# EXPLORING RISK FACTORS OF READMISSION FOR PATIENTS TRANSITIONING FROM HOSPITALS TO SKILLED NURSING FACILITIES

by

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November 2018

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The purpose of this study was to examine the relationship of patient level factors including personal characteristics such as age, sex, and race, health indicators such as admission diagnosis, comorbidity, risk scores, and community factors such as caregiver identified, discharge disposition, and admitting hospital to the outcome indicator of readmission for patients transitioning to skilled nursing facilities. The study also compared the performance of an industry standard risk scoring index and a health system specific risk index in identifying patients at high risk for readmission.

The study utilized a retrospective data set to examine research questions. Findings included that patient characteristics including sex, race, age, caregiver, diagnosis, and payor were not identified as factors in readmissions for patients transitioned to skilled nursing facilities. It was also noted that the industry standard risk scoring index appropriately identified patients who readmitted to acute care following a transition to a skilled nursing facility. Patients who were identified as high risk according to the index experienced higher rates of readmission than those who did not score as high risk. The health system specific readmission risk score was not as effective as the industry standard index in identifying patients at risk for hospital readmission

across dispositions to home, home with home health services, and skilled nursing facilities as well as across academic and community hospitals.

Attention to transitions of care will continue to grow as healthcare costs and outcomes are at the forefront of policymakers. It is imperative that nursing leaders and front-line staff understand the factors impacting patients during the transition process from acute care to skilled nursing facilities so that interventions may be implemented to facilitate positive transitions and mitigate risks from inhibiting factors. This study is unique in that the focus was on patient factors that impacted transitions of care from hospitals to skilled nursing facilities. This study allowed for these factors to be examined between patients that had a positive outcome of no readmission and those that had a negative outcome of readmission. By understanding these factors, nursing care delivery systems can be designed and implemented to support patient transitions and achieve positive outcomes.

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A Dissertation

Presented to the Faculty of the Department of Graduate Nursing Science

East Carolina University

In Partial Fulfillment of the Requirements for the Degree

Doctor of Philosophy in Nursing

by

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November 2018

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## DEDICATION

This work is dedicated to my husband, Michael, and our children, Zachary and Peyton. Your support and unconditional love have made this journey possible.

**ACKNOWLEDGEMENTS**

I would like to express my sincere gratitude to the following individuals who have helped me accomplish my goals: My dissertation committee chair, Dr. Schreier, and committee members, Drs. Swanson, Jarrett-Johnson, and Thompson. Your continuous support and guidance have been invaluable. My fellow classmates and cohort members. Your camaraderie will forever be cherished. My parents, Kenneth and Marie Bailey. Thank you for teaching me the importance of hard work. To all others who have offered wisdom and encouragement throughout this journey.

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# CHAPTER 1: INTRODUCTION

Patients who experience transitions of care from hospitals to skilled nursing facilities are at increased risk for readmission to the acute care setting. Of the more than 5 million individuals experiencing transitions of care from acute care hospitals to skilled nursing facilities annually, approximately 23-25% of Medicare patients will return to an acute care hospital within 30 days of the transition (King et al., 2013; Meehan et al., 2015; Mor, Intrator, Feng, & Grabowski, 2010). Readmission of patients from skilled nursing facilities is costly and contributes to fragmentation of medical care and poor patient outcomes (Boockvar, Fishman, & Kyriacou, 2004; Jencks, Williams, & Coleman, 2009). Studies have explored contributing factors to patient readmissions from skilled nursing facilities, including demographics, diagnosis categories, premature hospital discharge, and medication concerns (Jacobsen et al., 2016; Kim & Flanders, 2013; Kwan et al., 2007; Moore, McGinn, & Halm, 2007). However, there is inconsistency and mixed findings regarding the relationship between factors and readmission. There is also a gap in understanding those patients who transition successfully and do not experience an adverse outcome of readmission to acute care (Jacobsen et. al., 2016).

## Statement of Problem

With over 5 million patients transitioning from hospitals to skilled nursing facilities annually, along with the more than 1.4 million patients receiving care in over 15,000 nursing facilities, transitions of care have become an important focus in quality improvement for providers, policymakers, and regulators due to the costs and potential for adverse patient outcomes (Centers for Disease Control and Prevention, 2016; Centers for Medicare and Medicaid Services, 2016; Johnson & Bibbo, 2014). Older adults who transition to skilled nursing facilities following acute care hospitalization are at risk for poor outcomes including

deteriorating health, depression, and hospital readmission (King et. al., 2013; Mor, Intrator, Feng, & Grabowski, 2010). One of the most significant of these adverse outcomes is readmission to acute care. Hospital readmission from skilled nursing facilities results in the disruption of patient plans of care, stress, and an increased potential for adverse health outcomes including a higher risk of mortality (Allen et. al., 2011; Saliba, 2000). Nursing home residents who experience a hospital readmission often return to the skilled facility cognitively and functionally more impaired (Ouslander, Weinberg, & Phillips, 2000). Negative consequences of readmissions also include longer length of stay, higher patient mortality rates, reduced satisfaction of patients and their families, and negative hospital performance ratings on public websites. Many readmissions may be prevented with treatment occurring within the facility rather than in a costlier hospital setting. A prior study estimated that approximately 39% of all hospitalizations of skilled nursing facility patients may be avoidable, representing a potential savings of $1.9 billion per year (Yu, Yoon, & Grau, 2016). Considering the magnitude of this potential savings, avoidable readmissions from skilled nursing facilities was incorporated in The Protecting Access to Medicare Act of 2014 which includes readmission penalties for skilled nursing facilities starting in 2018 (Carnahan, Unroe, & Torke, 2016). Consequently, preventing hospitalization of skilled nursing facility patients within the first 30 days following transition is an important quality improvement objective. Unfortunately, little is known about the risk factors of hospital readmission for patients discharged from acute hospital care to skilled facility care. Moreover, the underlying individual patient related factors of hospital readmission following transition to skilled nursing facilities have not been evaluated extensively.

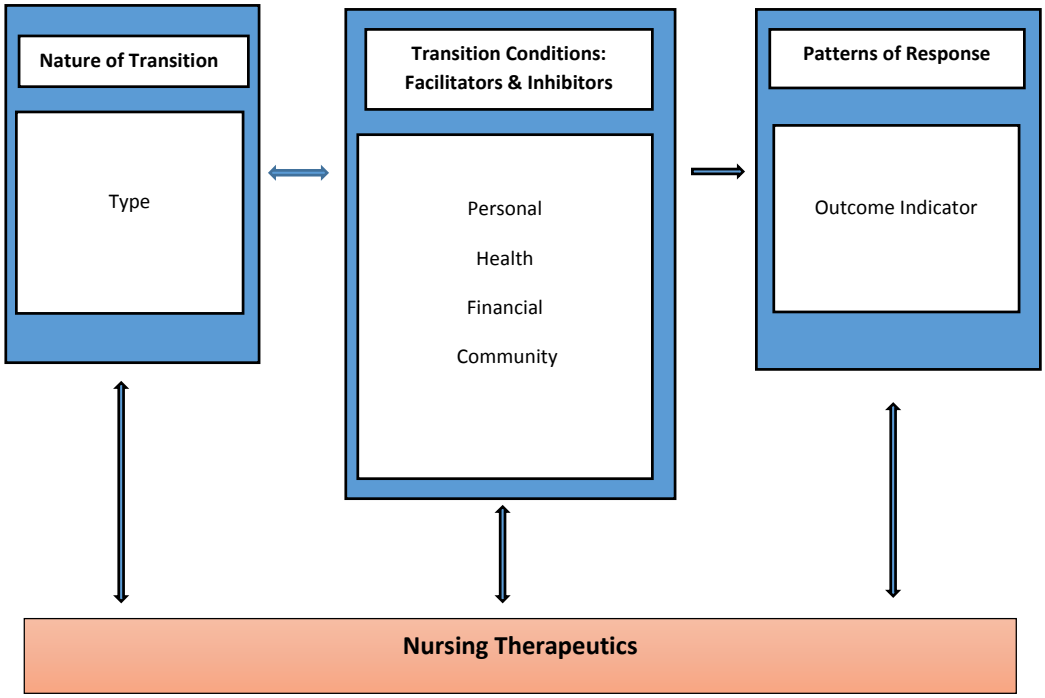
## Purpose

The purpose of this study is to examine the relationship of patient level factors including personal characteristics such as age, sex, and race, health indicators such as admission diagnosis, comorbidity, risk scores, and community factors such as caregiver identified, discharge disposition, admission location, and admitting hospital to the outcome indicator of readmission. The study will also examine the relationship of patient level factors between patients who experienced the outcome of readmission and patients who did not readmit. The study will explore how these factors facilitate or inhibit successful transitions for patients transferring from acute care into skilled nursing facilities and identify which factors contribute to hospital readmission. This study will be guided by transition theory framework.

## Theoretical Framework

According to Meleis' Transition Theory, there are three components of transition: (1) nature of transition, (2) transition conditions, and (3) patterns of response. This middle–range theory posits transitions as a central concept in nursing (Meleis, 2010; Meleis, Sawyer, & Im, 2000). The theory consists of relationships between types and patterns of transitions, properties of transition experiences, facilitating and inhibiting conditions, progress indicators, and outcome indicators (Eun-Or, 2014; Meleis, 2010; Shumacher & Meleis, 1994). The framework is underscored by nursing therapeutics. Meleis' conceptual framework is selected for the study as it depicts patient related areas of transitions, outcomes, and nursing therapeutics. The representative model constructed is derived from Meleis' theory and includes aspects of the original theory.

*Figure 1*. Conceptual model derived from Meleis' Transition Theory




The derived model depicts a situation specific context and demonstrates the relationships between the type of transition, facilitating and inhibitor factors, and outcome indicator. The variables within the relationships are specifically noted as transitions type, personal factors, health factors, financial factors, community factors, and outcome. The selection of these concepts for inclusion in the derived model is consistent with the literature review for patients experiencing a situational specific transition from acute care to skilled nursing facility care.

**Nature of Transition: Type**

The focus of this study is the situational transition of an unplanned relocation to a skilled nursing facility following an acute care hospitalization. A situational transition is an event that creates a change in a person's family situation often involving the addition or subtraction of persons in preexisting roles (Johnson, Morton, & Knox, 1992; Meleis, 2010; Young, 1990). The person admitted to the skilled nursing facility is subtracted from the environment of the family in

the home and added to the unfamiliar environment of the residents of the skilled facility. A situational transition is operationally defined as the relocation of a patient to a skilled nursing facility following discharge from an acute hospital.

**Transition conditions: Facilitators & Inhibitors**

Facilitating and inhibiting conditions are those factors that can influence the outcome of a transition event. These conditions can be personal factors, health factors, financial factors, and community factors.

**Personal factors.** Personal factors are an individual's characteristics. These factors differ from person to person and influence one's perceptions, attitudes, and behaviors. Personal factors for inclusion in this study include age, race, and sex.

**Health factors.** Health is generally defined as state of physical, mental and social well-being and not merely the absence of disease. (World Health Organization, 2006). The presence or absence of disease will usually have a significant impact on health. Indicators of disease are reflected by diagnoses with the cumulative impact of disease as comorbidity. Diagnosis and comorbidity are key elements of various predictive risk models, such as LACE and health system readmission risk indexes. These models identify patients at high risk for negative outcomes including readmission and mortality. This study will use diagnosis, comorbidity, and risk scores (LACE and health system readmission risk) as indicators of overall health.

**Financial factors.** There are a wide variety of payer sources for health care expenses. Medicare is a federally funded program for the aged and disabled (Centers for Medicare & Medicaid Services, 2014). This program pays for a sizable percentage of beneficiary health care expenditures (Centers for Medicare & Medicaid Services, 2018). Medicaid is a jointly funded, federal-state, program that provides health coverage to eligible low-income adults, children,

pregnant women, elderly adults, and people with disabilities (Medicaid, n.d.). Medicaid is often a proxy for income status since eligibility is generally based on poverty guidelines. Private insurers are third-party companies that provide a range of financial coverage for health care costs depending on the amount an individual or corporation pays for the health care services. (Kovner & Knickman, 2011). This study will use payor status as an indicator of financial factors.

**Community factors.** Community can be conceptualized in several ways including: a physical bounded place, a set of shared interests, a sense of belonging, receiving support from partners and family and having emotional relationships with others (Eika, Espnes, & Hvalvik, 2014; Meleis, 2010; Wahl, Iwarsson, & Oswald, 2012). Community as a physical place includes patient location before and after a transition event. Community as support includes availability of a caregiver or someone to assist with physical and emotional needs. For this study, community conceptualized as a physical place includes patient location prior to and following a transition event and community conceptualized as support is defined as the presence of a caregiver.

## Patterns of Response

Patterns of response includes outcome indicators. These indicators demonstrate how the patient is moving through the transition process and the result of the transition event.

**Outcome indicator.** Readmission occurs when a patient returns to an acute care hospital following discharge from an acute care hospital. Readmission is disruptive to the plan of care and places patients at increased risk for other adverse outcomes. The study definition of readmission is a patient returning to a hospital from a skilled nursing facility within 30 days of previous hospital discharge.

## Nursing Therapeutics

The model includes nursing therapeutics which can be viewed as the foundation to facilitate positive transitions or strategies designed to address gaps in care which may hinder positive transitions. Nursing therapeutics are bi-directionally linked to type of transitions, transition conditions, and patterns of response. The bi-directional relationship underscores the emphasis on nursing therapeutics driving positive transitions as well as transitions driving nursing care. The literature emphasizes the relationship of nursing interventions to patient transitions, specifically the importance of understanding the components of transitions in order to proactively implement interventions to facilitate positive transitions as well as to adapt nursing care to prevent negative outcomes of transition. Transition theory in nursing highlights the importance of professional support in periods of change (Meleis, Sawyer, Im, Hilfinger Messias, & Schumacher 2000).

**Theory Assumptions**

There are several general assumptions regarding transition theory. The first is that transitions of care are precipitated by a need for the transition. In the case of this study, the need for a transition in care is triggered by a clinical event which requires patient to transition. The next assumption is that transitions result in some type of change. For instance, the patient environment changes from the home to the skilled nursing facility. Additionally, it is assumed that transitions are complex (Meleis, 2010). This is evidenced by the model depicting inhibiting and contributing factors and the relationship to outcome indicators. This also assumes that transitions are susceptible to influence and changes to inhibiting and contributing factors may impact outcomes.

## Research Questions

The purpose of the study is to examine patient level contributing and inhibiting factors that impact patient transitions from acute care hospitals to skilled nursing facilities. Using a guiding framework derived from Meleis' Transition Theory, the study will explore the following questions:

1. What are the characteristics (age, sex, race, admission diagnosis, caregiver identified, discharge disposition, admission location, admitting hospital) of patients considered to be high risk for hospital readmission within 30 days according to the LACE index and how do these characteristics compare to those patients not identified as at high risk for admission?
2. What is the relationship between the LACE and Health System Readmission Risk (HSRR) indexes in identifying patients at high risk for hospital readmission within 30 days, and is the relationship moderated by such characteristics as age, sex, race, admission diagnosis, caregiver identified, discharge disposition, admission location, or admitting hospital?

## Study Plan

The study used a descriptive, correlational design to examine these research questions. The population for the retrospective data set analysis included adult patients who were transitioned from an acute care hospital to a skilled nursing facility. The study included those patients admitted and discharged between January 1, 2017-January 31, 2018 from a health system based academic medical center and associated community hospitals to skilled nursing facilities located within the geographical service area of the health system. Excluding skilled nursing facilities outside of the geographical service area will reduce the likelihood that patients were readmitted to hospitals not within the health system for which readmission data could not be collected.

## Significance of the Study

There is limited information about patient level factors that impact patient transitions from hospital to skilled nursing facilities. A comprehensive study of these factors and their relationship to patient outcomes would advance nursing knowledge. By understanding these factors, nurses can develop and implement targeted interventions based on predictive modeling to ensure patients at risk for readmission are identified and supported during transition. Nurses are integral to transitions of care. Nursing care is needed throughout the transition process to support patients during the experience. This includes the nurse's role in identification of patients who may be at-risk for readmission and guiding effective care prior to, during, and after the transition event. This study is an essential step toward understanding patient factors impacting readmissions and transitions of care across the healthcare continuum. By understanding the factors associated with rehospitalization, it may be possible to identify effective predictive models and clinical interventions to improve patient care and avoid common, costly, and potentially harmful rehospitalizations.

## Summary

The concept of transitions of care is complex and multifaceted. Transitions from acute care hospital to skilled nursing facility create changes in patient's life, health, relationships, and environments. Effective transitions of care optimize positive clinical outcomes, reduce patient and family uncertainty, reduce patient risk for adverse outcomes, and demonstrate collaboration among the healthcare team across the settings of care. On the contrary, poor transitions of care lead to poor clinical outcomes including adverse effects from medication errors, complications from procedures, infections, falls, and re-admission (Kim & Flanders, 2013). Older populations are especially vulnerable and at-risk for adverse outcomes during times of transition. The older

population is expected to double in size by the year 2050, surpassing 88 million, which means the number of transitions of care to skilled nursing facilities will increase accordingly (U.S. Census Bureau, 2010). Attention to transitions of care will continue to grow as healthcare costs and outcomes are at the forefront of policymakers. It is imperative that nursing understand the factors that may influence patient outcomes during the transition process from acute care to skilled nursing facilities. This study is unique because it examines the patient level factors that may impact transitions of care from hospitals to skilled nursing facilities. This study allows for comparisons between patients that have a positive outcome of no readmission and those that have a negative outcome of readmission based on these factors. By understanding these factors, nursing interventions can be identified and implemented to support transitions and achieve positive outcomes.

# CHAPTER 2: REVIEW OF LITERATURE

Transitions of care represent a vulnerable time for patients. Adults who experience a transition of care from an acute care hospital setting to a skilled nursing facility are at risk for adverse clinical outcomes including readmission (King et. al., 2013; Mor, Intrator, Feng, & Grabowski, 2010). Effective transition of care is widely reported in the literature as a key area to reduce readmission, associated healthcare costs, and improve patient safety and clinical outcomes. CMS reports that the national average risk-adjusted, all-cause, 30-day readmission rate for all patients in FY2011 was 18.1%, based on 1.8 million patient discharges to 13,161 skilled nursing facilities. However, researchers have found wide variation in readmission rates ranging from 0 to above 80% (Chen et al., 2012). The purpose of this study is to examine the patient level factors including personal characteristics such as age, sex, and race, health indicators such as admission diagnosis, comorbidity, risk scores, and community factors such as caregiver identified, discharge disposition, admission location, and admitting hospital to the outcome indicator of readmission for patients transitioning from acute care into skilled nursing facilities. The study will explore how these patient level factors facilitate or inhibit successful transitions for patients. This chapter reviews relevant literature on the relationships among the components of transitions of care: nature of transitions, transition conditions, and patterns of response.

## Transitions of Care

'Transition' comes from the Latin word transitio meaning "to go across" (Merriam-Webster, 2017). The term has widespread use and is generally defined according to the disciplinary focus. In healthcare, the term can used to describe various stages on the health-illness continuum including developmental stages (Kralik et al., 2006). In nursing, transitions

were defined by Meleis (2010) as a passage from one fairly stable state to another. Expanding on the term transitions, the concept of transitions of care can be defined as the movement of a patient from one setting of care (hospital, ambulatory practice, skilled nursing facility, home health, rehabilitation facility) to another (Centers for Medicare and Medicaid Services, 2014; Naylor, Aiken, Kurtzman, Olds, Hirschman, 2011; The Joint Commission, 2013).

A review and synthesis of the literature revealed recurring characteristics of the concept of transitions of care. The following attributes were repeatedly identified in relation to transitions of care: process, risk, uncertainty, movement, and collaboration. The first defining attribute is process. Throughout the literature, process was often cited in terms of discharge process from hospital or admission process to skilled nursing facility. In much of the literature, process marked the beginning and endpoints of transitions of care versus a true continuum. The second defining attribute is risk. Throughout the literature, risk was associated with transitions of care. Risk involved patient, provider, and organizational aspects. Transitions of care represent a vulnerable time for patients. Patients are at risk for medical errors associated with discharge processes, errors in medication reconciliation, and other adverse outcomes resulting from poor communication between healthcare providers during the time of transition (Block, Morgan-Gouveia, Levine, & Cayea, 2014). The third defining attribute of transitions of care was uncertainty. This attribute was present at patient, family, and provider levels. Patients undergoing a transition of care from the hospital setting to a skilled nursing facility often experience anxiety and stress states due to the unknown. Families experience similar uncertainty. Providers experience uncertainty with transitions of care in that the receiving provider is often unfamiliar with the patient clinical condition prior to the transition of care. The fourth defining attribute is cross continuum movement. Transition of care involves movement of

the patient from one setting of care to another. By definition, transition refers to 'going across'- in this case, movement across the continuum of care from acute care hospital to skilled nursing facility. The fifth defining attribute is collaboration. Effective transitions of care do not occur in isolation. Transitions require a sender and receiver. Collaboration is a key factor for closing gaps in patient care and communication of the longitudinal plan of care across settings (Block et al, 2014; Callahan, 2015; Berkowitz et al, 2013).

Meleis' Transition Theory delineates three components of transition: (1) nature of transition, (2) transition conditions, and (3) patterns of response. The theory consists of relationships between types and patterns of transitions, properties of transition experiences, facilitating and inhibiting conditions, progress indicators, and outcome indicators (Eun-Or, 2014; Meleis, 2010; Shumacher & Meleis, 1994). The following sections review the literature regarding the concepts to be studied within the components of transition theory.

**Nature of Transition: Type**

This study examined the situational transition of a relocation to a skilled nursing facility following an acute care hospitalization. This type of transition involves an event that creates a change in a person's family situation often involving the addition or subtraction of persons in preexisting roles (Johnson, Morton, & Knox, 1992; Meleis, 2010; Young, 1990). The person admitted to the skilled nursing facility is subtracted from the environment of the family in the home and added to the new environment of the residents of the skilled facility. Currently, it is estimated that approximately 40% of Medicare patients nationwide are discharged from an acute care hospital setting to skilled nursing facilities to complete their recovery (Mor, Inrator, Feng, & Grabowski, 2010). Of this 40%, approximately 20% are readmitted to acute care hospital settings within 30 days of discharge (Mor et al., 2010). The transition to a skilled nursing facility from an

acute care hospitalization is a major life change and generally the result of a triggering event such as a decline in health status or change in functional status that prevents a return to the pre-acute home setting (Altintas, Benedetto, & Gallouj, 2017). Other studies found that the transition decision-making was not as significant as the feelings of caregiver support during the transition process (Bookman and Harrington, 2007; Brownie, Horstmanshof, & Garbutt, 2014; Westin, Ohrn, & Danielson, 2012). The concept of support across the process aligns with the theoretical framework component of transitions conditions.

### Transition conditions: Facilitators & Inhibitors

Facilitating and inhibiting conditions are those factors that can influence response to a transition event. Facilitating conditions are those which move responses in a positive direction whereas inhibiting conditions create a negative influence. These facilitating and inhibiting conditions can be personal, health, financial, and community factors. Personal factors include age, sex, and race. Health factors include diagnosis, comorbidity, and level of risk. Financial factors include payor. Community factors include caregiver support and patient location across the transition event.

**Personal factor: Age.** The association between age and readmission risk is inconsistent in previous studies. Reports from the Agency for Healthcare Quality and Research on US hospital readmissions demonstrate that readmission rates vary substantially across the age range (Barrett, Wier, Jiang, & Steiner, 2015). For example, the report shows 30-day hospital readmission rates are much lower in children than in older adults (Barrett et al., 2015). However, in a study by Berry et al. (2018), researchers found that the odds ratio for readmission increased between ages 16 and 20 years, remained elevated between ages 21 and 44 years, incrementally decreased between ages 46 and 64 years, and decreased abruptly at age 65 years, after which the

odds remained constant with increasing age. There were also several disease or condition specific studies that found associations with age and readmission risk. For instance, Bliss et al. (2015) found that surgical patients age <65 were at-risk for readmission. Multiple studies found a linkage between readmission risk, increased age and end stage diagnoses including heart failure, pulmonary disease, cancer, and diabetes (Calvillo-King et al., 2013; Cheema, Brar, Cardenas, & Cheema, 2017; Chiang et al., 2015; Chung, Noh, & Gwak, 2017; Donate, Garces, & Rodenas, 2014; Echevarnia et al., 2017; Formiga, Masip, Chivite, & Corbella, 2017; Rathore et al., 2003; Shaefer, Elkareh, Ouartraolo, & Seymann, 2017). The mixed finding of the association between age and readmission coupled with the condition specific findings suggests that age may be a risk factor for readmissions in combination with other patient level factors.

**Personal factor: Sex.** There is also inconsistency in findings for the association of sex and readmission. Several studies found that males had a higher rate of readmission, suggesting male sex should be considered in readmission reduction plans (Amarasingham et al., 2012; Cui et al., 2015; Woz et al., 2012; Zapetero et al., 2012). However, findings varied with personal factor of sex among different diagnostic groups. In acute myocardial infarction patients and coronary artery bypass graft post-surgical patients, females were found to have a significantly higher risk of 30-day readmission compared to males (Fanari, Elliott, Russo, Kolm, & Weintraub, 2016; O'Brien et al., 2017). Among patients with pneumonia and those who experience percutaneous coronary intervention, male sex was a significant factor in readmissions (Minges, Herrin, Fiorilli, & Curtis, 2017). Inconsistency in sex and readmission was also noted in a systemic review of studies examining patients treated for pneumonia and heart failure (Calvillo-King et al., 2013). These mixed findings suggest that the influence of sex may be a risk factor for readmission in combination with other personal factors.

**Personal factor: Race.** Readmission rates vary across racial groups; however, studies have demonstrated significant association between race and readmission (Allaudeen, Vidyarthi, Maselli, & Auerbach, 2011; Chiang et al., 2015; Dailey, Cizik, Kasten, Chapman, & Lee, 2013). African American patients have been shown to experience higher readmission rates when compared to other races (Girotti, Shih, Revels, & Dimick, 2014; Joynt et al., 2011). Various studies found African American race as a readmission risk factor for patients with cancer, general medicine, and surgical diagnoses (Allaudeen et al., 2011; Chiang et al., 2015; Dailey et al., 2013; Gani, Lucas, Kim, Schneider, & Pawlik, 2015). Non-white race was found to be associated with readmission for heart failure and pneumonia diagnoses as well as with coronary artery bypass grafting procedure patients (Cavillo-King et al., 2013; Fanari et al., 2016). However, in a study by Epstein et al. (2009) among patients discharged from acute care following a critical illness, there was not a relationship between race and readmission. This was found in contrast to a study by Horney et al., (2017) that found white race associated with readmission for patients aged 65 and older. As with other personal factors, there are mixed findings regarding race and relationship with readmission, again suggesting that race may be a contributing factor rather than in isolation.

**Health factor: Diagnosis and Comorbidity.** The presence of chronic conditions and higher acuity illness during the initial admission has been cited as a risk factor of 30-day readmission throughout the literature (Amarsingham et al., 2015; Alassaad et al., 2015; Boriah et al., 2015; Cheema et al., 2017; Cui et al., 2015; Donate-Martinez et al., 2014; Fasolina & Phillips, 2016; Hao et al., 2015; Kulkarni, Smith, & Woeltje, 2016; Minges et al., 2017; Rubin et al., 2016; Shaefer et al., 2017). In a study of more than 6,800 general medicine patients in a large urban, university medical center six specific diagnoses associated with readmission were

identified: congestive heart failure, renal disease, cancer (with and without metastasis), weight loss, and iron deficiency anemia (Allaudeen, Vidyarthi, Maselli, & Auerbach, 2011). Heart failure and pneumonia have been studied extensively and linked to readmission risk (Banoff et al., 2016; Fasolina & Phillips, 2016; Formiga et al., 2017; Huynh et al., 2014; Shaefer et al., 2017; Wang et al., 2014; Yazden-Ashoor, Lee, Ibrahim, & Van Small, 2016). The linkage between diagnoses and readmission is also evidenced by the inclusion of diagnosis and comorbidity as key elements of various predictive risk models, such as LACE and health system readmission risk indexes. The LACE index includes scoring for the number of co-existing comorbidities as measured by the Charlson score (Grunier et al., 2011; van Walraven et al., 2010). The Charlson Comorbidity Index (CCI) is one of the most commonly used indices for measuring comorbidities. It combines comorbid information into a single parameter that measures the probability of multiple comorbidities being present (Elixhauser, Steiner, Harris, & Coffey, 1998). Similarly, the health system readmission risk index incorporates weighted scoring for key chronic disease diagnoses such as myocardial infarction, pneumonia, heart failure, chronic obstructive pulmonary disease, renal disease, diabetes, and hypertension. Based on the review of literature, there is overall consistency and agreement on the impact of disease and comorbidity to patient risk for readmission. However, there is variation on specific disease findings related to risk for readmission and populations studied.

**Financial factor: Payor.** Payor is less commonly cited in the literature as a factor for readmission; however, studies have limited populations to specific payors and examined readmissions within these populations. Several studies found patients with Medicare or Medicaid as primary payor were at increased risk for readmission (Allaudeen et al., 2011; Dailey et al., 2013; Horney et al., 2017; Li, Glance, Yin, & Mukamel, 2011). In contrast Kulkarni et al.

(2016) found that payor was not a significant factor for acute care readmission. Using the population of skilled nursing facility patients, Cai, Miller, Nelson, and Mukamel (2015) found an association between Medicaid status and readmission rates. They found that Medicaid patients residing in the same skilled nursing facility as private pay patients had a higher hospitalization rate. As previously noted, payor has been linked to readmission in combination with other factors such as age, sex, race, and diagnosis.

**Community factor: Caregiver support**. Community factors such as caregiver support and emotional relationships influence patient response to the transition process. The importance of caregiver support during transitions of care is well- documented (Johnson, Popejoy, & Radina, 2010; Keister, 2006; Marshall and Mackenzie, 2008; Tracy and Deyoung, 2004; Westin, Ohrn, & Danielson, 2011). Hu, Gonsahn, & Nerenz (2014) found that married patients had a significantly lower risk of readmission than those who were not married. This finding is consistent with a study by Arbaje et al. (2008) that identified patients who lived alone had a 50% increased odd of readmission compared to those who were not alone. Having consistent family / caregiver support across the transition process gives patients a sense of stability during a time of significant change.

## Patterns of Response

Patterns of response include outcome indicators. These indicators demonstrate how the patient is moving through the transition process and the result of the transition event.

**Outcome indicator: Readmission.** Readmission occurs when a patient returns to an acute care hospital following discharge from an acute care hospital. Readmissions can be planned or unplanned. Planned readmissions are those which are expected and most often elective or discretionary in nature (Cai, Miller, Nelson, & Mukamel, 2015). Unplanned

readmissions are those which are unexpected or nondiscretionary and most often urgent or emergent due to a deteriorating health condition (Cai, Miller, Nelson, & Mukamel, 2015). Readmissions are generally discussed in relationship to an index hospitalization with measurement of readmission outcomes based on the time period of thirty days following discharge (Centers for Medicare and Medicaid Services, 2014). It is has also been noted that patients experience the most challenging time in the first month following admission to a skilled nursing facility (Yu, Yoon, & Grau, 2016). During the first 30 days is when patients are adapting to their new environment and are vulnerable to decline and subsequent hospital readmission. Of the more than 5 million individuals experiencing transitions of care from acute care hospitals to skilled nursing facilities annually, approximately 23-25% of Medicare patients will return to an acute care hospital within 30 days of the transition (King et al., 2013; Meehan et al., 2015; Mor, Intrator, Feng, & Grabowski, 2010). Readmission is disruptive to the plan of care and places patients at increased risk for other adverse outcomes including deteriorating health, exposure to nosocomial infections, depression, and risk for additional rehospitalizations (Jacobsen et al.,2016; King et al., 2013; Mor, Intrator, Feng, & Grabowski, 2010; Naylor, Aikman, Kurtzman, Olds, & Hirschman, 2011). A research study by Jencks et al. indicated that around 20 percent of hospitalized Medicare patients are rehospitalized within 30 days and 56 percent within a year with considerable variation between states – lowest in Idaho (13 percent) and highest in Washington DC (23 percent) (Jencks, Williams, & Coleman, 2009).

**Nursing Therapeutics**

The transitions framework includes nursing therapeutics which can be viewed as the foundation to facilitate positive transitions or strategies designed to address gaps in care which may hinder positive transitions. Nursing therapeutics are bi-directionally linked to the transition

components: type of transitions, transition conditions, and patterns of response. The bi-directional relationship underscores the emphasis on nursing therapeutics driving positive transitions as well as transitions driving nursing care. The literature emphasizes the relationship of nursing interventions to patient transitions, specifically the importance of understanding the components of transitions in order to proactively implement interventions to facilitate positive transitions as well as to adapt nursing care to prevent negative outcomes of transition. Transition theory in nursing highlights the importance of professional support in periods of change (Meleis, Sawyer, Im, Hilfinger Messias, & Schumacher 2000). Nurses are integral to transitions of care. Nursing care is needed throughout the transition process to support patients during the experience.

**Readmission Risk Prediction Models**

There are numerous readmission prediction models found throughout the literature. However, a systematic review of prediction models for hospital readmission risk determined that most performed poorly (average C-statistic of 0.66) and efforts to improve their performance are needed for widespread usage (Kansagara et al., 2011). Predictive ability varied significantly between tools and populations. Although there was not a gold standard tool / model identified in the review, there was consistency in many of the variables tested. Common variables found within tools / models included: age, race, diagnoses, history of previous hospitalizations, length of hospital stay, and number of medications. Less common, yet significant variables included: marital status, living alone, payor, cancer diagnosis, and size of discharging medical facility. The overall variability of tool / model performance across similar and different populations may indicate that performance of the tool / model depends on the local context of the population. It

was also noted that patients discharged to a skilled nursing facility were often excluded from the study populations.

## Summary

The complexity of transitions of care has been well documented in healthcare literature. Previous studies have identified factors that place patients at risk for adverse outcomes of poor transitions including readmission. Most of these studies were focused on specific disease categories or on populations that were not elderly (Allen et al., 2011; Coleman, Min, Chomiak, & Kramer, 2004; Kind, Smith, Frytak, & Finch, 2007; Phillips et al., 2004). A review of the literature also suggested that many studies excluded patients who were discharged to skilled nursing facilities following acute hospitalization. Reasons for this exclusion were not well documented. Many studies were conducted over ten years ago which indicates there has been a longstanding concern about readmission as an outcome of transition of care.

Relocation to a new environment such as a skilled nursing facility is a complex and stressful process. Patients who experience transitions of care from hospitals to skilled nursing facilities are at increased risk for readmission to the acute care setting. Readmission of patients from skilled nursing facilities is costly and contributes to fragmentation of medical care and poor patient outcomes (Boockvar, Fishman, & Kyriacou, 2004; Jencks, Williams, & Coleman, 2009). However, there is a gap in understanding those patients who transition successfully and do not experience an adverse outcome of readmission to acute care (Jacobsen et. al., 2016).

Inconsistency in the limited published findings that examine patient level factors related to readmission for patients that transition to skilled nursing facilities from acute care necessitate further research. Moreover, the underlying individual patient related factors of hospital readmission following transition to skilled nursing facilities have not been evaluated extensively.

A comprehensive study of these factors and their relationship to patient outcomes would advance nursing knowledge. By understanding these factors, nurses can develop and implement targeted interventions to ensure patients transition successfully and do not experience a readmission event.

# CHAPTER 3: METHODOLOGY

The purpose of this study was to examine the relationship of patient level factors (personal, health, financial, and community) to outcome indicator (readmission). The study examined the relationship of patient level factors between patients who experienced the outcome of readmission and patients who did not readmit. The study explored how these patient level factors facilitated or inhibited successful transitions for patients transferring from acute care into skilled nursing facilities and identified which factors contributed the most to hospital readmission. This chapter is divided into six sections: (1) research design, (2) population and sample, (3) data collection procedures, (4) data analysis plan, (5) limitations and (6) summary.

## Study Design

The study used a descriptive, correlational design to examine patient level contributing and inhibiting factors that may influence patient transitions from acute care hospitals to skilled nursing facilities. The correlational design was used to perform an analysis of retrospective data. Using a guiding framework derived from Meleis' Transition Theory, the study explored the following questions:

1. What are the characteristics (age, sex, race, admission diagnosis, caregiver identified, discharge disposition, admission location, admitting hospital) of patients considered to be high risk for hospital readmission within 30 days according to the LACE index and how do these characteristics compare to those patients not identified as at high risk for admission?

2. What is the relationship between the LACE and Health System Readmission Risk (HSRR) indexes in identifying patients at high risk for hospital readmission within 30 days, and is the relationship moderated by such characteristics as age, sex, race, admission diagnosis, caregiver identified, discharge disposition, admission location, or admitting hospital?

## Study Population & Sample

The population for the retrospective data set analysis included adult patients who were transitioned from an acute care hospital to a skilled nursing facility. The study population included 27,868 patients who were admitted and discharged between January 1, 2017-January 31, 2018 from a large health system in Eastern North Carolina. The health system includes an academic medical center and associated community hospitals. The health system serves more than 1.4 million people in 29 eastern North Carolina counties. Adult patients 18 years and older admitted to medical and / or surgical services were included in the study. Adult patients receiving maternity and / or pregnancy related services were excluded from the study. Patients discharged to skilled nursing facilities located outside of the geographical service area of the health system were excluded. Excluding skilled nursing facilities outside of the geographical service area reduced the likelihood that patients were readmitted to non-health system hospitals for which readmission data could not be collected.

## Data Collection Procedures

Following East Carolina University and Medical Center Institutional Review Board (UMCIRB) study approval, data for variables including patient level factors (person, health, financial, and community) and outcome variable of readmission was obtained from existing patient medical records. A comprehensive data set of the discrete variables was provided by the health system corporate quality department. Data set included variables for all adult medical and

surgical service patients admitted between January 1, 2017-January 31, 2018. Readmission was indicated at the patient level by subsequent admissions throughout the data period. The length of time between patient admissions was used to determine readmission timeframe.

## Variables

The following variables, as identified in theoretical framework, were used for the study. The variables were extracted from the electronic medical record and included in the data set provided by health system staff.

### Personal Factors

Age- Defined as patient age in years.

Sex- Defined as patient biological sex, male or female.

Race- Defined as patient race identified as white, African American, Hispanic or Latino, two or more races, Asian, American Indian or Alaskan or other.

### Health Factors

Diagnosis- Defined as primary diagnosis, categorized according to the according to the International Statistical Classification of Disease and Related Health Problems.

Comorbidity- Defined as Charlson Comorbidity Index (CCI) score. The index is method of categorizing comorbidities of patients based on the International Classification of Diseases (ICD) diagnosis codes found in administrative data, such as hospital abstracts data. Each comorbidity category has an associated weight (from 1 to 6), based on the adjusted risk of mortality or resource use. The sum of all the weights results in a single comorbidity score for a patient. A score of zero indicates no comorbidities were found. The higher the score, the more likely the predicted outcome will result in mortality or higher resource use.

Risk Score- Defined as total score on LACE index and health system readmission risk (HSRR) index. The LACE index uses four factors to derive a risk score which is used to predict unplanned readmission after discharge from acute care hospitalization (van Walraven et al. 2010). The factors include length of stay ("L"); acuity of the admission ("A"); comorbidity measured with the Charlson comorbidity score ("C"); and emergency department use measured as the number of emergency department visits in the six months prior to admission ("E"). Score on the LACE index range from 0 to 19 with scores equal to or greater than 10 considered as high risk. The LACE index had C statistic value of 0.684 reported on derivation and validation of the index. Subsequent studies in other populations have noted the index to be variably predictive (Kanchanasuwan, Cobran, & Young, 2016; Low et al., 2015; Robinson & Hudali, 2017; Wang et al., 2014).

The health system readmission risk index uses nine factors to determine a readmission risk score. These factors include patient having a primary care provider, patient age, marital status, length of stay, diagnosis, emergency department utilization in last 6 months, payor, history of depression, and history of drug use. Scores range from 0 to 9 with scores equal to or greater than 5 considered as high risk, scores 3 and 4 considered as moderate risk and scores 0 to 2 as low risk. The derived index included elements present in the health system electronic health record foundation software platform as well as custom elements that were intended to capture characteristics of the local population. The score updates daily for admitted patients and has been used as the primary readmission risk stratification model across the health system hospitals since 2014.

**Financial Factor**

Payor- Defined as the individual or entity responsible for payment of acute care hospital episode. Categories include Medicare, Medicaid, Commercial, Self Pay, and other.

**Community Factors**

Caregiver status- Defined as presence of a caregiver identified in medical record, categorized as yes or no.

Location across transition event- Defined as the patient location prior to admission, categorized as home, skilled nursing facility, court, intermediate care facility, or other health care facility; admitting hospital defined as academic or community; and discharge disposition and / or service defined as home, home with services (home health or hospice), skilled nursing facility, court, federal hospital, psychiatric facility, rehabilitation facility, long term acute care hospital, and intermediate care facility.

**Readmission**

Readmission- Defined as a subsequent admission following an index admission within a specified time frame. For this study, the timeframe is within 30 days of index admission categorized as yes or no.

Patient level data was also provided for admitting hospital, county of discharge, and discharge disposition in order to stratify sample and identify inclusion and / or exclusion in the study. Admitting hospital was identified by hospital abbreviation and categorized into academic and community. County of discharge was used to determine any exclusions due to a discharge location outside of the health system service area. Discharge disposition was used to identify those patients that were discharged to a skilled nursing facility.

## Data Analysis Plan

Data was downloaded from Excel into the Statistical Package for Social Sciences (SPSS) version 24. Prior to analysis, all data were evaluated for outliers and missing data was evaluated and screened for appropriate inclusion / exclusion in the study. Descriptive statistics were calculated and analyzed for each of the variables. Descriptive statistics for continuous variables included values for mean, median, maximum, minimum, and standard deviation. Frequencies for categorical variables showed how many occurrences of a response. This provided an overview of the sample and a summary of the characteristics of the variables.

For question 1, descriptive statistics such as frequencies, percentages, means, and standard deviations were used to explore the characteristics (age, sex, race, admission diagnosis, caregiver identified, discharge disposition, admission location, admitting hospital) of patients considered to be at high risk for readmission and those patients not identified as at high risk for readmission. Comparisons between the high risk and low risk groups were explored using chi-square, t-test, and one –way ANOVA.

For question 2, chi-square was used for comparing frequencies of high risk and low risk groups as defined by the LACE and health system readmission risk scores. A series of chi-square analyses comparing the high-risk group and low risk group for each of the characteristics (age, sex, race, admission diagnosis, caregiver identified, discharge disposition, admission location, admitting hospital) were used to explore if relationship was moderated by such characteristics.

## Limitations

The focus of the study was adult patients who experienced a transition of care from an acute care setting to a skilled nursing facility. It did not include patients that transitioned to a

skilled nursing facility from settings other than an acute hospital. The study was also limited to one health system located in a rural area of North Carolina. A potential limitation of utilizing retrospective data that was not collected for the purpose of the study was that the researcher could not validate how the data was collected, responses interpreted, and accuracy of entry into the medical record.

## Summary

This chapter describes the research design, population and sample, data collection procedures, data analysis plan and limitations of the study. The purpose of this study was to examine the relationship of patient level factors (personal, health, financial, and community) to outcome indicator (readmission). The study examined the relationship of patient level factors between patients who experienced the outcome of readmission and patients who did not readmit. The study explored how these patient level factors facilitated or inhibited successful transitions for patients transferring from acute care into skilled nursing facilities and identified if there were any moderating characteristics. The selected population and data collection and analysis plan facilitated exploration of the relationships as stated in the research questions and supported by the theoretical framework.

# CHAPTER 4: EXPLORING ACUTE CARE READMISSION FOLLOWING TRANSITION TO SKILLED NURSING FACILITIES USING PATIENT CHARACTERISTICS AND LACE SCORE


## Abstract

**Background:** Hospital readmission following transition to skilled nursing care continues to be problematic for patients, health care providers, payors, and policy makers. Understanding patient characteristics and risk level may help identify patients who would likely benefit from targeted intervention. The purpose of this study was to explore patient characteristics and LACE score of patients who readmitted to acute care following transition to skilled nursing facility care.

**Methods**: A retrospective data analysis was conducted to explore patient demographic characteristics and LACE risk score for adult medical patients transitioned from 8 hospitals in North Carolina to skilled nursing facilities during 2017. A LACE index score of 10 or greater was used to identify patients at high risk for readmission.

**Results:** During the study period, 3045 patients were transitioned from acute care to skilled nursing facilities in the geographic service area of the health system. Of the 3045 patients transitioned to skilled nursing facilities, there were 770 readmissions to acute care. The overall readmission rate for the skilled nursing population studied was 25.3% with 48.7% of the readmissions occurring within 30 days of transition. High risk patients identified by the LACE index represented 70.6% of the readmissions. 75.2% of high risk patients using the LACE index readmitted within 30 days. Patient characteristics including sex, race, age, caregiver, and payor were not a significant factor in readmissions.

**Conclusions:** The LACE index score appropriately identified patients who readmitted to acute care following a transition to a skilled nursing facility. Patients who were identified as high risk

according to the index experienced higher rates of readmission than those who did not score as high risk.

Skilled nursing facilities are an essential component of the care continuum for many patients experiencing a transition from an acute care hospitalization. Annually, over 5 million patients are admitted to skilled nursing facilities following discharge from acute care which makes attention to transitions of care an important area in an increasingly value-focused healthcare environment (Centers for Disease Control and Prevention, 2016; Centers for Medicare and Medicaid Services, 2016; Johnson & Bibbo, 2014). Older adults who transition to skilled nursing facilities following acute care hospitalization are at risk for poor outcomes including deteriorating health, depression, and hospital readmission (King et. al., 2013; Mor, Intrator, Feng, & Grabowski, 2010). Hospital readmission from skilled nursing facilities results in the disruption of patient plans of care, stress, and an increased potential for adverse health outcomes including a higher risk of mortality (Allen et. al., 2011; Saliba, 2000). A prior study estimated that approximately 39% of all hospitalizations of skilled nursing facility patients may be avoidable, representing a potential savings of $1.9 billion per year (Yu, Yoon, & Grau, 2016). Considering the magnitude of this potential savings, avoidable readmissions from skilled nursing facilities was incorporated in The Protecting Access to Medicare Act of 2014. This Act includes readmission penalties for skilled nursing facilities starting in 2018 (Carnahan, Unroe, & Torke, 2016). Consequently, preventing hospitalization of skilled nursing facility patients within the first 30 days following a transition from an acute care setting is an important quality improvement objective. A gap in knowledge remains about the risk factors for hospital readmission for patients discharged from acute hospital care to skilled facility care.

There are numerous readmission prediction models found throughout the literature. A systematic review of prediction models for hospital readmission risk determined that most performed poorly (average C-statistic of 0.66) and efforts to improve their performance are needed for widespread usage (Kansagara et al., 2011). Predictive ability varied significantly between tools and populations. Although there was not a gold standard tool or model identified in the review, there was consistency in many of the variables tested. Common variables found within tools and models included: age, race, diagnoses, history of previous hospitalizations, length of hospital stay, and number of medications. Less common, yet significant variables included: marital status, living alone, payor, cancer diagnosis, and size of discharging medical facility. The overall variability of tool / model performance across similar and different populations may indicate that performance of the tool / model depends on the local context of the population. It was also noted that patients discharged to a skilled nursing facility were often excluded from these previously studied samples.

One of the most frequently cited predictive models for readmission risk is the LACE index. The LACE index (Table 1) incorporates length of stay (LOS), acuity of admission, Charlson Comorbidity Index (CCI), and emergency department visits in the past 6 months. It was originally developed to quantify risk of death or readmission (van Walraven et al., 2010). The index was derived and validated using data from over 4,000 patients who were discharged from 11 hospitals in Ontario, including 6 university affiliated and 5 community hospitals (van Walraven et al., 2010). The researchers used multivariable logistic regression to identify the four variables that were independently associated with death or readmission. The variables are assigned weighted values that are summed to determine a total score. LACE index scores of 10 and above have been association with the likelihood of early readmission to hospital (Gruneir et

al., 2011; van Walraven et al., 2010). However, the LACE index predictive performance has been noted to vary based on population and studies often excluded patients transitioning to skilled nursing facilities (Gruneir et al., 2011; van Walraven et al., 2010; Yazdan-Ashoori, Lee, Ibrahim, & Van Spell, Kanchanasuwn, Cobran, & Young, 2016; Low et al., 2015; Robinson & Hudali, 2017; Wang et al., 2014).

Nursing is essential to preventing readmission by identifying and addressing complications and contributing factors that may increase readmission risk, assessing patient and family knowledge, providing education throughout the hospital stay, preparing for discharge, and coordinating care transitions between inpatient and community-based providers and services (Naylor, Aiken, Kurtzman, Olds, Hirschman, 2011). Nursing interventions to reduce readmission depend on identifying patients who are at high risk for readmission. Since little is known about the risk factors of hospital readmission for patients discharged from acute hospital care to skilled facility care, the purpose of this study was to explore patient characteristics and LACE score of patients who readmitted to acute care following transition to skilled nursing facility care.

## Method

### Study Site and Participants

Data from eight health system based hospitals in eastern North Carolina was used for the retrospective analysis. The health system includes an academic medical center and associated community hospitals. The total population included 27,868 adult, medical and surgical patients age 18 and older who were discharged from a study hospital during the time period of January 2017 to January 2018. The study sample included 3045 patients who were discharged to a skilled nursing facility. Adult patients receiving maternity and / or pregnancy related services were be excluded from the study. Patients discharged to skilled nursing facilities located outside

of the geographical service area of the health system were also excluded. Excluding skilled nursing facilities outside of the geographical service area reduced the likelihood that patients were readmitted to non-health system hospitals for which readmission data could not be collected. The 13 month period was required to allow capture of 30 day readmissions.

**Data Collection Process**

Following East Carolina University and Medical Center Institutional Review Board (UMCIRB) study approval, data for variables including patient level factors (person, health, financial, and community) and outcome variable of readmission was obtained from existing electronic patient medical records. Patient level factors were grouped into personal factors, health factors, financial factors, and community factors. Personal factors included data for patient age, sex, and race. Health factors included data for primary diagnosis category as defined by ICD-9 code and readmission risk score as measured by LACE index. The components of the LACE index appear in Table 1. Financial factor was payor classification. Community factors included data for caregiver status. Readmissions were identified as subsequent admissions following the index admission in the data set. Data for all variables was extracted from existing electronic patient medical records and provided to the research team from the participating health system by an encrypted Microsoft Office Excel file. The data from the encrypted file was exported into SPSS for analysis.

**Data Analysis**

All data were summarized and interpreted for common themes of readmission. A series of chi-square tests was performed to examine relationships between the study variables and readmission status. Patients with LACE index score of 10 or greater were categorized as high risk for readmission. Readmission data was analyzed both at the episodic level and at the patient

level. Readmission timeframes were categorized into 30 day increments up to greater than 90 days from index admission.

**Results**

During the study timeframe, there were 27,868 patients discharged from study hospitals. The academic hospital accounted for 66% of all discharges and community hospitals accounted for 34% of discharges. Overall, 3045 patients, 1503 (8%) from the academic hospital and 1542 (16%) from the community hospitals, transitioned to skilled nursing facilities following discharge from study hospitals. Discharge disposition to skilled nursing facility represented 8% of the total discharges from the academic hospital and 16% from community hospitals (Table 2).

Characteristics of the study population are provided in Table 3. Patients' mean age was 74.6 years, 60.3% were Caucasian, and 38% were African American. Females represented 57.5% of the population and males at 42.5%. The primary payor was largely Medicare at 85.4%. Patient characteristics including sex, race, age, caregiver, and payor were not identified as factors in readmissions. Of the total 3045 patients, 472 (15.5%) had one readmission, and 298 (9.8%) had two or more readmissions. Of the total 770 patients that had a readmission, 597 (77.5%) were identified as high risk. Of the total 1003 patients identified as high risk by the LACE index, 59.5% of the patients had one or more readmissions. The results were further stratified based on discharge from an academic or community hospital (Table 4). When comparing readmissions by hospital type, 48% of the high risk patients from the academic hospital were readmitted, while 74.5% of the high risk patients from the community hospitals had one of more readmissions. Of the 472 single readmission patients, 230 (48.7%) of the readmissions occurred within 30 days of discharge. Of the 230, 173 (75%) were identified as high risk. When comparing 30 day readmissions by hospital type, 79% of the 30 day readmissions in the academic hospital were

high risk compared to 72% of the 30 day readmissions in the community hospitals (Table 5). For patients readmitted greater than 30 days after index admission, the percentage of patients identified as high risk was significantly higher for the academic hospital (79%) compared to the community hospitals (58%). Although statistically significant ($p$=.001) , the effect size was small (phi=.22).

**Discussion**

In this retrospective study of 3045 adult, medical and surgical patients transitioned from a health system's hospitals to area skilled nursing facilities, we found that the LACE index score appropriately identified patients who readmitted to acute care. Patients who were identified as high risk according to the index experienced higher rates of readmission than those who did not score as high risk. This finding was consistent for both academic and community hospitals, however it was noted that the capture of high risk patients was significantly lower in the community hospitals for patients readmitted greater than 30 days after discharge. This finding may be related to the acuity based services offered at community hospitals compared to the academic hospital as well as the higher overall percentage of patients discharged from community hospitals to skilled nursing facilities. Although 77.5% of the readmissions were identified by the index, there were over 20% of the readmissions that were not identified. These cases were not scored as high risk and they had a readmission. Furthermore, there was a high percentage of cases that scored as high risk but did not experience a readmission. These findings were similar to other studies noting the inconsistency and overall poor performance of risk assessment indexes (Kansagara et al., 2011). These findings also demonstrate the difference between retrospective review after a readmission event has occurred and predictive ability of a tool.

Hospitals need to determine a tolerable level of risk assessment performance for their population. Some may feel that capture of over two thirds of cases at risk for readmission within 30 days is acceptable whereas, others may deem this level of performance inadequate. It is also important for hospitals to determine how to operationalize readmission risk assessments. For instance, the LACE index total score is captured at discharge, so there may not be adequate time for implementation of strategies to prevent readmission. This is important to note for the population transitioning to skilled nursing care as they are likely complex and have multiple care needs. Optimization of time for implementation of risk reduction strategies may be best facilitated by a risk assessment performed early in the hospital stay, such as at admission. Hospitals also need to determine if their approach to readmission risk assessment is a single index used across all populations or multiple indexes targeted to subpopulations such as diagnosis or treatment specific. In our study, the LACE index was explored for a skilled nursing population; however, it is often not known at time of admission if a patient will be transitioning to skilled nursing care following hospitalization, so it may not be practical to segment populations. It may also be challenging for front-line staff to interpret multiple readmission risk assessments for various populations.

**Limitations and Future Research**

There are several limitations to the study which should be noted. First, the study utilized retrospective data from patient electronic health records in a single health system. The data was not initially collected for the purpose of the study hence interpretation of individual responses to data elements is solely at the discretion of the research team. This limitation was identified within the caregiver variable as 98.4% of patients had a caregiver identified, yet the research team does not know how the field was interpreted at the time of primary data collection such as

caregiver in role as emergency contact, direct care provider, payor support or otherwise. A more robust measure of caregiver support is needed for conclusive findings. Another limitation was distribution of race as category. Races other than white and African American did not have enough representation for adequate analysis. Lastly, due to large number and variations of diagnosis descriptors, analysis of diagnosis was accomplished only at the broad categorical level. Additional analysis or future studies may be warranted to explore individual diagnosis at the descriptor level.

The study provides unique insight to the potential of using patient characteristic data and risk index scoring to identify those who may likely readmit to acute care following transition to skilled nursing. Additional exploration of the population that scored high risk but did not readmit or those scoring low risk that readmitted following transition to skilled nursing facilities may also provide insight into readmission potential. Opportunities for additional studies may include exploring these characteristics and risk index scoring for patients that transition to other post-acute venues or receive post-acute services in their homes such as home health.

**Conclusion**

As health care providers, hospitals, payors, and policy makers continue to seek solutions for the challenge of readmissions, the need for reliable readmission risk assessments remains an important element. In this study, we explored patient characteristics and LACE score of patients who readmitted to acute care following transition to skilled nursing facility care. We found that the LACE index appropriately identified patients who readmitted to acute care following a transition to a skilled nursing facility. The LACE index may be a useful tool for hospitals to consider implementing for those patients transitioning to skilled nursing care. Additional

comparative studies are needed to explore the characteristics of patients who readmitted despite scoring as low risk.

Table 1

*LACE Index Definitions Utilized in Determining Total Score*

| | |
|---|---|
| **L**ength of Hospital Stay | Number of inpatient days for the index admission including day of admission and discharge.<br>Score Range: 1-7 |
| **A**cuity on Admission | Rating of acuity of admission: Emergent or Routine<br>Score: 3 or 0 |
| **C**omorbidity | Charlson Comorbidity: weighted score of co-existing medical conditions including previous myocardial infarction, cerebrovascular disease, peripheral vascular disease, diabetes without complications, congestive heart failure, diabetes with end organ damage, chronic pulmonary disease, mild liver or renal disease, any tumor (including lymphoma or leukemia), dementia, connective tissue disease, AIDS, moderate or severe liver of renal disease, and metastatic solid tumor.<br>Score Range: 0-5 |
| **E**mergency Department Utilization | Number of emergency department visits during the 6 months prior to the index admission.<br>Score Range: 0-4 |

Table 2

*Initial Discharge Disposition for All Study Participants*

| Disposition | Hospital Type | | Total N= 27868 (100%) |
|---|---|---|---|
| | Academic N= 18343 (66%) | Community N= 9525 (34%) | |
| Home | 13700 (75%) | 6679 (70%) | 20379 (73%) |
| Skilled Nursing Facility | 1503 (8%) | 1542 (16%) | 3045 (11%) |
| Home Health | 1898 (10%) | 821 (9%) | 2719 (10%) |
| Rehabilitation Facility | 302 (2%) | 49 (1%) | 351 (1%) |
| Intermediate Care Facility | 137 (1%) | 174 (2%) | 311 (1%) |
| Against Medical Advice | 200 (1%) | 73 (1%) | 273 (1%) |
| Home Hospice | 137 (<1%) | 70 (<1%) | 207 (<1%) |
| Court | 157 (<1%) | 33 (<1%) | 190 (<1%) |
| Inpatient Hospice | 147 (<1%) | 11 (<1%) | 158 (<1%) |
| Long Term Acute Care Hospital | 100 (<1%) | 23 (<1%) | 123 (<1%) |
| Other | 62 (<1%) | 50 (<1%) | 112 (<1%) |

Table 3

*Characteristics of Skilled Nursing Facility (SNF) Patients by Readmission Status*

| | Total Number of Patients Transitioned to SNF N= 3045 (%) | | |
|---|---|---|---|
| Characteristics | No Readmission N= 2275 (74.7%) | Readmission N= 770 (25.3%) | *p* Value |
| Age, years | | | <.05 |
| 18-40 | 31 (1.4%) | 14 (1.8%) | |
| 41-60 | 233 (10.2%) | 134 (17.4%) | |
| 61-74 | 719 (31.6%) | 252 (32.7%) | |
| 75-84 | 676 (29.7%) | 232 (30.1%) | |
| 85-94 | 528 (23.2%) | 123 (16.0%) | |
| ≥95 | 88 (3.9%) | 15 (1.9%) | |
| Sex | | | <.05 |
| Female | 1358 (59.7%) | 394 (51.2%) | |
| Male | 917 (40.3%) | 376 (48.8%) | |
| Race/ Ethnicity | | | <.05 |
| African American | 812 (36.0%) | 338 (43.9%) | |
| Hispanic/ Latino | 17 (0.8%) | 3 (0.4%) | |
| White | 1402 (62.1%) | 423 (54.9%) | |
| Other/unknown | 27 (1.2%) | 6 (0.8%) | |
| Payor | | | <.05 |
| Commercial | 125 (5.5%) | 39 (5.1%) | |
| Medicaid | 158 (6.9%) | 80 (10.4%) | |
| Medicare | 1960 (86.2%) | 640 (83.1%) | |
| Other/unknown | 32 (1.4%) | 11 (1.4%) | |
| Caregiver | | | <.05 |
| Yes | 2262 (99.4%) | 733 (95.2%) | |
| No | 13 (0.6%) | 37 (4.8%) | |

Table 4

*Initial LACE Index Score and Readmission Frequency for Patients Initially Discharged to Skilled Nursing Facility by Hospital Type*

| | Academic N= 1503 | | | Community N= 1542 | | |
|---|---|---|---|---|---|---|
| | LACE Total Score | | | LACE Total Score | | |
| Readmission Status | < 10 | ≥ 10 | $\chi^2$ | < 10 | ≥ 10 | $\chi^2$ |
| No Readmission | 878 (75%) | 297 (25%) | | 991 (90%) | 109 (10%) | |
| One Readmission | 41 (21%) | 155 (79%) | | 98 (35%) | 178 (65%) | |
| Two or More Readmissions | 8 (6%) | 124 (94%) | 395.11[1] | 26 (16%) | 140 (84%) | 626.41[2] |

[1] $p < .001$, phi = .51
[2] $p < .001$, phi = .64

Table 5

*LACE Score and Thirty Day Readmission Rate for First Readmission by Hospital Type*

| | Hospital Type | | | | |
|---|---|---|---|---|---|
| Days to Readmission | Academic | Community | $\chi^2$ | *p* Value | Phi |
| Less than 30 days | | | | | |
| Total Score < 10 | 21 (21%) | 36 (28%) | | | |
| Total Score ≥ 10 | 80 (79%) | 93 (72%) | 1.54 | .215 | .08 |
| Greater than 30 days | | | | | |
| Total Score < 10 | 20 (21%) | 62 (42%) | | | |
| Total Score ≥ 10 | 75 (79%) | 85 (58%) | 11.49 | .001 | .22 |

# CHAPTER 5: EXAMINING READMISSION WITH INDUSTRY STANDARD AND HEALTH SYSTEM SPECIFIC RISK INDEXES


## Abstract

**Background:** Hospital readmission continues to be problematic for patients, health care providers, payors, and policy makers. Understanding patient risk for readmission may help identify patients who would likely benefit from targeted intervention. The purpose of this study was to examine the performance of an industry standard risk index (LACE) and a health system specific readmission risk index (HSRR).

**Methods**: A retrospective data analysis was conducted to examine the performance of each index. The population included adult medical-surgical patients discharged from eight health system based hospitals to home, home health services, and skilled nursing facilities during 2017. A LACE index score of 10 or greater and a HSRR score of 4 or greater was used to identify patients at high risk for readmission.

**Results**: During the study period, 26,143 patients were discharged from acute care to either home, home with home health services, or skilled nursing facilities in the geographic service area of the health system. Of the 26,143 patients discharged, 5,286 (20%) were readmitted to acute care. Of those patients who readmitted, we found that LACE correctly designated 66% of those as high risk whereas the HSRR only correctly identified 23% of those as high risk. The underperformance of the HSRR was consistent across dispositions to home, home with home health services, and skilled nursing facilities as well as across academic and community hospitals.

**Conclusions:** The health system specific readmission risk score was not as effective as an industry standard index in identifying patients at risk for hospital readmission. It may be beneficial for hospitals to test existing industry standard indexes using their local patient population characteristics prior to developing additional models.

Hospital readmission continues to be problematic for patients, health care providers, payors, and policy makers. According to the Agency for Healthcare Research and Quality (AHRQ), between January and November 2011, there were approximately 3.3 million readmissions within 30 days of hospital discharge costing over $41billion (Agency for Healthcare Research and Quality, 2011). In addition to the significant financial costs, the clinical impacts to the patient may include fragmentation of medical care, deteriorating health, depression, stress, and a higher risk for mortality (Allen et. al., 2011; Boockvar, Fishman, & Kyriacou, 2004; Jencks, Williams, & Coleman, 2009; King et. al., 2013; Mor, Intrator, Feng, & Grabowski, 2010; Saliba, 2000). It is estimated that 11-13 percent of readmissions are preventable which means avoidance of negative clinical outcomes and a cost savings upward of $25 billion (Goldfield et al., 2008; Medicare Payment Advisory Commission, 2007)

To confront the issue of readmissions and to improve patient outcomes and reduce expenditures, The Patient Protection and Affordable Care Act of 2010 (ACA) included the Hospital Readmission Reduction Program (HRRP). This program reduces payments to hospitals that have excessive rates of readmission. Hospitals who perform worse than the average of all hospitals are penalized. (Centers for Medicare and Medicaid Services, 2018). In 2012, the first year of HRRP implementation, 307 hospitals faced the maximum penalty, resulting in $280 million dollars in loss to the hospitals with excessive readmissions (AHRQ, 2011). As hospitals and payors work to improve readmission rates and associated clinical and financial costs, a key

strategy has emerged that involves identifying patients who may be at high risk for readmission. By identifying high risk patients through predictive models, targeted interventions can be implemented to mitigate the readmission risk.

There are numerous readmission prediction models found throughout the literature. However, a systematic review of prediction models for hospital readmission risk determined that most performed poorly (average C-statistic of 0.66) and efforts to improve their performance are needed for widespread usage (Kansagara et al., 2011). Predictive ability varied significantly between tools and populations. Although there was not a gold standard tool or model identified in the review, there was consistency in many of the variables tested. Common variables found within tools and models included: age, race, diagnoses, history of previous hospitalizations, length of hospital stay, and number of medications. Less common, yet significant variables included: marital status, living alone, payor, cancer diagnosis, and size of discharging medical facility. The overall variability of tool / model performance across similar and different populations may indicate that performance of the tool / model depends on the local context of the population. It was also noted that patients discharged to care including skilled nursing facilities and / or home health services were often excluded from the study populations.

One of the most frequently cited predictive models for readmission risk was the LACE index. The LACE index incorporates length of stay (LOS), acuity of admission, Charlson Comorbidity Index (CCI), and emergency department visits in the past 6 months and was originally developed to quantify risk of death or readmission (van Walraven et al., 2010). The index was derived and validated using data from over 4,000 patients who were discharged from eleven hospitals in Ontario. The sites included six university affiliated and five community hospitals (van Walraven et al., 2010). The researchers used multivariable logistic regression to

identify the four variables that were independently associated with death or readmission. The variables are assigned weighted values that are summed to determine a total score. LACE index scores of 10 and above have been association with the likelihood of early readmission to hospital (Gruneir et al., 2011; van Walraven et al., 2010). However, the LACE index predictive performance has been noted to vary based on population and studies often excluded patients transitioning to skilled nursing facilities (Gruneir et al., 2011; van Walraven et al., 2010; Yazdan-Ashoori, Lee, Ibrahim, & Van Spell, Kanchanasuwn, Cobran, & Young, 2016; Low et al., 2015; Robinson & Hudali, 2017; Wang et al., 2014).

In an effort to address the performance variability of industry standard risk indexes and to capture risk characteristics of the local population, hospitals have developed system specific risk models based on information from local administrative and medical records. Hospital specific models often include variables found in industry standard indexes such as demographics, diagnoses, and health care utilization metrics such as emergency room visits or readmissions. A distinct difference in hospital specific risk models from industry standard indexes is the flexibility of data collection and administration (Yu et al., 2015). For instance, the LACE index is very specific in criteria and is performed at time of patient discharge whereas a hospital specific model could be performed at admission or modified throughout the inpatient stay. Another key difference is that hospital specific models are generally not scientifically tested for performance and validity but rather utilized as part of larger quality improvement initiatives focused on reducing readmissions.

The health system specific readmission risk (HSRR) model was developed and implemented by an area hospital system in an effort to determine risk index as part of their clinical transformation and quality improvement platform. To determine elements to be included

in risk scoring, they reviewed best practice and research literature regarding existing risk models as well as completed a retrospective review of health system hospital patient readmissions from the prior year. Common patient characteristics found across the readmission reviews were incorporated into the risk scoring model. These characteristics included patient age, assignment to a primary care physician, marital status, primary diagnosis, length of stay, emergency department utilization, payor, depression, and history of drug abuse. One point was assigned for each characteristic if the patient met criteria. The points were summed to determine overall risk score. The elements were embedded into the electronic health record (EHR) customizable risk template to facilitate real- time scoring, meaning that the risk score was initiated on admission and updated throughout the hospital stay.

As hospitals and health care systems continue to struggle with readmissions, which includes identifying patients at high risk for readmission, efficient utilization of resources is imperative. Recognizing the strengths and limitations of readmission risk models may help hospitals determine whether to utilize existing industry standard models and accept inherent limitations or develop site specific models which allow for more flexibility. The purpose of this study was to examine the performance of an industry standard risk index (LACE) and a health system specific readmission risk index (HSRR).

## Method

### Study Site and Participants

Data from eight health system based hospitals in eastern North Carolina was used for the retrospective analysis. The health system includes an academic medical center and associated community hospitals. The total population included 27,868 adult, medical and surgical patients age 18 and older who were discharged from a study hospital during the time period of January

2017 to January 2018. (Table 6) The study sample included 26,143 patients who were discharged to home, home with home health services, and skilled nursing facilities in the geographic service. Adult patients receiving maternity and / or pregnancy related services were excluded from the study. Patients discharged outside of the geographical service area of the health system were also excluded. Excluding patients outside of the geographical service area reduced the likelihood that patients were readmitted to non-health system hospitals for which readmission data could not be collected. The 13 month period was required to allow capture of 30 day readmissions.

**Data Collection Process**

Following East Carolina University and Medical Center Institutional Review Board (UMCIRB) study approval, data for variables including patient demographic characteristics, risk index scores, and pertinent information associated with index hospitalization and subsequent readmission was obtained from existing electronic patient medical records. Data was provided to the research team from the participating health system by an encrypted Microsoft Office Excel file. The data from the encrypted file was exported into SPSS for analysis.

**Data Analysis**

All data were summarized and interpreted for common themes of risk scoring and readmission. The data was analyzed to examine the performance of the two indexes in identifying patients as high risk and if those high risk patients experienced a readmission. Patients with LACE index score of 10 or greater were categorized as high risk for readmission. Patients with a HSRR index score of 4 or greater were categorized as high risk for readmission. Readmission data was analyzed both at the episodic level, patient level, and hospital level.

Readmission timeframes were categorized into 30 day increments up to greater than 90 days from index admission.

**Results**

During the study period, of the 26,143 patients discharged to home, home with home health, and skilled nursing facilities, 5,286 (20%) were readmitted to acute care. The overall readmission rate was 20%, with academic hospital readmission rate of 24% and community hospitals readmission rate of 14%. Of the 5,286 patients that were readmitted, the academic hospital had more readmissions of patients discharged to home (24%) compared to patients discharged home with home health (21%), or discharged to a skilled nursing facility (22%). This differed from the community hospitals that had a significantly higher percentage of skilled nursing facility patients readmitted (29%) than either home (10%) or home with home health (14%).

The LACE index designated a higher percentage of academic hospital patients as high risk in all three discharge dispositions compared to the HSRR. The LACE index also designated a higher percentage of community hospital patients as high risk who were discharged to skilled nursing facilities (28%) whereas the HSRR designated a larger proportion of high risk patients discharged to home (26%). (Table 7) The Kappa statistic was used to further compare the LACE index and HSRR risk predictions of readmission status across hospital type and discharge disposition. (Table 8) There was little agreement between the LACE index and the HSRR in predicting readmission; however, the two risk models were more in agreement in predicting risk for patients that did not have any readmissions during the study period. The largest agreement was for non-readmitted patients in community hospitals who were discharged to home with home health (.59). Moderate agreement was also found for non-readmitted patients in

community hospitals with a discharge disposition to a skilled nursing facility. The LACE index consistently had high risk proportions over 60% whereas the proportion of readmitted patients designated as high risk by the HSRR never rose above 30%. LACE had the highest prevalence of high risk predictions in patients with more than one readmission during the study period. In predicting $\leq$ 30 ay or greater than 30 day readmission, the LACE index had the strongest prediction for patients discharged home with home health and skilled nursing facilities from both the academic and community hospitals. (Table 9)

**Discussion**

In this retrospective study of 26,143 patients who were discharged from acute care to home, home health services, and skilled nursing facilities, we examined the performance of an industry standard readmission risk index (LACE) and a health system specific readmission risk index (HSRR). Although there was agreement between the two indexes based on cases assigned to low risk groups, the LACE index performed better at correctly identifying high risk patients that readmitted. The underperformance of the HSRR was consistent across dispositions to home, home health services, and skilled nursing facilities as well as hospital types.

LACE, as the higher performer between the two indexes, correctly identified only 66% of cases that readmitted. Therefore, a significant portion of the readmission population that was not captured by this index. This is consistent with previous studies findings of variable performance and inadequate capture of those patients likely to readmit to acute care (Kansagara et al., 2011). Despite gaps in predictive ability, hospitals and health systems likely benefit from implementation of readmission risk indexes in that the tools bring a heightened level of awareness to front-line staff about the importance of readmission prevention. They also potentially offer some comparative perspective of patient general risk and may help indicate the

need for service such as in-home support or facility based care. Industry standard indexes such as LACE offer a relatively simple framework for readmission risk stratification, however when the total score is captured at discharge, there may not be adequate time for implementation of strategies to prevent readmission.

A key advantage of a HSRR is the ability to determine when the readmission risk assessment occurs such as at the time of admission, updated throughout the stay, or at discharge. Another benefit of a HSRR index includes flexibility to adjust scoring variables based on site specific population characteristics (Yu et al., 2015). For instance, if the population served by an individual hospital is largely patients with cardiovascular disease, then the site may select more cardiac sensitive variables to capture potential risk. When developing readmission risk indexes or selecting an industry standard index, hospitals and health systems will also need to explore multiple variables and consider variables that may not be adequately captured in the electronic health record such as social determinants of health, health literacy, and patient engagement in care.

**Limitations and Future Research**

There are several limitations to the study which should be noted. First, the study utilized retrospective data from patient electronic health records in a single health system. The data was not initially collected for the purpose of the study therefore the research team does not know exactly how the data was collected and if there was consistency across data collection processes and locations. Next, the research team was only provided with the total scores for each index. The team did not have data on the individual items within each index so analysis was limited to utilization of the total risk score for each index. Lastly, the study was limited to data collected during initial hospitalization and subsequent readmissions. The research team recognizes that

readmissions may have been impacted by quality improvement efforts implemented at any of the study hospitals or providers, or other home based intervention or support that occurred during the study timeframe.

The study provides insight into the comparative performance of an industry standard readmission risk assessment index and a health system specific readmission risk assessment. Although the industry standard index performed better than the health system specific index, additional exploration of the population that scored high risk but did not readmit or those scoring low risk that readmitted is warranted.

**Conclusion**

There are many methods of identifying patients who may be at a high risk for readmission including utilization of risk indexes. Determining what type of readmission risk index adequately captures the characteristics of a site specific hospital population is challenging and may ultimately depend on what a site or organizations deems as a tolerable level of performance.

Table 6

*Initial Discharge Disposition for All Study Participants*

| Disposition | Hospital Type | | Total N= 27868 (100%) |
|---|---|---|---|
| | Academic N= 18343 (66%) | Community N= 9525 (34%) | |
| Home | 13700 (75%) | 6679 (70%) | 20379 (73%) |
| Skilled Nursing Facility | 1503 (8%) | 1542 (16%) | 3045 (11%) |
| Home Health | 1898 (10%) | 821 (9%) | 2719 (10%) |
| Rehabilitation Facility | 302 (2%) | 49 (1%) | 351 (1%) |
| Intermediate Care Facility | 137 (1%) | 174 (2%) | 311 (1%) |
| Against Medical Advice | 200 (1%) | 73 (1%) | 273 (1%) |
| Home Hospice | 137 (<1%) | 70 (<1%) | 207 (<1%) |
| Court | 157 (<1%) | 33 (<1%) | 190 (<1%) |
| Inpatient Hospice | 147 (<1%) | 11 (<1%) | 158 (<1%) |
| Long Term Acute Care Hospital | 100 (<1%) | 23 (<1%) | 123 (<1%) |
| Other | 62 (<1%) | 50 (<1%) | 112 (<1%) |

Table 7

*Prevalence of Readmit Status, LACE Risk Index, and Health System Readmission Risk (HSRR)Index for Initial Patient Discharge Sites of Home, Home with Home Health, and Skilled Nursing Facility for Academic and Community Hospital Patients*

| Variable | Home | Home with Home Health | Skilled Nursing Facility | $\chi^2$ | Phi / Cramer's V |
|---|---|---|---|---|---|
| Academic Hospital | | | | | |
| No Readmits | 10354 (76%) | 1507 (79%) | 1175 (78%) | | |
| 1 Readmission | 2040 (15%) | 183 (10%) | 196 (13%) | | |
| > 1 Readmission | 1306 (9%) | 208 (11%) | 132 (9%) | 42.64 | .03* |
| Community Hospitals | | | | | |
| No Readmits | 6018 (90%) | 703 (86%) | 1100 (71%) | | |
| 1 Readmission | 339 (5%) | 62 (7%) | 276 (18%) | | |
| > 1 Readmission | 322 (5%) | 56 (7%) | 166 (11%) | 400.37 | .15* |
| Academic Hospital | | | | | |
| LACE <10 | 11005 (80%) | 1301 (68%) | 927 (62%) | | |
| LACE ≥10 | 2695 (20%) | 597 (32%) | 576 (38%) | 364.44 | .15 |
| Community Hospitals | | | | | |
| LACE <10 | 6054 (91%) | 684 (83%) | 1115 (72%) | | |
| LACE ≥10 | 2695 (9%) | 137 (17%) | 427 (28%) | 378.60 | .21** |
| Academic Hospital | | | | | |
| HSRR Low | 12124 (88%) | 1569 (83%) | 1233 (82%) | | |
| HSRR High | 1576 (12%) | 329 (17%) | 270 (18%) | 91.89 | .07 |
| Community Hospitals | | | | | |
| HSRR Low | 4960 (74%) | 744 (91%) | 1357 (88%) | | |
| HSRR High | 1719 (26%) | 77 (9%) | 185 (12%) | 221.10 | .16 |

* Values are for Cramer's V and the effect size is small.
** Effect size is medium.
Note. All $p$ values are < .001.

Table 8

*LACE and Health System Readmission Risk (HSRR) Levels Associated with Initial Readmission Status in Patients Initially Discharged to Home, Home with Home Health, and Skilled Nursing Facilities from Academic and Community Hospitals*

| | LACE Risk | | HSRR Risk | | |
|---|---|---|---|---|---|
| Site<br>Readmission Status<br>Hospital Type | < 10 | ≥10 | Low | High | Kappa[1] |
| Home | | | | | |
| Academic | | | | | |
| No Readmission | 9719 (94%) | 635 (6%) | 9396 (91%) | 985 (9%) | .25 |
| 1 Readmission | 973 (48%) | 1067 (52%) | 1737 (85%) | 304 (15%) | .05 |
| >1 Readmission | 313 (24%) | 993 (76%) | 1019 (78%) | 287 (22%) | .05 |
| Community | | | | | |
| No Readmission | 5838 (97%) | 180 (3%) | 4488 (75%) | 1530 (25%) | .06 |
| 1 Readmission | 139 (41%) | 200 (59%) | 239 (71%) | 100 (29%) | -.21 |
| >1 Readmission | 77 (24%) | 245 (76%) | 233 (72%) | 89 (28%) | -.01 |
| Home with Home Health | | | | | |
| Academic | | | | | |
| No Readmission | 1236 (82%) | 271 (18%) | 1266 (84%) | 241 (16%) | .28 |
| 1 Readmission | 42 (23%) | 1417%) | 139 (76%) | 44 (24%) | .04 |
| > 1 Readmission | 23 (11%) | 185 (89%) | 164 (79%) | 44 (21%) | .02 |
| Community | | | | | |
| No Readmission | 654 (93%) | 49 (6%) | 652 (93%) | 51 (7%) | .59 |
| 1 Readmission | 23 (37%) | 39 (63%) | 52 (84%) | 10 (16%) | -.02 |
| > 1 Readmission | 7 (12%) | 49 (88%) | 40 (71%) | 161 (29%) | .05 |
| Skilled Nursing Facility | | | | | |
| Academic | | | | | |
| No Readmission | 878 (75%) | 297 (25%) | 988 (84%) | 187 (16%) | .38 |
| 1 Readmission | 41 (21%) | 155 (79%) | 152 (78%) | 44 (22%) | .10 |
| > 1 Readmission | 8 (6%) | 124 (94%) | 93 (71%) | 39 (29%) | .03 |
| Community | | | | | |
| No Readmission | 991 (90%) | 109 (10%) | 1011 (92%) | 89 (8%) | .43 |
| 1 Readmission | 98 (35%) | 178 (65%) | 227 (82%) | 49 (18%) | .07 |
| > 1 Readmission | 26 (16%) | 140 (84%) | 119 (72%) | 47 (28%) | .06 |

[1] Kappa criteria: < 0 poor, 0.00-0.20 slight, 0.21-0.40 fair, 0.41-0.60 moderate.

Table 9

*LACE and Health System Readmission Risk (HSRR) Levels Associated with Thirty Day Initial Readmission Status in Patients Initially Discharged to Home, Home with Home Health, and Skilled Nursing Facilities from Academic and Community Hospitals*

| Site<br>Readmission Status<br>Hospital Type | LACE Risk<br>< 10 | <br>≥ 10 | HSRR Risk<br>Low | <br>High |
|---|---|---|---|---|
| Home | | | | |
| Academic | | | | |
| ≤ 30 days | 782 (49%) | 809 (51%) | 1380 (87%) | 211 (13%) |
| > 30 days | 191(42%) | 258 (58%) | 356 (79%) | 93 (21%) |
| Community | | | | |
| ≤ 30 days | 59 (45%) | 71 (55%) | 93 (71%) | 37 (29%) |
| > 30 days | 80 (38%) | 129 (62%) | 146 (70%) | 63 (30%) |
| Home with Home Health | | | | |
| Academic | | | | |
| ≤ 30 days | 22 (24%) | 70 (76%) | 61 (66%) | 31 (34%) |
| > 30 days | 20 (21%) | 75 (79%) | 78 (86%) | 13 (14%) |
| Community | | | | |
| ≤ 30 days | 10 (32%) | 21 (68%) | 28 (90%) | 3 (10%) |
| > 30 days | 13 (42%) | 18 (58%) | 24 (77%) | 7 (23%) |
| Skilled Nursing Facility | | | | |
| Academic | | | | |
| ≤ 30 days | 21 (21%) | 80 (79%) | 75 (74%) | 26 (26%) |
| > 30 days | 20 (20%) | 75 (79%) | 77 (81%) | 18 (19%) |
| Community | | | | |
| ≤ 30 days | 36 (28%) | 93 (72%) | 101 (78%) | 29 (22%) |
| > 30 days | 62 (42%) | 85 (58%) | 126 (86%) | 21 (14%) |

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# APPENDIX: IRB APPROVAL LETTER

**EAST CAROLINA UNIVERSITY**
**University & Medical Center Institutional Review Board**
4N-64 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** ·
www.ecu.edu/ORIC/irb

## Notification of Initial Approval: Expedited

From: Biomedical IRB
To: Pamela Cowin
CC: Ann Schreier
Date: 5/30/2018
Re: UMCIRB 18-000696
Exploring Risk Factors of Readmission

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 5/29/2018 to 5/28/2019. The research study is eligible for review under expedited category #5. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

| Name | Description |
|---|---|
| Study Protocol | Study Protocol or Grant Application |
| Waiver of Authorization | HIPAA Authorization |

The Chairperson (or designee) does not have a potential for conflict of interest on this study.