Analysis of Clinical Data to Examine Utility of Quality Statements for the Management of Patients with Hip Fractures in the Emergency Department

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Bachelor of Science in Nursing with Distinction, University of Alberta, Edmonton, 2002

A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of

Master of Nursing

in the Graduate Academic Unit of Faculty of Nursing

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This thesis is accepted by the
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THE UNIVERSITY OF NEW BRUNSWICK

April, 2019

ABSTRACT

Background. Establishment of quality statements that depict best practice is a first step in improving healthcare delivery and patient outcomes.

Purpose. Examine feasibility of using quality statements to monitor and evaluate the care received by patients with hip fractures in the emergency department (ED).

Method. Retrospective analysis of administrative data to determine proportion of cases attaining the quality statements and examine differences in attainment by patients' age and sex, as well as time and day of presentation.

Results. Data for 191 patients were analysed. Half were over 80 years of age and spent over 7.5 hours in ED. Considerable variability was evident in the rate of attainment of the quality statements. Examined covariates did not help predict attainment.

Conclusion. This investigation is unique because it focuses on quality statements that are sensitive to nursing intervention and provides a foundation for examining the impact of ED nursing care on patient outcomes.

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CHAPTER 1: Introduction

Background

The implementation and evaluation of strategies to improve system efficiencies has been a focus of healthcare service research for more than three decades (Donabedian, 1988; Institute of Medicine (US) Committee on Quality of Health Care in America [IOM], 2001; World Health Organization, 2006). Although system efficiency is a necessary component of quality healthcare, it is recognized as insufficient (Doran & Pringle, 2011; Meisel, Carr, & Conway, 2012; Schull et al., 2011; Vermeulen et al., 2015). Increasingly, healthcare facilities and units, including the emergency department (ED), are attempting to demonstrate the quality of their service not only in terms of system efficiencies but also the outcomes of care (Donabedian, 2003; Doran & Pringle, 2011; Health Council of Canada, 2013; IOM, 2001; World Health Organization, 2006). In particular, healthcare facilities are attempting to demonstrate their effect on outcomes that positively impact and are meaningful to the recipients of their services (Canadian Institute of Health Research [CIHR], 2011; Schull et al., 2011).

A first step in improving the quality of healthcare is the establishment of explicit statements of what constitutes best practice within a specific health context (Agency for Healthcare Research and Quality [AHRQ], 2017b; IOM, 2011). These statements provide a basis for identifying measurable aspects of care in order to evaluate the quality of practice performance (i.e., quality measures). Key attributes of quality measures are that they are performance focused, measurable, sensitive to change and use readily accessible clinical data (National Institute for Health and Care Excellence [NICE], 2014). The extent that the quality measures are observed in practice provides an

indication of the quality of the care provided and the likelihood of attaining optimal patient outcomes (AHRQ, 2017b; IOM, 2001; NICE, 2014). To date work on the development of quality statements has largely been conducted in the United Kingdom (UK; NICE, 2014) and Australia (Australian Institute of Health and Welfare [AIHW], 2017). Work is needed to establish quality statements for the Canadian context, beginning in areas identified as priorities for practice improvement. Based on my clinical experience as an emergency nurse and discussions with representatives from the local ED program network, a practice issue identified as a priority for the establishment of quality statements is the pre-operative management of patients who sustain a hip fracture, particularly the care received in the ED. The management of patients with hip fractures in the ED warrants the development of quality statements, because this is the point of entry into the healthcare system for most of these patients (Castelli, Daidone, Jacobs, Kasteridis, & Street, 2015; Swift, Ftouh, Langford, Chesser, & Johanssen, 2016; Waddell et al., 2010), and where many may spend a large portion of the pre-operative period.

Hip fractures have been described as one of the most serious osteoporotic fractures and musculoskeletal injuries world-wide (Johnell & Kanis, 2006; A. Woolf & Pfleger, 2003). Approximately 30,000 Canadians experience a hip fracture each year (Osteoporosis Canada, 2013; Tarride et al., 2012). This type of fracture most commonly affects older adults (Leslie et al., 2009), who are at higher risk for experiencing adverse events and poorer long-term outcomes, such as loss of independence, institutionalization, and 1-year mortality rates of 20% (Aminzadeh & Dalziel, 2002; McCabe & Kennelly, 2015; Samaras, Chevalley, Samaras, & Gold, 2010). Such

outcomes increase costs not only for patients and their families but also the healthcare system (Cummings & Melton III, 2002; Haentjens et al., 2010; Martinez-Reig, Ahmad, & Duque, 2012). In the province of New Brunswick, it has been estimated that over 800 patients are admitted to hospital with hip fractures annually (Osteoporosis Canada, 2013). Further, not only does New Brunswick have the oldest population among the provinces (19.9% aged 65 years or older compared to 12.3% in Alberta; Statistics Canada, 2017), it also has a statistically significantly higher age-standardized (65 years and older) rate of hip fractures (589 per 100,000) when compared to the whole of Canada (500 per 100,000; Canadian Institute for Health Information [CIHI], 2015b). Given this, it is important to ensure that patients with hip fractures in New Brunswick receive care that optimizes their recovery. However, beyond the established quality statement (benchmark) for surgery within 48 hours of presentation to an acute care facility (CIHI, 2016; Orosz et al., 2004; Vidal et al., 2009; Waddell et al., 2010), quality statements for the pre-operative management of patients with hip fractures are currently not available in Canada. This is problematic because there is evidence to support that care received prior to surgery impacts long-term recovery (Clague, Craddock, Andrew, Horan, & Pendleton, 2002; Lucki, Napier, & Wagner, 2012; Orosz et al., 2004; Vidal et al., 2009; Wendt et al., 2016).

Quality statements are ideally derived from the recommendations contained within high-quality clinical practice guidelines that are based on the best available evidence (AHRQ, 2017a; IOM, 2011; NICE, 2014; S. H. Woolf, Grol, Hutchinson, Eccles, & Grimshaw, 1999). Because a search for clinical practice guidelines on the management of hip fractures yielded five clinical practice guidelines, I completed an

evidence synthesis, in the form of an umbrella review, to appraise the quality of the clinical practice guidelines using the instrument developed by the Appraisal of Guidelines Research and Evaluation (AGREE) Research Trust (Brouwers et al., 2010). I synthesized and grouped the recommendations addressing aspects of the pre-operative management of patients with hip fractures into six categories: timely surgery, expedited patient management, multidisciplinary approach to care, identification and treatment of correctable co-morbidities, pain management, and implementation of measures to prevent common complications. Details of this work have been published in an international peer-reviewed journal (Filiatreault, Hodgins, & Witherspoon, 2018). In preparation for my thesis research, I undertook the task of developing a set of quality statements for the management of patients with hip fracture in the ED that aligned with the recommendations found in the clinical practice guidelines and were performance focused, measurable and based on the best-available evidence. The creation of these statements was also informed by an examination of existing organizational and bibliographic databases for quality statements and measures, as well as published research investigating quality measures for the pre-operative management of patients with a hip fracture. This work resulted in the development of seven quality statements addressing the pre-operative management of patients with hip fracture in the ED that are sensitive to nursing intervention.

Purpose of Study

A retrospective analysis of electronically-available clinical data was conducted to examine the feasibility of using the developed set of quality statements to monitor and evaluate current practices. It is hoped that study findings will provide regional

stakeholders with baseline information about the care received by patients with hip fractures that can affect health outcomes and inform decisions about the quality of ED care provided, as well as areas that could be improved. This study also demonstrates the role nurses can play in establishing quality statements that reflect nursing's contribution to quality patient care.

CHAPTER 2: Literature Review

Conceptualization of Quality Statements

Much of the research on healthcare quality has been based on the seminal work of Donabedian (AIHW, 2017; Donabedian, 1988, 2003; NICE, 2014). In his conceptualization of healthcare quality and its evaluation, Donabedian (2003) defines three aspects of care provision: structure, process and outcome. Structure relates to the conditions under which care is provided, and includes: material resources (such as, available facilities and equipment); human resources (such as, healthcare provider staff mix); and organizational characteristics (such as, the number of beds and facility designation; Donabedian, 2003). Process encompasses activities or interventions pertaining to the diagnosis, treatment, rehabilitation and prevention of health conditions which are often operationalized in terms of time intervals (Donabedian, 2003). Outcomes relate to changes in the individual or population that can be attributed to healthcare, and can include changes in health status, as well as the knowledge, behaviors and satisfaction levels of patients and their significant others (Donabedian, 2003).

One of the main goals of healthcare quality research is to establish the causal links among the aspects of care: structure, process and outcome (Donabedian, 2003). The recommendations found in high-quality clinical practice guidelines support this goal by identifying the aspects of structure and process that increase the likelihood of attaining optimal outcomes for specific healthcare contexts. High-quality clinical practice guidelines provide an explicit link between each recommendation and its supporting evidence which may vary in strength from strong (such as, findings from randomized control trials) to very weak (expert opinion or consensus). Although in an

ideal world all clinical decisions would be based on high-quality evidence, this is not the current reality. It has been reported that as much as 50% of clinical decisions are based on expert opinion or tradition (Ebell, Sokol, Lee, Simons, & Early, 2017).

During the development of my thesis research, I worked from the assumption that quality statements about what constitutes best practice could be created from recommendations that stem from evidence linking the process and outcomes of care. These statements can be operationalized by identifying measurable aspects of care to evaluate practice quality.

Retrieving the Evidence

A multi-phased search was conducted to retrieve existing clinical practice guidelines, quality statements and quality measures addressing the pre-operative management of patients with hip fractures who present to an ED. The purpose of the first search was to retrieve relevant clinical practice guidelines, a description of the search strategy can be found in a paper that I wrote as part of an independent study (Filiatreault et al., 2018). Although the retrieved clinical practice guidelines were limited to those written in English, they provide an international perspective, as they were developed by groups in six countries: Australia and New Zealand, Canada, Scotland, the United Kingdom (UK), and the United States of America (USA). The year of last review or update for the five clinical practice guidelines ranged from 2009 to 2017. During the development of the quality statements, I also made use of summary documents published by members of two of the guideline development groups (Roberts & Brox, 2015; Swift et al., 2016).

Three organizations were identified that develop and maintain databases for the dissemination of quality statements and measures: the National Quality Measure Clearinghouse (NQMC [USA]; AHRQ, 2017c), the Australian Institute of Health and Welfare (AIHW, 2017), and the National Institute of Health and Care Excellence (NICE, 2017c [UK]). These databases were searched for relevant quality statements (or measures if statements were not available) for pre-operative management, using the keyword 'hip fracture'. This search resulted in: 1 quality measure from the NQMC (AHRQ, 2017c), 2 quality statements from the NICE (2017c), and 4 quality statements from the AIHW (2017; see Appendix A).

To examine how other researchers have studied quality measures for the management of patients with hip fractures in the ED I conducted a structured search of the Cumulative Index to Nursing and Allied Health (CINAHL) and PubMed bibliographic databases was conducted. Citations were excluded if they indexed materials that examined or evaluated the implementation of clinical pathways, programs, or interventions with no quality measure for the pre-operative period; examined quality measures for conditions other than hip fracture; did not address the pre-operative or ED period; or were written in a language other than English. A date limit was not placed on the search. The search involved a combination of keywords and Subject Headings addressing three components: hip fractures, quality measures, and emergency department (see Appendix B). The final search was conducted in two steps. First, the Subject Heading(s) and keywords for each of the three search components were combined using the Boolean operator 'OR' to retrieve citations with any of the terms. Then, the results of the three searches were combined using the Boolean operator 'AND'

to narrow the retrieved citations to those that included all the search components. Twenty-five articles were retrieved from PubMed and 43 from CINAHL. Titles and abstracts were reviewed and articles that did not meet eligibility criteria were removed. The citations were then exported to a reference manager program (Zotero), citations were merged and duplicates removed, resulting in 26 articles for full-text review. Articles were further assessed for eligibility and their reference lists were reviewed to identify other relevant publications.

I retained five articles for synthesis in this literature review. Reasons for excluding articles were grouped into three categories: generic quality measures (n = 5; e.g., examined general quality measures for various conditions); quality measures that did not pertain to the ED (n = 9); and no examination of quality measures (n = 4; examined the implementation of a specific program or intervention). In addition, a scoping review that was completed by Canadian researchers and focused on the identification of current or potential quality measures for the management of patients with hip fractures throughout the healthcare continuum (Pitzul et al., 2017) was excluded because the authors grouped all acute care services together and did not specify any quality measures for the ED. The five retained articles summarized retrospective studies and were published between 2009 and 2016 (see Appendix C). Interestingly, only one study exclusively examined the use of quality measures for patients with hip fractures in the ED (Taylor & Nairn, 2012). The retrieved studies provide an international perspective on this practice issue as the findings are based on data from the UK, Canada, Denmark, and the USA. Of the included studies, three involved nationally representative samples (Kristiansen, Kristensen, Nørgård, Mainz, &

Johnsen, 2016; Neufeld et al., 2016; Youde et al., 2009), and two were single site studies (Frood & Johnson, 2010; Taylor & Nairn, 2012).

Recommendations and Quality Statements

Based on my review and synthesis of the five clinical practice guidelines, I grouped the recommendations into six categories: timely surgery, expedited patient management, multidisciplinary approach to care, identification and treatment of correctable co-morbidities, pain management, and implementation of measures to prevent common complications. Three of the clinical practice guidelines provide a rating to indicate the strength of the supporting evidence for each recommendation; the Grading of Recommendations Assessment, Development and Evaluation (GRADE) method was used for two of the clinical practice guidelines (American Academy of Orthopaedic Surgeons [AAOS], 2014; National Clinical Guideline Centre [NCGC], 2011; NICE, 2017a), while a pre-developed, network-specific method was used for the other (Scottish Intercollegiate Guidelines Network [SIGN], 2009; see Table 1). Although ratings are provided in the Australian and New Zealand Hip Fracture Registry (ANZHFR, 2014) they were taken directly from the NICE clinical practice guideline (the parent clinical practice guideline; NCGC, 2011). The Bone and Joint Health Network Canada (BJHN-C) clinical practice guideline provides no indication of the strength of the evidence supporting its recommendations (Waddell et al., 2010). The number of recommendations put forward in the clinical practice guidelines relevant to the pre-operative period ranges from 8 (AAOS, 2014) to 20 (Waddell et al., 2010). These recommendations were used to develop seven statements for what constitutes

quality management for patients with a hip fracture in the ED that are sensitive to nursing intervention.

Table 1.
Grading Methods Used by Clinical Practice Guideline Development Groups

Evidence Appraisal Rating Method	
GRADE	**ABCD**
High	A
Moderate	B
Low	C
Very Low	D

References: Balshem et al. (2011), Guyatt et al. (2011), SIGN (2009)

Timely Surgery

Although time to surgery is not directly affected by nursing intervention, it is a widely accepted standard of care. All the clinical practice guidelines contain a recommendation for timely surgery, with the strength of the evidence ranging from moderate for the recommendation for surgery within 48 hours (AAOS, 2014) to weak for the recommendations for surgery within 36 hours (NCGC, 2011; NICE, 2017a) or as soon as possible after presentation (SIGN, 2009). Although the evidence for timely surgery has been described as "inconsistent and limited" (Neufeld et al., 2016, p. 366), it is widely accepted that early surgical repair improves post-operative and long-term outcomes for patients sustaining a hip fracture (AAOS, 2014; ANZHFR, 2014; NCGC, 2011; NICE, 2017a; SIGN, 2009; Waddell et al., 2010). A quality statement and/or measure pertaining to early surgery was also found in each of the quality measure databases (AIHW, 2017; NICE, 2017b; NQMC, 2015). These statements or measures are framed in terms of surgery within 48 hours, with the exception of the statement put forward by the NICE (2017b) which reduces the time to 36 hours. Four of the 5 retrieved articles reported the percentage of cases receiving surgery within 48 hours, with percentages ranging from 69 to 89% (Frood & Johnson, 2010; Kristiansen et al.,

2016; Neufeld et al., 2016; Youde et al., 2009). One of the challenges in investigating this quality statement is the multiple ways in which time to surgery is computed, as the start time has been defined in terms of time from injury, time from ED presentation, or time from inpatient admission. In a comparison of 30-day outcomes for those who received surgery within 36 hours of arrival versus 48 hours Neufeld and colleagues (2016) reported that shorter time to surgery was associated with a lower rate of 30-day mortality (OR 0.88; 95% CI 0.78 to 0.99; $p = .028$) and minor post-operative complications (e.g., urinary tract infection or pneumonia; OR 0.92; 95% CI 0.84 to 0.99; $p = .038$) but not major post-operative complications (e.g., septic shock or stroke; OR 0.93; 95% CI 0.83 to 1.05; $p = .234$). For the purposes of this study, I phrased the quality statement to be consistent with the measure currently used by the Canadian Institute for Health Information (CIHI, 2016) which is surgery within 48 hours of ED presentation:

Quality Statement
A patient presenting to the ED with a suspected hip fracture will receive surgery within 48 hours of arrival.

Expedited Patient Management

Recommendations for expedited patient management exist in the SIGN (2009) and the BJHN-C (Waddell et al., 2010) clinical practice guidelines and are based on expert opinion/consensus. The recommendations include: physician assessment within 1 hour of presentation, specialist assessment(s) (orthopedics, and possibly anesthesia and internal medicine physician) within 2 hours of presentation, and patient transfer to hospital ward within 2 to 4 hours. In two of the articles, time spent in the ED was investigated as a quality measure (Taylor & Nairn, 2012; Youde et al., 2009). In a single

site study, Taylor and Nairn (2012) reported that 93% of cases were transferred from the ED within 4 hours. A lower percentage (77% of cases) was reported by Youde and colleagues (2009) using data from 173 UK hospital trusts. One explanation for these relatively high percentages, is that the National Health Service imposed financial penalties to institutions for not meeting the time target to discharge or transfer patients from the ED within 4 hours (Day & Oldroyd, 2012). Since the release of the SIGN (2009) and BJHN-C (Waddell et al., 2010) clinical practice guidelines, the emphasis on time targets and financial penalties has decreased (Nuffield Trust & The Health Foundation, 2017; Royal College of Physicians, 2017). Given the reduced emphasis on time targets internationally, the lack of recommendations for expedited care that are sensitive to nursing intervention combined with an increased emphasis on a comprehensive approach to care, I decided to frame the quality statement in terms of multidisciplinary practice.

Multidisciplinary Approach to Care

Recommendations supporting multidisciplinary management of patients were found in all the clinical practice guidelines. The establishment of multidisciplinary programs has been identified as integral to the care of patients who sustain a hip fracture (ACSQHC, 2016; NCGC, 2011; NICE, 2017b; Royal College of Physicians, 2017; Swift et al., 2016). However, only three of the clinical practice guidelines recommended multidisciplinary management starting in the ED that was supported by moderate evidence (ANZHRF, 2014; NCGC, 2011; NICE, 2017a; Waddell et al., 2010). Although none of the retrieved articles examined multidisciplinary management, multidisciplinary hip fracture programs have been widely implemented in the UK ('Hip Fracture

Programme'; Royal College of Physicians, 2017), Denmark ('Danish Multidisciplinary Hip Fracture Registry' (Kristiansen et al., 2016), Australia and New Zealand (AZNHRF, 2014), and Sweden (Hommel & Bååth, 2016). The Australian Commission on Safety and Quality Health Care (ACSQHC, 2016) has also put forward a quality statement for the implementation of orthogeriatric models of care (multidisciplinary care model with involvement of geriatric and orthopedic services throughout the plan of care), which begins with the initiation of a multidisciplinary protocol or clinical pathway upon arrival to the ED (ACSQHC, 2016). To help expedite such management, Waddell and colleagues (2010) recommend that policies be put in place to allow nurses to initiate such protocols or clinical pathways. From this review, I developed a quality statement to support multidisciplinary management:

Quality Statement
A patient presenting to the ED with a suspected hip fracture will receive care based on a pre-established multidisciplinary clinical pathway or protocol that can be initiated by nurses.

Identification and Treatment of Correctable Co-Morbidities

Historically, a reason to delay surgery for patients with hip fractures has been the presence of co-morbidities (Swift et al., 2016). Such delays are now viewed as unnecessary and as contributing to a higher incidence of post-operative complications (ACSQHC, 2016; NCGC, 2011; Swift et al., 2016). Rather than delaying surgery, the emphasis has shifted to the early identification and treatment of correctable co-morbidities (i.e., conditions that are secondary to the injury but may complicate the surgical procedure if not ameliorated through intervention; Swift et al., 2016). Recommendations contained in the clinical practice guidelines vary in the strength of the supporting evidence ranging from expert opinion/consensus to moderate, as well as

in the number of conditions to be identified and optimized. The number of conditions identified in the clinical practice guidelines as correctable range from 1 to 6 and include: anemia; altered coagulation status; fluid and electrolyte imbalance; metabolic derangement; cardiac arrhythmia, ischemia, or failure; and acute or chronic respiratory conditions. A quality statement emphasizing the importance of timely identification and treatment of correctable co-morbidities was also found in two of the quality measure databases (AIHW, 2017; NICE, 2017b).

Emergency nurses can be instrumental in the identification of correctable co-morbidities beginning with the assessment of a baseline set of vital signs on patients' arrival to the ED (Taylor & Nairn, 2012). A complete set of vital signs is generally considered to include five components: heart rate, respiration rate, oxygen saturation, blood pressure and temperature. The NICE (2007) defines a baseline set of vital signs as a minimum standard of care for all acutely ill people who present to the ED. By expanding this initial set of vital signs to include a capillary measure of blood glucose (finger stick), nurses can expedite the identification and optimization of patients with abnormal fluctuations (high or low) in blood glucose (ANZHRF, 2014; NCGC, 2011; NICE, 2017a). Only two studies were found that examined the documentation of baseline vital signs, however, what constituted a set of vital signs differed between the studies (Taylor & Nairn, 2012; Youde et al., 2009). Youde and colleagues (2009) only examined oxygen saturation on room air and reported that it was documented in 90% of the cases. While, Taylor and Nairn (2012) examined the full set of five vital signs and reported that they were documented in 85 to 99% of cases, however, they reported that an initial capillary blood glucose level was documented in only 24.3% of cases. From

this review, I developed a quality statement to facilitate the identification and treatment of common correctable co-morbidities:

Quality Statement
A patient presenting to the ED with a suspected hip fracture will have a complete set of vital signs, plus a capillary blood glucose, assessed within 30 minutes of arrival to support timely assessment and management of pre-existing co-morbidities.

Pain Management

Pain is a major source of psychological and physiological stress for those who sustain a hip fracture (NCGC, 2011; NICE, 2017a). Providing adequate pain management is not only a high priority for patients who have sustained a hip fracture (AAOS, 2014; ANZHRF, 2014; NCGC, 2011; SIGN, 2009; Swift et al., 2016; Waddell et al., 2010), it is also integral to preventing complications such as delirium (ACSQHC, 2016; Morrison et al., 2003; Roberts & Brox, 2015; Swift et al., 2016; Waddell et al., 2010). Differences are evident in the recommendations for the management of pain and the strength of the supporting evidence found in the clinical practice guidelines. For example, the only recommendation put forward in the AAOS (2014) practice guideline was to use regional analgesia (nerve block) as the first-line treatment for pain, based on strong evidence. This is incongruent with the recommendations contained in the other four clinical practice guidelines which relegates the use of nerve blocks to an adjunct therapy due to the need for specially trained personnel, which may delay pain relief and increase the risk for complications (ANZHRF, 2014; NCGC, 2011; NICE, 2017a; SIGN, 2009; Waddell et al., 2010), however the supporting evidence is limited to expert opinion/consensus. Only the AIHW (2017) database contains a quality statement which indicates, patients are to be assessed for pain at the time of presentation and regularly thereafter, as well as receive multimodal analgesia (opioid or non-opioid orally,

intravenously, subcutaneously, or intramuscularly), if clinically appropriate (ANZHRF, 2014; British Pain Society & British Geriatrics Society, 2007; NCGC, 2011). Further evidence to support the recommendations in the clinical practice guidelines was found in a systematic review, conducted by Stang, Hartling, Fera, Johnson, and Ali (2014), examining quality measures for the assessment and managment of pain in the ED.

Two of the five research articles examined aspects of pain management for patients with hip fractures in the ED. Taylor and Nairn (2012) reported that 91.9% of cases had a documented pain assessment, but they did not state when it was assessed or if reassessment occurred. They also reported that only 69.2% of cases were offered or received analgesia during the ED stay. Findings reported by Youde and colleagues (2009) based on data from a nationally representative sample suggest that only 46% of patients with hip fractures received analgesia within 60 minutes of arrival in the ED. From this review, I developed two quality statements for the management of pain:

Quality Statements
A patient presenting to the ED with a suspected hip fracture will be assessed for pain on arrival, 30 minutes after receiving analgesia and hourly until transferred from the ED.
A patient presenting to the ED with a suspected hip fracture will receive analgesia within 60 minutes of arrival, or there will be documentation outlining why this was deemed not to be clinically appropriate.

Implementation of Measures to Prevent Common Complications

Cognitive and delirium assessment. Patients who have sustained a hip fracture are at high risk of developing delirium, which has been associated with increased morbidity and mortality, as well as a decreased chance of return to independence post-operatively (ACSQHC, 2016; NCGC, 2010, 2011; Swift et al., 2016; Waddell et al., 2010). Assessing cognitive status soon after presentation is important in establishing a

baseline which will facilitate the early detection of cognitive changes, including delirium (NCGC, 2010, 2011; Swift et al., 2016; Waddell et al., 2010). Recommendations for pre-operative cognitive assessment and delirium prevention were found in three of the clinical practice guidelines based on moderate evidence (ANZHRF, 2014; NCGC, 2011; NICE, 2017a; Waddell et al., 2010). Assessment and documentation of level of consciousness using a tool such as the Glasgow Coma Scale (GCS) is a minimum standard for cognitive assessment (NICE, 2007). However, a more thorough assessment is obtained using a tool such as the Confusion Assessment Method (CAM) which evaluates, not only level of consciousness, but also attention and thought processes (NCGC, 2010). Only Youde and colleagues (2009) investigated the proportion of cases with an assessment of cognitive function and reported that it was documented in 29% of cases.

Pressure injury risk assessment. Due to the potential frailty of this patient population, interventions to reduce the risk of skin breakdown need to be initiated early (NCGC, 2011; Swift et al., 2016). To support this, four of the clinical practice guidelines include recommendations for patients with hip fractures to be assessed for pressure injury risk in the ED using a recognized tool (such as, the Braden Pressure Injury Risk Assessment), either based on moderate evidence (SIGN, 2009) or a separately published clinical practice guideline (ANZHRF, 2014; NCGC, 2011; NICE, 2017a). The proportion of cases in which skin assessment was documented in the ED was investigated in two studies. In their single site study Taylor and Nairn (2012) reported only 8.1% of cases had a documented skin assessment. While, Youde and colleagues (2009) reported the documentation of skin assessment in 46.1% of cases in

their nationally representative sample. From this review, I developed two quality statements for the prevention of common complications:

Quality Statements
A patient presenting with a suspected hip fracture will have a cognitive status assessment during the ED stay.
A patient presenting with a suspected hip fracture will be assessed for pressure injury risk during the ED stay.

Factors Affecting the Attainment of Quality Measures

Of the five research articles found that examined quality measures for the management of patients with hip fractures in the ED, only two attempted to identify factors that influenced their attainment (Kristiansen et al., 2016; Neufeld et al., 2016). However, they only examined these factors in terms of the attainment of the target for time to surgery. Using data from the American College of Surgeons National Surgical Quality Improvement Project database, Neufeld and colleagues (2016) attempted to predict the likelihood of missing the time to surgery target (within 36 hours) based on a number of demographic, co-morbidity and operative factors using data for over 26,000 cases. They found that failure to attain this quality measure was statistically significantly higher for those who were: older (>90 years), female, part of an ethnic minority, overweight or obese, had pre-existing medical conditions (dyspnea; infectious illness; bleeding disorders; abnormal hematocrit, platelet count, or International Normalized Ratio [INR]), or poor functional status (Neufeld et al., 2016). The type of fracture and surgical approaches were also identified as contributing factors (Neufeld et al., 2016). Kristiansen and colleagues (2016) linked data for over 25,000 cases from the Danish Multidisciplinary Hip Fracture Registry with the Danish National Registries in order to investigate whether time of admission influenced the attainment of the time to surgery

measure of within 48 hours. For their analysis time to surgery was operationalized in terms of the shift by comparing evening and night shifts to the day shift, as well as the day of the week comparing admissions on a weekend, holiday or vacation period to a weekday. Surprisingly, findings from their primary analysis suggested that patients admitted during the evening and night shifts were more likely to attain the time to surgery target than those admitted during the day shift. Based on subsequent analysis using different definitions of 'off-hours' they concluded that the primary finding was influenced in large part by weekend admissions (Kristiansen et al., 2016).

Conclusion

Creating quality statements that are performance focused, measurable and sensitive to change is only the first step. Prior to the introduction of these quality statements within the clinical setting, work is needed to identify clinical data elements that are available, accessible and relevant to the quality statements. Work can then be conducted to determine the feasibility of using these data elements to monitor and evaluate practice performance and to identify factors that affect the attainment of the quality statements.

CHAPTER 3: Method

Research Aim

A retrospective analysis of electronically-available clinical data from one ED for the 2016-2017 fiscal year was conducted to test the feasibility of using the set of evidence-based quality statements to evaluate current practices in the management of patients with hip fractures in the ED. The specific objectives were to:

1. Determine the proportion of cases in which the quality statements are met, individually and as a set.
2. Examine whether attainment of the quality statements was affected by patients' age and sex, as well as the day and time of presentation.

Study Setting, Population and Sample

The study was conducted using clinical data from a tertiary care referral facility identified as the 'Centre of Expertise' for orthopedic surgery in a regional health network located in eastern Canada. The ED of this healthcare facility has a daily patient census of approximately 150 patients and provides care for approximately 200 patients with hip fractures each year (R. Ward, Orthopedic Clinical Nurse Specialist, personal communication, February 14, 2017).

Data Sources

Clinical data were retrieved from two electronic administrative databases maintained by the healthcare facility. Information on hip fracture admissions was retrieved from the '3M Health Information System' which is used to capture administrative, clinical and demographic information on all hospital discharges (M. Wilson, Hospital Information Analyst, personal communication, March 16, 2018).

Regionally, the health network has been using this database to monitor the number of admissions with a diagnosis of hip fracture by healthcare facility for over 5 years. At the time of the study, the only information captured in the 3M database about ED presentations was patient demographics, triage code, as well as the date, time and type of arrival and disposition. Patients admitted to hospital through the ED are identified by a Medicare number, a hospital number, and a unique ED record number. Information on the care received by patients presenting to the ED is found in the Meditech Emergency Department Management (EDM), an electronic documentation system adopted by the ED over 15 years ago (N. Moore, Administrative Director, personal communication, March 23, 2018). The majority of care provided in the ED is documented using the EDM system, with the exception of medication administration. Once patients are discharged from hospital, the medication administration record is scanned and merged with the electronic ED health record (N. Moore, Administrative Director, personal communication, March 23, 2018). The 3M and EDM are standalone information systems with limited transfer of information between systems.

Ethical Approval

Prior to accessing the clinical data, approval from the Faculty of Nursing Research Ethics Committee, the Horizon Health Network Research Ethics Board and the University of New Brunswick Research Ethics Board was obtained. In addition, permission to work with the data was received from the Horizon Health Network Human Research Protection Program following completion of the Collaborative Institutional Training Initiative (CITI) Canada Privacy Basic Course and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research

Ethics (TCPS 2: CORE). During the planning and execution of the study, consideration was given to the Canadian Tri-Council's foundational value of respect for human dignity which is manifested through three core principles: respect for persons, concern for welfare and justice (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council of Canada, 2014). Given this study involved the use of pre-existing data, with no collection of additional information, it was viewed as posing minimal risk to the individuals to whom the health records belong. The data retrieved were for the fiscal year of 2016 to 2017 so could not affect the clinical course of the actual patients. Although findings from this investigation will have no direct benefit for these individuals, the knowledge gained will hopefully inform clinical practice and improve health outcomes for future patients with hip fractures. To maintain privacy and confidentiality the hospital information analyst created a password protected Excel file with the requested data elements from the 3M and EDM databases. The file did not contain any information that could identify specific individuals. Cases were identified by a unique numerical identifier. Upon receipt of the data file, it was saved on a password protected computer. The file will be kept for 7 years, then permanently deleted. Only the members of my supervisory committee and I have access to the data. If findings from this investigation lead to new areas of investigation, ethical approval will be obtained prior to further analyses.

Study Design

An advantage of conducting research using routinely collected health data is that it provides access to a larger sample than can typically be acquired prospectively, at

least within the timeframe of a Master's program. As more and more health data are collected and stored electronically the potential for conducting such research increases (Benchimol et al., 2015). However, the availability of such data introduces new challenges which place constraints on the research questions that can be posed. Two of the challenges are the availability, accessibility and quality of the data, as well as the identification and retrieval of relevant cases (Auten & Ishimine, 2016; Patanwala, 2017; Worster & Haines, 2004).

Data Availability, Accessibility and Quality

Through consultation with the hospital information analyst and thesis committee members, data fields relevant to the quality statements were identified that could be accessed and used to assess the quality of care for patients with hip fractures in the ED. Given the volume of electronic data available, pragmatic decisions needed to be made as to what data elements to retrieve. In an attempt to increase the reliability of the data collected, decisions were made to focus on data available in a fixed (categorical response options) rather than free-text format, as well as to limit this investigation to the examination of the first documented occurrence of the aspect of care. Relevant data fields were not found for the quality statements addressing multidisciplinary approach to care and pressure injury risk assessment so these quality statements could not be examined. In addition to the data elements pertaining to the quality statements, data were retrieved for demographic and clinical characteristics that were predicted to explain differences in the attainment of the quality statements. A list of the data elements retrieved is presented in Table 2 and their operational definitions and response options are found in Appendix D.

Table 2.
List of Data Elements to Evaluate the Five Quality Statements

Quality Statement	Data Elements
A patient presenting to the ED with a suspected hip fracture will:	
... receive surgery within 48 hours (2,880 minutes) of arrival	- Date of presentation - First time stamp on arrival to ED - Date arrived to operating room - Time arrived to operating room
... have a complete set of vital signs, plus a capillary blood glucose, assessed within 30 minutes of arrival	- First documented time and value of: heart rate (per minute) respiratory rate (per minute) oxygen saturation (percentage) blood pressure (mmHG) temperature (degrees Celsius) capillary blood glucose (mmol/l)
... be assessed for pain on arrival and 30 minutes after receiving analgesia	- Time and value of: initial pain score first pain score after analgesia
... receive analgesia within 60 minutes of arrival	- Time documented initial analgesia administration
... have a cognitive status assessment completed during the ED stay	- Documentation of a completed: Confusion Assessment Method (CAM) and/or Glasgow Coma Scale (GCS)

Identification and Retrieval of Relevant Cases

Although the quality statements are written in terms of all those with a "suspected hip fracture", case selection for this study was limited to the health records of patients admitted to hospital with a diagnosis of hip fracture. Basing case selection on admitting diagnosis rather than presenting complaint was viewed as more appropriate as patients with hip fractures may present with a variety of complaints or concerns such as confusion, pain, or history of a fall. Case selection was conducted using the criteria established by Canadian Institute for Health Information (CIHI), using the codes assigned in the International Classification of Diseases version 10, Canadian edition

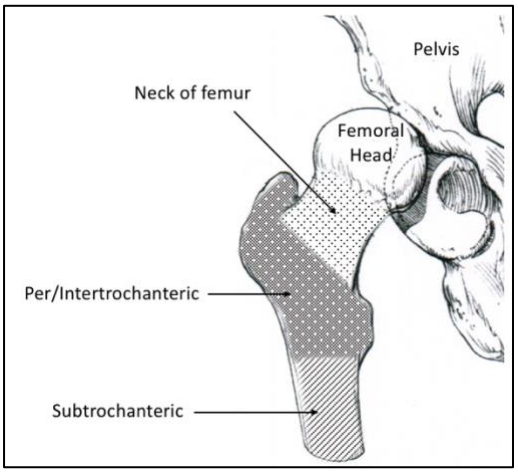
(ICD-10-CA). To be selected a case must have had one of three ICD-10-CA diagnostic codes (S72.0, S72.1 or S72.2) and one of three types of admission codes (main diagnosis, pre-admit comorbidity, or service transfers; see Table 3; CIHI, 2015a, 2016). In addition, cases were limited to those admitted through the ED, who were over 18 years of age and had a triage score of '2' to '5'. The Canadian Triage and Acuity Scale (CTAS) system is used in the ED to prioritize patients based on acuity and risk with lower scores indicating the need for more rapid intervention (Bullard et al., 2017). National time targets for physician assessment have been established for the triage scores with CTAS 1 (requiring resuscitation) indicating the need for immediate assessment; CTAS 2 (emergent), assessment within 15 minutes; CTAS 3 (urgent), within 30 minutes; CTAS 4 (less urgent), within 60 minutes; and CTAS 5 (non-urgent), within 120 minutes (Bullard et al., 2017). Bullard and colleagues (2017) assert that the appropriateness of the assigned CTAS scoring is contingent on the completion of a detailed assessment by a clinically experienced nurse.

Table 3.
Relevant International Classification of Diseases 10 Canadian Edition Diagnosis Codes

Code	Label
Diagnostic	
S72.0	Fracture of neck of femur Includes: Fracture of hip NOS (unspecified)
S72.1	Pertrochanteric fracture Includes: Intertrochanteric fracture, Multiple pertrochanteric fracture, Trochanteric fracture
S72.2	Subtrochanteric fracture
Admission	
type (M)	Most Responsible Diagnosis
type (1)	Pre-admit Co-morbidity
type (W), (X), (Y)	Service Transfer

Note: See Figure 1 for visual depiction of different hip fracture locations

Figure 1. Anatomy of hip fracture locations



Relevant information from the EDM database was retrieved manually by a nurse who was an employee of the regional health authority and was familiar with the electronic ED health records because a process has not been established to permit the electronic retrieval of these data. To expedite the retrieval of information from the ED health record in the EDM database, a standardized data collection instrument was created (see Appendix E). To determine its ease of use and time required for completion, the data collection instrument was piloted by the Administrative Director for Critical Care and the Emergency Department, who is a thesis committee member and familiar with the ED health record. Following data retrieval, an inter-rater reliability check of the ED data was completed on randomly selected cases comprising approximately 10% of the sample (20 cases). Three discrepancies were noted in the time recorded for post analgesia pain assessment (i.e., during the check an earlier pain assessment was found than the one documented by the data abstractor). However, none of the discrepancies affected the attainment of the quality statement (i.e., revised times still exceeded 30 minutes post analgesia administration). In addition, one case was found in which a time was documented for post analgesia pain assessment with no corresponding numerical

pain score. Upon examination of the ED record it was noted that there was documentation indicating the patient exhibited facial expressions of pain (i.e., "grimacing") after receiving analgesia. Because of this notation, a decision was made to code this case as attaining the quality statement. No other data irregularities were found during this reliability check.

Data Management

Upon receipt of the Excel data file created by the information analyst, it was imported to SPSS v25® for MAC. Prior to conducting any statistical analyses, a preliminary quality check of the data was conducted to assess the accuracy of the data and completeness of variable coding. Inconsistencies were observed in the formatting of the date of initial assessment for 72 cases, this information was manually re-entered. The data were also assessed for the presence of outliers and improbable responses. One case had a questionable date of surgery as it was recorded as one month after the date of ED presentation. The hospital information analyst was contacted to verify the actual date of surgery. Two cases were also found with improbable values recorded for vital signs (e.g., heart rate of 20 beats per minute and oxygen saturation of 64%). Re-examination of the EDM database revealed that these values had been entered incorrectly, therefore, the correct values were entered into the data file. Finally, a comparison was made between the times recorded for the initial pain assessment and analgesia administration. In 23 cases, the time of initial pain assessment occurred after initial analgesia administration. These times were re-entered as post analgesia pain assessments and the initial time for pain assessment was coded as not completed.

Computed Variables

Using the date and time of ED arrival as the zero point for care delivery, variables were computed to reflect six time increments: to surgery, complete vital signs, blood glucose assessment, initial pain score, first analgesia administration, as well as total time spent in the ED. The values computed for ED length of stay was compared to the time lapse recorded in the 3M database. Differences between the two time variables ranged from 0 (no difference) to 1,440 minutes. There were 18 cases with a difference between the two values exceeding 15 minutes. The discrepant values were manually check by examining the recorded times for triage and ED departure to check the accuracy of the times computed. A decision was made to use the computed time for this analysis rather than the 3M time lapse. A seventh time increment variable was computed using the documented time of initial analgesia administration as the zero point to express the time increment between initial analgesia and post analgesia pain assessment.

In the EDM database pain scores are documented using an 11-point numerical rating scale with scores ranging from 0 to 10 and higher scores indicating more severe pain. For the purposes of this study, a new variable was created with the pain scores recoded according to the categories used in the CTAS system: 0 to 3 coded as 'mild pain'; 4 to 7 coded as 'moderate pain'; and 8 to 10 coded as 'severe pain'.

Finally, a dichotomous variable was created for each quality statement indicating whether or not there was documentation indicating its attainment. Indication that the quality statement was met was assigned a value of '1' while absence of such documentation was assigned a value of '0'. Demographic (age and sex) and clinical (day and time of ED presentation) data retrieved from the 3M database were also recoded into dichotomous variables. These variables were coded so that the attribute predicted to

increase the likelihood of attainment of the quality statement was assigned the higher value of '1': indicating sex-male, age-younger, time-day shift, and day-weekday. Because there is no widely accepted cut point signifying the older elderly in Canada (Statistics Canada, 2018), the median for the sample was used as the cut point. A weekday presentation was defined as occurring from 0800 on Monday to 1559 on Friday.

Data Analysis

Descriptive statistics appropriate for the level of measurement were generated to examine the characteristics of each study variable and address Objective 1. Graphic representations were also created to examine the shape of the distribution for continuous variables. To observe the strength and direction of the associations among the variables, bivariate descriptive statistics (correlations) were computed. Multiple regression analyses were then conducted to identify factors that helped explain the attainment of the quality statements. Prior to regression analyses, assessment of the univariate and bivariate descriptive statistics were conducted to ensure the assumptions underlying the statistical test were satisfied. When examining the attainment of the quality statements, one-tailed tests were conducted with alpha pre-set at .05. An alpha of .05 indicates a willingness to falsely reject a true null hypothesis 5 times out of 100 and a one-tailed test indicates the direction of the association was specified (directional hypothesis) a priori (prior to analysis). The confidence interval for the one-tailed tests are reported so the lower value depicts the 90% confidence limit and the upper value the 99.9% limit. For analyses in which a directional hypothesis was not specified, a two-tailed test was conducted.

CHAPTER 4: Results

Sample Characteristics

Data were obtained for 194 cases representing patients who presented to the ED and were subsequently admitted to hospital with a primary diagnosis of hip fracture. Three cases did not meet the inclusion criteria for age or triage score and were therefore excluded, resulting in 191 cases available for analysis. Three-quarters of the sample were female with the majority of cases being 65 years of age or older (89.5%) with slightly more than half being 80 years and older (see Table 4). Triage scores for the sample ranged from 'non-urgent' to 'emergent', with 58% of cases classified as urgent; of note, almost 29% were classified as less or non-urgent. The majority of cases involved patients who arrived by ambulance (92.7%) from home or a private residence (57.1%) on a weekday (67.0%) during the evening or night shift (53.4%). Interestingly, although the percentage of cases in the winter was relatively high (29.3%), a similar percentage presented in the summer (30.9%). Of the 191 cases, the majority received surgical intervention (96.9%), however six cases were managed medically. Interestingly, the reason for deferring surgical intervention in these cases was not apparent upon examination of demographic or clinical characteristics, for example patients ranged in age from 54 to 93 years, with half of cases under 85 years, and four were transported from a private residence, while only two came from an extended care facility.

Table 4.
Descriptive Statistics for Sample Characteristics (N = 191)

Variable	Descriptive Statistics
Age in years	
Mean (SD)	79.7 (11.2)
Median (min to max)	81.0 (51 to 101)
Sex, *n* (%)	
Female*	144 (75.4%)
Male	47 (24.6%)
Triage Score, *n* (%)	
2 - Emergent	25 (13.1%)
3 - Urgent*	111 (58.1%)
4 - Less urgent	43 (22.5%)
5 - Non-urgent	12 (6.3%)
Arrived by Ambulance, *n* (%)	
No	14 (7.3%)
Yes*	177 (92.7%)
Arrived from Type of Facility, *n* (%)	
Home/Private residence*	109 (57.1%)
ED/Acute care	55 (28.8%)
Long-term/Special care home	27 (14.2%)
Day of the Week Arrived, *n* (%)	
Weekend	63 (33.0%)
Weekday*	128 (67.0%)
Season Arrived, *n* (%)	
Spring (Mar, Apr, May)	36 (18.8%)
Summer (June, July, Aug)*	59 (30.9%)
Autumn (Sept, Oct, Nov)	40 (20.9%)
Winter (Dec, Jan, Feb)	56 (29.3%)
Shift Arrived, *n* (%)	
Evening/Night Shift (1601 to 0759)*	102 (53.4%)
Day Shift (0800 to 1600)	89 (46.6%)
Surgical Intervention, *n* (%)	
No	6 (3.1%)
Yes*	185 (96.9%)

Note: * = Mode; min = minimum, max = maximum; % = valid percent; Mar = March, Apr = April, Aug = August, Sept = September, Oct = October, Nov = November, Dec = December

Time in Emergency Department and to Surgery

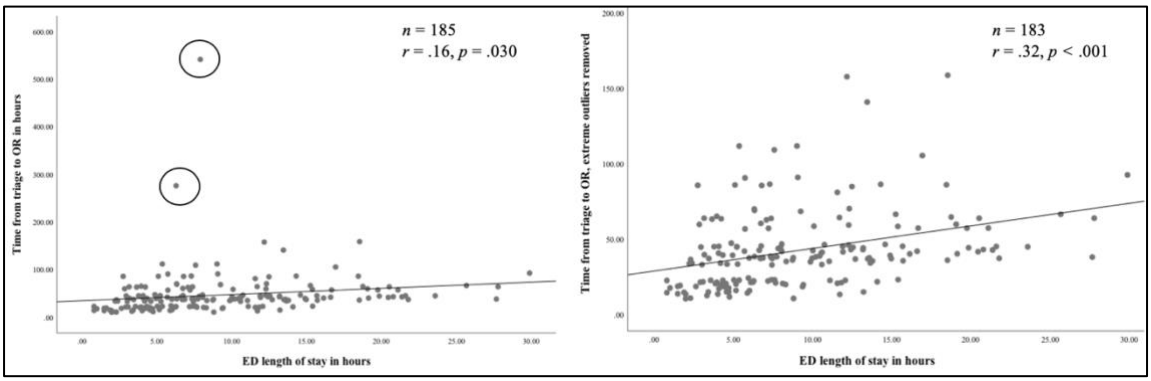
The length of time that patients spent in the ED ranged from less than one hour (49 minutes) to almost 30 hours (1,794 minutes), with half of patients spending more than 7.5 hours in the ED (see Table 5). Variability was also evident in the time from triage to operating room arrival, with times ranging from 10 to 542 hours. An initial examination of the association between length of ED stay and time to the operating room indicated a weak positive association ($r = .16$; $p = .030$). Examination of the scatterplot for the association between the two variables suggests the strength of the association was weakened by two outliers (see Figure 2). These cases involved relatively short ED stays (6.3 and 7.9 hours) but prolonged delays for surgery (276.3 and 541.6 hours). Although removal of these two cases increased the strength of the association, it remained weak ($r = .32$, $p < .001$).

Table 5.
Descriptive Statistics for Time Lapse in ED and to Surgery (N = 191)

Time Lapse	Descriptive Statistics
Total time in ED in hours[δ]	
Mean (SD)	9.2 (5.9)
Median (min to max)	7.5 (0.8 to 29.9)
Time from triage to OR in hours[δ]	
Mean (SD)	46.4 (48.1)
Median (min to max)	38.1 (10.3 to 541.6)

Note: [δ] The higher reported mean compared to median time reflects the positive skewness of the distribution; OR = operating room.

Figure 2. Scatterplots. Association between ED length of stay and time to surgery with and without extreme outliers.



Length of Emergency Department Stay

To examine if ED length of stay is affected by the patients' age and sex or by the time and day of presentation a linear regression was conducted. Due to the positively skewed distribution for total time in the ED, a decision was made to transform the data using the square-root arithmetic function in SPSS, so values more closely approximated a normal distribution (Polit, 2010; see Figure 3). Prior to conducting the regression analysis, bivariate descriptive statistics were examined to assess for the presence of multicollinearity among the predictor variables (see Table 6). A problem with multicollinearity was not evident as the strongest correlation was a weak negative association between sex and age that was not statistically significant. The collinearity diagnostics also suggest the predictor variables were not strongly correlated as the computed tolerance values ranged from .976 to .996 and the variance inflation factors (VIF) ranged from 1.005 to 1.024. Larger values for tolerance (e.g., >.10) and smaller values for VIF (e.g., <10) signal the absence of multicollinearity (Keith, 2006).

Results of the multiple linear regression suggest the set of predictors made a statistically significant contribution to explaining the variability in the time that patients spent in the ED ($F_{4,186} = 6.35$; $p < .001$; see Table 7; the computed F-statistic is beyond

the critical value of 1.97 determined using G*Power® software program version 3.1.9.3 for MAC). Approximately 10.1% of the variance for the time spent in the ED was explained by the set of predictor variables (Adjusted R^2 = .101); however, only time of presentation made a statistically significant contribution. The beta (-.33) suggests a weak negative association, indicating that patients who presented during the day shift tended to spend less time in the ED.

Figure 3. Original and transformed distribution for time lapse in ED in hours (*N* = 191).

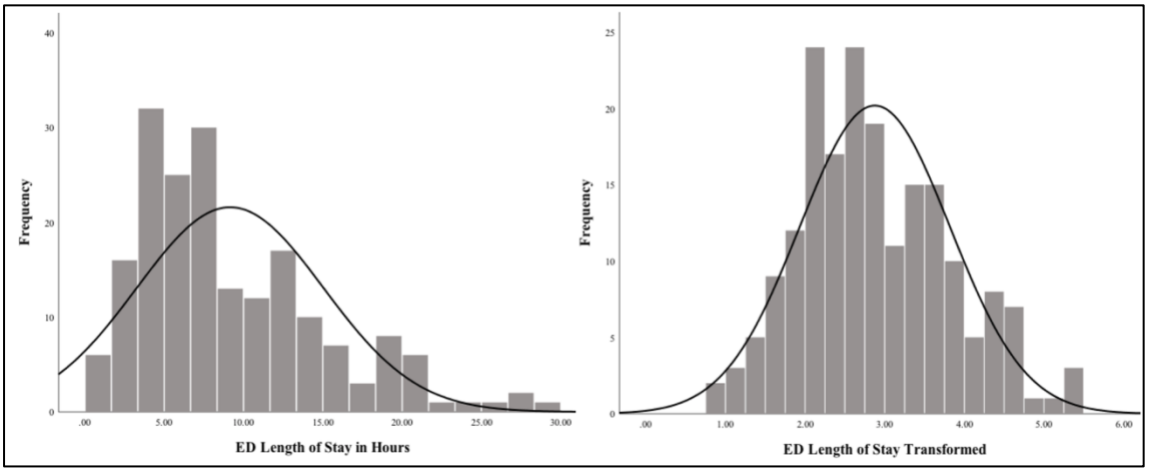


Table 6.
Pearson's r Correlations for Transformed Time in ED and Predictor Variables (N = 191)

	1	2	3	4	5
1 Time in ED	1.00				
2 Age in years	-.03 (.693)	1.00			
3 Sex, male	.11 (.115)	-.13 (.083)	1.00		
4 Time, day shift	-.33 (<.001)	.09 (.212)	-.02 (.763)	1.00	
5 Day, weekday	-.02 (.798)	.03 (.730)	-.07 (.375)	.01 (.913)	1.00

Note: *p*-values are in parentheses.

Table 7.
Standard Multiple Regression Examining Predictors of ED Length of Stay (N = 191)

Independent Variables	B-weight	95%CI	Beta	t-value (*p*-value)	Adjusted R^2	Test Statistics
Age in years	0.001	-0.01 to 0.01	.02	0.21 (p = .831)	.101	F = 6.35 df 4, 186 p <.001
Sex, male	0.24	-0.06 to 0.54	.11	1.56 (p = .120)		
Time, day shift	-0.62	-0.88 to -0.36	-.33	-4.75 (p <.001)		
Day, weekday	-0.19	-0.29 to 0.25	-.01	-0.14 (p = .891)		
Constant	3.02					

Note: 95% CI = 95% Confidence Interval of the B-weights

A post hoc assessment of the residuals was completed to examine the assumption that the errors of prediction are random with no association between errors and predicted values. Examination of the standardized residuals revealed three cases with values greater than or equal to +/- 2.5 which was considered extreme. To examine their effect on the results, the analysis was re-run with these three cases removed. Although removal of these cases made a slight improvement in the variance explained (increased to 13.1%), a decision was made to report the initial analysis because all of the cases deemed to be outliers involved patients who presented during the weekend and spent over 20 hours in the ED. Given that long patient stays are a reality in many EDs in Canada (CIHI, 2018) and internationally (Elder, Johnston, & Crilly, 2015; Nuffield Trust & The Health Foundation, 2017), it was considered inappropriate to disregard the experience of these patients by deleting the cases from the analysis.

Attainment of Quality Statements

The proportion of cases with documentation indicating attainment of the seven aspects of care addressed in the quality statements are presented in Table 8. Of the 185 cases involving surgical intervention, 74.6% (n = 138) attained the quality statement for

surgery within 48 hours. When initial vital signs were examined as a set of five, 88% attained the quality statement. Twenty-three cases did not have documentation for one or more vital sign: heart rate (1 missing), respiratory rate (9 missing), oxygen saturation (5 missing), blood pressure (3 missing), and temperature (7 missing). Only 5 cases (2.6%) had a documented value for capillary blood glucose, with only three (1.6%) having complete vital signs plus a blood glucose documented. A baseline cognitive assessment was documented in only one case (0.5%).

Table 8.
Frequencies and Proportions of Cases Attaining Quality Statement Variables (N = 191)

Quality Statement	Frequency (%)
A patient presenting to the ED with a suspected hip fracture will:	
receive surgery within 48 hours$^{\delta}$ (*n* = 185)	138 (74.6%)
have a complete set of vital signs within 30 minutes$^{\delta}$	168 (88.0%)
have a capillary blood glucose within 30 minutes$^{\delta}$	5 (2.6%)
have a cognitive status assessment in the ED	1 (0.5%)
be assessed for pain within 30 minutes$^{\delta}$	100 (52.4%)
receive analgesia within 60 minutes$^{\delta}$	57 (29.8%)
be assessed for pain 30 minutes after receiving analgesia (*n* = 142)	7 (4.9%)

Note: $^{\delta}$ = of arrival to the ED; % = valid percent.

Pain Management

Approximately 62% of cases had an initial pain score documented in the ED, however only 52% of cases had a pain score documented within 30 minutes of arrival (see Table 9). Of the patients who attained this quality statement, pain scores ranged

from 0 to 10, with higher scores indicated more severe pain. Interestingly, the proportion of cases classified as having mild, moderate or severe pain were relatively equal. Documentation of analgesia administration during the ED period was evident for three-quarters of cases, but less than one-third (29.8%) received it within 60 minutes of arrival which is the timeframe of the quality statement. Documented times for initial analgesia ranged from prior to triage (-0.1 hours) to over 22 hours after triage. For the 142 patients who received analgesia during the ED period, half waited over 80 minutes (1.4 hours). Fourteen cases had documentation indicating administration of analgesia prior to their arrival but received no subsequent analgesia during the ED period. For an additional 35 cases, there was no documentation to indicate the patient received analgesia either prior to or during their ED stay. Only 74 of the 142 cases receiving analgesia had documentation indicating that pain was reassessed during the ED period. However, the time for this reassessment ranged from 12 minutes (0.2 hours) to over 16 hours. Only seven cases attained the quality statement for post analgesia pain assessment within 30 minutes.

For 49 cases there was no documentation to indicate the assessment of pain at any time during the ED period, even though 29 of these patients received analgesia. Another 12 cases had no documentation to indicate that pain was assessed or analgesia administered during the patient's ED stay which ranged from 1.5 to 11.7 hours, with half spending over 4 hours in the ED.

Table 9.
Descriptive Statistics for Pain Management (N = 191)

Variable	Descriptive Statistics
Initial Pain Assessment	
- during entire ED period, *n* (%)	118 (61.8%)
- within 30 minutes of ED presentation, *n* (%)	100 (52.4%)
pain severity (*n* = 100)	
mild (0 to 3)	35 (35.0%)
moderate (4 to 7)	30 (30.0%)
severe (8 to 10)	35 (35.0%)
Initial Analgesia Administration	
- during entire ED period, *n* (%)	142 (74.3%)
- within 60 minutes of presentation, *n* (%)	57 (29.8%)
- documented analgesia prior to presentation, *n* (%)	14 (7.3%)
Post Analgesia Pain Assessment (*n* = 142)	
- during entire ED period, *n* (%)	74 (52.1%)
- within 30 minutes of receiving analgesia, *n* (%)	7 (4.9%)
Time Intervals in Hours, Median (range)	
- triage to initial analgesia (*n* = 142)	1.4 (-0.1 to 22.8)
- initial analgesia to pain reassessment (*n* = 74)	2.0 (0.2 to 16.7)

Predicting Attainment of the Quality Statements

Overall, no case attained the set of 7 quality statements. The quality statement with the highest percentage of attainment was for a complete set of initial vital signs (88.0%), whereas the quality statement with the lowest attainment was for a baseline cognitive assessment (0.5%). One-tailed logistic regression analyses were conducted for quality statements that met the requirement of having at least 40 observations (10 per predictor variable) for each group formed by the outcome variable (Hair, Black, Babin, & Anderson, 2010; Stoltzfus, 2011). This requirement was met by three of the quality statements: timely surgery, initial pain assessment and initial analgesia administration.

Results of these analyses suggest the set of predictor variables (patients' age and sex, as well as time and day of presentation) did not improve the ability to predict the attainment of these quality statements (see Table 10, 11 and 12). Given this, the individual effect of each predictor was not examined.

Table 10.
Multiple Logistic Regression Examining Predictors of Timely Surgery Quality Statement (n = 185)

Predictor	B-weight (SE)	Wald Statistic (*p*-value)	OR	CI Odds Ratio	Model Fit Chi-Square
Age, <80 years	-0.12 (0.35)	0.12 (*p* = .367)	0.89	0.50 to 2.80	
Sex, male	-0.30 (0.40)	0.57 (*p* = .226)	0.74	0.38 to 2.76	7.27 (df 4)
Time, day shift	0.81 (0.36)	5.09 (*p* = .012)	2.24	1.25 to 7.29	*p* = .061
Day, weekday	-0.40 (0.38)	1.11 (*p* = .147)	0.67	0.36 to 2.34	Nagelkerke R^2 = 5.7%
Constant	1.15				

Note: OR = Odds Ratio; CI = confidence interval with lower value corresponding to 90% and upper value corresponding to 99.9%; df = degrees of freedom

Table 11.
Multiple Logistic Regression Examining Predictors of Initial Pain Assessment Quality Statement (N = 191)

Predictor	B-weight (SE)	Wald Statistic (*p*-value)	OR	CI Odds Ratio	Model Fit Chi-Square
Age, <80 years	0.45 (0.30)	2.37 (*p* = .062)	1.58	0.97 to 4.21	
Sex, male	-0.49 (0.35)	1.98 (*p* = .080)	0.62	0.35 to 1.92	4.77 (df 4)
Time, day shift	-0.22 (0.29)	0.54 (*p* = .231)	0.81	0.50 to 2.12	*p* = .156
Day, weekday	0.16 (0.31)	0.25 (*p* = .311)	1.17	0.70 to 3.26	Nagelkerke R^2 = 3.3%
Constant	-0.12				

Note: OR = Odds Ratio; CI = confidence interval with lower value corresponding to 90% and upper value corresponding to 99.9%; df = degrees of freedom

Table 12.
Multiple Logistic Regression Examining Predictors of Initial Analgesia Quality Statement (N = 191)

Predictor	B-weight (SE)	Wald Statistic (*p*-value)	OR	CI Odds Ratio	Model Fit Chi-Square
Age, <80 years	0.23 (0.32)	0.53 (*p* = .235)	1.26	0.74 to 3.63	
Sex, male	-0.34 (0.39)	0.76 (*p* = .191)	0.71	0.38 to 2.54	1.56 (df 4) *p* = .408
Time, day shift	-0.16 (0.32)	0.23 (*p* = .315)	0.86	0.51 to 2.45	
Day, weekday	-.16 (0.34)	0.23 (*p* = .317)	0.85	0.49 to 2.57	Nagelkerke R^2 = 1.2%
Constant	-0.72				

Note: OR = Odds Ratio; CI = confidence interval with lower value corresponding to 90% and upper value corresponding to 99.9%; df = degrees of freedom

CHAPTER 5: Discussion

The emergency department (ED) is the point of entry into the acute care system for the majority of patients who sustain a hip fracture. Despite this, little attention has been given to the care these patients receive during this portion of the acute care period. Findings from this study highlight the need for such investigation as half of cases involved patients who spent more than 7.5 hours in the ED, with four spending more than a day. This study is based on the premise that the care received in the ED by patients with suspected hip fractures not only facilitates the early recognition of these injuries, but also factors that can complicate the management of these patients and negatively affect short and long-term outcomes. It was undertaken to test the feasibility of using a set of evidence-based quality statements to monitor and evaluate the quality of ED care received.

Early Identification to Support Timely Management

In most EDs, the initial assessment or triage of patients is performed by a registered nurse. The purpose of triage is to prioritize patients based on the acuity of their presenting complaint and the risk for complications or deterioration (National Emergency Nurses Association [NENA], 2014). This prioritization is conducted to optimize not only the management of the particular patient, but also the operational flow of the department in terms of the utilization of limited resources (human, material and physical; NENA, 2014). The assigned triage score sets the stage for the care trajectory in the ED by establishing time targets for the initiation of diagnostic and treatment processes (Bullard et al., 2017). Assigning an appropriate triage score to patients with hip fractures can be difficult as these patients generally do not present to the ED with

this diagnosis. They are more likely to present with vague complaints, such as weakness, confusion, and/or pain (Waddell et al., 2010). In older adults, expected manifestations of hip fractures (such as, affected leg shorter and externally rotated or reports of localized pain in affected area) may not be evident due to age-related musculoskeletal, neurological or cognitive changes (Bonne & Schuerer, 2013). The triage assessment can be further complicated by incomplete information about past medical history (e.g., presence of pre-existing co-morbidities), as well as the events preceding presentation to the ED (e.g., whether or not a fall occurred; Waddell et al., 2010). These factors can result in under-recognition of the injury or underestimation of the acuity or urgency of the patient's condition and the risk for complications or deterioration. Such underestimation is commonly referred to as 'under-triage' (Chang, Bass, Cornwell, & Mackenzie, 2008).

In the updated 2016 CTAS guideline, an attempt was made to address the issue of under-triage by the introduction of a 'Frailty Modifier' which permits nurses to triage patients whose condition is currently stable as 'urgent' (CTAS 3) if a prolonged wait time may put them at risk for deterioration or undue suffering due to their physical, cognitive or socioeconomic status (Bullard et al., 2017). Factors that may make it appropriate to apply the Frailty Modifier to patients with a suspected hip fracture include: older age (> 80 years), cognitive impairment, general weakness, immobility or pain (Bullard et al., 2017; Waddell et al., 2010). Given this, it was surprising to find almost one-third of cases in the current study were triaged as less or non-urgent (CTAS 4 or 5). Although it was not possible to determine the appropriateness of the triage decisions using the data retrieved further investigation is warranted to examine the

reliability and accuracy of triage decisions for patients with suspected hip fractures, as well as factors influencing these decisions.

Attainment of Quality Statements

The seven quality statements developed for this investigation were derived from a review and synthesis of current clinical practice guidelines and reflect the best available evidence for the pre-operative management of patients with suspected hip fractures. During the formulation of these quality statements efforts were taken to ensure they were performance focused, measurable and sensitive to change (NICE, 2014). Unfortunately, two of the quality statements (pressure injury risk assessment and multidisciplinary approach to care) could not be examined due to limitations in the data available in a fixed versus free-text format. Because the aspects of care addressed by the constructed quality statements are viewed as fundamental for all (100%) patients with suspected hip fractures a high level of attainment was anticipated. However, the actual level of attainment observed ranged from 0.5% for the documentation of cognitive status to 88.0% for the reporting of an initial set of five vital signs.

The extent that quality statements are observed in practice provides an indication of the quality of care provided and the likelihood of attaining optimal patient outcomes (AHRQ, 2017b; IOM, 2001; NICE, 2014). The process of comparing the observed rate of attainment for a measure of quality practice to a pre-defined standard or level of performance is commonly referred to as benchmarking (Benson, 1994). Currently, the only established benchmark for the pre-operative management of patients with hip fractures in Canada is that 85.0% of patients will have surgery within 48 hours of arrival to an acute care facility (CIHI, 2016). This level of practice performance was not

achieved in the current study as only 74.6% of patients received surgery within this timeframe. Although this percentage differs from the rate of 84.8% reported by CIHI (2016) for the same geographical region and fiscal year, it does fall within the reported 95% confidence interval of 72.1 to 99.1%. One explanation for the observed difference in the two percentages is that the percentage in the current study is an unadjusted rate, while the rate reported by CIHI (2016) is adjusted based on the age, sex and admission criteria (emergent or urgent) of patients. CIHI (2016) makes this adjustment to permit comparisons across facilities or jurisdictions.

Implications for Practice

Traditionally the focus of ED care has been on the rapid triage, initial stabilization and disposition (i.e., discharge or admit to hospital) of patients (Hwang et al., 2013), however, findings from this investigation suggest this focus of care may not be sufficient to address the needs of patients who present to the department with a suspected hip fracture. By broadening the focus of ED care and enacting the quality statements, emergency nurses can play a pivotal role in optimizing short and long-term outcomes for this vulnerable patient group by facilitating the early identification and management of correctable comorbidities and reducing the incidence of preventable complications. Enactment of the quality statements within the emergency department would not require a significant investment of time or increase nurses' work but could result in a significant cost-savings for the healthcare system. Implementation and evaluation of the quality statements and their effect on patient outcomes would be facilitated by the creation of fixed-format data entry fields in the electronic emergency record that indicate attainment of the quality statement, as well as by the establishment

of mechanisms to permit the aggregate retrieval and examination of these data. Working with ED nurses, benchmarks could then be established in terms of what constitutes an acceptable rate of attainment for each quality statement and practice changes that would support their attainment.

Implications for Research

One of the main goals of healthcare quality research is to establish the causal links among the structure, process and outcomes of care (Donabedian, 2003). In his conceptualization of healthcare quality and its evaluation, Donabedian (2003) asserted that the structure (material and human resources) of a healthcare facility and how it is organized influences the care delivered by healthcare providers (process) which in turn affects the outcomes achieved. In this investigation, I examined the association between the structure and process of the care provided by ED nurses by linking data from the ED and inpatient health records. Although the results of my analysis suggest attainment of the quality statements, which reflect processes of care, was not affected by patients' age and sex or the day and time of their presentation, this may be attributed in part to the low rate of attainment for many of the quality statements. It is also possible that the care provided by ED nurses to patients with suspected hip fractures is not affected by these characteristics. Further research is required to determine the merits of these hypotheses and identify other structural aspects that affect the process and outcomes of ED nursing care. Given the relative dearth of research examining ED care of patients with hip fractures and its effect on short and long-term outcomes, numerous avenues warrant investigation. Due to increasing patient volumes in many emergency departments, a structural aspect of care that has been a major focus of investigation is ED crowding

(Boyle et al., 2016; Hwang et al., 2011; Stang, Crotts, Johnson, Hartling, & Guttmann, 2015). Three measures of ED crowding have been recommended to address the three stages of patient flow within the emergency department: number of patients in the waiting room (input), ED occupancy (percentage of ED beds filled; throughput), and the number of admitted patients in the ED awaiting transfer to an inpatient unit (output; Stang et al., 2015). It is reasonable to assume that the nature of the association observed between ED crowding and attainment of a quality statement could differ depending on which of the three measures is examined.

The ability to link electronic data capturing the ED period with information from the inpatient record supports efforts to examine the association between attainment of the quality statements and patient outcomes (e.g., short-term – occurrence of post-operative delirium; long-term - return to preinjury functional independence). Such efforts would be enhanced by augmenting administrative databases to capture key aspects of ED care as well as patient outcomes. As a first step, prospective studies might be undertaken to identify key aspects of nursing care that impact outcomes for patients with hip fractures.

Strengths and Limitations

Conducting research using data from administrative databases has strengths and limitations. This investigation was constrained by the nature of clinical information available within the databases. The decision to limit this investigation to data available in a fixed format may have led to under-estimation of the actual rate of attainment of the quality statements as this information may have been documented in other sections of the patient record (e.g., ED nursing notes or medication administration record).

Measures taken to enhance the quality of the data included completion of an inter-rater reliability check of the data abstracted from the ED record, as well as re-computation of pre-existing time duration variables found in the database (for example, length of ED stay). However, this was a single site study, therefore replication is warranted with examination of other factors that may affect attainment of the quality statements, and ultimately patient outcomes.

Conclusion

This study is unique because it focuses on the examination of quality statements that are sensitive to nursing intervention and provides baseline information about the care received by patients with hip fractures in the emergency department. It is the first known Canadian study to move beyond time targets in an attempt to examine the quality of care that patients with suspected hip fractures receive in the emergency department. Establishing the feasibility of creating evidence-based quality statements and evaluating their level of attainment in the practice setting is an important first step in improving ED care of this patient population. It is hoped that the findings from this investigation will spark discussions about the merits of establishing quality statements that depict best practice and hopefully improve the quality of care delivery.

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Appendix A

Summary of Quality Statements Derived from National Organizations

Priority Category	Quality Statement		
	NICE	**ACSQHC**	**AHRQ**
	A patient presenting to the hospital with a suspected hip fracture will:		
Timely Surgery	... have surgery on a planned trauma list on day of, or day after presentation.	... receive surgery within 48 hours, if no clinical contraindication exists and patient prefers surgery.	... have surgery within 48 hours of presentation at a hospital.
Multidisciplinary approach to care	... be cared for within a 'Hip Fracture Programme' at every stage of the care pathway.	... be offered treatment based on an orthogeriatric model of care as defined in the 'Australian and New Zealand Guideline for Hip Fracture Care'.	
Identify & treat correctable co-morbidities		... receive care guided by timely assessment and management of medical conditions, including diagnostic imaging, pain assessment and cognitive assessment.	
Pain management		... be assessed for pain at time of presentation and regularly ... receive pain management including the use of multimodal analgesia, if clinically appropriate.	
Measures to prevent common complications	-	-	-

Appendix B

Search Strategy Keywords and Subject Headings

Search 1	
Keywords	**MeSH and CINAHL Subject Headings**
hip fracture*	Hip Fractures: *exploded, including*: femoral neck fracture (PUBMED), hip fracture, stress (CINAHL)
proximal femoral fracture*	
femoral neck fracture*	
Search 2	
Keywords	**MeSH and CINAHL Subject Headings**
quality measure*	Quality Indicators, Health Care: *not exploded* (PUBMED) Clinical Indicators *no subject headings indexed below in hierarchy* (CINAHL) Benchmarking *no subject headings indexed below in hierarchy* (PUBMED and CINAHL)
quality statement*	
quality indicator*	
quality standard*	
clinical indicator*	
benchmark*	
Search 3	
Keywords	**MeSH and CINAHL Subject Headings**
emergency department	Emergency Service, Hospital: *exploded, including*: Trauma Centers (PUBMED) Emergency Service: *exploded, including*: Trauma Centers (CINAHL)
emergency service*	
emergency care	
emergency room	
accident and emergency	
casualty	
emergency unit	
emergency ward	
preoperative care	
preoperative period	
preoperative	

Appendix C

Synthesis of Retrieved Studies Examining the use of Quality Measures for the Management of Patients with Hip Fracture in the Emergency Department

First author, year Purpose	Sample/ setting	Findings Pertaining to Proposed Quality Measures
Frood, 2010 Purpose Compare proportion of cases achieving time to surgery within 48 hours by time of ED presentation to time of hospital admission	N = 6,627 Country: Canada Data: CIHI's Discharge Abstract Database & National Ambulatory Care Reporting System from Ontario acute care facilities Period: April to Dec. 2009	Percent cases that met time to surgery (<48hrs): - from time of ED registration (71%) - from time of hospital admission (78%) Half of cases spent more than 5hrs in ED (range not reported): - Spent > 12 hours in ED (10%)
Kristiansen, 2016 Purpose Association between time (day of week or shift) of ED presentation and time to surgery (< 48hrs)	N = 25,305 Country: Denmark Data: Danish Multidisciplinary Hip Fracture Registry (DMHFR) linked with data from Danish National Registries Period: March 2010 to Nov. 2013	Increased risk of missing time to surgery (> 48hrs): Primary analyses - admission during day shift Subsequent analyses - admission during 'off-hours' = weekends and holidays regardless of shift
Neufeld, 2016 Purpose Primary: Determine proportion of cases that met Surgery ≤ 36hrs Secondary: (i) identify factors associated with missing time to	N = 26,066 Country: USA Data: American College of Surgeons-National Surgical Quality Improvement Project (ACS-NSQIP) database Period: Jan. 2005 to Dec. 31, 2013	Time to surgery: - ≤36hrs (71.4%) - 37 - 48hrs (18.0%) - >48hrs (10.6%) Statistically significant predictors for missing timely surgery (≤ 36hrs): Age (>90yrs), female, ethnic minority, 'totally dependent' functional status, overweight or obese, dyspnea, infectious illness,

surgery; (ii) determine association with mortality, complications, and length of stay		bleeding disorder, high hematocrit, low platelet count, high international normalized ratio (INR) Shorter time to surgery associated with: - lower 30-day mortality - fewer minor post-operative complications Shorter time to surgery not associated with: - incidence of major post-operative complications
Taylor, 2012 Purpose Audit compliance with best practice standards in the ED	N = 185 Country: UK Data: Emergency Department Information System (EDIS) records from one large teaching hospital Period: May to July 2010	Time patient spent in ED: - less than 2hrs (6.2%) - less than 4hrs (93%) Documentation of: - five baseline vital signs (85-99%) - blood glucose (24.3%) - pain assessment (91.9%) - time and type of first analgesia (69.2%) - pressure injury assessment (8.1%)
Youde, 2009 Purpose Assess compliance with best practice standards	N = 3,184 Country: UK Data: 173 acute hospital trusts admitting orthopedic trauma cases in England, Wales, Northern Ireland, and Channel Islands; and all primary care trusts in England Period: Oct. to Dec. 2006	Time to surgery within 48 hours (69%) Time spent in ED: - $\leq$ 120 mins (20%) - 121 - 240 mins (57%) - > 240 mins (23%) Documentation of: - received analgesia (95%), - analgesia within 60 mins of presentation (46%) - oxygen saturation on room air (90%) - assessment of cognitive function (29%) - pressure injury assessment (46%)

Appendix D

Key Variables of Interest and Operational Definitions

Concept Variables in 3M Data File	Operational Definition	Response Options
Demographic Variables		
Most responsible diagnosis (case selection)	Admitting diagnosis of acute hip fracture	International Classification of Disease (ICD)-10-CA [type (M), (1), (W), (X), (Y)]: S72.0 S72.1 S72.2
Mode of arrival	Documented mode of arrival on admitting record	Mode of arrival: Ambulance – by ground Carried Police Stretcher Walk-in Wheelchair
Arrival from	Documented source of arrival on admitting record	Emergency Department Extra-Mural Home Hotel Dieu Perth-Andover Nursing home Oromocto Public Hospital School Special care home Telecare Upper River Valley Hospital Veterans Affairs

	Triage score	Documented Canadian Triage Acuity Scale (CTAS) score on triage assessment on a scale of 1 (requiring resuscitation) to 5 (non-urgent)	1 - 5
Factors Affecting Attainment (predictor variables)			
	Age	Age of patient at time of arrival to the ED	years
	Sex	Sex of patient recorded on health record	male/female
	Day of presentation	Day/month/year recorded on triage record	1-31/1-12/2016-2017
	Time of presentation	Time of day (2400 hours) recorded on triage record	0000 - 2359
Attainment of Quality Measure (outcome variables)			
	Day of presentation	Day/month/year recorded on triage record	1-31/1-12/2016-2017
	Time of presentation	Time of day (2400 hours) recorded on triage record	0000 - 2359
Timely Surgery	Time lapse in ED	Time in minutes patient was in ED from time documented at triage to time of discharge from ED recorded	00:00 - ___
	Time departed ED	Time of day (2400 hours) recorded patient discharged from ED	0000 - 2359
	Day arrived to operating room	Day/month/year recorded patient arrived to OR	1-31/1-12/2016-2017
	Time arrived to operating room	Time of day (2400 hours) recorded patient arrived to OR	0000 - 2359

Concept Variables from ED chart review		Operational Definition	Response Options
Attainment of Quality Measure (outcome variables)			
Identify & Treat	Heart rate Respiratory rate Oxygen saturation level Blood pressure Temperature Capillary blood glucose	Time of day (2400 hours); value of initial assessment and documentation (i.e., triage or initial assessment recorded in ED record)	0000 - 2359; rate per minute 0000 - 2359; rate per minute 0000 - 2359; percentage (%) 0000 - 2359; mmHG 0000 - 2359; Celsius 0000 - 2359; mmol/l
Pain Manage	Pain assessment	1) Time of day (2400 hours) documented; value of initial assessment (i.e., triage or initial assessment) using pain assessment tool (i.e., 0 to 10 pain scale) 2) Time of day (2400 hours) documented; value of first post analgesia pain score	1) 0000 - 2359; 0 - 10 2) 0000 - 2359; 0 - 10
	Pain relief	Time of day (2400 hours) first analgesia administration documented	0000 - 2359
Preventative	Confusion assessment method	Documented assessment using CAM completed in the ED yes or no, if yes time of day completed (2400 hours)	Yes/No; 0000 - 2359
	Glasgow Coma Scale	Documented assessment using GCS completed in the ED (documented on a scale 0 to 15) yes or no, if yes time of day completed (2400 hours)	Yes/No; 0000 - 2359

Appendix E

Data Collector Instrument

Instructions:

Record **FIRST** documented **time** and **value** from ED record (either triage or initial nursing assessment) for each case

Enter numerical value for each variable (with the exception of the CAM and GCS [completed - yes/no]

Case	Age (yrs)	Sex	Initial Vital Signs												Pain Score				Initial analgesia	Initial Cognitive Assess			
			Heart Rate		Resp Rate		Blood Pressure		SpO2		Temp		Glucose		1st		2nd			CAM		GCS	
			time	/min	time	/min	time	mmHG	time	%	time	°C	time	mmol/l	time	0 - 10	time	0 - 10	time	time	yes/no	time	yes/no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no
		☐ M ☐ F																			☐ yes ☐ no		☐ yes ☐ no

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Conference publications:

Filiatreault, S., Hodgins, M., Witherspoon, R. (2018). Umbrella review of hip fracture practice guidelines with a synthesis of recommendations for the pre-operative period (CIHR-IHSPR/CAHSPR Student Poster Competition, 2nd Prize). Canadian Association for Health Services & Policy Research (CAHSPR) 2018 Conference, Montreal, QC.

Hodgins, M., **Filiatreault, S.**, Jackshaw, R., Logan, S., Keeping-Burke, L., Moore, N., Fraser, J., Stack, B., Buck, D. M., Arbeau, D., Low, J., Yu, W. (2018). Collaborative longitudinal investigation of transition from hospital to home: A feasibility study (Poster). Canadian Association for Health Services & Policy Research (CAHSPR) 2018 Conference, Montreal, QC.

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