2012; Gonzalez, 2005; Miller et al., 2012; Patten, Kircher, Ostlund & Nilsson, 2004; Patten, Kircher, Ostlund, Nilsson & Svenson, 2006; Potter et al., 2005). Consequently, these two variables may play a role in handover quality from the perspectives of both incoming and outgoing nurses when measured using alternative methods, such as through the cognitive stacking measure proposed by Potter and colleagues (2005).

**Staffing.** Nurse staffing at the beginning of the shift did not have a significant influence on quality of handover communication. Only 37% of study participants reported that nurse staffing at the beginning of their shifts was adequate enough to fulfill workload demands, which also suggests that nurses had high workloads. This finding is in contrast to several studies suggesting that workload has a negative impact on handover communication (Olsen et al., 2013; Sharit et al., 2008; Siemsen et al., 2012). It is also in contrast to safety theory, which suggests that increased workload may serve as a latent condition (Ebright et al., 2003; Reason, 1990, 2000), and may lead to increased pressure to perform, pushing practice beyond the boundaries of safety (Amalberti et al., 2006). One possible explanation for this finding is that staffing may be a variable that is more likely to influence quality from the perspective of the outgoing nurse, as it is the outgoing nurse that is often scrambling to complete work prior to shift handover. Another possible explanation for this finding is that staffing is a distinct concept from workload and that this concept should have been operationalized in a different manner, such as through a workload measurement tool (e.g., NASA-Task Load Index).

**Distractions.** The impact of distractions (positive and negative) did not have a significant influence on quality of handover communication. This is an interesting finding as positive intrusions, which are closely related to distractions, were significant predictors of handover quality. This finding conflicts with both handover and safety literature suggesting that interruptions and distractions can interfere with the ability to process and store information and ability to manage competing priorities (Jett & George, 2003; Laxmisan et al., 2007; Potter et al., 2005). Distractions were also cited as barriers to handover (Benson et al., 2007; Birmingham et al., 2014; Kerr et al., 2011; Lawrence et al., 2008; Nagpal et al., 2011; Staggers & Jennings, 2009; Street et al., 2011), resulting in increased length of time for handover (Currie, 2002), information loss (Dayton & Henriksen, 2007; Laxmisan et al., 2007) and unclear handover presentation (McCloughen et al., 2008). According to Jett and George (2003), distractions are
breaks in concentration, which are not related to the task at hand. Intrusions on the other hand, result in a temporary halt in activity (Jett & George, 2003). Nagpal and colleagues (2011) reported that clinicians were distracted during 35% of observed handovers. Therefore, it is possible that nurses are so accustomed to distractions that they are able to ignore them, unlike intrusions, which require a shift in cognitive focus. Another possible explanation for this finding is the lack of differentiation between intrusions and distractions in the literature. It is possible that intrusions are the only type of interruptions that influence handover, yet as many studies include them both under the umbrella term of interruptions, this distinction is not identified.

**Psychological precursors.**

*Job stress.* Anxiety and time stress are components of job stress according to Parker and Decotiis (1983). Neither anxiety nor time stress were found to be significant predictors of handover quality. On average, ED nurses in this study did not report high levels of anxiety (23.8% reported high anxiety) or time stress (24.2% reported high time stress). This finding is contrary to research by Stathopoulou et al. (2011), who reported that there was a small, yet statistically significant correlation between anxiety and working in the ED. This difference may be the result of different measurement instruments. This study employed the Job Stress Scale, which is intended to measure the concepts of anxiety and time stress in the broader context of the work environment. Conversely, Stathopoulou et al. (2011) used the Hamilton Anxiety Rating Scale which is a clinical tool used to measure anxiety symptoms (Stathopoulou et al., 2011).

*Time pressure.* Time pressure was not found to be a significant predictor of handover quality. On average, ED nurses reported low levels of time pressure (79.7%). This is in contrast to findings reported by Adriaenssens and colleagues (2011), who found that Belgian ED nurses had significantly higher levels of time pressure, compared to nurses in the general hospital setting. It is possible that outgoing nurses may be more likely to experience time pressure when compared to incoming nurses, as they often have a number of tasks such as charting to complete before the end of their shifts.

*Fatigue.* Both acute and chronic fatigue were hypothesized to influence quality of handover communication from the perspective of the incoming nurse, yet neither of these factors were found to be significant predictors. In this sample, 82.8% of nurses reported experiencing moderate to high levels of acute fatigue, while 48.9% reported moderate to high levels of chronic fatigue. Since 82.8% of incoming nurses in this sample reported experiencing moderate to high
levels of acute fatigue, it is possible that fatigue itself may have influenced ratings of handover quality. Since fatigue can result in decreased mental acuity and vigilance, it is possible that nurses may have rated handover quality more highly than they would have if they were not fatigued.

Psychological precursors including job stress, time pressure and fatigue were hypothesized to influence handover communication as a result of literature suggesting that psychological precursors can lead to hindered communication (Barnlund, 1968), as well as impaired performance (Ebright et al., 2003; Leape, 1994; Reason, 1990). This can include compromised information processing ability, limited clinical decision making, decreased mental acuity, diminished short-term memory and overall decreased vigilance (Caldwell, 2001; Geiger-Brown et al., 2012; IOM, 2004; Jeffs et al., 2009; Kunert et al., 2007; Lee et al., 2004; Lockely et al., 2007; Sexton et al., 2000; Swaen et al., 2003), all of which were believed to negatively influence the incoming nurse’s ability to receive handover communication, thus resulting in decreased ratings of quality. Although handover communication requires information processing and interpretation by the incoming nurse, it is possible that the presence of psychological precursors in the outgoing nurse will have a greater impact on handover quality. This is because although handover communication requires both a sender and receiver, it is ultimately the outgoing nurse’s (sender) responsibility to process, synthesize and deliver information to the incoming nurse.

Since there are several possible explanations for these findings, it is suggested that the effects of psychological precursors on handover quality should be further explored using other research methods. For example, psychological precursors may be better assessed using an observational study design where external observers rate handover quality in the presence of job stress, time pressure and fatigue.

**Technology.** The availability of handover related technology was not found to be a significant predictor of handover quality. However, study findings revealed a weak yet statistically significant correlation between handover quality and technology ($r = 0.133, p = 0.05$). The majority of study participants (72.7%) reported that they did not have access to technology that made it easier to receive handover communication. However, 41% of nurses reported that they had access to electronic health records, while 13% had access to bedside documentation technology and 4% had access to handheld applications. This is congruent with
findings from a number of studies indicating that the electronic health record did not facilitate communication among nurses (Ash, Berg & Coiera, 2004; Carrington, 2012; Carrington, 2011). However, these findings are in contrast to other handover literature suggesting that technology may improve handover as a result of organizing and streamlining patient information (Randell et al., 2011; Strople & Ottani, 2006). Findings from this study suggest that at present, technology to support handover communication is not widely available. As technology continues to advance in the form of handheld applications and mobile devices, this factor may influence handover communication in the future.

**Patient / family participation.** Patient and family participation in handover was hypothesized to positively influence handover quality, yet study results did not support this hypothesis. The majority of the sample did not include the patient and/or family in handover (91.6%), despite the fact that the practice of bedside handover is increasing in prevalence. This is supported by Johnson et al.’s (2012) study of handover on hospital inpatient units. They found that patients were included in handover approximately 5% of the time and this was often comprised of superficial greetings rather than authentic involvement. In 2013, Staggers and Blaz published a handover literature review and concluded that there was insufficient evidence to support broad implementation of bedside handover. However, several recent studies have reported that patient and family participation in handover provides benefits for both nurses and patients (Jeffs et al., 2013; Jeffs et al., 2014; Kerr et al., 2014; Klim et al., 2013; Lu et al., 2014; Maxson et al., 2012). The ED is a setting where there has been resistance towards this method of handover as a result of privacy concerns (Currie, 2002; Kerr et al., 2014). Therefore, patient and family participation in handover communication may be a factor that influences handover quality in other settings such as inpatient units. It is also possible that the impact of patient and family participation in handover may have a greater influence on handover quality from the perspective of the patient. Several recent studies have reported that patients appreciate the opportunity to participate, as it keeps them informed, enables a connection with the nurse, improves perceptions of safety and satisfaction (Ford, Heyman & Chapman, 2014; Jeffs et al., 2014; Kerr et al., 2014; Lu et al., 2014).

**Use of structured handover tools.** Similar to patient and family participation in handover, the use of structured handover tools has received an increased amount of attention in handover related literature. Although use of a structured handover tool was hypothesized to have
a positive influence on handover quality, this variable was not a significant influencing factor. In fact, the majority of study participants (89%) reported that they did not use a handover tool to guide communication. Studies testing the use of structured handover tools such as checklists and mnemonic devices have reported positive outcomes such as improved continuity of care and increased consistency, accuracy, completeness, organization and retention of information (Benson et al., 2007; Bhabra et al., 2007; Currie, 2002; Johnson & Cowin, 2013; McFetridge et al., 2007; Moseley et al., 2012; Nelson & Massey, 2010; Siemsen et al., 2012; Weiss et al., 2013). However, according to a recent literature review on handover tools, there has been no consensus on the use of a single structured handover tool (Anderson et al., 2014). Theoretically, it would make sense for handover tools to increase handover quality, as they create structure for handover content and contribute to the provision of organized information, one of the defining features of handover quality (Manser et al., 2013). However, one criticism of structured handover tools is that they often address the contributions of outgoing nurses and not those of incoming staff (Eggin & Slade, 2012). This notion could potentially explain these findings. Since the use of handover tools may not provide obvious benefits to incoming nurses, it is possible that handover tools may instead have an impact on handover quality from the perspective of the outgoing nurse.

**Experience.** As handover communication is learned through experience (Kerr, 2002; Hardey et al., 2000), it was hypothesized that handover quality would be influenced by the nurse’s level of experience. Despite being supported by literature, this was not supported by study findings. Safety literature suggests that increased experience leads to fewer knowledge-based errors (Amalberti, 2001). While in handover related literature, nurse experience was also found to lead to increased ability to prioritize and clarify information, leading to improved handover (McFetridge et al., 2007; Sharit et al., 2008). However, most recently, Carroll and colleagues (2012) identified a contradictory finding, that nurse experience could be a barrier to handover, when the nurse had prior knowledge of the patient. Generally, ED nurses should not have prior knowledge of patients, as they are not meant to stay in the ED for extended periods of time. Consequently, this may be another factor that should be measured in outgoing nurses. Although incoming nurses must use knowledge-based performance to receive and interpret handover, the need for knowledge-based performance may be increased in outgoing nurses. As
such, level of experience in the outgoing nurse may have a greater impact on the delivery of high quality handover.

**Generalizability of Study Findings**

In this study, 43.6% of participants reported working in community hospitals with more than 100 beds, 33.0% worked in small hospitals with less than 100 beds and 22.5% worked in urban teaching hospitals. The nurse survey was pilot tested with six RNs from a local urban teaching hospital. Nurses from this setting may have responded to and interpreted survey questions differently than nurses from community or rural settings. Therefore, it is unknown whether or not pilot test results are generalizable beyond the sample of pilot test participants.

Two hundred and thirty one participants took part in this research study. The majority of study participants were female (96.0%), with a mean age of 51.4 years (SD 7.4). Compared to the general population of Ontario RNs, this sample differs slightly. The average age of Ontario nurses in 2014 was 45.4 years of age (CNO, 2014), which is younger than the average age of 51.5 years for study participants. Ninety four percent of the population of Ontario RNs is female, compared to 96% in the current sample. ED specific nurse population statistics are not available, as such, it is not known whether or not study participants are reflective of Ontario’s population of ED nurses. Therefore, readers will have to determine the level of generalizability relative to their RN populations and ED settings.

**Study Limitations**

**Study design.** There are limitations associated with the cross-sectional survey design of this study. As data were collected at one point in time, participant responses were limited by their ability to recall previous events (Shi, 2008). Cross-sectional surveys such as those used in this study are not amenable to collecting certain types of data such as cognitive capacity and focus of attention. Attempts to overcome this limitation were made by using survey items to collect data related to these two concepts.

There are a number of variables that could potentially influence handover quality that were not included in this study, such as those that were not identified in handover literature. Consequently, this study design is not able to rule out all alternative explanations of factors influencing handover quality (Shi, 2008).

**Threats to internal validity.** Internal validity refers to “the degree to which it can be inferred that an observed outcome was caused by …independent variable[s], rather than by
uncontrolled extraneous factors” (Polit, 2010, p.402). A serious threat to the internal validity of this study was participants’ abilities to accurately recall information while responding to the survey, known as recall bias. Recall bias may be intentional or unintentional and results from limited human memory capacity (Hassan, 2006). Recall bias may attenuate or inflate conclusions drawn from this research study. To minimize this bias, participants had to meet inclusion criteria specifying that they had worked at least one shift in the past ten days where they received handover communication. Only those participants meeting these criteria were included in the study. Therefore, it is estimated there was minimal recall bias.

Selection bias is another threat to the internal validity of this study. Selection bias occurs when participants have certain characteristics that lead them to respond to the survey in a certain way (Shi, 2008). For example, those who receive the survey may be more likely to respond positively than those who were not surveyed. One strategy to mitigate this threat is randomization (Shi, 2008). Randomization of ED nurses was carried out by the CNO when creating a list of eligible participants.

All data were collected using self-report measures. The use of self-report measures posed a threat to the internal validity of this study. Self-report measures are often associated with biases such as self-preservation, where people try to portray themselves in a positive light (Beal & Weiss, 2003). Self-report survey measures are also subject to reactivity, where participants may provide socially desirable answers rather than true answers (Shi, 2008). To overcome these threats, participants were reassured about anonymity and confidentiality of survey responses.

**Construct & content validity.** Construct validity assesses whether or not selected instruments are measuring the concepts that they were intended to measure (Doordan, 1998; Shi, 2008). Content validity refers to whether there are enough items present to cover the domain of the concept (Nunnally & Bernstein, 1994; Shi, 2008). Study data were gathered using a mix of previously validated instruments as well as with researcher created items. Although existing instruments were re-validated using confirmatory factor analysis, single researcher created items could not be validated in this manner. Therefore, it is possible that these researcher created items were not measuring the concepts that they were intended to measure. To overcome this limitation in the dependent variable, the overall quality score was correlated with the score derived from participant responses to Manser et al.’s (2013) rating tool for handover quality. These items were significantly correlated ($r = 0.743, p = 0.01$), indicating that the single item used to assess quality
in the survey was reflective of handover quality as defined by Manser and colleagues (2013). To overcome threats to construct and content validity for remaining single item variables, members of the doctoral supervisory committee assessed single items for face validity.

**Threats to external validity.** External validity pertains to generalizability of inferences to populations outside of the study sample (Creswell, 2009; Shadish, Cook & Campbell, 2002). In this study, a response rate of 40.1% for the nurse survey was obtained, therefore, non-response bias posed a threat to external validity of this study. Non-response bias occurs when participants who respond to the survey are different than those who receive the survey but choose not to respond (Shi, 2008). Sample demographics differ slightly from the general population of RNs in Ontario. As previously discussed, ED specific nurse sample demographics are not available, consequently, it is not known whether or not study participants were different than those who either were not surveyed or chose not to respond.

There are other threats to the external validity of this study as a result of the small sample size. The small sample creates a risk of sampling error, as the sample may not be representative of the population. However, it should be noted that even though the sample was small, the study was adequately powered to detect a medium sized effect with $\beta = 0.20$ and $\alpha = 0.05$ (Tabachnick & Fidell, 2013).

As external validity is concerned with generalizability, the fact that this study only takes place in one Canadian province with one specific group of nurses makes it difficult to generalize beyond this particular population (Schwab, 1999). However, for feasibility reasons, sampling in other provinces was not possible.

**Statistical conclusion validity.** Since data obtained in this study did not adhere to assumptions required for multiple linear regression, data were recoded into categorical variables. This was a limitation of this study as it may have had an impact on study findings. By dichotomizing variables, variability in participant responses was lost, meaning that differences between groups may have been underestimated (Altman & Royston, 2006). Statistical power was reduced as a result of this information loss, leading to an increased risk of a Type 1 error (Altman & Royston, 2006; Royston, Altman & Sauerbrei, 2006). Furthermore, Royston and colleagues (2006) suggest that when more than two predictor variables are dichotomized, spurious findings may result. To minimize these limitations, a Bonferroni adjustment was applied to reduce the risk of a Type 1 error (Tabachnick & Fidell, 2013). Sensitivity analyses
were also performed using logistic regression, as well as through comparison of linear regression results using both dichotomous and continuous data. Each method of analysis resulted in approximately the same outcomes, suggesting that findings were not likely spurious.

**Common method variance.** Common method variance “is an artifact of measurement that biases results when relations are explored among constructs measured by the same method” (Spector, 1987, p.438). Common method variance may result in spurious correlations, causing researchers to draw false conclusions (Doty & Glick, 1998; Spector, 1987). Common method variance threatens this study’s internal and external validity as only one source of data is being used.

Potential sources of common method variance in this study are related to common rater effects where the dependent and independent variables come from the same source (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Examples of common rater effects include consistency motif, acquiescence bias, social desirability, and mood state (Podsakoff et al., 2003). Consistency motif occurs when participants desire to respond in a uniform manner, acquiescence bias occurs when participants choose to agree with all questions, social desirability is when participants respond according to what they believe is socially desirable, and mood state occurs when participants respond in a manner corresponding with their current mood (Podsakoff et al., 2003; Spector, 1987). As nurses are rating handover given by their peers, they may also be subject to the leniency bias, where they portray those that they know in a better light than those that they are unfamiliar with (Podsakoff et al., 2003).

Item characteristic effects lead to the interpretation of survey items (Podsakoff et al., 2003). Item ambiguity and negatively worded items can result in item characteristic effects, which can produce artificial relationships (Podsakoff et al., 2003). Participants may not understand questions and may interpret them in a different way than the researcher intended and therefore use their own judgment to interpret questions (Podsakoff et al., 2003).

Common method variance can threaten the validity of conclusions regarding observed relationships between variables (Schwab, 1999). Although there has been recent debate about the existence of negative impacts of common method variance (Spector, 2006), steps to minimize its effects were taken as a precautionary measure. For example, scale items did not contain double-barreled questions, but rather the survey contained questions that were short, simple and specific, and jargon free (Podsakoff et al., 2003; Shi, 2008). Clear and concise question lead-ins were
used to provide definitions related to several study concepts (e.g., handover quality, technology, interruptions, face-to-face handover, handover tools, handover participants, experience). This was intended to minimize item characteristic effects, as participants did not have to interpret questions (Podsakoff et al., 2003). Participants were reassured about anonymity and confidentiality of information contained in the survey and the amount of requested identifying information was limited. Participants were further advised that all files and data would be kept secure through encryption and double locking (Shi, 2008). This was intended to minimize the impact of socially desirable responses and leniency biases, as participants were reassured that their answers would never be shared outside of the research team.

**Other limitations.** The use of two overarching theoretical perspectives to guide this research has been identified as a study limitation. Following a review of the literature, no single theory or conceptual model was adequately able to explain all factors influencing quality of handover communication. Therefore, the hypothesized conceptual model tested in this research drew upon theoretical work of both Reason (1990) and Amalberti and colleagues (2006), as well other conceptual models produced by other authors (e.g., Cheung et al., 2010; Lawrence et al., 2008; Sharit et al., 2008). Kristjanson, Tamblyn and Kuypers (1987) argue that nurses could benefit from the use of multiple theoretical perspectives in practice. Their rationale is that the use of only one theory limits opportunities to explore phenomena outside of the selected theoretical model. As the model tested in this research is intended to ultimately inform and influence nursing practice, the use of multiple theoretical perspectives to understand factors that influence handover quality should not be considered as a drawback.

**Implications**

There are a number of implications for nurses, nurse leaders, nurse educators and researchers resulting from each of the significant handover quality influencing factors. The flow of patients through triage was identified as one factor that influences quality of handover communication. Triage is a role that is carried out by nurses, so it is important for them to be cognizant of the implications for handover. Triage nurses should aim to ensure that the flow of patients into the department is smooth and that workload for new patients is distributed among staff. It is recognized that this is not always possible, as the flow of patients through triage is also a broader system level issue. Healthcare leaders and policy makers should continue to encourage patients to visit primary care providers and urgent care centres whenever possible, to divert
patients with non-urgent issues away from the ED, thus decreasing the number of patients presenting at triage. Contingency plans for increasing the number of triage stations and nursing staff during times of increased volume should be developed and implemented as necessary. This is congruent with the high-level class of actions taken to reduce risk related to staff factors identified in the WHO’s International Classification for Patient Safety (WHO, 2009), where the focus is on prevention of safety incidents. Additionally, leaders and policy makers should ensure timely discharge of patients from inpatient units to allow new patients to flow from the ED to these units.

As relationships between incoming and outgoing nurses play a pivotal role in perceived quality of handover communication, there are implications for nurses, nurse leaders, nurse educators and managers. Nurse leaders, educators and managers should aim to foster a collegial environment to facilitate the development of nurse relationships. This may be accomplished through shared break space and lunchrooms on the unit aimed at promoting staff interaction. Social events planned outside of work hours may also encourage socializing and enable the development of staff relationships. Nurse managers and leaders should aim to avoid use of agency or temporary staff to improve continuity and opportunities for interaction within the workplace. Nurse leaders and managers should also consider the implementation of training programs that promote teamwork and communication. Staff training interventions can be situated within the high-level class of actions taken to reduce risk related to staff factors, identified in the WHO’s International Classification for Patient Safety (WHO, 2009). Nurses should be made aware of the importance of relationships and the impact that they may have on handover quality. Through increased awareness, nurses will be encouraged to take part in social activities both within and outside of the workplace.

Findings from this research suggest that positive intrusions have a positive influence on handover quality. Therefore, ED staff should be encouraged to communicate vital patient information even if it results in an intrusion during a handover exchange. It is recognized that not all intrusions are positive in nature, therefore, it is important for ED staff to be cognizant of those that do not contribute to handover quality. As intrusions can come from a variety of sources, orientation for all new ED staff should include education about the impact of intrusions on handover communication (McGillis Hall et al., 2010b). Nurse managers and leaders should create policies and processes to facilitate handover that is free from intrusions, with the
exception of those that are positive in nature. This includes paying particular attention to the physical work environment, as this can promote interruptions (Jett & George, 2003). Patients and families may also benefit from patient/family education about the impact of intrusions so that they recognize that handover is critical communication moment that should not be interrupted (McGillis Hall et al., 2010b) unless they are conveying information that adds value to handover.

Given that a positive safety climate was found to positively influence handover quality, there are implications for nurse leaders, managers and educators. According to Campbell and colleagues (2010), interventions related to improving safety climate should be targeted towards ED level leaders, managers and educators as opposed to broader organization level executives. Findings from their study suggest that there are differences between ED safety climates and those of the broader organization, as the ED represents a clinical microsystem (Campbell et al., 2010). In a recent literature review, Weaver and colleagues (2013) identified interventions aimed at improving safety culture. Nurse leaders, managers and educators should implement these interventions to foster positive safety climates within their organizations. First, staff should receive training related to teamwork and communication (Weaver et al., 2013). Not only will this promote a positive safety culture and improved team relationships, a focus on communication training may improve nurse communication skills, thereby improving the delivery of handover. Training also provides opportunities for nurse educators to emphasize handover communication as a safety related behavior (Manser & Foster, 2011). Nurse leaders and managers should initiate executive walk-abouts in the ED (Weaver et al., 2013). This intervention will ensure that leaders and managers have an understanding of the practice environment. Understanding the clinical environment will facilitate decision-making as well as the development of policies that support high quality handover (e.g., triage arrangements). Nurse leaders, managers and educators should focus on empowering staff and encouraging them to report safety concerns, errors and near misses. In “closing off the Swiss cheese holes” (Jeffs et al., 2009), leaders, managers and educators can use lessons learned from errors and near misses to promote organizational learning and prevent similar occurrences in the future. This is congruent with the high-level class of actions taken to reduce risk related to organizational/environmental factors identified in the WHO’s International Classification for Patient Safety (WHO, 2009), where the focus is on prevention of safety incidents. Finally, nurse leaders, managers and educators at all levels should convey that safety is a top priority for the organization, making it clear that safety is valued over
pressures for production. This will help to prevent staff from moving towards the boundaries of unsafe practice.

The final implications arising from this research are directed towards nurse educators within hospitals and educational programs. Nursing students, as well as nurses should receive ongoing education about the importance of handover communication, especially as a mechanism to ensure patient safety. Beginning at the undergraduate level, nursing professors should identify high quality handover communication as a feature of patient safety. Educators and leaders in the practice environment should further reinforce this notion as according to Scovell (2010) “…[nurse-to-nurse handover] is one of the most important rituals of the nursing shift” (p.35).

**Theoretical Contributions and Revised Model of Factors Influencing Quality of Handover Communication**

This research provides theoretical contributions to handover communication literature, as to date, few quantitative studies reporting factors that influence quality of nurse shift handover in the ED have been published. Informed by study findings, which were based on Reason’s (1990) Swiss Cheese Model (SCM), Amalberti et al.’s (2006) System Migration Model (SMM), as well as communication and handover literature, a revised model of factors influencing quality of handover communication is proposed (Figure 19). This model includes triage flow, intrusions, safety climate and relationships as direct influencing factors on quality of nurse shift handover communication in the ED.

Additional theoretical contributions pertain to the confirmation of theoretical models used to guide this research, including the SCM, SMM and the World Health Organization’s (2009) International Classification for Patient Safety (ICPS). Findings from this study confirm the notion that adverse events can have a multitude of contributing factors at both individual and organizational levels. Furthermore, findings from this study suggest that depending on the context, contributing factors can also serve as defensive layers as proposed by Reason (1990) and/or actions taken to reduce risk proposed by the WHO (2009). For example, a poorly perceived safety climate was hypothesized to contribute to poor quality handover (contributing factor). However, in this study, a positive safety climate was found to have a positive impact on handover, possibly because leaders and managers are responsible for implementing policies that facilitate delivery of safe handover (defensive layer or action taken to reduce risk). Similarly, negatively perceived intrusions were hypothesized to have a negative impact on handover quality
Yet, study results demonstrated that positively perceived intrusions had a positive impact on handover quality, possibly because they provided additional relevant information to the handover (defensive layer or action taken to reduce risk).

In this study, handover quality influencing factors were also mapped to the ICPS’ high-level class of contributing factors/hazards. As this model is intended to “define, harmonize and group a standardized set of patient safety concepts...in a way that is conducive to learning and improving patient safety across time and borders” (Sherman et al., 2009, p. 3), applying the model to a wide variety of patient safety issues, including handover, will contribute to the promotion and uptake of the model.

Figure 17. Revised model of factors influencing quality of ED nurse shift handover.

Future Research

Through the literature review, 18 factors were hypothesized to influence handover quality in the ED setting. Much of the handover related literature used to inform the development of the conceptual model was carried out on inpatient units. Although this research only identified four significant influencing factors, it is possible that some of the remaining 14 factors would be significant in explaining handover quality in settings outside of the ED. Therefore, there are future opportunities to further test and refine the originally hypothesized model in inpatient settings.

This research further supports and expands upon a concept that is scarcely explored in handover literature. That is, the difference in perceptions of handover quality depending on the
role of the nurse participating in the information exchange (e.g., incoming versus outgoing). Although this study tested a conceptual model from the perspective of incoming nurses, there were a number of factors that were not significant. However, there is strong support for these factors in the literature. Therefore, these factors may be significant when exploring perspectives of outgoing nurses. It should also be noted that as patients are increasingly included in the handover process, they might have different perceptions of what constitutes a high quality handover. Essentially, handover quality may be in the eye of the beholder. This notion provides the impetus for additional handover related research. For example, the newly proposed hypothesized conceptual model of handover should be tested on incoming nurses and outgoing nurses to examine differences. Additionally, it may be worthwhile to re-conceptualize the definition of handover quality to include perspectives of both incoming and outgoing nurses. This is best reflected in the following quote by Eggins and Slade (2012): “Our research suggests that an effective handover involves all participants collaborating to manage both information and interaction in the communicative accomplishment of clinical handover” (p.225). Rather than rate handover by evaluating the sender, it is proposed that handover be evaluated through both the perspectives of the sender and receiver simultaneously. Furthermore, as patients increasingly participate in handover exchanges, a model that includes their perspectives should also be considered (Staggers & Blaz, 2013).

Based on the above discussion, there were some concepts identified in this study that may have been more accurately measured using observational data, such as cognitive capacity and focus of attention. Future studies should include mixed methods to allow for opportunities to conduct cognitive function tests, either using simulation or in real time immediately prior to handover. Finally, using findings identified in this study, nurse researchers can begin to examine ways in which handover interventions can be developed, aimed at those factors that were reported to be significant including relationships, intrusions, safety climate and triage flow.

Conclusions

Poor quality handover communication can result in negative consequences for patients, nurses and healthcare organizations (Australian Council for Safety & Quality in Health Care, 2005). As such, this study aimed to develop and test a conceptual model of factors influencing quality of ED nurse shift handover from the perspective of incoming nurses. After testing the hypothesized model using data gathered from ED nurses across Ontario, only four factors were
identified as significant predictors of handover quality. Flow of patients through triage, positive relationships between the incoming and outgoing nurse, positive safety climate and positive intrusions were found to positively influence quality of nurse-to-nurse shift from the perspective of incoming ED nurses. Although these results contribute to an expanding body of handover literature, there remain a number of opportunities to further explore these as well as other related concepts. Using findings from this study, a revised model of factors influencing handover quality was proposed. This model should be tested in an observational or simulated environment and include both perceptions of quality from both incoming and outgoing nurses. Despite the need for additional research, findings from this study contribute to our understanding of factors influencing handover quality and result in a number of implications for nurses, nurse leaders and researchers. By developing interventions targeted towards significant influencing factors, ED nurse-to-nurse shift handover quality can be improved.
References


Johnson, M. & Cowin, L.S. (2013). Nurses discuss bedside handover and using written handover


Appendix A: Table of Instruments

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<thead>
<tr>
<th>Variable</th>
<th>Measure</th>
<th>Items (R indicates reverse coded items)</th>
<th>Scoring</th>
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</table>
| Handover quality | Adapted from Manser et al. (2013) | A quality handover is defined as nurse-to-nurse communication that includes a discussion of patient care and assessment information, information that is provided in a timely and organized manner, and creating a shared understanding by providing opportunities for questions and clarification. Based on this definition, please respond to the following question: | 1 = Poor  
2 = Fair  
3 = Good  
4 = Very good  
5 = Excellent |
|                |                          | 1) Overall, the quality of this handover was ____                                                      |                                                                                              |
| Triage flow    | Researcher created       | 1) Overall, how would you rate the flow of patients through triage in your Emergency Department?       | 1 = Poor, there are frequent patient backlogs  
2 = Marginal, there are occasional patient backlogs  
3 = Good, patients flow smoothly into the department |
| Staffing       | Researcher created       | 1) Considering the workload at the beginning of your last shift when you received handover, how would you describe the level of nurse staffing? | 1 = Inadequate, unable to manage workload demands  
2 = Marginal, it was difficult but possible to manage workload demands  
3 = Adequate, able to manage workload demands |
| Intrusions     | Researcher created       | Please consider the following information when responding to the next question:                      | 0 = No  
1 = Yes                                                                                      |
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<th>Variable</th>
<th>Measure</th>
<th>Items (R indicates reverse coded items)</th>
<th>Scoring</th>
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|          |         | An intrusion is defined as an unexpected encounter initiated by another individual that disrupts handover and causes it to stop temporarily. The intrusion can negatively impact the delivery of handover if the intrusion leaves little time for handover OR the intrusion can assist with handover by presenting relevant information (for example, critical lab results). | 1 = Very negative impact  
2 = Negative impact  
3 = Neutral / no impact  
4 = Positive impact  
5 = Very positive impact |
| Intrusion|         | 1) While receiving shift handover, did you experience an intrusion?  
2) If you experienced an intrusion, how would you rate the impact on handover?  
3) If intrusions were experienced, please identify the source(s). (Check all that apply):  
  o Patients  
  o Families  
  o Colleagues  
  o Other. Please specify |         |
| Distractions | Researcher created | Please consider the following information when responding to the next question:  
A distraction is defined a break in concentration caused by competing activities or environmental stimuli that are not related to the task at hand (for example, IV alarms). Distractions can be perceived as negatively impacting handover by causing nurses to lose focus OR they may be perceived positively if they increase the amount of attention given to handover. | 0 = No  
1 = Yes  
1 = Very negative impact  
2 = Negative impact  
3 = Neutral / no impact  
4 = Positive impact  
5 = Very positive impact |
|          |         | 1) While receiving shift handover, did you experience distractions?  
2) If you experienced a distraction, how would you rate the impact on handover?  
3) If distractions were experienced, please identify the source(s). (Check all that apply):  
  o Call bells |         |
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<th>Variable</th>
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<td></td>
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<td>o Alarms from monitors and IV pumps</td>
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<td></td>
<td></td>
<td>o Other. Please specify</td>
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<tr>
<td>Cognitive capacity</td>
<td>Researcher created</td>
<td>Please consider the following information when responding to the next question:</td>
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<td></td>
<td></td>
<td>Cognitive capacity is defined having sufficient mental space to be able to carry out cognitive work such as information processing and decision making.</td>
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<td></td>
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<td>While considering the above definition, please indicate your level of agreement with the following statement.</td>
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<td>The last time that I received handover I felt I had enough cognitive capacity to receive and process information.</td>
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<tr>
<td>Focus of attention</td>
<td>Researcher created</td>
<td>Please indicate your level of agreement with the following statement.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>The last time that I received handover, I was able to focus my attention on the information that I was receiving.</td>
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<tr>
<td>Anxiety</td>
<td>Job Stress Scale: Anxiety Subscale (Parker &amp; Decotiis, 1983)</td>
<td>When responding to the following questions, please think back to the last handover that you received.</td>
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<td></td>
<td>1) I have felt fidgety or nervous as a result of my job.</td>
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<td></td>
<td></td>
<td>2) My job gets to me more than it should.</td>
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<td>3) There are lots of times when my job drives me right up the wall.</td>
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<td>4) Sometimes when I think about my job I get a tight feeling in my chest.</td>
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<td></td>
<td>5) I feel guilty when I take time off from my job.</td>
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<td></td>
<td></td>
<td>1 = Strongly disagree</td>
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<td></td>
<td></td>
<td>2 = Disagree</td>
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<td></td>
<td></td>
<td>3 = Somewhat disagree</td>
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<td></td>
<td></td>
<td>4 = Neutral</td>
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<td></td>
<td></td>
<td>5 = Somewhat agree</td>
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<td></td>
<td></td>
<td>6 = Agree</td>
<td></td>
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<td></td>
<td></td>
<td>7 = Strongly agree</td>
<td></td>
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<tr>
<td>Variable</td>
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<td>Items (R indicates reverse coded items)</td>
<td>Scoring</td>
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| **Time stress** | Job Stress Scale: Time Stress Subscale (Parker & Decotiis, 1983) | When responding to the following questions, please think back to the last handover that you received.  
1) Working here makes it hard to spend enough time with my family.  
2) I spend so much time at work, I can’t see the forest for the trees.  
3) Working here leaves little time for other activities.  
4) I frequently get the feeling I am married to the company.  
5) I have too much work and too little time to do it in.  
6) I sometimes dread the telephone ringing at home because the call might be job-related.  
7) I feel like I never have a day off.  
8) Too many people at my level in the company get burned out by job demands. | 1 = Strongly disagree  
2 = Disagree  
3 = Somewhat disagree  
4 = Neutral  
5 = Somewhat agree  
6 = Agree  
7 = Strongly agree |
| **Time pressure** | Adapted time pressure scale (Teng et al., 2010) | When responding to the following questions, please think back to the last handover that you received.  
1) At the start of my shift, I felt heavy time pressure.  
2) At the start of my shift, I felt very busy.  
3) At the start of my shift, I felt that I had limited time.  
4) At the start of my shift, I felt in a hurry.  
5) At the start of my shift, I did not have enough time to complete what I should have done. | 1 = Strongly disagree  
2 = Disagree  
3 = Somewhat disagree  
4 = Neutral  
5 = Somewhat agree  
6 = Agree  
7 = Strongly agree |
| **Acute fatigue** | Occupational Fatigue Exhaustion Recovery (OFER-15): Acute Fatigue subscale | When responding to the following questions, please think back to the last time that you received handover.  
1) After a typical work period I have little energy left.  
2) I usually feel exhausted when I get home from work.  
3) My work drains my energy completely every day.  
4) I usually have lots of energy to give to my family or friends (R). | 0 = Strongly disagree  
1 = Disagree  
2 = Somewhat disagree  
3 = Neutral  
4 = Somewhat agree |
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<th>Items (R indicates reverse coded items)</th>
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<tbody>
<tr>
<td>Chronic fatigue</td>
<td>Occupational Fatigue Exhaustion Recovery (OFER-15): Chronic Fatigue subscale (Winwood et al., 2006)</td>
<td>1) I often feel I’m ‘at the end of my rope’ with my work.</td>
<td>0 = Strongly disagree</td>
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<td></td>
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<td>2) I often dread waking up to another day of my work.</td>
<td>1 = Disagree</td>
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<td>3) I often wonder how long I can keep going at my work.</td>
<td>2 = Somewhat disagree</td>
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<td>4) I feel that most of the time I’m just ‘living to work’.</td>
<td>3 = Neutral</td>
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<td>5) Too much is expected of me in my work.</td>
<td>4 = Somewhat agree</td>
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<td>5 = Agree</td>
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<td>6 = Strongly agree</td>
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<tr>
<td>Relationships</td>
<td>Positive Relationships Subscale (Carroll et al., 2012)</td>
<td>When responding to the following questions, please think back to the last handover that you received.</td>
<td>0 = Strongly disagree</td>
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<tr>
<td></td>
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<td>1) I felt positive about this handover.</td>
<td>1 = Disagree</td>
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<td>2) I felt comfortable enough to speak up if I perceived a problem during this handover.</td>
<td>2 = Somewhat disagree</td>
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<td>3) I felt a positive connection with the other nurse during this handover.</td>
<td>3 = Neutral</td>
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<td>4 = Somewhat agree</td>
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<td>5 = Agree</td>
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<td></td>
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<td></td>
<td>6 = Strongly agree</td>
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<td></td>
<td></td>
<td></td>
<td>7 = Strongly agree</td>
</tr>
<tr>
<td>Safety climate</td>
<td>Safety Attitudes Questionnaire : Safety Climate Subscale (Sexton et al., 2012)</td>
<td>1) I would feel safe being treated here as a patient.</td>
<td>1 = Strongly disagree</td>
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<tr>
<td></td>
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<td>2) I am encouraged by my colleagues to report any patient safety concerns I may have.</td>
<td>2 = Disagree</td>
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<td></td>
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<td>3) The culture in this ED makes it easy to learn from errors of others.</td>
<td>3 = Somewhat disagree</td>
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<td>4) I receive appropriate feedback about my performance.</td>
<td>4 = Neutral</td>
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<td></td>
<td>5) Medical errors are handled appropriately here.</td>
<td>5 = Somewhat</td>
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<td></td>
<td></td>
<td>6) I know the proper channels to direct questions regarding patient safety</td>
<td>6 = Strongly agree</td>
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<td>Variable</td>
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| 2006)    |         | in this ED. 7) In this ED, it is difficult to discuss errors. (R) | agree  
|          |         |                                        | 6 = Agree  
|          |         |                                        | 7 = Strongly agree |
| Technology | Researcher created | There are technologies available to enhance the delivery of handover communication, these include electronic medical records, bedside documentation devices, and handheld applications. Thinking back to the last handover that you received, please indicate your level of agreement with the following statement. 1) Technology available in my Emergency Department made it easier for me to receive handover communication. Please indicate the types of technology that you used when you last received handover (Check all that apply):  
|          |         | o Electronic medical record  
|          |         | o Bedside documentation technology  
|          |         | o Handheld applications  
|          |         | o Other, please specify | 1 = Strongly disagree  
|          |         |                                        | 2 = Disagree  
|          |         |                                        | 3 = Somewhat disagree  
|          |         |                                        | 4 = Neutral  
|          |         |                                        | 5 = Somewhat agree  
|          |         |                                        | 6 = Agree  
|          |         |                                        | 7 = Strongly agree |
| Face-to-face communication | Researcher created | Handover communication can take place using a variety of different modes of communication (e.g., tape recorded, read, or verbally face-to-face). 1) Was the last shift handover communication that you received face-to-face? 2) If handover communication was not face-to-face, how was it delivered?  
|          |         | o Tape recorded  
|          |         | o Written  
|          |         | o Other. Please specify | 0 = No  
<p>|          |         |                                        | 1 = Yes |</p>
<table>
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<th>Variable</th>
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<th>Items (R indicates reverse coded items)</th>
<th>Scoring</th>
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</table>
| **Handover tools**            | Researcher created             | Some Emergency Department use tools such as checklists or mnemonic devices (e.g., SBAR, ISHARED, IPASSTHEBATON, etc.) during handover communication.  
  1) Was the last shift handover that you received guided by a handover tool?  
  2) If handover was guided by a tool, what type of tool was used?  
    o Checklist  
    o Mnemonic device such as SBAR, ISHARED, IPASSTHEBATON  
    o Other. Please specify.                                                                 | 0 = No  
                              |                                 | 1 = Yes                                                                   |                       |
| **Patient / family participation** | Researcher created          | Some Emergency Departments include patients and / or family members in shift handover communication. This may be at the bedside or in a conference room.  
  1) During the last shift handover that you received, was the patient and / or family included in a face-to-face discussion?                                                                }| 0 = No  
                              |                                 | 1 = Yes                                                                   |                       |
| **Nurse experience**          | Researcher created, adapted from Benner (1982) | Using the definitions below (adapted from Benner, 1982), how would you describe your current level of experience in the Emergency Department? Choose only one.  
  o **Novice** (beginner with no experience, aware of general rules to guide practice)  
  o **Advanced beginner** (limited experience, rely on policies and procedures to guide practice in addition to experience)  
  o **Competent** (plans actions based on conscious, abstract, and analytical thinking and understands actions in terms of long range goals)  
  o **Proficient** (understands situations in their entirety, uses holistic understanding to improve decision-making, anticipates situations and plans accordingly)  
  o **Expert** (no longer relies on rules or guidelines to determine)                                                                                   | 1 = Novice  
                              |                                 | 2 = Advanced beginner  
                              |                                 | 3 = Competent  
                              |                                 | 4 = Proficient  
<pre><code>                          |                                 | 5 = Expert                                                                  |                       |
</code></pre>
<table>
<thead>
<tr>
<th>Variable</th>
<th>Measure</th>
<th>Items (R indicates reverse coded items)</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>actions, has vast background experience, uses intuition to understand clinical situations</td>
<td></td>
</tr>
<tr>
<td>Other demographic &amp; organizational questions</td>
<td>Researcher created</td>
<td>1) What nursing education you have completed? (Check all that apply)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>o RN diploma</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Baccalaureate degree in Nursing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Masters of Nursing</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>o PhD in Nursing</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>2) Do you hold an Emergency Nursing specialty certificate? N/Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) How many years have you worked as an Emergency Department nurse?</td>
<td></td>
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<td></td>
<td></td>
<td>4) Please indicate your year of birth.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>5) What is your sex? M /F</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>6) How would you describe the hospital where you are currently employed? (Choose only one)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Urban teaching hospital</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Community hospital (greater than 100 beds)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Small hospital (less than 100 beds)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>7) When you received your last shift handover, what type of patient assignment did you have?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Patients on stretchers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Patients in an ambulatory area with stretchers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Patients in a fast track, rapid assessment, or ambulatory area</td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Measure</td>
<td>Items (R indicates reverse coded items)</td>
<td>Scoring</td>
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<tr>
<td></td>
<td></td>
<td>where patients remain in the waiting room</td>
<td></td>
</tr>
<tr>
<td>8)</td>
<td></td>
<td>How long has it been since you last received shift handover? (Please indicate the number of days)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Pilot Test Recruitment Letter

Dear Emergency Department Nurse,

As part of my doctoral dissertation (Factors Influencing Quality of Emergency Department Nurse Shift Handover) at the University of Toronto’s Lawrence S. Bloomberg Faculty of Nursing, I am developing a model of factors that influence quality of handover communication (also known as shift report) among Ontario Emergency Department nurses. Prior to surveying a large population of Emergency Department nurses across Ontario, I am looking for volunteers to pilot test the survey. This study is important because understanding factors that influence handover quality will enable researchers to develop interventions to improve handover in the future. Your participation in pilot testing of my Emergency Department nurse survey will ensure that the survey is clear and easy to complete.

Participation will involve completing the survey while sharing your thoughts about question wording with the researcher. The entire process should take no longer than 60 minutes and can be completed at a time and place that is convenient for you. While completing the survey, you have the option to skip any questions that you do not wish to answer. To be eligible to participate, you must meet the following criteria:

1) Must be a RN providing direct patient care in Hospital X’s Emergency Department
2) Must have at least 6 months of work experience in the Emergency Department
3) Must have worked a shift where you received shift handover at least once in the last 10 days (e.g. not triage).

Your participation in this study is entirely voluntary and there is no requirement to participate. Your participation will be confidential and identifying information such as your name and address will not be linked to study results. Your participation or non-participation in the study will have no impact on your employment.

Study participants will be provided with a gift card to thank them for their time.
If you are interested in participating in this study or have questions, please contact Heather Thomson at heather.thomson@mail.utoronto.ca or by phone at the University of Toronto 416-XXX-XXXX.

Hospital X’s site Principal Investigator for this study is ________, Nursing Unit Administrator, contact information.

Thank you for considering participation in this important pilot testing phase of the study.

Kind regards,

Heather Thomson, RN PhD Candidate
Ann Tourangeau, RN PhD
INVITATION TO PARTICIPATE IN A STUDY ABOUT
NURSE-TO-NURSE HANDOVER COMMUNICATION

As part of my doctoral dissertation at the University of Toronto’s Lawrence S. Bloomberg Faculty of Nursing, I am developing a model of factors that influence quality of handover communication (also known as shift report) among Ontario Emergency Department nurses. Prior to surveying a large population of Emergency Department nurses across Ontario, I am looking for volunteers to pilot test the survey. I would like to invite you to participate in this pilot test because understanding factors that influence handover quality will enable researchers to develop interventions to improve handover in the future.

Participation will involve completing the survey while sharing your thoughts about question wording with the researcher. The entire process should take no longer than 60 minutes and can be completed at a time and place that is convenient for you. While completing the survey, you have the option to skip any questions that you do not wish to answer. To be eligible to participate, you must meet the following criteria:

1) Must be an RN providing direct patient care in Hospital X’s Emergency Department
2) Must have at least 6 months of work experience in the Emergency Department
3) Must have worked a shift where you received shift handover at least once in the last 10 days (e.g., not triage)

Your participation in this study is entirely voluntary and there is no requirement to participate. Your participation will be confidential and identifying information such as your name or address will not be linked to study results. Your participation or non-participation in the study will have no impact on your employment.

Study participants will be provided with a gift card to thank them for their time.
If you are interested in participating in this study or have questions, please contact Heather Thomson at heather.thomson@mail.utoronto.ca or by phone at 416-XXX-XXXX.

Hospital X's site Principal Investigator for this study is ____, Nursing Unit Administrator, contact information.

Thank you for considering participation in this important study.
Appendix D: Pilot Test Consent Form

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title
Factors Influencing Emergency Department Nurse Shift Handover

Investigator

Co-Investigators
Heather Thomson, RN PhD Candidate, Ann Tourangeau, RN PhD

Sponsor
University of Toronto, Lawrence S. Bloomberg Faculty of Nursing

Introduction
You are being asked to take part in a research study. Please read this explanation about the study and its risks and benefits before you decide if you would like to take part. You should take as much time as you need to make your decision. You should ask the study staff to explain anything that you do not understand and make sure that all of your questions have been answered before signing this consent form. Before you make your decision, feel free to talk about this study with anyone you wish. Participation in this study is voluntary.

Background and Purpose
This is the first phase of a two phase research study. The first phase of the study consists of a pilot test of a nurse survey looking at factors that influence quality of nurse-to-nurse shift handover communication (also known as shift report) in the Emergency Department (ED). The pilot test is important to make sure that the survey is clear and easy to complete for ED nurses. The second phase of this study will include a mail out of this survey to a random sample of ED nurses across Ontario. The overall purpose of this research study is to understand factors that contribute to quality nurse-to-nurse shift handovers. Recent evidence suggests that little is known about the factors that lead to high quality nurse-to-nurse shift handover. By understanding factors that contribute to quality handover, researchers will be able to develop evidence-based interventions to improve shift handover. This research is being conducted as part of a doctoral dissertation at the University of Toronto, which is being supervised by Dr. Ann Tourangeau.
• You have been asked to take part in this research study because you work as a nurse providing direct patient care in Hospital X’s Emergency Department.
• About 5 RNs working in Hospital X’s ED will be included in this pilot test (phase 1 of this study). The survey will not be pilot tested elsewhere.

**Study Design**
• This study is a pilot test of a survey designed to test factors that are believed to influence the quality of nurse-to-nurse handover communication.
• You will be in this study for approximately 60 minutes.

**Study Procedures**
This pilot test will require a one-time face-to-face meeting with the researcher. The researcher will meet with you at a time and place that is convenient for you.

If you agree to participate in this pilot test, you will be asked to complete an 84 question survey about factors that influence the quality of the last shift handover that you received. While completing the survey, you will be asked to think out loud, providing feedback about question clarity and ease of completion. It is estimated that this will take approximately 60 minutes.

**Risks Related to Being in the Study**
There are no medical risks if you take part in this study, but being in this study may make you feel uncomfortable. There is minimal risk that emotional distress or discomfort may be created by some survey questions. Should you experience distress or discomfort while completing this survey, you may refuse to answer questions or stop the survey at any time without providing a reason. Participation in this study is entirely voluntary.

**Benefits to Being in the Study**
You will not receive any direct benefits from being in this study.

**Reimbursement**
As a token of appreciation for participation in this study, you will be provided with a $20 Starbucks gift card. If you withdraw from the study at any time, you will be permitted to keep the gift card.
**Voluntary Participation**

Your participation in this study is voluntary. You may decide not to be in this study, or to be in the study now and then change your mind later. You may leave the study at any time without affecting your employment status. You may refuse to answer any question you do not want to answer, or not answer an interview question by saying “pass”.

We will give you new information that is learned during the study that might affect your decision to stay in the study.

**Confidentiality**

If you agree to participate in this study, the researcher will collect your name and postal code for the purpose of removing you from the phase 2 study mailing list provided by the College of Nurses of Ontario. This way you will not be asked to complete the survey a second time. All information collected during this study will be kept confidential and will not be shared with anyone outside the study unless required by law. You will not be named in any reports, publications, or presentations that may come from this study.

The list containing your personal information (name and postal code) will be kept in a double locked area in the Faculty of Nursing at the University of Toronto. The researcher and her supervisor will be the only people with access to the information. Once your name has been removed from the phase 2 study mailing list, the list containing your information will be physically and securely destroyed.

Representatives of Hospital X’s Research Ethics Board may look at the study records and at your personal information to check that the information collected for the study is correct and to make sure the study followed proper laws and guidelines.

If you decide to leave the study, the information about you that was collected before you left the study will still be used. No new information will be collected without your permission.

**In Case You Are Harmed in the Study**

If you become ill, injured or harmed as a result of taking part in this study, you will receive care. The reasonable costs of such care will be covered for any injury, illness or harm that is
directly a result of being in this study. In no way does signing this consent form waive your legal rights nor does it relieve the investigators, sponsors or involved institutions from their legal and professional responsibilities. You do not give up any of your legal rights by signing this consent form.

**Expenses Associated with Participating in the Study**
You will not have to pay to participate in this study.

**Conflict of Interest**
Heather Thomson, the researcher will pay for the costs of doing this study as part of her doctoral dissertation. She has an interest in completing this study. Her interests should not influence your decision to participate in this study. You should not feel pressured to join this study.

**Questions About the Study**
If you have any questions, concerns or would like to speak to the study team for any reason, please call: Heather Thomson at 416-XXX-XXXX.

If you have any questions about your rights as a research participant or have concerns about this study, call Chair of Hospital X’s Research Ethics Board (REB) or the Research Ethics office number at ____. The REB is a group of people who oversee the ethical conduct of research studies. These people are not part of the study team. Everything that you discuss will be kept confidential.

**Consent**
This study has been explained to me and any questions I had have been answered. I know that I may leave the study at any time. I agree to take part in this study.

_________________________  __________________________  ______
Print Study Participant’s Name  Signature  Date

(You will be given a signed copy of this consent form)
My signature means that I have explained the study to the participant named above. I have answered all questions.

_________________________________  ______________________  ____________
Print Name of Person Obtaining Consent  Signature                 Date

Was the participant assisted during the consent process?  □ YES  □ NO

If YES, please check the relevant box and complete the signature space below:

☐ The person signing below acted as a translator for the participant during the consent process and attests that the study as set out in this form was accurately translated and has had any questions answered.

_________________________________  ______________________
Relationship to Participant               Language

☐ The consent form was read to the participant. The person signing below attests that the study as set out in this form was accurately explained to, and has had any questions answered.

_________________________________  ______________________  ____________
Print Name of Witness  Signature                 Date

_________________________________
Relationship to Participant
Appendix E: Study Information Letter

RESEARCH STUDY: FACTORS INFLUENCING QUALITY OF EMERGENCY DEPARTMENT NURSE SHIFT HANOVER

Dear Emergency Department Nurse:

You are invited to participate in a research study about Emergency Department nurse-to-nurse shift handover. You have been invited to participate because you work as a nurse providing direct patient care in an Ontario Emergency Department and have indicated that you are interested in participating in research on your College of Nurses of Ontario registration form.

The purpose of this research is to understand factors that contribute to quality nurse-to-nurse shift handovers from the perspective of receiving nurses. Nurse-to-nurse shift handover is the exchange of information between nurses that occurs during shift change. Although a number of handover interventions have been developed, little is known about the factors that lead to high quality handover. By understanding factors that contribute to quality handover, evidence-based interventions can be developed to improve shift handover. This research is being conducted as part of a doctoral dissertation at the University of Toronto, which is being supervised by Dr. Ann Tourangeau.

In order to make a decision about whether or not you wish to participate in this study, you should understand enough about its risks and benefits to be able to make an informed decision. This is known as the informed consent process. Please ensure all of your questions have been answered to your satisfaction before participating in the survey. All research is voluntary. Your decision to participate, or not to participate, or to later withdraw participation may be done without explanation and without any consequences to your employment. You are able to withdraw from the study even after the survey has been returned by mail.

If you have worked in the Emergency Department for at least 6 months providing direct patient care and have received shift handover at least once in the past 10 days (e.g., not triage or float), you are invited to participate in this study. If you agree to participate in this study phase, you are asked to complete and return the enclosed survey. I estimate that this will take approximately 30 minutes.

The survey asks you to identify which work-related factors and life situations may influence the quality of shift handover that you last received. Although this study is focused on the perceptions of nurses who have received shift handover, the intention is not to minimize the importance of sent shift handover. Both the sending and
receiving aspects of nurse-to-nurse shift handover are integral to safe patient care. The perspective of receiving nurses is being investigated in this study to make data collection and study results more focused.

All survey information will be kept confidential and anonymous. Only a study number will be used to identify you. Your identity will not be known as your name will not appear on the survey. Only your unique study number appears on your survey and your return envelope (for mailing and re-mailing purposes ONLY). This study number is important for me to keep track of who has returned either a completed or blank survey.

All of your responses will be strictly confidential and only my PhD supervisory committee and I will have access to information collected about you and your perceptions. No names or identifying information will be used in any presentation or report that may be published. Only summarized group information will be presented. Your completed survey will be included in the survey database with a study number only. All information will be securely locked in a research office at the Faculty of Nursing, University of Toronto for a period of two years, after which it will be securely and physically destroyed. Electronic data files will be stored in a password protected computerized database. Aggregated data (not containing personal information) will be reported in my doctoral dissertation, as well as in future publications. If you wish to receive a copy of study results, please do not hesitate to contact me at heather.thomson@mail.utoronto.ca.

There are no known risks involved in participating in this study. However, there is minimal risk that emotional distress or discomfort may be created by some survey questions. Should you experience distress or discomfort while completing this survey, you can suspend or end your participation in the study without providing a reason. You may also choose to return an incomplete survey if there are questions that you do not wish to answer. Participation in this study is entirely voluntary.

As a token of appreciation for considering participation in this study, a charitable donation will be made to charity. A choice of 3 charities is offered including the Ronald McDonald House, Heart & Stroke Foundation or United Way. You may receive no other direct benefits from being in this study, although you may find that completing this survey provides an opportunity to reflect upon shift handover. The information you provide will assist in understanding the factors that contribute to the quality of nurse-to-nurse shift handover in the Emergency Department. This information will contribute to the development of appropriate strategies to improve the quality of Emergency Department shift handover.
If you do not work as a nurse providing direct patient care in an Emergency Department in Ontario or you have not received shift handover communication in the last 10 days or you do not wish to participate in the survey, we encourage you to place the uncompleted survey into the stamped and addressed return envelope and place it in the mail. This way, you will not be sent an additional follow-up survey.

If you have any questions or concerns about the study, you can contact me at 416-XXX-XXXX or heather.thomson@mail.utoronto.ca.

If you have any concerns or questions about your rights as a research participant in this study, please contact the Office of Research Ethics, University of Toronto at (416) 946-3273 or by email at ethics.review@utoronto.ca.

Consent

I understand that by returning a completed survey, I have consented to being included in the above mentioned study and any questions I have were addressed to my satisfaction. I understand that my participation is voluntary and that I may withdraw at any time without consequences. I understand that I will not benefit from my involvement in the study and that a copy of this form has been given to me. I voluntarily consent to participate in this study.

Thank you very much for considering participating in this study.

Sincerely,

Heather Thomson RN, PhD Candidate

Ann Tourangeau RN, PhD, Doctoral Supervisor

DISCLAIMER

The College of Nurses of Ontario’s involvement in this research is limited to the provision of a mailing list. The College does not endorse or participate in this research in any manner.
Appendix F: ED Nurse Survey

Please return this survey in the pre-addressed, postage-paid envelope to:

Heather Thomson, RN, Doctoral Candidate
Lawrence S. Bloomberg Faculty of Nursing
University of Toronto
130 - 155 College Street
Toronto, Ontario M5T 1P8

If you have any questions about this survey, please contact:
heather.thomson@mail.utoronto.ca
416-978-6913

RESEARCH STUDY:
Factors Influencing Quality of Emergency Department Nurse-to-Nurse Shift Handover

Introduction: You are invited to participate in this study that is designed to gain a better understanding of factors that influence quality of nurse-to-nurse shift handover communication (also known as shift report). The enclosed survey is confidential and anonymous, and only grouped data will be used for research purposes. Your name will not appear on the survey or in the survey database. A study number identifies who you are for the purposes of mailing surveys and reminders. As a token of appreciation for considering participation in this study, a charitable donation will be made on your behalf to one of three charities.

When you are completing this survey, please think back to the most recent handover that you RECEIVED. Upon survey completion, please return the survey by mail using the postage paid return envelope.

Please complete this survey ONLY if you meet the following criteria:

1) You are a Registered Nurse providing direct patient care in an Emergency Department (ED) in Ontario.
2) You have been working in the Emergency Department for at least 6 months.
3) You have received shift handover in the last 10 days (e.g., not float or triage).

If you do not work in an Emergency Department in Ontario, if you have not been working in the Emergency Department for at least 6 months, if you have not received shift handover in the last 10 days, OR if you do not wish to participate in this study, please place an X in the appropriate box below and return the blank survey in the pre-addressed postage paid envelope. This will ensure that we remove your contact information from the mailing list and we DO NOT contact you again about this study.

[ ] I DO NOT WORK IN AN EMERGENCY DEPARTMENT IN ONTARIO
[ ] I DO NOT HAVE AT LEAST 6 MONTHS OF EMERGENCY DEPARTMENT EXPERIENCE
[ ] I HAVE NOT RECEIVED SHIFT HANDEOVER IN THE LAST 10 DAYS
[ ] I DO NOT WISH TO PARTICIPATE IN THIS STUDY

© This survey may not be copied or used without the permission of the Principal Investigator, Heather Thomson
When completing this survey, please think back to the LAST time that you RECEIVED shift handover (also known as shift report).

SECTION A: YOUR HOSPITAL & LAST SHIFT WORKED

1. How would you describe the hospital where you are currently employed? (Select only one)
   - [ ] Urban teaching hospital
   - [x] Community hospital (more than 100 beds)
   - [ ] Small hospital (less than 100 beds)

2. When you last RECEIVED shift handover, for what type of patient assignment did you receive handover? (Select the one most relevant)
   - [ ] Patients on stretchers
   - [ ] Patients on stretchers in an ambulatory area
   - [ ] Patients in a fast track, rapid assessment, or ambulatory area where patients remain in the waiting room

3. How long has it been since you last RECEIVED shift handover? (Please indicate the number of days, today would be 0)
   __________ # of Days Ago

SECTION B: LAST HANDOVER EXPERIENCE

A quality handover is defined as nurse-to-nurse communication that includes a discussion of patient care and assessment information, information that is provided in a timely and organized manner, and creating a shared understanding by providing opportunities for questions and clarification. Based on this definition, please respond to the following question:

1. Overall, the quality of the last handover I RECEIVED was:
   - Poor
   - Fair
   - Good
   - Very Good
   - Excellent
   - [ ]
   - [ ]
   - [ ]
   - [ ]

Please CIRCLE the extent to which you agree or disagree with each statement regarding the LAST shift handover that you RECEIVED.

<table>
<thead>
<tr>
<th>Generally speaking, would you say that...</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. The information provided to me during handover helped me to prioritize patient care.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>3. Handover followed a logical/sensible structure.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4. The person handing over the patient continuously used the available documentation (patient chart, etc.) to structure the handover.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>5. Not enough time was allowed for the handover.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>6. All relevant information was selected and communicated.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>7. Priorities for further treatment were addressed.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8. The person handing over the patient clearly communicated her / his assessment of the patient at shift handover.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>9. Possible risks and complications were discussed.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>10. It was easy to establish good contact with the outgoing nurse at the beginning of handover.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>11. There was tension within the team during handover.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
Please **CIRCLE** the extent to which you agree or disagree with each statement regarding the LAST shift handover that you **RECEIVED**.

<table>
<thead>
<tr>
<th>Generally speaking, would you say that...</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Questions and ambiguities about patients were resolved during shift handover.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>13. The team jointly ensured that the handover was complete.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>14. Documentation was complete.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>15. The patient’s experience was considered carefully during handover (respect).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

Please consider the following information when responding to the next question:

There are technologies available to enhance the delivery of handover communication, these include electronic medical records, bedside documentation devices, and handheld applications.

Thinking back to the last handover that you **RECEIVED**, please indicate your level of agreement with the following statement.

16. **Technology is available in my Emergency Department to make it easier for me to RECEIVE handover communication.**

<table>
<thead>
<tr>
<th>Strongly disagree / technology is not available</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

17. Please indicate the types of technology that you used when you last **RECEIVED** handover (Select all that apply):

- ☐ Electronic medical record
- ☐ Bedside documentation technology
- ☐ Handheld applications
- ☐ Other. Please specify ____________________________

Please consider the following information when responding to the next question:

Handover communication can take place using a variety of different modes of communication (e.g., tape recorded, read, or verbally face-to-face).

18. Was the last shift handover communication that you **RECEIVED** face-to-face?

- ☐ No
- ☐ Yes - If yes, please go to question # 20

19. If handover communication was not face-to-face, how was it delivered?

- ☐ Tape recorded
- ☐ Written
- ☐ Other. Please specify ____________________________

Some Emergency Departments include patients and/or family members in shift handover communication. This may be at the bedside or in a conference room.

20. During the last shift handover that you **RECEIVED**, was the patient and/or family included in a face-to-face discussion?

- ☐ No or Not Applicable
- ☐ Yes
Please consider the following information when responding to the next question:

Some Emergency Departments use structured handover tools such as checklists or mnemonic devices (e.g., SBAR, ISHARED, IPASSTHEBATON, etc.) during handover communication.

21. Was the last shift handover that you RECEIVED guided by a structured handover tool?
   □ Yes
   □ No - if no, please go to question # C1

22. If handover was guided by a tool, what type of tool was used? (Select all that apply):
   □ Checklist
   □ Mnemonic device such as SBAR, ISHARED, IPASSTHEBATON
   □ Other. Please specify________________________

SECTION C: YOUR WORK ENVIRONMENT

Please consider the following information when responding to the next question:

An intrusion is defined as an unexpected encounter initiated by another individual that disrupts handover and causes it to stop temporarily. The intrusion can negatively impact the delivery of handover if the intrusion leaves little time for handover OR the intrusion can assist with handover by presenting relevant information (for example, critical lab results).

1. How would you rate the overall impact of Intrusions on your ability to RECEIVE handover communication?

<table>
<thead>
<tr>
<th>Very negative impact</th>
<th>Negative impact</th>
<th>Neutral / no impact</th>
<th>Positive impact</th>
<th>Very positive impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

2. If intrusions were experienced during the last handover that you RECEIVED, please identify the source(s). (Select all that apply):
   □ Patients
   □ Families
   □ Colleagues
   □ Other. Please specify________________________

3. How would you rate the overall impact of Distractions on your ability to RECEIVE handover communication?

<table>
<thead>
<tr>
<th>Very negative impact</th>
<th>Negative impact</th>
<th>Neutral / no impact</th>
<th>Positive impact</th>
<th>Very positive impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

4. If Distractions were experienced during the last handover that you RECEIVED, please identify the source(s). (Select all that apply):
   □ Call bells
   □ Alarms from IV pumps
   □ Alarms from monitors
   □ Background noise or chatter
   □ Other. Please specify________________________

5. Overall, how would you rate the flow of patients through triage in your Emergency Department at the beginning of the last shift when you RECEIVED handover?

   | Poor, there were frequent patient backlogs | Marginal, there were occasional patient backlogs | Good, patients flowed smoothly into the department |
   | □                                            | □                                        | □                                      |

6. Considering the workload at the beginning of your last shift when you RECEIVED handover, how would you describe the level of nurse staffing?

   | Inadequate, unable to manage workload demands | Marginal, it was difficult but possible to manage workload demands | Adequate, able to manage workload demands |
   | □                                        | □                                      | □                                      |
SECTION D: COGNITIVE PROCESSING

Please consider the following information when responding to the next question:

Cognitive capacity is defined as having sufficient mental space to be able to carry out cognitive work such as information processing and decision making. Cognitive capacity can be negatively impacted by factors such as stress and fatigue.

While considering the above definition, please indicate your level of agreement with the following statements.

1. The last time that I received handover, I felt that I had enough cognitive capacity to receive and process information.

   Strongly disagree  Disagree  Somewhat disagree  Neutral  Somewhat agree  Agree  Strongly agree
   □  □  □  □  □  □  □

2. The last time that I received handover, I was able to focus my attention on the information that I was receiving.

   Strongly disagree  Disagree  Somewhat disagree  Neutral  Somewhat agree  Agree  Strongly agree
   □  □  □  □  □  □  □

SECTION E: YOUR RELATIONSHIP WITH THE OUTGOING NURSE

Please circle the extent to which you agree or disagree with each statement regarding the last shift handover that you received.

<table>
<thead>
<tr>
<th>Please indicate your level of agreement with the following statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I felt positive about this handover.</td>
<td>1  2  3  4  5  6  7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I felt comfortable enough to speak up if I perceived a problem during this handover.</td>
<td>1  2  3  4  5  6  7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I felt a positive connection with the other nurse during this handover.</td>
<td>1  2  3  4  5  6  7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION F: YOUR FEELINGS ABOUT WORK DURING LAST HAN.DOVER

Please circle the extent to which you agree or disagree with each statement regarding the last shift handover that you received.

<table>
<thead>
<tr>
<th>Please indicate your level of agreement with the following statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. At the start of my shift, I felt time pressure.</td>
<td>1  2  3  4  5  6  7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. At the start of my shift, I felt very busy.</td>
<td>1  2  3  4  5  6  7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. At the start of my shift, I felt that I had limited time for handover.</td>
<td>1  2  3  4  5  6  7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. At the start of my shift, I felt in a hurry.</td>
<td>1  2  3  4  5  6  7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. At the start of my shift, I did not have enough time to complete what I should have done.</td>
<td>1  2  3  4  5  6  7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION G: YOUR FEELINGS ABOUT WORK IN GENERAL

Please CIRCLE the extent to which you agree or disagree with each of the following statements related to feelings about your work in general.

<table>
<thead>
<tr>
<th>Please indicate your level of agreement with the following statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have felt fidgety or nervous as a result of my job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2. My job gets to me more than it should.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>3. There are lots of times when my job drives me right up the wall.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4. Sometimes when I think about my job, I get a tight feeling in my chest.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>5. I feel guilty when I take time away from my job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>6. Working here makes it hard to spend enough time with my family.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>7. I spend so much time at work, I can’t see the forest for the trees.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8. Working here leaves little time for other activities.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>9. I frequently get the feeling I am married to the company.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>10. I have too much work and too little time to do it in.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>11. I sometimes dread the telephone ringing at home because the call might be job-related.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>12. I feel like I never have a day off.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

Please CIRCLE the extent to which you agree or disagree with each of the following statements related to feelings about your work in general.

<table>
<thead>
<tr>
<th>Please indicate your level of agreement with the following statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Too many people at my level in the company get burned out by job demands.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>14. After a typical work period I have little energy left.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>15. I usually feel exhausted when I get home from work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>16. My work drains my energy completely every day.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>17. I usually have lots of energy to give to my family or friends.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>18. I usually have plenty of energy left for my hobbies and other activities after I finish work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>19. I often feel I’m ‘at the end of my rope’ with my work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>20. I often dread waking up to another day of my work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>21. I often wonder how long I can keep going at my work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>22. I feel that most of the time I’m just ‘living to work’.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>23. Too much is expected of me in my work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
SECTION H: SAFETY CLIMATE

Please **CIRCLE** the extent to which you agree or disagree with each of the following statements related to feelings about your **work in general**.

<table>
<thead>
<tr>
<th>Please indicate your level of agreement with the following statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The levels of staffing in this ED are sufficient to handle the number of patients.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2. I would feel safe being treated here as a patient.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>3. I am encouraged by my colleagues to report any patient safety concerns I may have.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4. Health team members frequently disregard rules or guidelines (e.g., hand-washing, treatment protocols/clinical pathways, sterile field, etc.) that are established for this ED.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>5. The culture in this ED makes it easy to learn from errors of others.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>6. I receive appropriate feedback about my performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>7. Medical errors are handled appropriately here.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

Please **CIRCLE** the extent to which you agree or disagree with each of the following statements related to feelings about your **work in general**.

<table>
<thead>
<tr>
<th>Please indicate your level of agreement with the following statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neutral</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. I know the proper channels to direct questions regarding patient safety in this ED.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>9. In this ED, it is difficult to discuss errors.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>10. Hospital management does not knowingly compromise the safety of patients.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>11. This institution is doing more for patient safety now, than it did one year ago.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>12. Hospital leadership is driving us to be a safety-centered institution.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>13. My suggestions about safety would be acted upon if I expressed them to management.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
SECTI ON I: YOUR INFORMATION

1. What is your sex?
   □ 1. Male
   □ 2. Female

2. What is your year of birth?
   19

3. Using the definitions below (adapted from Benner, 1982), how would you describe your current level of experience in the Emergency Department? Choose only one.
   □ 1. Novice (beginner with no experience, aware of general rules to guide practice)
   □ 2. Advanced beginner (limited experience, relies on policies and procedures to guide practice in addition to experience)
   □ 3. Competent (plans actions based on conscious, abstract, and analytical thinking and understands actions in terms of long range goals)
   □ 4. Proficient (understands situations in their entirety, uses holistic understanding to improve decision-making, anticipates situations and plans accordingly)
   □ 5. Expert (no longer relies on rules or guidelines to determine actions, has vast background experience, uses intuition to understand clinical situations)

4. What education you have completed? (Check all that apply)
   
   In Nursing
   □ 1. RN diploma
   □ 2. Baccalaureate degree
   □ 3. Masters degree
   □ 4. PhD

   Outside of Nursing
   □ 1. Diploma
   □ 2. Baccalaureate degree
   □ 3. Masters degree
   □ 4. PhD

5. Do you hold any of the following Emergency Nursing specialty certificates?
   □ 1. Trauma Nursing Care Course (TNCC)
   □ 2. Emergency Nursing Pediatric Certification Course (ENPC)
   □ 3. CNA Emergency Certification
   □ 4. Other. Please specify________________________

6. How many years have you worked as an Emergency Department nurse?
   ______ Years

To thank you for your participation, please select ONE charitable organization to which a donation will be made on your behalf.

   □ 1. Ronald McDonald House (www.rmhc.canadas.com/)
   □ 2. Heart and Stroke Foundation of Ontario (www.heartandstroke.on.ca)
   □ 3. United Way (www.unitedway.ca)

Please include any additional comments that you have:

_____________________________________________________
_____________________________________________________
_____________________________________________________
_____________________________________________________

THANK YOU FOR YOUR PARTICIPATION IN THIS SURVEY. YOUR VALUABLE TIME IS GREATLY APPRECIATED!!!
Dear Emergency Department Colleague,
You were recently mailed a survey package on the topic of nurse-to-nurse shift handover because you are employed in an Ontario Emergency Department. Your input is valuable to this study. Your participation will lead to further understanding of what influences the quality of nurse-to-nurse shift handover.
If you have already completed this survey, thank you very much for your contribution. If not, I encourage you to do so today.
Thank you,

Heather Thomson, RN, PhD candidate
## Appendix H: Hypotheses Pre and Post Variable Dichotomization

<table>
<thead>
<tr>
<th>Original Hypotheses (Continuous variables)</th>
<th>Revised Hypotheses (Dichotomized variables)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1) Inadequate staffing will negatively influence the quality of handover communication.</td>
<td>Adequate staffing will positively influence the quality of handover communication.</td>
</tr>
<tr>
<td>H2) Backlogs in patient flow through triage will negatively influence the quality of handover communication.</td>
<td>Smooth patient flow through triage will positively influence the quality of handover communication.</td>
</tr>
<tr>
<td>H3) Negative intrusions experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
<td>Positively perceived intrusions experienced by the incoming nurse will positively influence the quality of handover communication.</td>
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<td>H4) Negative distractions experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
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<td>H5) Decreased cognitive capacity experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
<td>Sufficient cognitive capacity experienced by the incoming nurse will positively influence the quality of handover communication.</td>
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<td>H6) Decreased focus of attention experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
<td>Adequate focus of attention experienced by the incoming nurse will positively influence the quality of handover communication.</td>
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<td>H7) High anxiety experienced by the incoming nurse will negatively influence the quality of handover communication.</td>
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<td>H15)</td>
<td>Face-to-face communication will positively influence the quality of handover communication.</td>
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<td>H16)</td>
<td>Use of structured handover tools will positively influence the quality of handover communication.</td>
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<td>Patient/family participation in handover will positively influence the quality of handover communication.</td>
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<td>Increased level of incoming nurse experience will positively influence the quality of handover communication.</td>
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<td>H22)</td>
<td>Staffing levels will moderate the relationship between time pressure and handover quality.</td>
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